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Of this issue of the Street Railway Journal, 8500 copies are printed. Total circulation for 1906 to date, 147,300 copies, an average of 8183 copies per week.

Conducting Pleasure Parks

In conducting street railway parks, the mistake is often made of installing and maintaining those attractions that appeal to the lower class of patrons. We refer to cheap shows, the sale of intoxicating liquors, nickel gambling machines and similar devices. It may be stated with certainty that when such attractions are maintained in a park in a small city or town, and the class to which such a park appeals begins to frequent it, disorder will prevail, and sooner or later both the park and the company backing it will acquire a bad reputation. The better class of people will avoid the place thereafter, and soon the park will be abandoned as a failure.

This remark applies especially to parks in smaller localities. In cities with a population large enough to support two parks it is probably best to have them of such a nature that they attract different classes of people. The cheaper amusements may be provided in one resort, while the better class of entertainments, band concerts and other features that appeal to the higher grade of patrons may be maintained in an entirely separate place. This plan is pursued by two or three companies which we call to mind. There is nothing in the higher grade parks to attract the undesirable element, and they increase from year to year in popularity with the better class. For the less refined element, which always exists in any large city, other parks are conducted, several miles distant from the former. Here cheap shows and other attractions demanded by the class of people for whom these parks are intended to appeal are maintained.

In general, we do not believe it wise to attempt to make people of widely different types, socially and intellectually, mix in amusement resorts. An attempt to do so will almost invariably end in failure, and especially will this be the case in a comparatively small town.

The Functions of Limited Service on Traction Lines

It is interesting to note that the high-speed lines of the great traction belt in Ohio and Indiana are getting down to a standard of policy as to the best methods of handling the so-called limited service. This subject has occasioned a great deal of controversy during the past two or three years. The first roads to put on limited service did so with an idea of accommodating the traveler who was going a considerable distance, that is, from one large town to another. A slight excess fare was instituted to discourage the use of these cars by those who desired to ride locally for short distances. Later, when a number of lines were connected up, there came the interline limiteds with chair seats, and, in two or three instances, buffet service. The idea of these ventures was that they would capture from the steam roads the highest class of through service. One road in this district even installed sleeping cars, although its route was not long enough to permit the passenger to go to bed. By this time the majority of the experimenters with these innovations have become pretty thoroughly disillusionized. It is becoming generally admitted that there is little demand among the class of people who patronize the traction lines for the extreme luxuries of the long-distance limited steam trains. While the electric lines are making through connections and quickening their schedules over long distances, the great mass of revenue will probably continue, as it has in the past, to come from the poorer class of people who desire to save money, the commercial traveler who wants to make quick jumps from town to town, and a very small proportion from the sightseer who is viewing the country and takes this method of seeing the villages and towns.

The latest form of limited service adopted by the majority of the roads in the district mentioned provides for the conveniences of these people, without attempting to cater to the small proportion who travel in parlor cars. The chair-seat

idea has been given up by the great majority of roads, because chairs greatly reduce the seating capacity of a car. The limiteds, in the majority of cases, are proving the most popular cars, and on many roads they have been crowded much of the time. And to offer a man a ride in a beautiful car without furnishing him a seat is the worst kind of a farce. A number of roads increased the seating capacity of their chair cars by leaving out the baggage compartment, but this plan is now generally acknowledged to have been a mistake. The limiteds are supposed to cater to the convenience of the traveling man, but if the traveling man cannot carry his sample trunks with him he has no use for the speedier car. While there are now several roads with runs of from 100 miles to 150 miles, it is found that comparatively few of the patrons of these cars travel the entire distance; in other words, the way passengers still greatly predominate. If the seats are made comfortable and have high-roll backs, the patrons do not care especially for the chair seats, especially as many of the chairs used by interurban roads are not designed for fleshy people. Moreover, the seats, as a rule, are not adaptable for a reclining position, due, of course, to the desire to secure a maximum seating capacity and the necessarily narrow width of the car. Some of the roads are building limited cars with ordinary seats in the passenger compartments and chair seats in the smokers, which is a good arrangement, although it has the objection of limiting the seating capacity of the smoking compartment, which is usually the popular portion of the car on long trips.

The matter of excess fares on limiteds seems to have settled itself, due largely to the passage of a two-cent fare law in Ohio. This law has brought down the rates of the steam roads to a point where the electrics have had to shave off the extras to keep below them. Indiana roads have followed the same plan as the Ohio roads in this matter, because the excess fare has been found to drive away a good many passengers who could otherwise be secured. The question of the advisability of running limiteds only a few times a day or every other car has also been quite thoroughly threshed out. As intimated, there has been more and more of a demand for the faster car, and practically all the roads operating this service have found it desirable to make every other car a limited. The opinion is also growing that a car once in two hours is often enough for the farmers and denizens of small hamlets, which is a further argument in favor of more frequent fast cars.

In brief, it has been found that the limited service, which accommodates the greatest number of people, calls for ordinary seats of comfortable design, a large seating capacity, service every two hours, no excess fares, baggage on all limiteds, stops in towns of 1500 or more, and speed as fast as consistant with safe operation. When electric roads are built entirely on private right of way, through cities and towns, as well as through country districts, and when there is business enough to warrant the operation of several cars in a train, it will be time enough to cater to the wants of the elite among the traveling public.

The Situation at San Francisco

Sufficient time has elapsed since the disaster at San Francisco so that a general idea can be obtained of at least the street railway situation in that city. The accounts first published indicated that the loss to the physical property of the company had been large. Fortunately, however, later reports, such as published in our issue of last week, and confirmed this week, show a much more favorable condition of affairs. Extensive changes and improvements had been planned, but most of them had not been undertaken as yet. This condition, combined with the fact that the center of the city, where the fire started, was still equipped with cable apparatus and the early hour of the earthquake, which was at a time when most of the cars were in the car houses in the outskirts of the city, explained the comparatively small loss. Incidentally, the earthquake has demonstrated in a very effective way the relative capacities for resisting the effect of seismic shocks of buildings of different characters and on different foundations. The safest locations were in the hilly districts, where bed rock exists at or near the surface, and here very little damage was done. The modern "sky scrapers" were also practically uninjured structurally by the shock, and most of the damage was confined to the buildings on made land. Masonry walls, when well braced, stood the shock remarkably well. A considerable amount of brick masonry of poor quality was thrown down. Several brick stacks were injured, indicating that these structures, unless well braced, are susceptible to injury. There was comparatively little damage to the trolley tracks, except through the destruction of the overhead wires from falling buildings, but greater injury to the underground cable conduits, which seemed impotent to resist the ravages of fire and earthquake, as both alike tend to close the slot. With commendable enterprise, the street railway management has undertaken the immediate reconstruction of its disabled lines and has completed the equipment of the most important ones so rapidly that they have been of incalculable service in removing the debris, and otherwise assisting in the rehabilitation of the city.

Besides the effect on the condition of the company's property, the question naturally rises as to the influence of the disaster upon the future earnings of the San Francisco system. Upon this point it is possible to reason only by analogy. Precedents of a certain kind can be found in the results following the great fires at Baltimore and Patterson. These disasters, it is true, are not quite comparable in their effects, because of the large exodus from San Francisco, and the fact that on account of the earthquake many persons, not required to live in the city for business reasons, may have objections to it as a place of residence. We hardly believe, however, that these conditions will have a permanently serious effect upon the developments of the city. The experience of the past two weeks indicates that buildings can be erected which will not be injured from earthquake shocks, while the influx of workmen and artisans to undertake the reconstruction required in San Francisco will, undoubtedly, largely counterbalance in number the loss of those former residents who have moved away from the city since the fire, and who have no intention of returning. The harbor at San Francisco possesses so many advantages that if practical immunity can be secured from another such disaster by the erection of a different class of buildings, as now seems probable, there will always be an important commercial city on the Golden Gate.

Allowing, however, for the difference already mentioned between the San Francisco disaster and those already referred to, the experience of the street railways in Baltimore after the

fire of February, 1904, and of those of Paterson after the fire and flood two years previously, is of interest.

According to statistics the recovery of the Baltimore railway system from the effects of the fire in that city was very rapid. The conflagration occurred on Feb. 7. The day before the fire the United Railways Company of Baltimore operated 621 cars over 34 lines, and its receipts amounted to $15,298. The service on the day after the fire included only fifteen lines and only eighty-two cars were run. The receipts on that day were $2,015. The receipts on the day after the fire, therefore, were only about 14 per cent of those on the day before the fire, and there was a reduction of 88 per cent in car mileage. By the end of February the comparison with the previous year showed a reduction of only 35.1 per cent in car mileage and of 22.8 per cent in passenger receipts. The decreases for the month of March, the month after the fire, were 22.43 per cent in mileage and 6.65 per cent in receipts; for April, 10.15 in mileage and 1.17 per cent in receipts. In May the receipts showed an increase of $7,364, equal to 1.5 per cent. For the full year, 1904, the receipts of the company amounted to $5,451,180, a decrease of only $29,449 compared with the receipts of 1903.

In the case of Paterson, the effects of the fire of Feb. 9 and the flood of Feb. 16, 1902, on the earnings of the street railway lines of that town were almost negligible. The earnings of the Paterson lines of the Public Service Corporation for the month of February, 1902, amounted to $25,939, compared with $26,029 in February, 1901. For the year 1902 the receipts were $417,112, an actual increase of $12,642 over those of the previous year.

The Gasoline Car

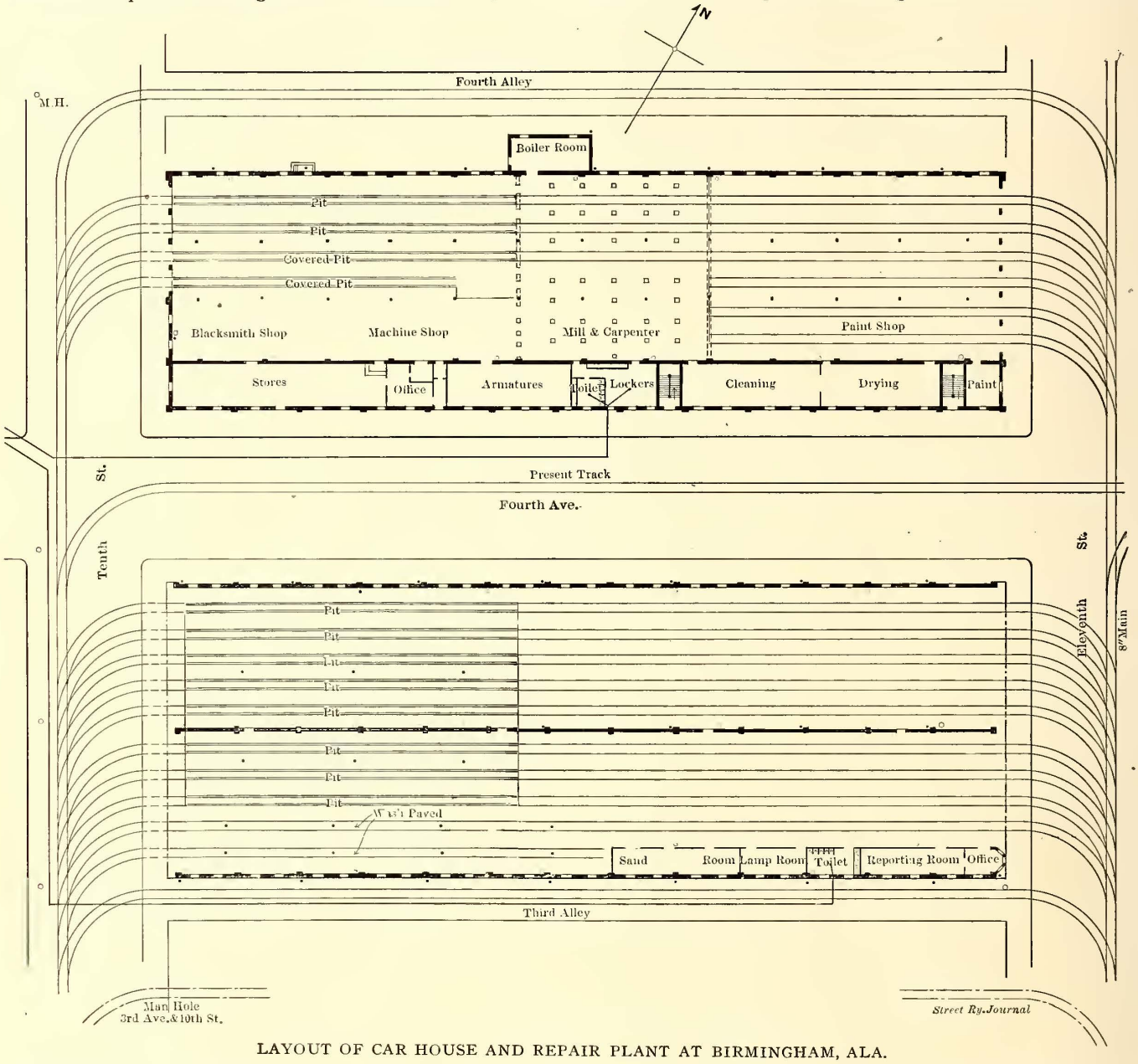
Mr. Hild's paper on this topic, published in this issue, is altogether the best summary of the situation which we have yet seen. It is a peculiarly difficult one to treat, by reason of the scarcity of data on the performance of gasoline cars, and yet in these days of high-powered automobiles one can get a pretty close line on engine performance, which, after all, is the vital factor, so far as the motive power is concerned. We certainly agree, to begin with, that of the self-propelled cars only those driven by internal combustion engines can be seriously considered. No refinement is likely to bring the steam dummy into popular favor, while it is conceivable that the gasoline street car might readily make friends, since it is reasonably quiet and free from smoke or smell. Reliability, however, is quite another matter, and one which it is very difficult fairly to judge. Obviously far more complicated than an electric-motor car, the gasoline or gasoline-electric car certainly has the burden of the proof in reliability. On the other hand, it is hardly fair to judge this by the data derived from automobiles, which necessarily operate under far less favorable conditions, are much more lightly built, and are altogether of a character to indicate a relatively high repair bill. Then, too, the engines of the car are larger, more powerful, and operated under better conditions for efficiency than those of an automobile, and hence should give a better economic result.

Coming down to particulars and basing his judgment on the best data attainable, Mr. Hild figures out the operating cost of a gasoline car of size commensurate with an interurban electric car at nearly 15 cents per car mile, as against about 6 cents for the trolley car. The power items are here taken at 7 and 1.91 cents respectively. This is not unduly high for the gasoline car, considering its relatively great weight, and the large engines necessary for anything like high acceleration. A special mechanic is assumed as part of the car crew, which brings the labor item up to 3 cents per car mile for the gasoline outfit. This is according to present custom, but we must own that it is an item which eventually should be dispensed with. It ought to be possible, and probably is possible, to build a gasoline equipment for such service which can be effectively handled by the driver alone. The requirements of the service are less severe than in the working of a high-power touring car, and one good man should be able to handle the car. The maintenance charge against the gasoline car is taken at 4 cents per car mile, including the car and all its equipment. Such a value is subject to some uncertainty, but the same item for the electric car is 1.5 cents, and the difference does not look excessive in view of the comparative complication. Perhaps it could be cut down when the gasoline car got fairly on a commercial basis, but even so, we should hesitate to reduce it more than a cent. Looking the estimate all over, one can hardly see an opportunity for cutting down the cost with the self-propelled car more than a couple of cents, unless by a change of fuel. Cheap alcohol, which we hope Congress will soon give us, or the production of an engine utilizing kerosene successfully, would reduce the fuel bill somewhat.

Look at the question any way you may, however, there is a considerable margin in favor of the straight-electric car when in anything like active service. We have as yet said nothing of the so-called gasoline-electric car, since there is no reason to expect it to show much better economic results than the straight gasoline car, however much more facile the control may be. Broadly, the economy of both types should be nearly the same, differing in items, but not greatly in amount. With this general showing, the necessary limitations of the gasoline car are apparent. It can only compete with a trolley car on favorable terms when the latter would show abnormally high cost per car mile. This could happen through a very considerable increase in cost of power over Mr. Hild's figures, or by so infrequent service as to exaggerate the fixed charges or by a combination of these unfavorable conditions. With costly fuel and infrequent service a point can be reached, as Mr. Hild points out, at which the self-propelled car would have the advantage. On some rural lines we can easily see where a gasoline car could be used with real advantage, such as a line which would operate say two cars on one hour headway, and the trolley system has to endure large fixed charges and an abnormal cost of power, at times perhaps as high as that which Mr. Hild estimates for the gasoline car. Bearing this in mind, one may fairly predict a real field of usefulness for the self-propelled car, although not a very large one. In certain cases, it may prove a convenience temporarily on roads ultimately best worked on the ordinary trolley system, or as auxiliary equipment for use in emergencies. Meanwhile, we hope that it will be carefully worked out for these very purposes, and in so doing improvements will be made that may very possibly extend its sphere. There is much to hope from the internal combustion engine in many directions, and the more it is investigated and improved the better.

CAR HOUSE, SHOPS AND SHOP PRACTICES AT BIRMINGHAM, ALA.

The car-housing and repair plant for taking care of all the cars of the Birmingham Railway, Light & Power Company was erected about three years ago, and took the place of several car houses and shops scattered throughout the Birmingham district, which were formerly owned by the independent companies prior to the consolidation. The house and shop are in charge of W. A. McWhorter, master mechanic and assistant superintendent. J. L. Mason is assistant master mechanic. The plant consists of two independent buildings, separated by an 80-ft. street.



LAYOUT OF CAR HOUSE AND REPAIR PLANT AT BIRMINGHAM, ALA.

CAR-HOUSE DESIGN

The car house is 400 ft. long by 140 ft. wide, and contains ten tracks. The layout is what may be termed a "straight through" arrangement, that is, the building is open at both ends and all the tracks, with the exception of a short track for washing purposes, extend straight through the building, and there are track connections to the street at both front and rear.

At one end of the house, eight of the tracks pass over a concrete pit which is 160 ft. long, and serves as an inspection and working pit for cars as they come in off the line. The method of carrying the tracks across this pit area is unique, and will be described in detail in connection with the description of the repair shops. The building is divided longitudinally by a fire wall into two bays, each approximately 68 ft. wide. The accompanying plan will serve to make clear other details of the interior arrangement.

As to the structual features of the building itself, the walls are of red pressed brick and the roof is carried on two sets of truss-spans extending in each case from the center fire wall to the outer walls. The roof is flat, and is covered with composition fire and weather proofing. In addition to the numerous windows along the sides, light is secured through a system of roof monitors, which are placed crosswise in order to throw the light lengthwise of the house.

REPAIR-SHOP DESIGN

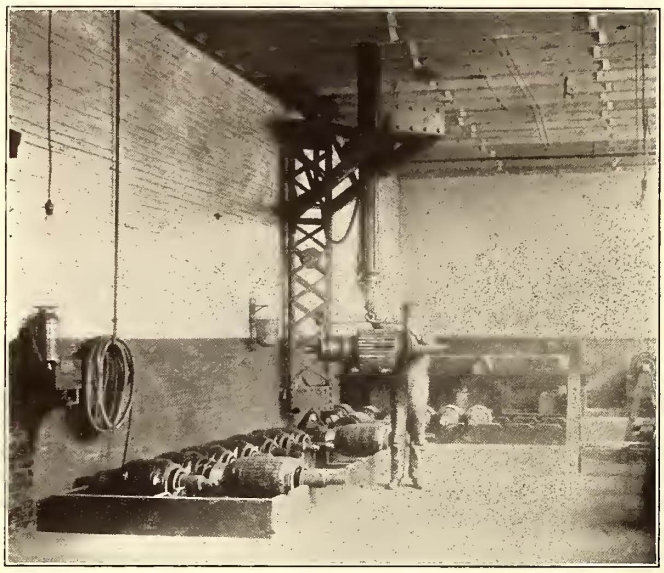
The repair shop building is similar in general construction to the car house. The roof spans, however, are supported on I-beams, which are carried by the outside walls and two rows of latticed columns through the center. This arrangement, in conjunction with the cross monitors in the roof, gives a particularly well-lighted shop.

Along one side of the shop building is a narrow two-story

REAR VIEW OF CAR HOUSE AND REPAIR SHOP AT BIRMINGHAM

CAR HOUSE AND REPAIR SHOP AT BIRMINGHAM. THE BUILDING IN THE FOREGROUND IS THE CAR HOUSE, AND THE REPAIR SHOPS ARE SHOWN IN THE BACKGROUND

annex, separated from the main shop by a fire wall and utilized on the ground floor for store-room, offices, armature room, and for cleaning, drying and paint-storage in connection with the paint-shop work.

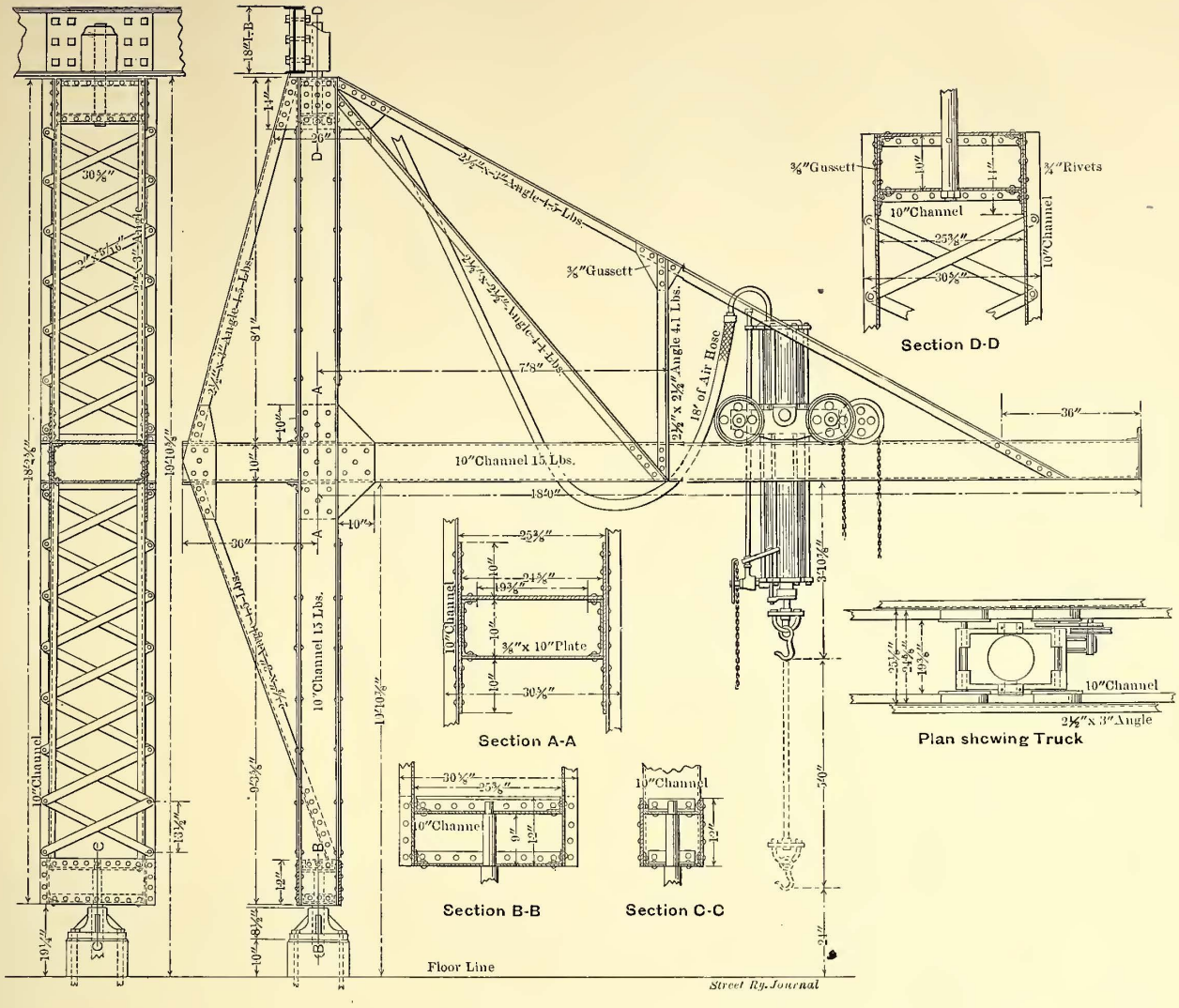


VIEW IN ARMATURE ROOM AT BIRMINGHAM SHOPS, SHOWING JIB CRANE FOR HANDLING ARMATURES

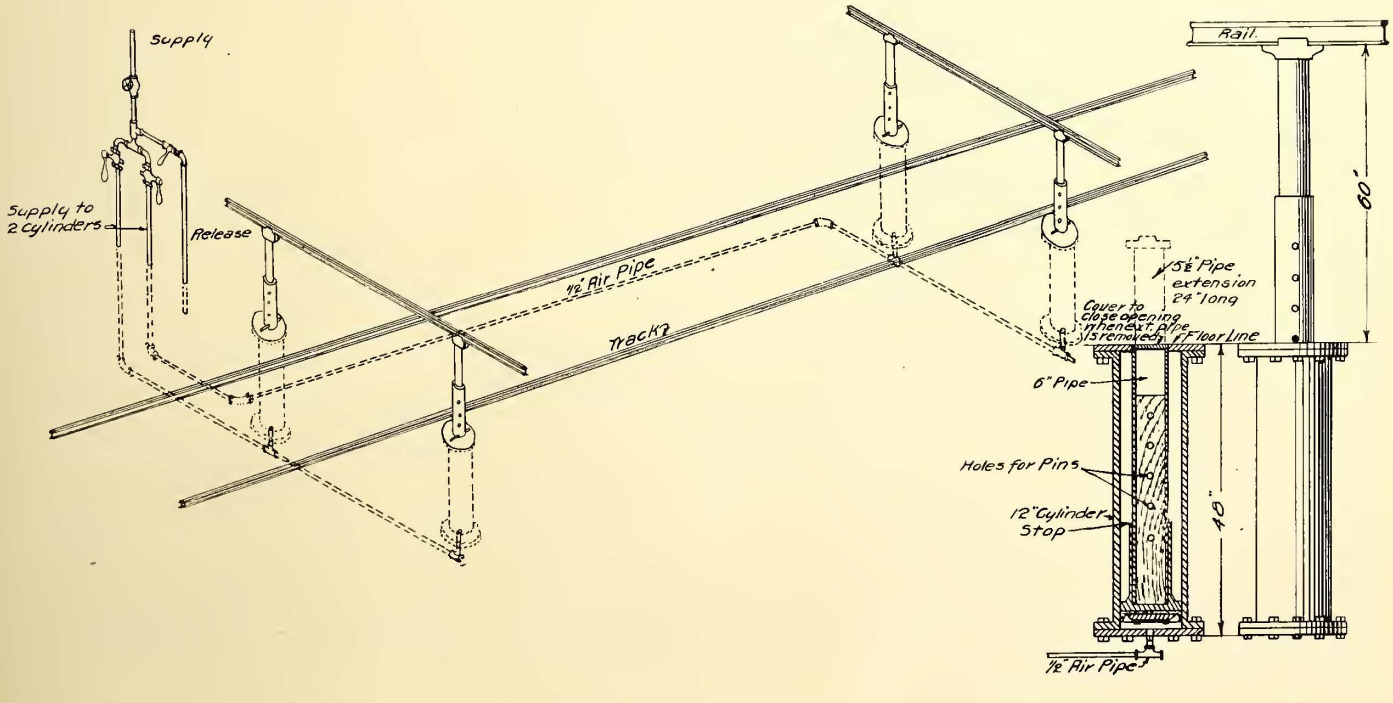
As in the case of the car house, the shop building is open at both ends and the arrangement of the tracks is on the "straight through" idea, that is, beginning at one end the shop is apportioned off to the various classes of the work in the order in which a car would naturally receive attention. First comes the blacksmith shop, then the machine shop, then the mill and carpenter shop, and at the far end the paint shop. The tools and machines for carrying on the work in each of these departments occupy floor space equal in width, approximately, to about one-half the width of the shop building, and the remaining space to the outer wall is occupied by the tracks, three of which extend straight through the building from end to end, with one extra stub track for the blacksmith and machine shops, and three extra stub tracks for the paint shop. Thus, cars can be brought directly opposite the particular department that is doing the work on them.

From this, it will be understood that the movement of cars through the shops is from one end of the building toward the other, as the work of repairs to trucks, motors, car bodies and painting progresses, but the movement of material and parts, while the work is in progress, is across the building, back and forth between tools and tracks, the layout offering every facility for handling all classes of car repair and maintenance work systematically and with maximum convenience and despatch.

A PORTION OF THE REPAIR SHOPS AT BIRMINGHAM, SHOWING METHOD OF SUPPORTING RAILS OVER PITS, AND CONVENIENT ARRANGEMENT OF JIB CRANE AND JACKS FOR EXPEDITING TRUCK AND MOTOR REPAIR WORK



DETAILS OF TYPE OF JIB CRANE USED IN REPAIR SHOPS AT BIRMINGHAM FOR VARIOUS PURPOSES



ISOMETRIC SKETCH OF AIR JACKS AT BIRMINGHAM SHOPS FOR RAISING CAR BODIES

At the machine-shop end of the building, that is to say, the section devoted to truck and motor repairs, the four tracks pass over a concrete pit, which is 170 ft. long and four tracks wide. The opening under the two tracks nearest the shop tools is planked over with removable flooring, to better accommodate certain classes of repairs, leaving the other two tracks with open pits for the removal of motors and motor parts, wheels, axles, etc.

PIT DESIGN

The method of carrying the tracks over the pit area, as already referred to, is unusual, and merits particular attention. The track rails are supported on 6-in. wrought-iron pipe stanchions, which at the bottom are screwed into cast-iron base plates resting on concrete foundations, and spaced longitudinally 7½ ft. apart. At the top, each of the stanchions has a special casting in the shape of a deep collar clamped around the pipe, the tops of the collars forming bearing plates to which are directly bolted the flanges of the track rails, which are 7-in. 80-lb. T-rails. The construction gives well-lighted, well-ventilated and unobstructed pits, there being no walls, partitions or cross-bracing to interfere with free access underneath all the tracks. The floors of the pits are concrete. The accompanying half-tone illustrations show clearly the details of the arrangement, and are commended to the attention of anyone interested in pit designing.

PIT CONVENIENCES

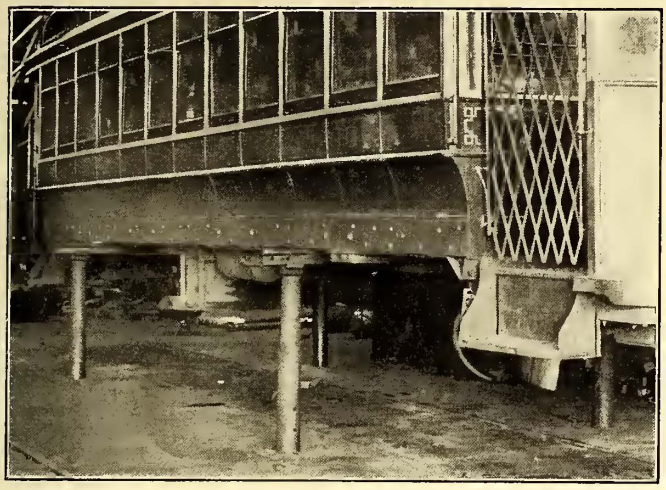
The two pit tracks that are not floored over with the removable planking, are provided with one hydraulic jack for removing armatures, two air jacks for the same purpose, and one hydraulic jack for removing wheels and axles. The hydraulic lifts are operated with hand pumps. Between the two tracks are two swinging jib cranes fitted with air hoists for picking up motor and truck parts and wheels from the floor of the pits, and swinging them across to the floor of the general shop on the higher level. This arrangement has been found exceedingly convenient, and has helped in large measure in keeping down cost of motor and truck repairs, as there is no unnecessary labor in handling material and parts. In connection with the subject of pit jacks, it may be said that the jacks designed for use with compressed air cost about $16 each, while the jacks that are operated hydraulically cost two or three times that amount. It has been the experience at Birmingham that for this particular class of work air is more easily handled than the hydraulic pumps, and if the installation was to be made over again it is probable that air lifts in the pits would be used exclusively.

Each of the two tracks that are planked over is provided with an air lift for raising car bodies free from the trucks. Each lift comprises four vertical cylinders, resting on concrete foundations. These cylinders are 4 ft. high and 10 ins. in diameter, and they are set with their tops flush with the floor. In each cylinder is a piston formed of a 6-in. cast-iron pipe. If it is desired to lift a car body higher than the total travel of the pistons, extension pieces consisting of 5-in. pipe, 2 ft. long, are adjusted to the tops of the pistons, thus giving a total lift of 5 ft. above the floor. One of the drawings shows plainly the details of this arrangement for raising cars. The object of the removable extension pieces in the top of the pistons, is to leave the car floor unobstructed when the jacks are in the lowest po-

VIEW IN REPAIR SHOPS AT BIRMINGHAM, SHOWING JIB CRANE FOR SERVING WHEELS AND AXLES TO BORING MACHINE AND WHEEL PRESS

sitions, as the extensions can then be taken off and there will be no projections above the floor level. The car body is held in the raised position by means of pins inserted in holes in the 6-in. pistons in the manner shown in the diagram.

The cylinders are connected two in series, as indicated

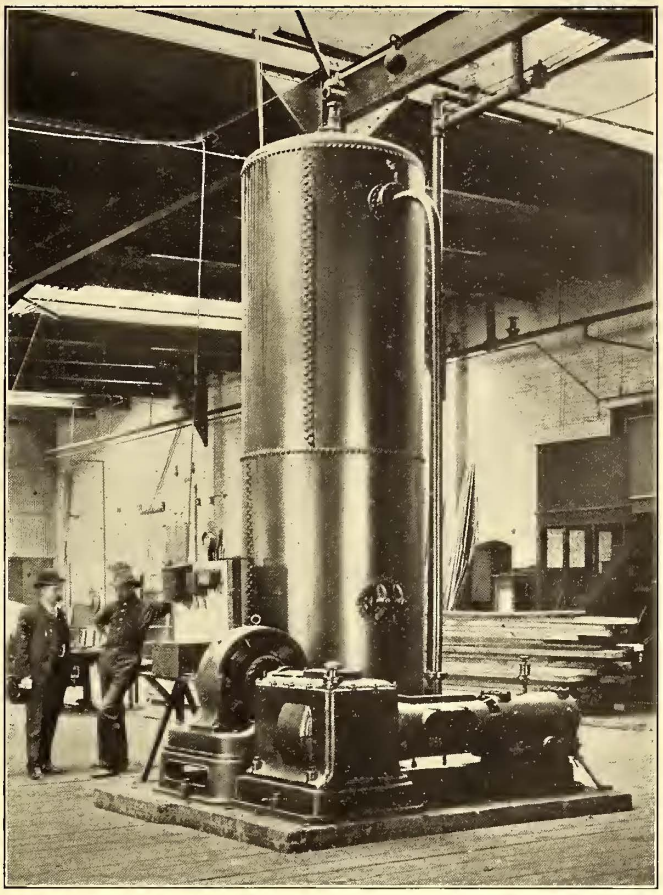


CAR-BODY ON AIR JACKS AT BIRMINGHAM SHOPS

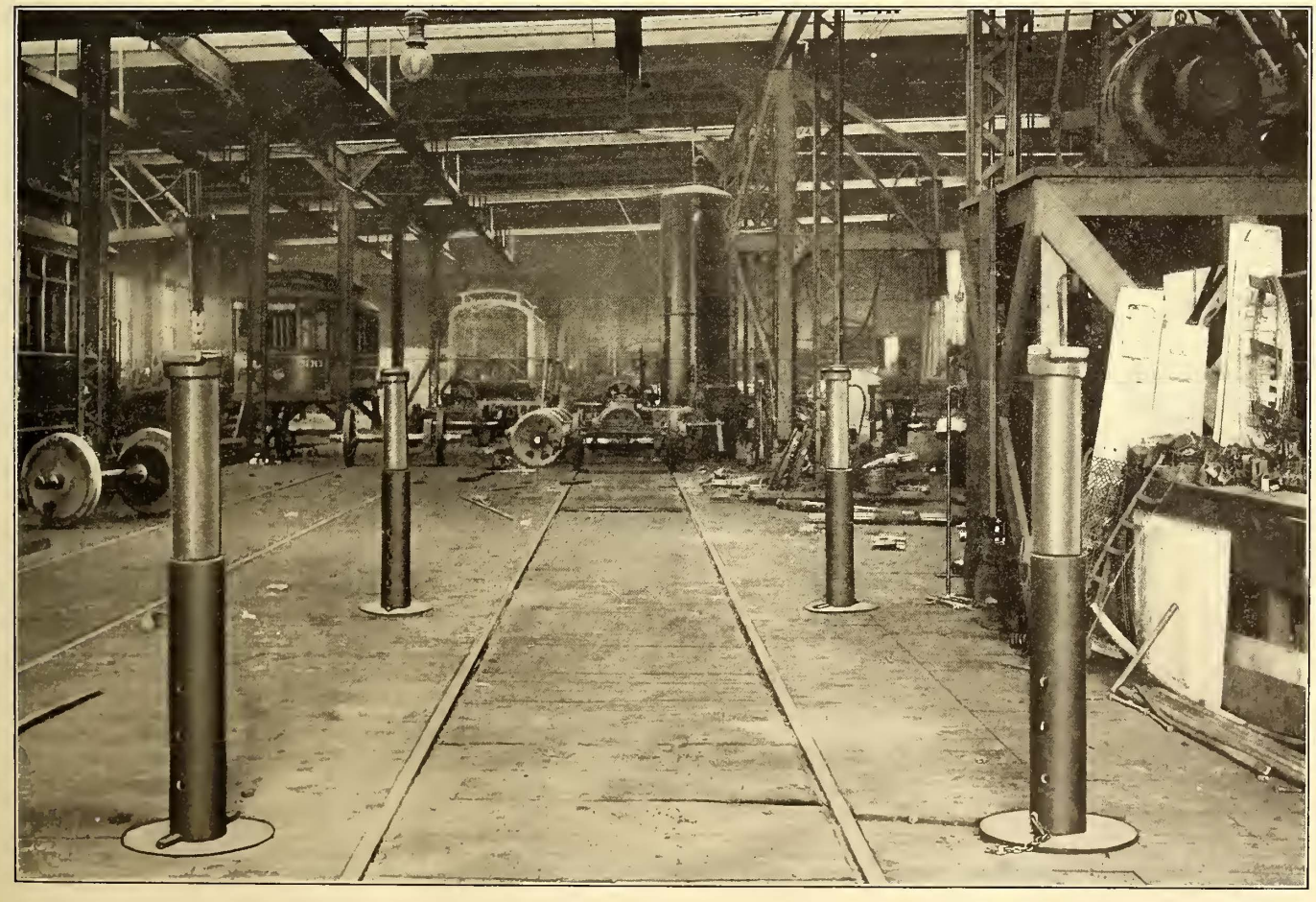
in the diagram. Air is supplied to each pair through a ¾-in. pipe, and the same pipe is used to exhaust the air when the car body is being lowered, by means of a simple arrangement of valves, which is also plainly indicated on the diagram.

COMPRESSED AIR

An important feature of these shops is the many applications to which compressed air is put throughout the plant. Air is used in pneumatic tools for riveting, drilling, boring



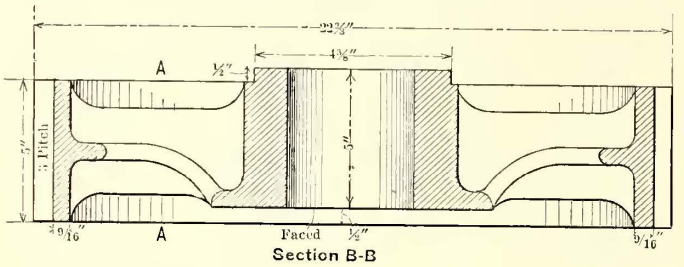
AIR-COMPRESSING PLANT AT BIRMINGHAM SHOPS

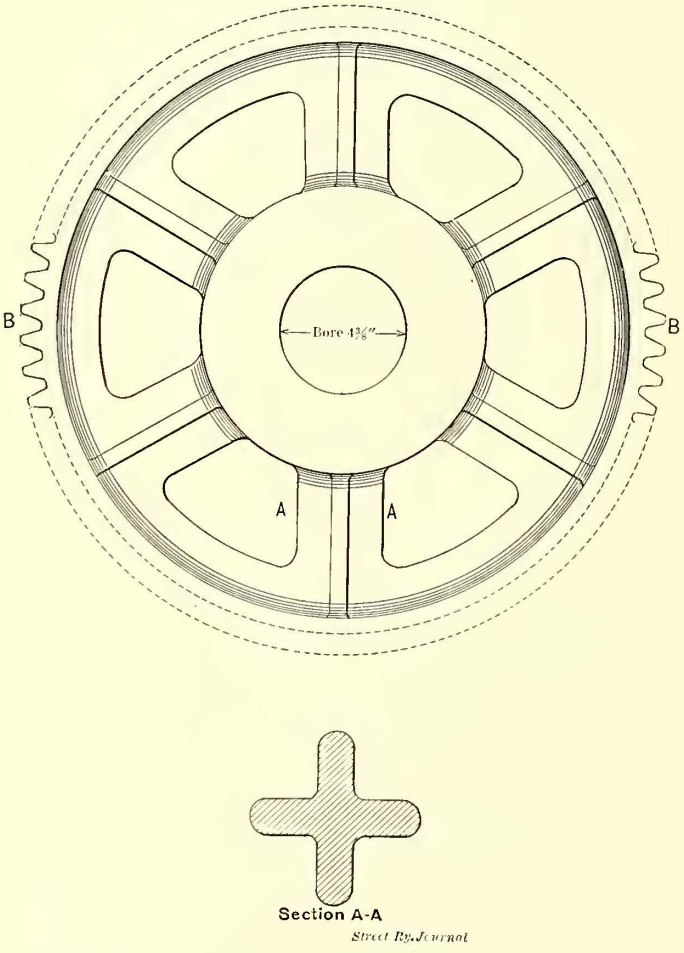


PORTION OF REPAIR SHOPS AT BIRMINGHAM, SHOWING AIR JACKS FOR RAISING CAR BODIES

and other purposes in the machine and carpenter shops; in the pits, for operating numerous cranes, car hoists, and jacks; for blowing gas furnaces and blacksmith forges, and for blowing out motors and controllers and cleaning cars.

The air is obtained from a compressing outfit, located in the center of the general shop. The plant consists of a Christensen compressor, driven by a 35-hp 500-volt motor taking current from the trolley circuit. The storage tank,





SPECIAL 66-TOOTH SOLID GEAR, USED BY BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

as will be seen from one of the engravings, consists of a vertical reservoir made of boiler plate riveted at the seams.

The reservoir is 17 ft. 6 ins. high and 5 ft. 2 ins. in diameter. A safety valve at the top protects the tank against excessive pressure. The motor is started and stopped by an automatic switch, which cuts in and out at predetermined pressures. The plant has a capacity of about 200 cu. ft. of free air per minute.

The air is utilized at about 100-lbs. pressure. The air pipes are carried underneath the flooring, and extend to all parts of the plant, along the sides of the pits, along the shop benches, into the armature room and wherever the air can be utilized. Branches from the air mains are brought up at the building columns at frequent intervals, and take-offs are provided from the pit and bench-supply pipes, so that the men by means of flexible-hose connections can obtain air at any point for any purpose. The air supply is also carried through an underground pipe to the car house, located across an intervening street, where it is available for hoisting and cleaning purposes. As a detail of experience, it may be said that no trouble has been found in transmitting air for distances up to 500 ft., and air is available at the distant ends of the supply pipes at pressure sufficient to serve all purposes.

JIB CRANES

For handling parts and material, extensive use is made in these shops of a novel pattern of jib crane designed by Ford, Bacon & Davis. There are two of these cranes for serving the repair pits, one for handling wheels to and from the boring machine and for carrying wheels and axles to the wheel press; one for serving wheels and axles to the turning lathe, and one for handling armatures in the armature room. The cranes are of different sizes suited to the particular work they are to perform, but the details of construction are the same in each case. The general design will be understood from the working drawing reproduced on page 699, which shows a crane of 5630-lbs. capacity, with 10-in. air hoist, used for handling wheels and axles.

The upright standard of the crane is a 10-in. lattice-channel girder, pivoted at the top and bottom in cast-iron bearings. The jib arm, upon which the air hoist travels, is 18 ft. long, and the crane will therefore serve the area included in a circle 36 ft. in diameter. The master mechanic is of the opinion that cranes of this kind offer the ideal way of handling material in the pits, and of carrying work to and from stationary tools.

GEARS

The Birmingham company has discarded split gears, and has adopted exclusively a solid gear designed by the master mechanic, and made by the E. W. Bliss Company, of Brooklyn, N. Y. The features of the design are the extra heavy ribbed spokes between the hub and the rim, and the shape of the hub, which has been modified to suit the special form of motor bearings used on the Birmingham cars. The gear is shown in one of the drawings herewith. It is the practice to press gears on to the axles with about 20-tons pressure.

MOTOR BEARINGS

For motor bearings, the company has adopted an extra long brass bearing the feature of which is a heavy collar, which is primarily intended to prevent grit from working into the bearings. On the gear side this collar is inside the gear case and forms a 10-in. bearing plate against the gear, the entire inner side of the gear, as will be noticed from the drawing, being faced off to a machine finish to give a good bearing surface for the face of the collar. On the wheel side, the collar on the bearing is let into the hub of the wheel sufficiently to give a tight-bearing fit, so there is no chance for dirt or grit to work into the bearing, either from the gear side or the wheel side. Moreover, the addition of the collar to the bearings has increased the life of motor bearings 20 per cent, inasmuch as the ordinary style of bearing usually wears fastest at the end that bears against the gear, and has to be discarded for this reason before the bearing itself is worn out. The collar gives a larger wearing surface at the ends, and therefore increases the life.

It will be noticed also that the bearing is 10⅝ ins. long,

which gives 1½ ins. more of wearing surface in the length. The material used is a good bronze gun metal. Oil is employed for lubrication and is fed through an oil cup, which is a modification of the Galena cup. The bearings, as described, cost about $5.50 each, and from the shop records it appears that several sets have been in constant service for 10 months, and have made 50,000 miles without showing signs of excessive wear. It is expected that they will run at least 100,000 miles before they have to be replaced.

WHEEL PRACTICE

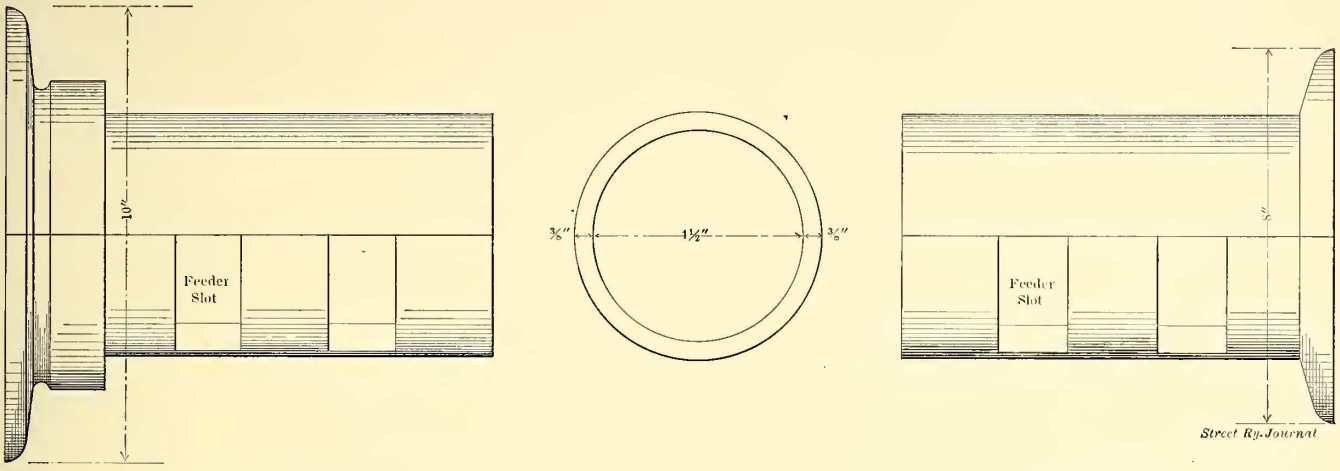
The company is using cast-iron wheels for city service, but in an experimental way is trying steel wheels on interurban cars. At present, 40 pairs of Taylor wheels are in use. These have been running a little less than a year, and thus far have averaged something over 30,000 miles. The wheels at this writing are just beginning to come in for their first turnings, and the indication is that the lot will average 50,000 miles before the first turning will be necessary.

No special provision has yet been made for doing the turning work, but such of the wheels as have required it have been turned in an ordinary 40-in. lathe at a cost of approximately $2 per pair for the actual machine work. This cost can be reduced when better facilities for doing the work have been provided. The figure given does not include the cost of removing and replacing wheels under cars, and the master mechanic points out that the cost of doing this work should not be charged as an additional cost against the steel wheels, providing they make the same or greater mileage between turnings as cast-iron wheels, for the cost of replacing either would be the same.

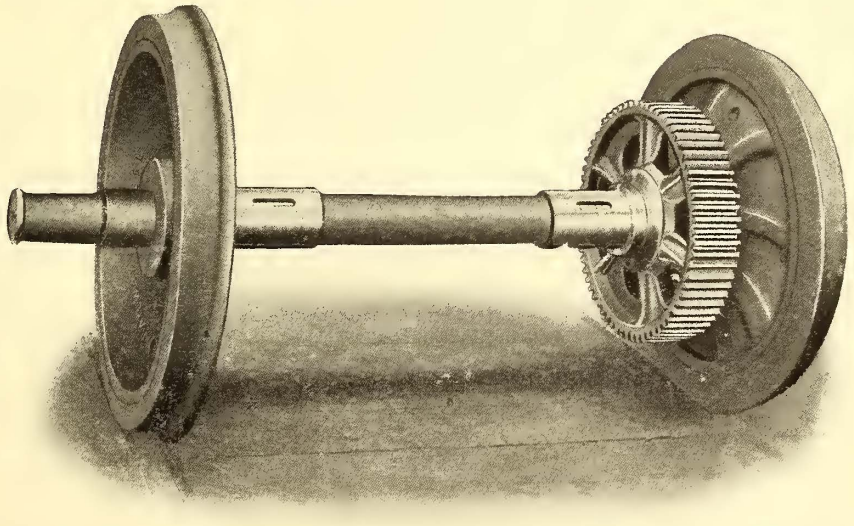
Both cast-iron and steel wheels are pressed on and off axles in a hydraulic press, at about 35 or 40 tons pressure. To avoid breaking wheels when they are being pressed on and off, it is the practice to use a heavy steel ring of sufficient diameter to pass over the gear. This ring presses upon the wheel just inside the rim, and distributes the pressure equally to all the spokes or, in case of a plate wheel, distributes the pressure evenly over a considerable area. The use of this ring has entirely eliminated the breaking of wheels in the pressing off process, and is believed to be an improvement over the more common method of inserting steel bars through the spokes of the gear, as the bars concentrate the whole load at two points on the wheel and, if a wheel happens to fit a little tighter than usual on the axle, it is almost impossible to drive it off without breaking.

COST OF ARMATURE COILS

All the armature and field coils required on the system, are made at these shops. The master mechanic states as his opinion that a railway company can make its own coils at less cost than it can buy them, provided it has sufficient work to warrant a well-equipped coil department, and a well-organized winding force. At these shops, for instance, a set of coils for GE-57 motor that formerly cost $27, is now produced for $24. The coil room has taping machines, pneumatic presses for pressing coils, electrically heated oven and other modern labor-saving devices for doing this work at minimum cost.



SPECIAL MOTOR BEARING USED BY BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

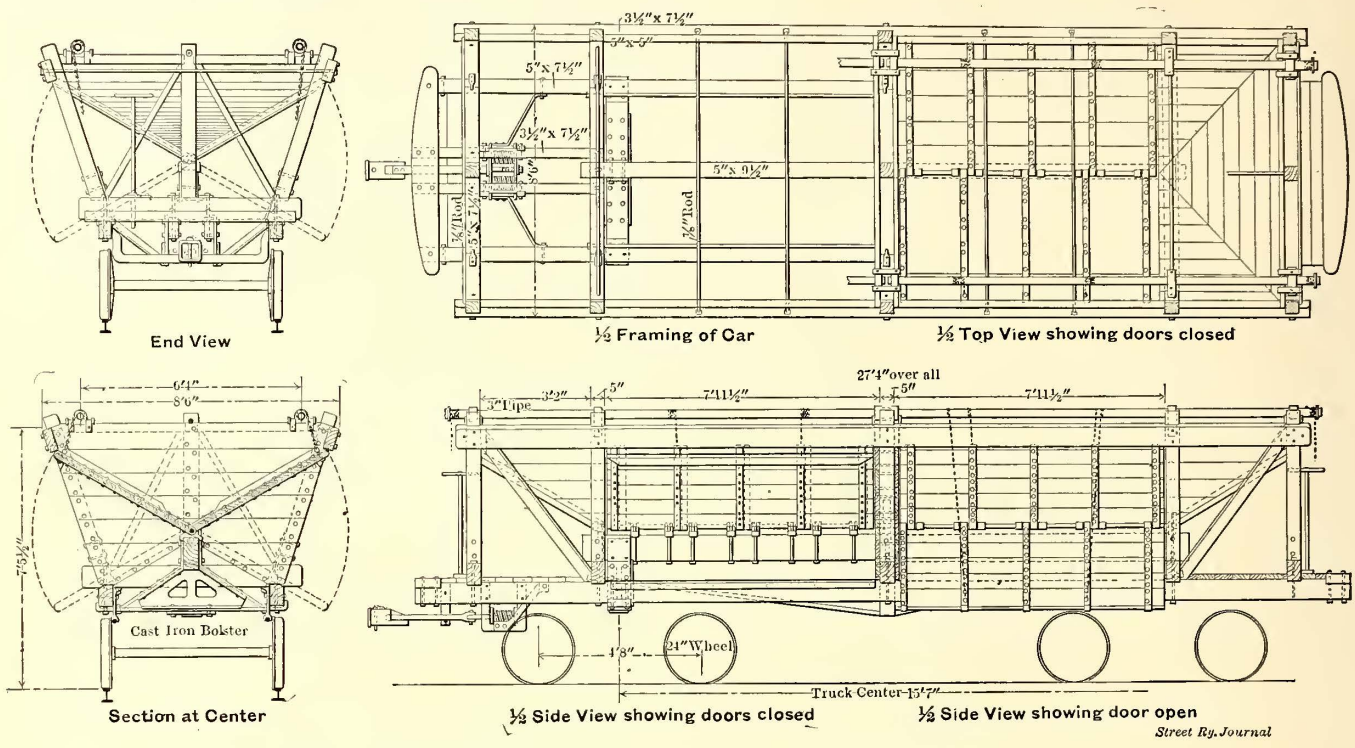


STANDARD WHEEL, AXLE, AND GEAR, AND SPECIAL MOTOR AXLE BEARING WITH COLLAR USED AT BIRMINGHAM

BALLAST DUMP CAR

There has recently been built at these shops a dump car for hauling sand, slag-ballast, and similar material. As will be understood from the accompanying half-tone engraving and drawing, the car is 27 ft. 4 ins. over all, and

is built with two separate compartments, thereby giving facilities for dumping either one-half the load or the entire load at any one place. Each compartment or hopper is V-shape, the two sides consisting of wooden doors lined with steel plate. The two doors are hinged at the bottom to a common horizontal rod, and are normally held in the raised position by chains which are wound upon shafts formed of 3-in. double-strength wrought-iron pipe. The doors are let down or raised by rotating these shafts by means of hand cranks at the ends. Each compartment has capacity for 6 cu. yds. of material.



BALLAST CAR BUILT AT SHOPS OF BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY

CAR EQUIPMENT

The company owns 214 cars, including motor cars and trailers. The electrical equipment includes a total of 430 motors, of which 100 are of the GE 1000 type, 60 are the GE 67 type and 270 are GE 57's. The standards in rolling stock adopted by the company were described in the STREET RAILWAY JOURNAL for March 24, 1906.

The longest continuous trip in one direction over electric roads, was made several weeks ago by two cars which were purchased by the Canton-Akron Company from a road at Wabash, Ind., to replace some cars which were destroyed by fire some time ago. The cars were shipped by their own power over electric lines from Wabash to Canton by way of Fort Wayne, Lima, Toledo, Cleveland and Akron, in all about 400 miles.

TWO-COMPARTMENT BALLAST CAR USED AT BIRMINGHAM

BUILDING CARS

The management is favoring the policy of building its cars at its own shops. During the past year, four new trail cars were turned out from this plant, and preparations are under way for building eighteen new motor cars.

INTEGRATING WATTMETERS ON THE CARS OF THE CLINTON STREET RAILWAY

It is usually conceded that integrating wattmeters, if placed on cars and read at frequent intervals, would be the means of detecting undue consumption of current by individual motormen, defective apparatus, tight brakes and other irregularities which cause increased current consumption. However, lack of actual data from systems where meters have been installed on the original cost and the maintenance of the meters has done much to retard their general adoption.

General Manager R. M. Howard, of the Clinton Street Railway, Clinton, Ia., has all of his cars, with the exception of a line car, equipped with meters, and the general results obtained are very interesting. In short, the consumption of power has been reduced 20 per cent. Trouble with the electrical equipment and its maintenance has also been reduced. Very little difficulty has been experienced in keeping the meters in order. The latter are of the Thomson type, and are placed overhead in the vestibules of the cars. The motormen take all the readings, which are obtained when the men begin their run and when the car is turned in or given to another motorman. To facilitate reading, each motorman is supplied with a small pad of blanks of the form illustrated. The motorman enters the actual readings of the dial and makes the subtraction. He also enters the length of his run in hours. These slips are turned in each day and the readings are transferred to two books, one a "car power record," the other a "motorman's power" record. After entering the readings the constant of the meter is taken into consideration, and the total consumption in watts is computed.

MOTORMEN'S POWER RECORD. 411

NAME.....

DATE		FROM	TO	METER READING From	METER READING To	Constant	Total Hours	Total Current Used	REMARKS
		M	M						
		M	M						
		M	M						
		M	M						
		M	M						
		M	M						

MOTORMEN'S RECORD OF METER READINGS

The power records contain space for remarks, and under this heading is usually entered the condition of the weather, as this has quite a bearing on the current consumption. The use of two books enables any excess of current by either a motorman or a car, to be caught at once.

At the end of each week the total consumption of each motorman for the week is divided by the total hours of operation of the cars by the motorman, and the result, which is in watts per car hour, is posted on a bulletin board in the trainmen's room.

Merits are given for the least consumption, and, besides, there has arisen a spirit of rivalry among the men—with the result that each tries to keep his record the lowest. Attempts to keep the record lowest causes each man to accelerate slowly and to coast as much as the schedule will permit. As all the cars on the same run consume about the same amount of current, the motormen know what the consumption should be, and any excess is at once reported, and the car is examined.

On the main line, with a single-truck car, weighing 12 tons, driven by two GE-67 motors, and operated on a schedule of 8.56 miles per hour, the average consumption is 10 kw-hours per car-hour. At the present time, under ordinary conditions, the readings of the different men on this line vary in amount from 9.5 kwh to 11 kwh per car-hour. The economy from the use of meters is well shown by the reduction in consumption by the different motormen since the meter system was put into operation. When the meters were first installed the consumption of different men varied from 10 kwh to 15 kwh per car-hour. Had the meters never been installed the inefficient men would, no doubt, have continued to use 50 per cent more current than was necessary. However, the excessive consumption of these directed attention to their methods of operating the car, with the result that, in a few weeks, they were enabled to reduce the current used.

The system is also of value in training new men. When first put on a car these men used about 14 kwh per car-hour. After a period of two weeks the consumption drops to 12 kwh, and remains at this figure for about three weeks, when it drops down to about 10 kwh, which is the average amount. Tight brakes and defective electrical apparatus are shown at once by high readings of the meter. Tight brakes will frequently cause a 50 per cent increase in the readings of the meter. As it is to the motorman's interest to keep the consumption down, he returns his car to the car house for inspection at the first opportunity after discovering any increase in current consumption. The meter readings are also utilized to obtain the line and track losses. At intervals of one or two months, the total of the readings of the meters on all of the cars is compared with the readings of the station wattmeter, and the line losses are at once apparent.

As a consequence of the better handling of the cars, induced by the use of the meters, the maintenance expenses of the electrical equipment of the cars is much lower than it was before the installation of the meters. A grounded or defective armature is of rare occurence. The life of brake-shoes has been increased considerably. At the present time a shoe lasts about six months. Dupont shoes, with an original weight of 28 lbs., are employed, and they are worn down to about 10 lbs. before being discarded.

MOTORMAN'S DAILY POWER STATEMENT. CAR NO. 27

NAME J. Wilson DATE 4/15 1906

TIME 5½ hrs. Meter Reading Constant 2

FROM		TO		FROM	TO	AMOUNT USED.
A. M.	P. M.	A. M.	P. M.			
5 50		11 20		.0436	.0726	290

STATEMENT OF POWER CONSUMPTION

Since installation the maintenance cost of the meters has been approximately $3 per year per car. Practically the only attention given them is that of renewing jewels and of polishing the commutators. In the last two years but one meter has been injured by lightning.

Mr. Howard believes the use of wattmeters has a good effect on the discipline of the employees in general. They feel that in the operation of the road every little detail is being given attention, that the operation of the road is better systematized, and that their own conduct and actions are being watched closely.

The Swedish Government has introduced a bill in Parliament authorizing a grant for the purchase of waterfalls belonging to private persons with a view to utilizing them for supplying power for the proposed electric State railways. It is further proposed to expend a sum not exceeding 5,000,000 kroner ($1,350,000) to purchase waterfalls which may be considered necessary for working the railways in the immediate future and the purchase of which cannot be delayed without detriment to the State.

THE FREMANTLE (AUSTRALIA) MUNICIPAL TRAMWAYS

Fremantle is one of the most important ports of Australia, and is situated in the southwestern part of the State of West Australia. It is here that the mail boats from England or

POWER HOUSE OF THE FREMANTLE MUNICIPAL TRAMWAYS

the Continent of Europe first call on their way to the main eastern commonwealth ports.

The road is owned by the municipality and is controlled by a board of five members, called the Fremantle Municipal Tramways & Electric Lighting Board. The members are elected on a separate franchise, as follows: One each in Fremantle and East Fremantle by freehold property owners, and one each in both municipalities by occupiers of property, making four in number. The Mayor of Fremantle is, ex-officio, the fifth member. The control of the trams and lighting is, therefore, taken away from the councils, and handed to a board constituted for the management alone. This is the first and only municipal tramway in Australia, the others being either State owned, as in New South Wales, or privately owned, as in the remainder of the States. Municipal lighting, on the other hand, is quite customary in Australia.

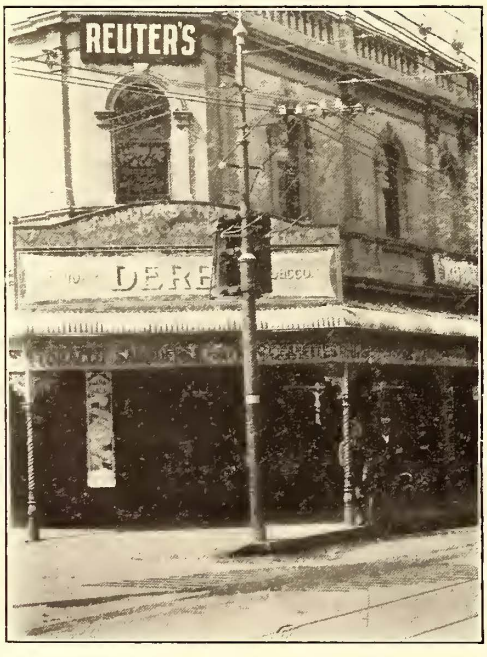
The tramways and lighting system not only serves Fremantle proper, which has a population of about 23,000, but also the suburb East Fremantle, with a population of 4000. The latter furnished one-seventh of the capital, while Fremantle proper furnished the remainder. The road was opened Oct. 30 of last year. Previous to this time cabs were the only means of transit and gas the only method of lighting.

The contract for the construction of the entire system was secured by the firm of Noyes Brothers on a commission basis, for which they were to find the capital, design, buy the necessary material, supervise and control the construction on behalf of the Tramway Board. The necessary powers for borrowing up to £100,000 by the municipalities on debenture stock was incorporated in the act incorporating the Board. The work is now successfully completed, and although the contract time does not elapse for two months more, some sections have been working since October last.

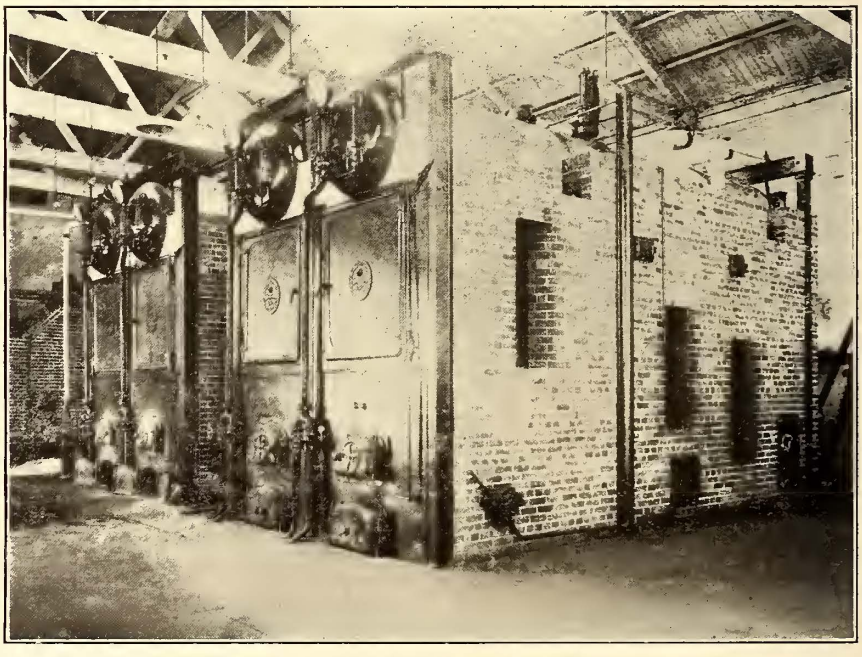
POWER HOUSE

The power house is a substantial brick building, located at the South Mole, on the edge of the harbor, and alongside the railway. At one end of the building is located a small iron building, in which the battery is housed. The main building is divided by a brick wall into an engine room, 87 ft. long by 34 ft. wide, and a boiler room, 87 ft. long by 45 ft. wide; the engine room floor is some 6 ft. higher than the boiler room, which allows for the carrying of exhaust pipes, and also connecting cables underneath the main floor.

The boiler room has installed in it at present four boilers, in two batteries of two boilers each, and additional room for two more boilers of the same capacity. The boilers are of the Babcock & Wilcox manufacture, each having a heating surface of 1426 sq. ft., and grate area of 28 sq. ft. They are designed for 160-lbs. working pressure, and up to 150 degs. superheat. Each boiler has a water drum, 3 ft. 6 ins. in diameter, and 24 ft. long, and nine rows of 4-in. Mannessmann cold drawn steel tubes, the superheater of mild steel tubes is located underneath the rear part of the water drums, as is the usual practice with this type of boiler. The two feed pumps are Worthington duplex, having steam cylinder, 6 ins.



50-KW TRANSFORMER PLACED ON A TRAMWAY POLE IN FREMANTLE



BOILER ROOM IN FREMANTLE MUNICIPAL TRAMWAYS POWER HOUSE

in diameter, water cylinder 3½ ins. in diameter, with 6-in. stroke; they are of the usual standard brass-fitted pattern of this maker.

A Guttmann water softener, having a capacity of 300 gallons per hour, is located in the boiler room. Exhaust steam from the feed pump is utilized to heat the water in the water softener for precipitating the impurities, soda ash being used as the reducing agent; this was essential on account of the very hard nature of the local water. In the main flue is located a Green economizer, divided in two sections of 96 tubes each, arranged in eight rows of 12 tubes, each being 9 ft. long by 4½ ins. in diameter. The scrapers are driven by a 2-hp motor geared down, and located on top of the economizer chamber.

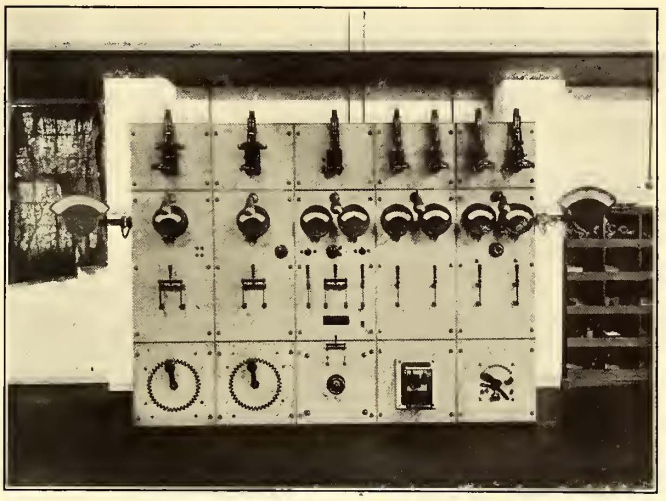
The condenser system consists of a Worthington surface condenser, 12 ft. long by 2 ft. 7 ins. wide, by 4 ft. 8 ins. high. The area of the cooling surface is 1400 sq. ft. The air pump, by the same maker, is vertical, three-throw, single acting, and is driven by a 500-volt Westinghouse shunt-wound variable-speed motor. The circulating pump in this case is of the centrifugal type, driven likewise by a 500-volt shunt-wound variable-speed motor. The piping for the inlet and discharge of the circulating pump is carried in a brick tunnel under the buildings directly to the sea. This latter construction permits of the suction pipes being readily inspected, and also eliminated a long discharge pipe, besides allowing for a handy drain from the boiler room.

The generators are four in number, two being d. c. machines for the tramways, and two a. c. machines for lighting, each being direct connected to English high-speed engines. The d. c. generators are each 150 kw, 550 volts, 430 r. p. m., compound wound; while the a. c. generators are each 150 kw, 2200 volts, two-phase, 50 cycles, 428 r. p. m. The exciters are mounted directly on an extension of the main bed plate with their armatures mounted on the main shaft. These generators have revolving fields and stationary armatures, and

ENGINE ROOM IN POWER HOUSE OF THE FREMANTLE MUNICIPAL TRAMWAYS

were manufactured by the British Westinghouse Electrical & Manufacturing Company. The four engines driving these generators are all similar, with the exception of the slight difference of speed. They are of the Belliss & Morcom high-speed vertical compound type, taking steam at 150 lbs. pressure, with 100 degs F. superheat, and running with a 24-in. vacuum. They are guaranteed to give 265 bhp, with a consumption not exceeding 22 lbs. steam per kw at full load; and at half load 23.4 lbs. They have a central valve, are entirely enclosed, having forced lubrication; an enclosed governor on the end of the engine shaft, which works directly by a series of levers on the inlet valve, provides close and sufficient regulation. The engines have given splendid satisfaction during their operation, and are very economical in all-day service.

The d. c. switchboard consists altogether of five panels of the best Italian marble, arranged as follows: Two generator panels, on each of which is mounted one two-pole circuit



THE DIRECT-CURRENT SWITCHBOARD

breaker, one ammeter, one lamp, one main two-pole switch and rheostat on the bottom panel, one battery panel, having circuit breaker, one differential ammeter, and one differential voltmeter, also the necessary main switches for putting the battery either to the feeders or cutting it out entirely. The two feeder panels have been arranged for supplying two feeders on each panel with the usual meters and switches. The board is also fitted with a main voltmeter, ammeter, and Thomson recording wattmeter.

The a. c. switchboard is entirely separate from the d. c. board, and consists of six panels of the best Italian marble. There are two generator panels, with oil-break switches. Each panel has two ammeters, and recording and integrating wattmeters, with the usual ground detector. In front of each panel are pedestals on which are mounted the field switches and the handles which control the resistances in the fields of the exciter and main generators. Three of the feeder panels are the same, with the exception of the Stillwell regulators; each feeder panel is arranged with two single-phase, double-throw oil-break switches and an ammeter in each phase. There are four Stillwell regulators on the board for controlling the same number of single-phase feeder circuits. The arc panel is fitted up for one series a. c. arc circuit with a double-throw oil switch and ammeter; there are also three plug switches for short circuiting or opening the secondary of the balanced regulating arc transformer, which is located in the basement. Both the boards have a very neat appearance, and add materially to the beauty of the engine room. This switchboard was made by the generator builder.

An automatic reversible booster set has been installed for charging the battery of 265 Tudor cells. The booster consists of a 500-volt shunt-wound motor, with its armature pressed on the same shaft as that which carries the armatures of the

booster and exciter. The booster is of the differential multipolar type, with a capacity of 150 amps. at 150 volts. The exciter furnishes the current for the shunt fields of the booster and carries the main current in its series-field winding, while its shunt is separately excited. The battery consists of 265 cells of the German Tudor type, as manufactured by the Accumulatorenfabrik Aktiengesellschaft. The battery has a capacity of 296 amps. at the one-hour rating, and a charging

BATTERY ROOM OF THE FREMANTLE TRAMWAYS SYSTEM

rate of 144 amps. Each cell has eight positive and nine negative plates. The battery is laid out in six rows of cells, two rows being placed back to back.

THE PERMANENT WAY

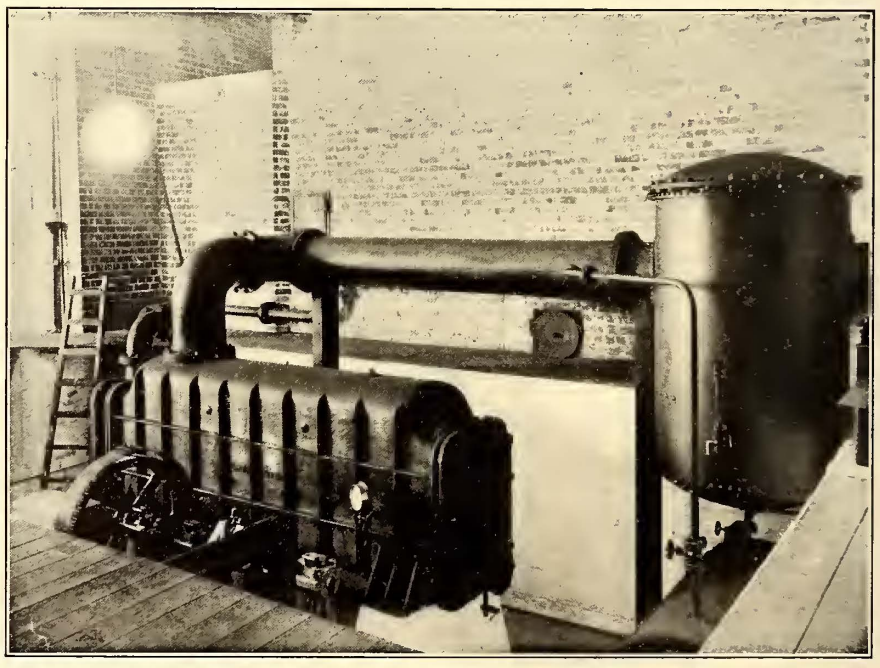
The total length of permanent way laid consists of 7.1875 miles of single-track lines, that is, running track in macadamized road 6.1 miles; running track in wood blocking, .37 mile; and sidings, passing stations, car house, etc., .71 mile. The gage is 3 ft. 6 ins., this being exclusively the practice in this State, both for the State Railways, and also with the tramways at Perth and Kalgoorlie. There are four different routes, with a loop in the central part of the city. The construction is single track throughout, with passing stations suitably placed. The lengths of the routes, from the center of the city, are as follows: East Fremantle, 1.80 miles; South Fremantle, 1.48 miles; Marmion Street, 1.24 miles; Beaconsfield, 1.61 miles. This latter route runs .41 mile over the Marion Street route; central portion of city, .78 mile. On all these routes the tracks are placed on one side of the roadway in such a manner that when duplicated, if required, the track will be central, with the exception of High Street and Market Street, which are too narrow for double track. The rails are 92 lbs. per yard, 6½ ins. deep, of the grooved-girder type, with 6½-in. base for the straight track, and 95 lbs. per yard, of the same type, for curves.

The type of construction of the permanent way of the macadamized roads was carried out on the usual lines. The street was excavated to a depth of 15 ins., and Jarrah (Westralian hardwood) ties, 6 ft. 6 ins. long x 9 ins. wide, by 4½ ins. deep, were spaced 2 ft. 6 ins. apart on a 4-in. bed of 2-in. ballast. This ballast is what is called locally "Capstone," or weather hardened surface sand stone. It is very hard and has proved to make a splendid road bed. Blue stone would have cost double the amount, without bettering the class of construction to any marked extent.

Each rail joint is bonded with two No. 0000 B. & S. Chicago bonds, 3 ft. long, and every other rail is cross bonded with No. 00 B. & S. tinned cross bonds, applied to the rails by the Brown plastic alloy method, with bolted heads. All special work is well bonded, and special long bonds carried around the work. The fish plates are 2 ft. 7 ins. long, of mild steel, and secured by six 1-in. bolts, with spring washers, the five tie rods for each 40-ft. rail of the macadamized road are of mild steel, ¾ in. in diameter, and threaded for 5 ins. on each end. The tie rods in the wood-block construction are flat, with the exception of the ends.

After the rails, sleepers, bonds, etc., had been placed in position and the capstone ballast filled in to a couple of inches above the rails, the whole was rolled by an 18-ton roller, and is afterward packed under the head and guard of rails. This top was then sprinkled with tar and covered with 2 ins. to 2½ ins. of tarred ¾-in. ironite, which is broken slag that has been slowly cooled. On top of this was placed a small amount of tarred screenings, then dusted and again rolled with the steam roller. The result has been a remarkably good road, at a minimum amount of cost for this country.

Part of High and Cliff Streets was paved with wood blocks previous to the putting down of the tram tracks, and the wood blocks were but 6 ins. deep, resting on a concrete bed, 8 ins. thick. The rails being 6½ ins. deep, it was necessary on removing the blocks for putting down the rails to chip a groove in the concrete, from 1 in. to 1½ ins. deep, for laying the rails and allowing for a fresh bedding of concrete. These were anchored at every joint by an inverted piece of old tram rail, being bolted to each rail and buried in the concrete. On curves and special work the anchors took the form of ties of the standard type, being buried in the bed with the rail secured to them by screws. The special work was also made by the Lorain Steel Company, and was fitted up and marked at the works before being sent out.

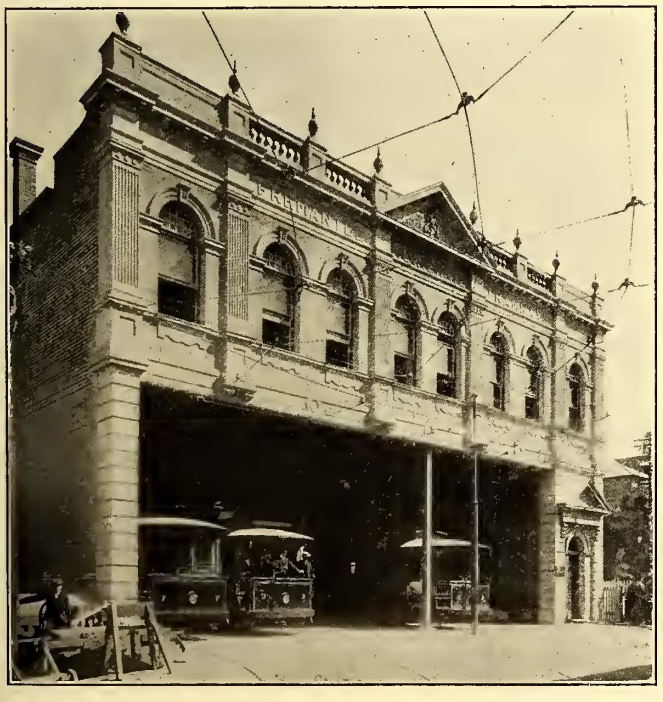


CONDENSER PIT, SHOWING SURFACE CONDENSER, AND ECONOMIZER IN THE BACKGROUND

OVERHEAD CONSTRUCTION

For the central part of the city about a mile of Mannessmann steel span and anchor poles was put in. The poles are 28 ft. long, 7 ins. external diameter at base, and 3 ins. at the top for the former, and 29 ft. long, 8 ins. external diameter at base, and 3¾ ins. at the top for the latter. These poles are of weldless tubular steel, and have three different reductions in diameter for each pole, with ornamental collars, caps, etc. Some of the tramway poles also carry wires and arc lamps for the lighting, and where this occurs the poles are slightly larger, with the necessary arms for carrying the cables and lamps. The wooden span and anchor poles are Jarrah wood, 29 ft. long, and 10 ins. base, by 7 ins. top for the span poles, and for the anchor, 29 ft. long, by 12 ins. in diameter at base, and 9 ins. diameter at top. They were all adzed and trimmed up, and an ornamental cast-iron cap placed on top, which not only improves their appearance but also protects the pole from splitting, an inherent defect of Jarrah when exposed to weather. All the poles are put in the ground to a depth of 6 ft., concrete being used with the steel and wooden anchor poles.

The trolley wire is No. 000 B. & S. gage hard drawn circular copper wire. The span wire is galvanized steel, composed of seven strands No. 11 B. W. G. wire. The trolley wire is put up in duplicate throughout, the distance between the two wires being 6 ins. It is required by the local post office officials that guard wires shall be placed over all trolley wires where there are any telephone or telegraph wires. These merely consist of two No. 10 B. & S. galvanized wires, carried about 18 ins. above the trolley wire, and separated from each other by about 2 ft. They are insulated from ground by small button insulators, being interposed between main guard wires and the poles. The feeders are four in number



CAR HOUSE AND GENERAL OFFICES OF THE FREMANTLE MUNICIPAL TRAMWAYS

and are carried underground from the power house to the car house, where they are brought up the poles and to their various feeding points by aerial cables.

CAR HOUSE AND ROLLING STOCK

The car house, which is located on High Street, is a substantial two-story brick building, having a frontage on the street of 70 ft. and a depth of 151 ft. The ground floor is entirely used for the storage of cars, rooms for motormen and conductors, store, receiving office, and machine shop. There are five tracks carried into the shed, one only runs a third of the length of the building, the others being extended practically the full length of the building. The floors are made of

HALF-CLOSED, HALF-OPEN TYPE CAR USED IN FREMANTLE

granolithic, and suitable brick pits for inspecting and repairs have been constructed. The first floor contains the board's, manager's, and general offices.

The rolling stock consists of fourteen Brill combination type cars, which differ from the standard California type, inasmuch as a partition between the motorman's platform and the open compartment is placed so that there is no passenger seat on the motorman's platform. This has proved most convenient, as it keeps the passengers away from the motorman. The closed compartment of the car is 11 ft. 6 ins. over the end panels, and is attractively finished in cherry, stained mahogany, and highly polished. The ceilings are of decorated bird's-eye maple. The cars are 28 ft. 4 ins. over the crown pieces, and 8 ft. 5 ins. from end panels of closed compartment over crown pieces. The width over sills is 7 ft. 9½ ins. in the closed compartment, and 6 ft. 11¾ ins. in the open compartment. The width over the posts is 8 ft. 4 ins. in the closed and 7 ft. 10 ins. in the open sections. Thirty-six passengers may be comfortably seated. The long dropped platforms are supported without strain to the body by angle irons, with the upper flange under the sills of the body and offset prolonged to carry the platform, a cantilever arrangement, which adds greatly to the strength of the car. A detailed description of this type was published on page 844 of the May 6, 1905, issue of the STREET RAILWAY JOURNAL.

Each car is equipped with two British Westinghouse No. 80 motors, having a continuous capacity of 34 amps. at 300 volts, temperature not to exceed under these conditions 75 degrees C. The controllers are by the same maker, type No. 210. They are also arranged for the control of the magnetic brakes, which have been installed on each car. The controller is large and has ample capacity for the work. The magnetic brakes are of the Newell track type, taking current from the motors when braking, and the solenoids also control the wheel brakes by a series of levers. They have been so successful that the State Public Works Department has not required the Tramway Board to place fenders on their cars, as the other two companies in this State have to do. These cars are without doubt the finest in Australia, as the design is extremely suitable for the Australian climate. The weather, even in the winter, is not cold, and in the summer the cars should be as open as possible, but protection from the dust is also required. The side curtains of these cars, however, quite meet the case, and the general public opinion

is that they could not be better for the local conditions. Smoking is allowed in either end of the open compartment, but not in the closed compartment of any car.

The sprinkler car is the standard Brill type, with double-head sprinklers at both ends. The capacity is 2500 gallons.

TRAMWAY FARES AND TICKETS

The fares on the tramways are as follows: 3d. (6 cents) cash is charged from any part of the city to the termini of any line, but twelve tickets for the same journey are sold for 2½ shillings (60 cents), and can be obtained from any conductor; workman's tickets are sold for 3d. cash each, and are good for return, but may be used only during certain hours; school children, between the ages of 12 years and 20 years, 3d. cash with return, good only during certain hours; children between the ages of 3 years and 12 years, on any line, 1d. cash; on what is called the city loop, from the Town Hall on High Street, and the City Markets on South Terrace, to termini in the business part of the city, 1d. cash. Specimens of several tickets are reproduced in the accompanying cuts. Transfers are issued at all connecting lines.

GROUPS OF DIFFERENT FORMS OF FARE TICKETS AND TRANSFER USED ON THE FREMANTLE TRAMWAYS

The method of collecting fares is based on the check-ticket system. Every passenger has a check given him in exchange for his fare. These are different in color and marking for each different fare collected, and the checks are supposed to be destroyed by the passenger on leaving the car. With good inspection and checking the method works most satisfactorily, and seems the most approved scheme of collecting fares in Australia.

The check for transfer is issued by the conductor on receipt of duly punched transfer from some other line. The transfer itself is somewhat different from the ordinary transfer, inasmuch as the date is not stamped, but a place allowed for punching the same. The transfer points being very few, and the number transferred not being very large, it was a saving in time and labor not to have them dated.

For motormen and conductors, the "On Service" ticket shown is issued to them weekly, the number being the number of trips they will have to make into the car house to take shift. On making trips with these tickets they are given a check on the car called an "On Service" check. This latter method is followed for the reason that every passenger in the car must have a check ticket when the inspector goes through for the purpose of inspecting the different tickets.

With the exception of the adult tickets, the samples of tickets reproduced are only temporary ones. The workman's and school tickets will be blocked similar to the adult ticket.

The tramways and lighting systems have now been in operation for some months, and the engineers, Noyes Brothers, are about to turn the undertaking over to the Tramway Board, after having demonstrated the entire success of the whole scheme. The engineer at present in charge of the construction and operation is F. A. McCarty, of the contracting firm.

The report of the Anglo-Argentine Tramways Company for 1905 shows a heavy increase in earnings, but this is mainly due to the fact of the inclusion for the first time of the system of the City of Buenos Ayres Company. A comparison with the report for 1904 would, therefore, be illusory and even a comparison of the results of the City of Buenos Ayres Company a year ago would be unsatisfactory, as the lines of that undertaking are now in process of being converted to electric traction. The gross earnings of £720,500 are, however, a very gratifying achievement, though on the mileage run receipts are a trifle less and expenses a trifle more. The number of passengers carried was nearly 82,500,000. The net revenue amounts to £255,600, and as the annual income payable to the City of Buenos Ayres Company represents its share of the distributable earnings of the lines, the surplus remaining for the Anglo-Argentine proprietors admits of the holders of the common stock receiving a dividend of 8 per cent, as heretofore. The amount carried to reserve is £20,000, as against £10,000, but whereas last time £25,000 was placed to the renewals fund, nothing is transferred in this report. The balance forward, however, is increased from £5,900 to £10,200.

NEW ENGLAND STREET RAILWAY CLUB

The April meeting of the New England Street Railway Club was held in Boston, at the American House, on the evening of April 26, President Winsor being in the chair. The speaker of the occasion was John S. Schumaker, of the Farrell Foundry Company, Ansonia, Conn., his subject being "Fuel and Boiler Furnaces." An abstract follows:

The handling of fuel and the design of boiler furnaces have a marked influence upon the economy of a plant. The important consideration in the choice of fuels is not so much a question of the number of heat units which are contained in a given quantity of fuel as the number which can be utilized per dollar paid. This is true of the boiler furnaces in general use to-day. In an internally-fired tubular, a return tubular, or a vertical-tubular boiler, or some of the water-tube boilers as ordinarily set, great concessions have been made in the design in order to maintain a furnace temperature of 3000 degs. F. In such a furnace, when a shovelful of soft coal is thrown upon a bed of hot fuel, the volatile matter is quickly distilled, some of it before the coal lands, and if the atoms of hydrogen and carbon thus distilled do not immediately find their quota of oxygen, there is small chance that they will while within the sphere of our influence.

Flaming should cease before any abstraction of heat by the boiler proper takes place. Much may be effected in this respect by reducing the velocity of the gases through the boiler. Flame in the last pass of the gases in a water-tube boiler is the result of burning soft coal with too much draft, and it is in no sense beneficial. Any attempt to use the tubes of a fire tube or the tube spaces of a water-tube boiler for a combustion chamber results in inefficiency. Combustion and the transmission of heat cannot go on at the same time and the same place with economy. The 100 or 150 per cent excess of air over that theoretically required to effect the combustion of the fuel will not compensate for the lack of even distribution of the oxygen in the furnace, but will act as a heat insulation in the fire tubes and tube spaces, to permit combustion to go on. Something must come between the unconsumed gases and the cold tubes, or the combustion will never be completed. This is why a soft coal, with 20 per cent of volatile matter, or so, is not the best fuel for many boilers. When the time and place for combustion are a minimum, hard coal is the more desirable, from the standpoint of heat-unit economy. No large quantities of combustible gases are quickly distilled with each firing of the hard coal to be swept into the heating space before a sufficient time has elapsed for combusiton.

The percentage of moisture in coal seldom receives proper attention. The percentage of ash is often considered of grave importance, but in a recent case, in a change from coal containing 6.15 per cent ash to one containing 5.23 per cent ash, the moisture increased from 1.28 per cent to 3.62 per cent. The ash is inert, but the moisture takes away the heat units necessary to evaporate it and is discharged into the uptake as a gas with over twice the specific heat of nitrogen. Moisture also makes it necessary to increase the velocity of the gases through the furnace and boiler, which is objectionable. A furnace should be something other than a place into which coal is poked. Down-draft furnaces have helped in some cases, but often the furnace is inadequate and the air is excessive in quantity. The velocity of the gases is determined by the draft, which overcomes a fixed resistance, except for the variations in the thickness of the fuel on the grates. The draft is made strong enough to pass 200 per cent of the air necessary for the combustion of the fuel through the boiler and furnace, overcoming the combined resistances.

With induced draft, either by fan or chimney, this means that just above the fuel with a bed 12 ins. to 14 ins. thick, we have a vacuum equal to from .75 in. to 1 in. of water, with a total draft of from 1 in. to 1.5 in. of water. As soon as the fire doors are opened to add fuel there is a strong inrush of air, so that natural draft, with a hand-fired grate, does not help in reducing the velocity of the gases.

Forced draft by steam jet has very little in its favor. The steam can in no case give up more heat by association than it has taken for its dissociation, and although association may follow dissociation, making a closed cycle, netting 100 per cent in itself, there is still a net loss through the furnace. An additional weight of gases has to be added to the gases normally voided by the chimney in order to move the steam vapor, amounting in weight from 3½ per cent to 12 per cent of the steam output. Another ill effect of the steam jet is the abrupt and local change of temperature in the furnace, which allows no graduated range. Ideal draft conditions can be produced with forced fan draft.

The higher the temperature the more quickly does combustion take place, and the more nearly the chemical proportions approached the best, the more rapid will be the burning of the fuel. A perfect chemical mixture of carbonic oxide and air will require from .04 sec. to .07 sec. to become carbonic acid upon ignition per cubic foot of gas. This is too short a time for the boiler furnace, through which the gases pass at a rate of from 20 ft. to 50 ft. per second. It is very important to reduce the amount of air close to that theoretically required for the combustion of the fuel, for the excess of air frequently takes away 15 per cent of the total heat value.

With a proper arrangement of forced draft the fan can be gaged so as to deliver just about enough air for combustion, and at a pressure capable of penetrating the bed of the fuel, leaving the balance of the draft sufficient to carry the product of the furnace through the boiler and flues. The latter draft should show less than .05 in. just above the bed of fuel. The firing doors can then be opened as frequently as necessary for the addition of fuel, or for attending a fire. As far as possible fuel must be added in such a manner that the percentage of volatile matter is kept as low and as uniform as possible. This will give an air rate practically uniform and will best be accomplished by adding small quantities of coal frequently, spread uniformly over the fire. The best gas mixing is accomplished just above the fire, and as one goes higher up in the furnace there is the greater tendency for the gases to stratify. With the furnace and draft conditions as outlined it is probable that 95 per cent of the plants operated can increase their efficiency from 10 per cent to 15 per cent, while doing from 80 per cent to 125 per cent of their rating. The chief difficulty of the mechanical stoker is its inability to meet the demands upon it, by reason of the erratic burning of fuel, and it is not, in practice, the automatic machine it is expected to be.

To sum up, the three prime factors bearing upon the economical burning of fuel are: First, a boiler furnace that is a furnace; second, the proper maintenance of the fuel burning; third, the proper air through the furnace for the particular conditions of the individual plant. The greatest of these factors is the air rate. It is well worth while to attempt to operate the boilers with due regard to the plant's load factor.

Mr. Schumaker concluded by forecasting the characteristics of the boiler furnace of the not distant future, basing his opinion upon a comprehensive consideration of all the factors entering into the generation of power from fuel, including extensive experiments conducted by himself, with the assistance of L. M. Glodell, under the auspices of Franklin Farrel. In the light of these experiments the chimney will be eliminated, and the entire furnace will be placed within the boiler proper, subjecting the whole to boiler pressure. Mr. Schumaker has already operated such a boiler and furnace at 80 lbs. pressure.

SOME FEATURES OF SHOP PRACTICE AT ST. JOSEPH, MO.

The shop practice of a company maintaining its cars in an up-to-date manner usually contains many features of universal interest in the street railway field and the practice in the shops of the St. Joseph Railway, Light, Heat & Power Company is no exception. Through the courtesy of General Manager J. H. Van Brunt and the assistance of F. A. Dillman, master mechanic of the system, it is possible to present here several of the features of the practice in these shops.

A storage car house occupies the southeast corner of the rectangular space taken up by the shops at Highland and St. Joseph avenues. The machine and repair shop are on the west side of the storage car house, the paint shop to the north, while the carpenter and wood working shop is at the northwest corner and between the paint and machine shops. Tracks entering the repair shop continue on through the wood-working room and then by a right angle turn into the paint shop. This arrangement permits cars brought in for repair to be carried successively through the repair shop, the carpenter shop and finally through the paint shop with the least amount of movement. In the design of the shops special attention was given the lighting arrangements. Skylights in all portions of the roof admit light to every part of the shop.

Very little trouble is experienced with the electrical and mechanical equipment of the cars, and this is largely due to the frequent and rigid inspections to which they are subjected. One armature winder rewinds and repairs all the armatures and fields of all the cars on the system, there being a total of 177 cars. This number, however, includes summer bodies as well as winter. There are required 77 cars, however, to operate the schedule. The repair work moreover is not sufficient to keep the armature winder busy and he is compelled to spend much of his time at other work.

Every ninety days cars are given a general inspection of electrical apparatus, including circuit breakers, lightning arresters and other parts often neglected. The motors are opened and the armatures are dropped and blown out. Twice each year the insides of the shells are painted with an elastic insulating paint. This inspection is most rigid, and after a car has been gone over everything is in first class order. At the time the electrical inspection is made the trucks and the car body are gone over thoroughly and all nuts and bolts are tried. Controllers are gone over once a week. One man spends all of his time on these alone.

A record of all the work done on cars is kept in the office. Cards, one for each car, are inserted in a rack and upon these are written the date of the changing of bearings, date of overhauling, and on the front of the card, where it is visible when the cards are in the rack, is written the date at which the car is to come into the shop for overhauling and inspection. The system is comparatively simple, yet it serves its purpose.

CLEANING CARS

The clean appearance of the cars is due to the thorough washing given them each week. Two men are engaged in this work continually. The cars are placed over a section of a track provided with a drain, and the outside of the body, the trucks and the vestibules are washed with a hose. Afterwards they are scrubbed with a brush and are finally wiped off with a chamois. The interior of the car also receives a good cleaning at the same time. The floors are scrubbed, the windows cleaned and all the woodwork is rubbed off with a chamois. Two men are able to clean cars in this manner at the rate of about ten a day.

The fact that the cars are kept well painted and varnished makes the cleaning process easier. Cars are invariably put through the paint shop once each year, which is a rather frequent interval when it is considered that the bodies are in service but half a year. They are first taken in the wash room and scrubbed thoroughly. After being inspected, the bodies are put through the carpenter shop, where needed repairs are made and are then taken into the paint shop. This shop contains four tracks and has a capacity for twelve cars. One mistake often made in the painting of cars is that proper time is not allowed. The process is rushed and all coats are not allowed to dry thoroughly before others are applied. In this particular Mr. Dillman is most insistent. The ample capacity of the shops, together with the fact that the cars are painted during those periods of the year when the type of body is out of service, offers no excuse for rushing the work. In their yearly trip through the paint shop usually the exteriors of the cars are simply touched up and varnished, the iron work

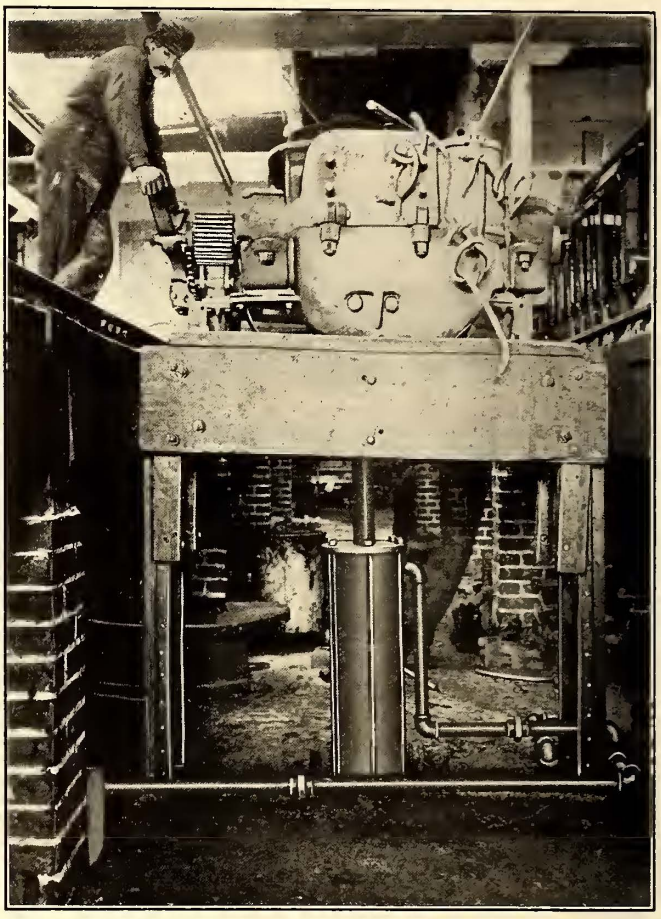


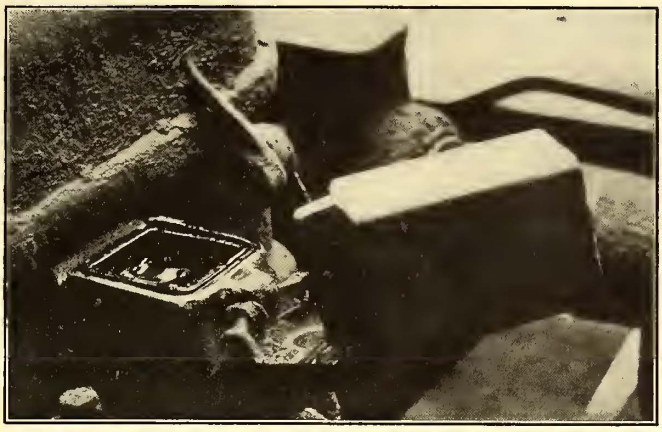
FIG. 1.—HYDRAULIC HOIST IN PIT

blacked off, the roofs and floors painted and the interior finish varnished. On about one-third, however, the trucks are painted in addition. It is also the custom to burn off and repaint completely about fifteen cars per year. The facilities offered for doing the work in the paint shop, together with the fact that the work is carried out in a systematic manner, makes the labor cost comparatively small. The average cost of labor for overhauling one lot of sixty-nine cars was $10.44 per car. Of these forty-nine were scrubbed, touched up, varnished, blacked off, had their roofs and floors painted and were oiled inside. The remainder had their trucks painted in addition.

The truck repair shop contains several devices for facilitating work that are of special interest. In Fig. 1 is shown a hydraulic jack installed in the pit, which is of great convenience in changing motors from one truck to another and in raising car bodies. Two of these are installed in the shop.

The cylinder of each of them is an 8-in. wrought iron pipe upon which top and bottom heads are bolted by six rods extending the full length of the pipe along the outside. A leather-packed piston head is fitted to a 2½-in. piston rod. The upper end of the rod terminates in a flat head. In the illustration a wood platform is shown fitted over the head for handling motors. Four guides, at the sides of the pit, keep the top to the platform level. The piston is raised by admitting water from the city mains underneath it. Both the inlet and discharge are controlled by ordinary globe valves. An additional pipe leading from the cylinder near the top carries away the water leaking past the piston. When car bodies are hoisted the wood table is removed and the piston is made to lift directly against the sill.

Some of the later motors are fitted with bearings adapted to oil lubrication. All of the older ones provided with grease boxes are now lubricated with oil by means of the box shown in Fig. 2. The illustration shows an oil box fitted in the grease box of a GE 800 motor. Another oil box is shown resting on the motor. The lug at the bottom fits into the oblong hole in the bearing shell and thereby assists the dowel pin to hold the shell in position. Through the center of the box a 17-64-in. hole is drilled. A rod ¼ in. in diameter is inserted in this. When the box is in position the lowed end of this rod extends through the box and rests lightly on the shaft or axle. The upper end extends through the center of the box almost to the top. The box is filled two-thirds full with tightly packed wool waste, and on top of this Galena car oil is poured. The feeding takes place through the 1-64-in. clearance between the rod and the hole through the bottom. The slight scraping or chattering movement of the rod, due to its resting on the shaft, no doubt assists in the feeding, and because of the absence of this movement the feeding is practically stopped when the car is not in motion. All the armature bearings are fitted with this box, the motor axle as well as the armature bearings. The oil boxes are filled every third day, and other than this they require practically no attention. On a test, a car fitted with this oil box ran 1246 miles on three pints of oil. This included all the oil used on four armature and four motor axle bearings.



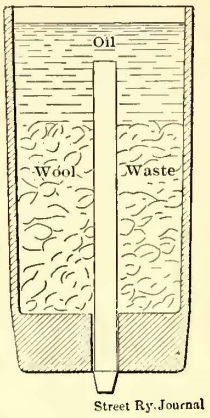


FIG. 2.—GREASE BOX WITH OIL CUP INSIDE; ALSO SECTION OF OIL CUP

A pressure far beyond the rated capacity of the hydraulic wheel press is often required to remove wheels from axles. On one occasion the wheel press was damaged. To prevent further injury to the press, it is now the practice to bore the hubs and crack them by a blow with a sledge hammer. Fig. 3 shows a device for drilling the hubs, which consists simply of a shaft carrying a drill chuck and supported in a wood frame. Power is obtained from a bolt machine near by. The pulley is keyed to the shaft and the feed screw on the end moves forward the pulley as well as the shaft and drill chuck. The face of the pulley is sufficiently broad to allow considerable movement. Hinged arms with hooks to catch behind the flanges of the wheel are bolted to each side of the wood frame and these hold the wheel in position when pressure is applied on the drill. After a 15-16-in. hole is drilled, a sharp blow with a sledge cracks the hub and the wheel is easily removed.

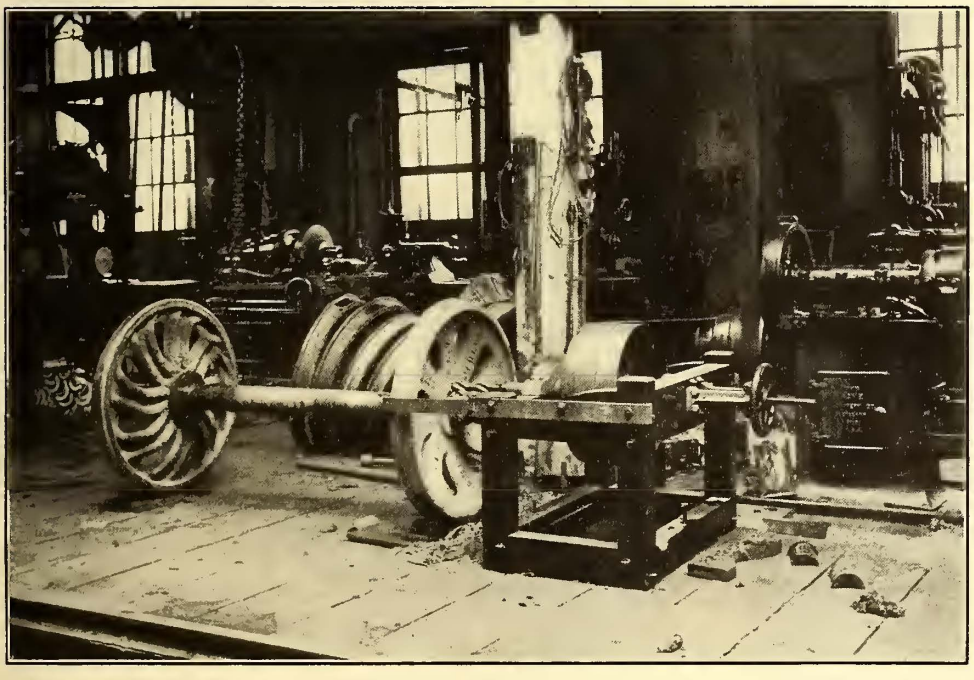


FIG. 3.—MACHINE FOR DRILLING THE HUBS OF CAST-IRON WHEELS

A great deal of trouble has been experienced by the burning of the controller cylinders under some of the segments and this burning is often so severe that a new segment cannot be attached to the old base. Fig. 4 shows a burned controller. It may be seen that quite a portion of the segment base is burned away. The illustration also shows a controller repaired by means of a brass base casting similar to the one shown resting on the star wheels of the controllers. When a cylinder is to be repaired the burned segment base is turned down flush with the barrel of the cylinder and the brass casting is finished to fit. By means of screws the casting is clamped over the cylinder and the copper segments are then attached in the usual manner. This method of repairing controllers has been the means of putting in good condition many cylinders which would otherwise be useless.

A convenient platform for working on the eaves and roofs

of cars is used in the carpenter shop. This is shown in Fig. 5. It is suspended to the roof high enough above the floor so that it does not cause inconvenience to those working beneath. In the same illustration is shown a summer body which is being fitted with a new floor framing. Trouble has been experienced by cars drooping down at the ends. To prevent this the sill plates of the cars being repaired are given a 4-in. camber, bowing down at the middle point. This curvature is given them by swedging them while cold. After the plates are drawn down on the sills and the car set on the trucks, this amount of camber causes the cars to be slightly bowed down in the middle, which permits the platforms to droop slightly before the car is perfectly straight.

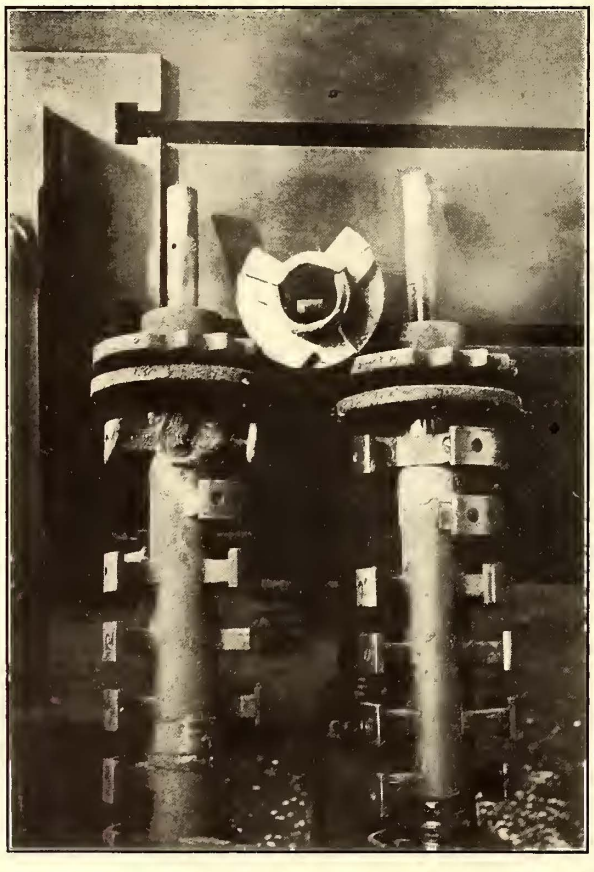


FIG. 4.—A BURNED CONTROLLER AND A REPAIRED ONE, WITH REPAIR CASTING

Mayor Weaver approved plans for the Philadelphia Rapid Transit Company's Market Street subway east of City Hall. Building of the underground electric railway will be pushed, and the company anticipates its operation within two years.

THE NEW CLOSED CAR ADOPTED BY THE SCHENECTADY RAILWAY COMPANY

The Schenectady Railway Company sometime ago placed in service twelve closed cars, which in their design are believed to embody the most advanced practice for city and suburban operation. They were built at the Kuhlman works of the J. G. Brill Company, according to design and specifications prepared by J. G. Baukat, formerly engineer of the Schenectady Railway Company. A most interesting feature of these cars is the novel brake-rigging arrangement devised by Mr. Baukat, which permits the maximum number of braking combinations possible on double-truck cars using power and hand-brakes. This rigging will be described hereafter in detail.

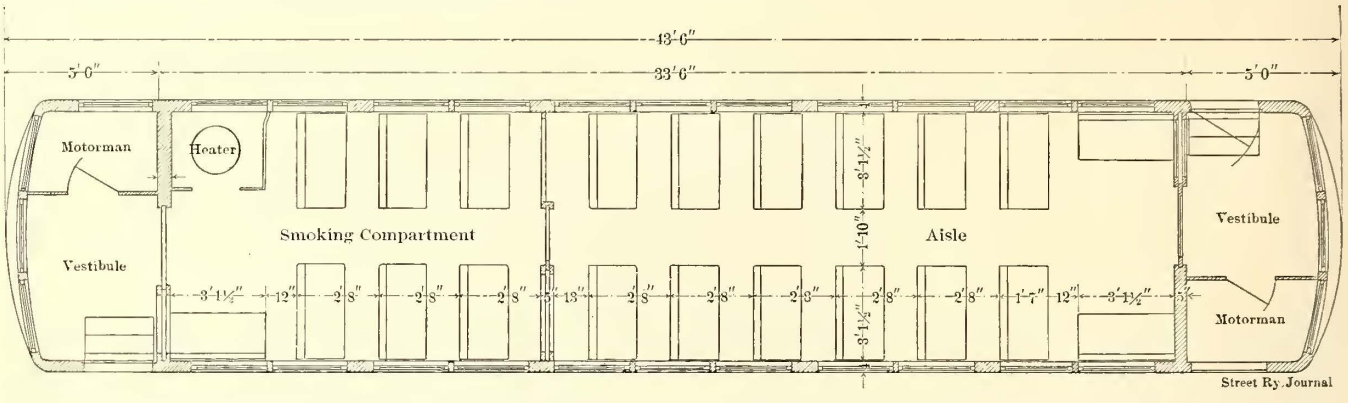


FIG. 1.—PLAN OF SCHENECTADY CAR, SHOWING SEATING ARRANGEMENT, LOCATION OF HEATER, VESTIBULE AND MOTOR COMPARTMENTS

FIG. 5.—ELEVATED PLATFORMS IN CARPENTER SHOP, ST. JOSEPH, MO.

The body of each of these cars is 33 ft. 6 ins. long, divided into a passenger compartment 20 ft. 1½ ins. long and a smoking compartment 12 ft. 1½ ins. long. The length over the bumper sills is 42 ft. 8 ins.; and the length over the bonnets, 42 ft. 11½ ins. The width of the bottom of the car over the panels and over the posts is 8 ft. 5½ ins.; the width over the drip rails, 8 ft. 8 ins.; height from the floor to the ceiling, 8 ft. 6 ins.; height of the doorways,

approximately, 6 ft. and 6 ft. 6 ins.; height from the bottom of the sills to the top of the trolley board, 9 ft. 7 ins. The seats, which were furnished by the Hale & Kilburn Manufacturing Company, are made up of eighteen cross-seats, and three longitudinal ones near the motorman's cabs, giving a total seating capacity of forty-two.

Each side sill is built up of one 7-in. channel, one 7-in. x 3½-in. angle, one ⅜-in. x 24-in. steel truss plate with Georgia pine filling strips. The center sill, eye-beams and all cross sills and braces for the entire bottom framing, are also of steel as shown on the plan. The flooring is of Georgia pitch pine, with the foot at each end bolted to the top rail. The roof is painted with thick white lead, and all the nail holes, screw holes and joints are puttied and covered with No. 8 cotton duck laid in white lead and covered with three coats.

The dasher steel is of No. 12 B. & S. gage, one piece on the side and one piece on the front. The step openings are enclosed with doors of the standard steam road type. The step openings are closed by a trap door furnished by the O. M. Edwards Company, of Syracuse, N. Y. The treads are of second-growth white ash 1¼-in. thick, faced with 1 in. of half-round iron, secured to malleable iron hang-

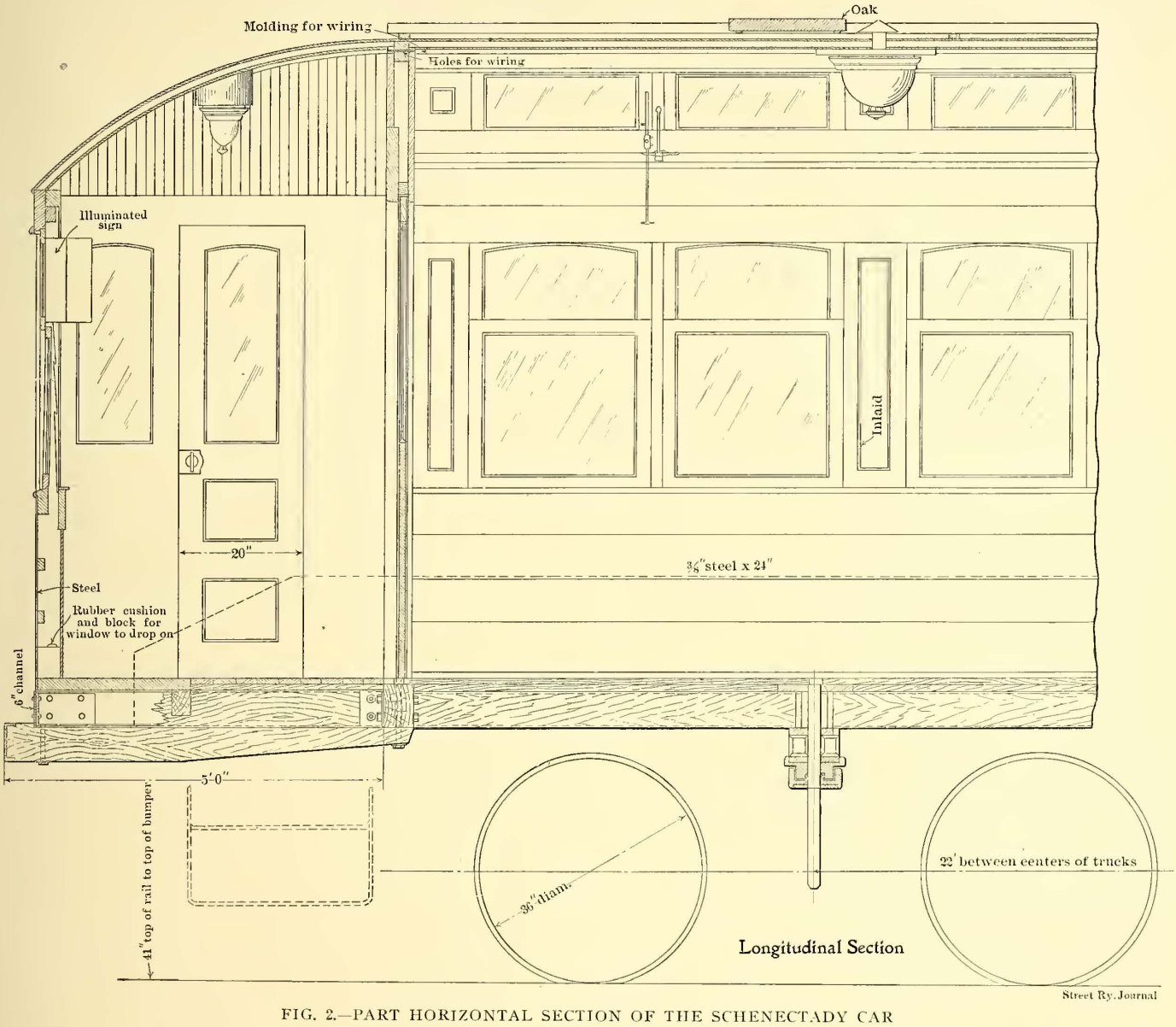


FIG. 2.—PART HORIZONTAL SECTION OF THE SCHENECTADY CAR

3¼ ins. wide by ⅞ ins. thick, is secured to the sills with flat-head screws, and has four trap doors for securing access to the motors. There are two steel bolsters and four chafing irons per car in addition to steel bumpers, consisting of 6 in. channel beams. The doors and side posts are of white ash tenoned, leaded and secured by strap bolts. The body framing, such as center rib rails, window rails and belts, side and corner posts, drip and guard rails, letter boards, side and end ribs are of white oak secured with pins and with all tenons or inter-locks leaded.

The roof frame is of white ash, and the roof is strengthened with concealed ⅝-in. steel rafters. The latter are so placed as to receive the strain of the trolley apparatus to the best advantage, and are forged to the shape of the roof in a solid piece

ers, and provided with a back fender or riser which prevents the passenger's foot from slipping through. The treads are covered with strips of non-slipping metal. A motorman's step is placed in the right hand diagonal corner of the guard rail, and another on the corner posts and suitable step on landing on the deck.

The car interior is of a dull mahogany or wax finish in natural wood, and inlaid. All fancy carving and panel work has been omitted, and no stain is used. In applying this finish, there were used one coat of range shellac, two coats of rubbing varnish, and one coat of finishing varnish rubbed to a dull polish. Each car is heated by a Franklin hot water heater, which is enclosed by a removable partition provided with a door and lock. This partition is finished to cor-

respond with the interior of the rest of the car. It is bolted to the main car body with brass angles on to brass plates, the latter being screwed on to the side of the car.

The two vestibules are furnished with three lights each, while there are eleven windows on each side of the car fitted with double thickness American plate glass—all side sashes are fitted with the O. M. Edwards balance sash. The upper sash are stationary. All of the side windows are provided with curtains, and those in the motorman's cab (including the glass door) are arranged to enable the motorman to shut off all light from the passenger compartment. All curtains are of double-coated Pantasote, mounted on 1-in. rollers and fitted with the No. 86 Forsyth fixtures, made by the Curtain Supply Company, of Chicago, Ill.

The ventilator sash is pivoted in the center, and is arranged to have two ventilators manipulated by one ventilator opener. There are eight ventilators in the smoking compartment, and twelve in the other section. Over each of the Holophane globes there are ventilator openings, as in steam railroad cars. This arrangement is shown in Fig. 2.

Illumination is provided through five 12-in. Holophane globes in the car proper, and one 6-in. globe in each vestibule. The bottom of every one of these globes has a hole for ventilation, and is suspended by a brass ring, which is properly hinged and held to a frame mounted on a wooden block, and designed to correspond in finish to the wire moldings. All of the car wiring, which is laid out for Type-M control, consists of asbestos-covered cable, and each wire is separately concealed in iron-pipe under the car, using special design fittings for bends and bell mouth with rubber bushings in same where wire leaves iron pipe. Wherever a wire is carried through a partition of the floor, it is protected with a circular loom or soft rubber bushing.

Special attention was given to the subject of car painting, and the following represents the order in which each coat was applied at intervals of 48 hours; (1) one coat of oil and lead priming; (2) application of white lead putty; (3) three coats of lead; (4) three coats of rough stuff; (5) scoured to a surface; (6) one coat of ground color; (7) two coats of color; (8) two coats of wearing body varnish. The underside of the car bottom frame has two coats of lead paint mixed with oil, and the underside of the roof-board received one coat of boiled oil before the head lining was put up.

Each car is mounted on two Brill 27-E-1 trucks, somewhat modified by Mr. Baukat, using a steel bolster, Taylor brake hanger, truss plates against the bolster, and a special designed adjusting bar for adjusting brake-shoes, instead of turn buckle. They are equipped with 36-in. diameter Taylor fused steel-tired wheels, and carrying GE-74 motors geared for a speed of 40 miles an hour. The air brake equipment is of the Christensen straight air type, as made by the National Electric Company, of Milwaukee, Wis.

The brake-rigging of these cars possesses some very interesting features, and, therefore, its construction will be discussed in detail. The first feature to be noted in the accompanying Fig. 3, is, that should the inside pull-rods G or H, which form a part of the power-braking arrangement, break, it is still possible to use the brake-rods belonging to the hand-brake system. Thus, the air and hand-brakes operate independently. Assuming that it is desired to set the brakes from the No. 1 end of the car, the brake wheel in the corresponding vestibule is applied until it has taken up the 8 ft. of chain, which in turn pulls the floating lever A. The latter then pulls over the rod E in the direction indicated by the arrow, and since this rod E is attached to a pair of brake-shoe levers, the brake-shoes on truck No. 1 are set up. After the first set of shoes have been applied, the lever A will pull the longer rod D, which in turn will act on fixed lever B until the pulling over of rod F causes its corresponding brake-shoe levers to set the shoes on truck No. 2. Of course, the same thing could be accomplished with the hand-brake from the other end of the car as the mechanism at both ends is exactly alike. It should also be noted that if the long or through pull-rod D breaks, it is still possible to set the breakers on No. 1 truck because lever A will pull up against the strap shown on drawing, and then continue to pull rod E over as before. Should the broken rod happen to be the through lever C, it would still be possible to set the brakes on truck No. 2. Even if both through levers and the small pull-rod at one end of the car were broken, it would still be possible to brake the second truck by signaling to the conductor at the rear of the car, and the same thing is true should lever E or F break. It is apparent from the foregoing that without any complex or expensive construction, there has been secured by this design a great degree of safety in a double-truck car using both power and hand-brakes.

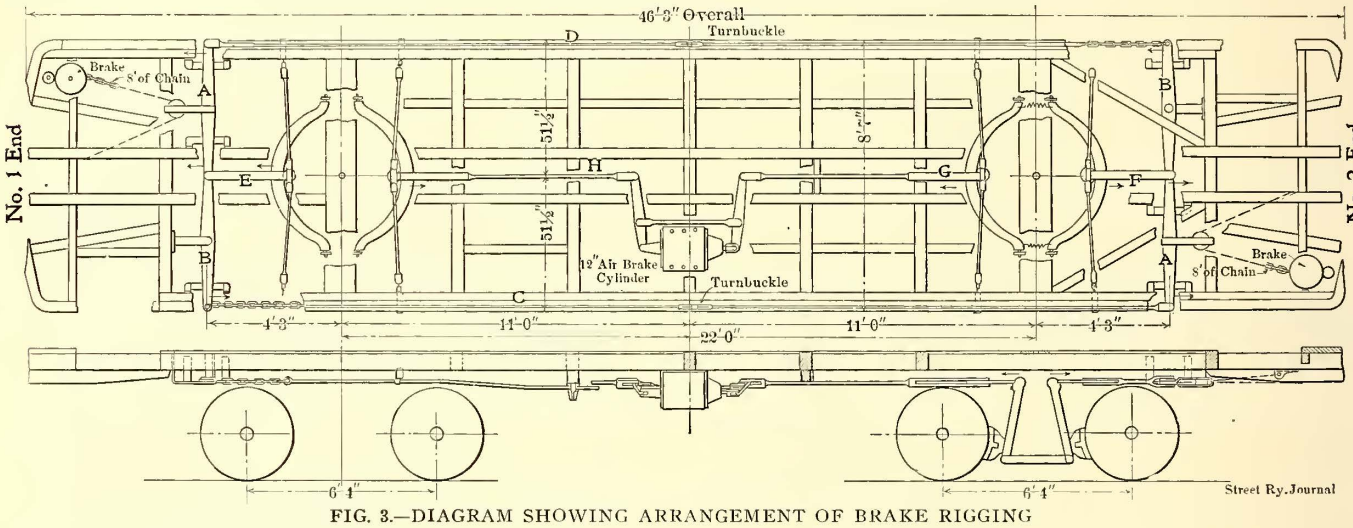


FIG. 3.—DIAGRAM SHOWING ARRANGEMENT OF BRAKE RIGGING

In honor of the annual Mardi Gras celebration at New Orleans, the New Orleans Railway & Electric Light Company has recently published a handsome booklet, containing views of some of the finest electric lighting decorations used during the festival, and operated by power furnished by the company.

THIRD ANNUAL CONVENTION OF THE IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION—II

In the last issue of the STREET RAILWAY JOURNAL was published an abstract of the first day's proceedings of the third annual convention of the Iowa Street and Interurban Railway Association, held at Des Moines, Ia., April 19 and 20. The proceedings of the first day covered a paper on transfers by John F. Ohmer, of Dayton, Ohio, one on bond and motor testing by R. W. Conant, of Cambridge, Mass., and another on the discipline of car service employees, by J. G. Huntoon, of Davenport, Ia. Herewith is given an abstract of the papers and discussion during the second day, Friday, April 20.

FRIDAY MORNING SESSION

The session Friday morning was opened by F. W. Hild, who presented a paper on "The Adoption of Gasoline Motors for Street and Interurban Service," of which the following is an abstract:

THE GASOLINE CAR FOR INTERURBAN SERVICE

In view of the present widespread interest in steam railroad circles in the self-contained power car as a means of meeting the increasingly severe competition of the electric roads, it may not be amiss to consider this type of car from the view point of the electric railway engineer. That the large steam roads have keenly felt the electric railway competition, has long been known, and it is now particularly evidenced by the various methods under consideration for meeting it. Thus the Union Pacific has built at its Omaha shops a straight gasoline car, wherein the power output of a gasoline engine is mechanically transmitted to the car wheels. The Burlington, some months ago, built at its Aurora shops, and for a short time experimentally operated, a gasoline-electric car, wherein the power output of the gasoline engine was transmitted electrically to the wheels. The Delaware & Hudson[1] has placed in operation a gasoline-electric car. The Lake Shore is also trying such a type of car. The Ohio River & Columbus Railway, according to the technical press, is experimenting with a steam-propelled car, which is to be a modern edition of the old-time steam dummy. The press has described the F. M. Hicks gasoline-electric car[2] for the St. Joseph Valley Traction Company and, very recently, the Strang car[3], a gasoline-electric car which ran with its own power from Philadelphia, where it was built, to Kansas City, where it is to go into service on an interurban road in that vicinity.

The writer has seen experimental outfits utilizing the automobile principle of carrying the motive power on the truck frame. In one case, it was a high-pressure superheated steam engine, with direct-chain transmission and with flash boiler, kerosene or gasoline pan burner, radiating condenser, etc., all very much like the equipment of the well-known "White" steam automobile. In another case, it was a four-cylinder gasoline engine, with friction disc transmission, etc., similar to automobile equipment.

The independent motor car idea had its inception abroad and much more work has been done in this direction in France, Germany, and Great Britain than in this country. The most conspicuous application of the idea is the steam motor cars of the Great Western Railway, of Great Britain.[4] This railway has in use a number of modernized steam dummy cars using coal as fuel for steam generation. The preference on the continent seems to be for the internal combustion engine, and several experimental gasoline-engine cars being tried. The Wurtemburg State Railway[5] is one of the most aggressive of foreign roads in trying the independent motor car. This railway has experimented with electric storage-battery cars, with steam-motor cars of the Serpollet type and gasoline cars of the Daimler-motor type. It is interesting to note that the Wurtemburg State Railway put an independent gasoline-motor car into service in December, 1893, something over twelve years ago.

There can be no doubt that most of the several types of self-power-contained cars will find useful fields of application and will become valuable auxiliaries to the standard forms of rail transportation; but also, in the judgment of the writer, there should be no doubt that these fields of application will be relatively restricted and do not include such as are now served by the usual electric system. The factors which have made electric traction so successful in city, urban and interurban service are many and varied, but those which enter into a discussion involving a consideration of other types of motor cars, are:—

(a) Reliability and simplicity.
(b) High-schedule speeds and high-train frequency.
(c) Cleanly and noiseless operation.
(d) Low cost of operation and of maintenance.

On the other hand, the self-powered cars enjoy two advantages which are the sole reasons for the present interest in this type of car. They are:—

(e) Absence of external power transmission circuits.
(f) Less initial investments.

It is the purpose of this paper briefly to investigate and compare these several factors.

Apparently the greatest difficulty encountered by the designers of the gasoline cars, is the transmission of power from the engine to the driving wheel. This is not surprising in view of the fact that the internal combustion engine is essentially a constant-speed motor, and that railway work demands wide ranges of variable speeds. At the present time, the favorite means appears to be the use of electricity, indicating that the difficulties of direct mechanical transmission and variable-speed operation are so great as to warrant the rather roundabout transmission involved by the addition of generators, with or without batteries, and the standard railway type motors and control. Indeed, it is claimed by the promoters, that the efficiency of the gasoline-electric outfits compares very favorably with any type of mechanical transmission and, moreover, has the greater advantages of large variations of speed, flexible driving, ease of control, and lesser wear and tear. The acceleration and change of speed are smooth, and without the jar or shock which is ever present with any mechanical change-speed gear. This situation suggests to electrical engineers the early discussions of series vs. shunt motors for railway work. The designers of the gasoline-electric cars, while fully agreed as to the method of power application, nevertheless differ among themselves on the important question of power supply. Some insist that a storage battery is an indispensable adjunct, for the reason that gasoline engines have low efficiencies at fractional loads, and, furthermore, have practically no overload margin. The battery, therefore, is needed to take care of the recurring inevitable overloads. Others, however, prefer to use a much larger generating unit, largely because of the saving in weight and space, and the avoidance of acids and fumes.

The Union Pacific gasoline motor car No. 1 is the best known of the straight gasoline cars, and while not much of detail has been allowed to come to the public, the general

[1]See STREET RAILWAY JOURNAL for Feb. 10, 1906.
[2]See STREET RAILWAY JOURNAL for Apr. 8, 1905.
[3]See STREET RAILWAY JOURNAL for Mar. 3, 1906.
[4]See STREET RAILWAY JOURNAL for Nov. 5, 1904.
[5]See STREET RAILWAY JOURNAL for Nov. 5, 1904.

features of the car are, according to published reports: Car body, 56 ft. over all; weight, 26 tons to 29 tons; seating capacity, approximately 50; motive power, 100 hp (rated) gasoline engine.

Gasoline motor car No. 2, of the Union Pacific Railway, is considerably larger than car No. 1, and has several improvements which were suggested by the tests made with car No. 1. It is 55 ft. long, has two 4-wheel trucks, and seats 57 passengers. It is of the same general design as car No. 1, and is of steel construction throughout. The car weighs 56,000 lbs., although it is expected that additional cars which are to be built will not exceed 50,000 lbs., as it was very difficult to obtain proper material, and heavier parts were used than were necessary. The car is driven by a 100-hp, 6-cylinder gasoline engine, designed especially for this purpose. It has a "make and break" spark ignition, with a primary battery for starting and a magneto for regular running service. The lever which controls the metal clutch is operated by air, which is controlled by a specially designed operating valve, by means of which the car may be started at a slow speed and the engine disconnected or thrown into high speed at will. The driving wheels are 43 ins. in diameter; the other wheels are 34 ins. All wheels are of rolled steel.

The car is ventilated by means of Cottier suction ventilators. The circulating coils for cooling the gasoline engine are so arranged that during cold weather the fresh air supply for the passenger end of the car may be warmed by passing over them. The car is lighted by acetylene gas, and the 25 panel lights are so arranged that while the lighting is very brilliant, it is of a mild and diffused character, and not wearisome to the eye. The interior of the car is finished in antique mahogany with a cream white ceiling and decorated in gold and sepia. The car has been in use since Sept. 14, and is giving very satisfactory results. It accelerates rapidly and is capable of developing a high speed. It was built at the Omaha shops of the Union Pacific Railroad, under the supervision of W. R. McKeen, Jr., superintendent of motive power, who has invented and patented the important features of construction.

RELIABILITY

It probably needs no argument to show that the straight electric car considered alone is far less complicated, and hence far more reliable than any other form of motor car. The straight electric has the minimum of moving parts, all of which (excepting the brake mechanism, which are common to all cars) are non-reciprocating, while all other types of self-propelled cars have reciprocating mechanism, which include a great number of moving parts, more or less complicated in adjustment. The greater simplicity and reliability of the standard electric car is perfectly obvious in the fact that, aside from the conductor or fare collector, but one attendant, the motorman, is necessary for the car operation, whereas, every type of independent railway motor car, so far as the writer knows, requires an additional skilled mechanic to look after the portable power plant. Of course, efforts are and will be made to render the equipment so thoroughly automatic as to permit the dispensation of this skilled mechanic. Far be it from the writer's wish to infer that American inventive ingenuity may not accomplish this, but a few healthy doubts as to its early attainment are permissible when one remembers the automobile enthusiast who stated that he owned a car for three years, of which he spent one year on it and the other two under it. The annoyances which may attend the use of a private vehicle may be tolerated by the owner, but such annoyances would be prohibitive in a public utility like a transportation system, therefore, the need of mimimizing interruptions and delays will undoubtedly compel the retention of the extra attendant.

But the question of reliability of the straight electric goes beyond the car itself, and involves a consideration of power generation and transmission. Power-generating machinery, both steam and electric, has been brought to a very high order of development, and in the hands of thoroughly competent operators, the probability of interruption of power service through failure of this machinery is extremely remote, particularly if the plant be provided with a judicious, yet reasonable, reserve. There are plants in this country which have operated for years without failing to deliver power, and it has come to be understood that the engineer who fails to "keep the busses hot" must have an exceptionally good excuse in order to retain his job. The modern transmission circuit, whether for alternating current or direct current, is of sturdy construction, mechanically strong and reliable, so that the percentage of failures due to all causes except the elements is no greater and usually less than experienced with other parts of the roadway.

SCHEDULE SPEEDS AND TRAIN-FREQUENCY

It is a peculiar fact that no other form of machinery, whether used for power generation, power translation, or power utilization, has such high efficiency, such capacity for overload and such flexibility of control as has electrical apparatus. The remarkable speed and torque characteristic of the series-wound motor permit of a smooth and rapid rate of acceleration, absolutely under the control of the operator. This rate of acceleration may be practically anything desired, and is accomplished without resorting to excessive power demand or abnormally large motors. The maximum acceleration is usually determined by the comfort of the passengers, and by the slipping of the wheels, and is not limited by energy consumption. Indeed, it has been shown that for a given schedule the equipment having the highest rate of acceleration will perform the service with the least energy consumption.

The facility for maximum acceleration, the great capacity for overload, and the high ratio of power to weight, enable the straight electric car to handle successfully and economically higher schedule speeds than any other type of car, no matter how equipped. The steam-engine operated car, because of the overload power of the steam engine, would probably come next, while the gasoline car, with direct mechanical transmission would, because of the absence of starting torque and of overload capacity of the gasoline engine, fall well below them all. High accelerating power becomes more important as the number of stops in a given distance increase, and it is this fact, as well as the difficulty of mechanically transmitting power from the gasoline engine to the drivers, which renders combination gasoline-electric cars at present the most promising of the self-contained cars. Moreover, with the straight electric system practically no power is wasted. The motorman, by the simple manipulation of his controller, utilizes the power only as it is needed. Any system of transportation employing self-contained motive power units must be obviously at a disadvantage in this respect, since fuel consumption must go on all the time the train is in service, whether it is coasting or standing at a station.

CLEANLY AND NOISELESS OPERATION

The great importance of cleanly and noiseless operation of trains is best evidenced by the action of the New York Central, the New York, New Haven & Hartford, the Pennsylvania, the Long Island Railroad, and the Baltimore & Ohio in electrifying their largest terminals. It is well known that this action was largely brought about by public sentiment. That the builders of self-contained cars appreciate the importance at least of cleanliness is indicated by the fact that nearly all are using oil for fuel, and practically none of them would

consider the smoke, cinder and soot-producing fuels, such as coal, etc. The advantages, if any, are in favor of the standard electric system, for there must always be present some vibration and some exhaust fumes from the engine of the self-powered car.

OPERATING AND MAINTENANCE COST

The absence of actual operating data of self-contained cars does not permit at the present time of a comparison of actual maintenance and operating charges between such cars and the straight electric. It is perfectly logical, however, to expect, in view of the complicated mechanism of the former and extreme simplicity of the latter, that the maintenance charges for the self-contained car system will be greater than for the straight electric. The maintenance cost may reasonably be expected to be about midway between the electric car and the steam locomotive. The operating cost of the several types of self-contained cars will naturally vary among themselves, but in all instances such costs, exclusive of interest on the investments, will be materially higher than the straight electric, and in most cases, the costs, including interest charges, will favor the straight electric.

This reasonably follows, in view of the high efficiency of the modern power station and transmission systems of electric traction, and also because of the high weight efficiency of electric cars. The independent motor car must not only drag along its own power plant, but it must sacrifice valuable remunerative space in order to carry it. For the same remunerative capacity, the self-contained car will weigh from 50 per cent to 100 per cent more than the standard electric car. Under the same conditions of track, speed and distance the energy consumption required to move cars of any sort will vary as their weight, hence it follows that the energy consumption of the self-contained car, will be from 50 per cent to 100 per cent greater than the electric car. The labor expense of practically all types of self-contained cars will be 50 per cent and upward greater than the straight electric, for the reason that, in addition to motorman and the conductor, a skilled mechanic is necessary for the operation of the power generating apparatus in each of the self-contained cars. This attendant is usually paid 30 cents to 40 cents per hour, or from 50 per cent to 100 per cent higher wages than the ordinary platform men receive.

All self-contained cars, excepting those equipped with storage batteries, must have prime movers of sufficient capacity to accelerate the cars suitably, and since the power required for accelerating is from two times to four times that for full-speed running, and also because of the intermittent power demand in railway service, it follows that the average load on the prime mover will be but a fraction of its rated power, hence the efficiency of engine operation, whether steam or gasoline, must be low. This condition is worse with gasoline engines which have no overload margin, and in such cases the average load will probably not exceed 40 per cent. Where a floating storage battery is carried on the car, it is, of course, possible to use a smaller engine and to work it at close to its rating most of the time, and the fuel cost per ton mile of such a car would be somewhat less than of one without battery.

The St. Joseph Valley locomotives, with single trailer, during the early days of its operation, averaging 66 miles per day, consumed 50 gals. of gasoline per day. This worked out per train mile as follows:

	Cents
Fuel at 16 cents per gal	12
Labor, 75 cents per hour	3.4
Acid, water, waste, sundries	.6
	16.0

H. M. Beardsley published in the STREET RAILWAY JOURNAL, July 15, 1905, a very complete table of operating statistics of electric roads in New York State. A study of this shows that straight-electric operation per car mile is much less than the above figures, and if the comparison be made on the basis of cost per car seat or unit of remunerative space, the showing will be still more in favor of the straight-electric cars. The average of ten roads in the table, work out as follows:

	Cents
Power	2.629
Wages of conductor and motorman	4.146
Car service supplies	.109
Miscellaneous	.16
	7.044

Comparison between a single concrete case and an average of a lot of widely varying cases, while giving an indication, is not convincing. Therefore, it may be of more interest to compare briefly the requirements and performance of a gasoline-electric car, and a straight car for transporting a given number of passengers, under the same conditions of distance, time, stops and road-way. Assume a line 25 miles long, standard steam railroad construction, stops of 15 seconds duration

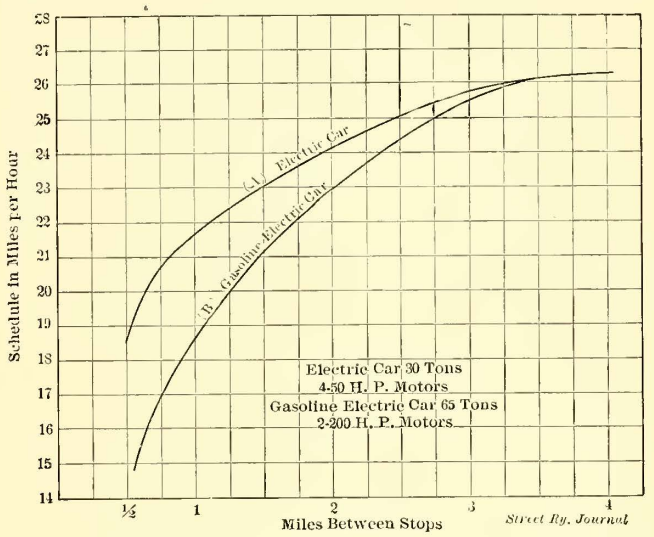


FIG. 1.—CURVES SHOWING COMPARATIVE SCHEDULE PERFORMANCE OF ELECTRIC AND GASOLINE CARS

each, to average one every three miles. It is desired to operate a car seating 48 passengers, making the run one way in one hour.

Let us take the D. & H. car previously mentioned. It has been recently described in the technical press, but no hint of its detailed performance published, so we must rely upon calculated performance. This car weighs about 125,000 lbs., and the car body measuring 65 ft. over all, is of the combination type, that is with passenger and smoker compartments, seating a total of 40 passengers, and with baggage express compartment. A standard interurban car, about 45 ft. long, will seat comfortably 48 passengers, and will weigh, fully equipped, 24 tons to 28 tons. With four 50-hp motors, geared to about 35 miles to 38 miles per hour maximum speed, and with normal trolley voltage, such a car will perform very satisfactorily the service outlined.

In Fig. 1 are two curves, showing the schedule performance, which might be expected of the two cars, B referring to the gasoline-electric car and A to the standard-interurban car. Incidentally, it is interesting to observe that as the frequency of stops increases, the self-contained car falls much more rapidly away from the schedule than the straight electric. Thus, at one stop per mile, it can do 18¾-m. p. h. schedule, while the straight electric can do 21¾ m. p. h.

Under the conditions assumed, the rate of energy consumption of the straight-electric car will be about 60 watt-hours per ton mile at the motors, and this value will be used as applying to the combination-self-powered car, although, as a matter of fact, the input to the latter will be somewhat higher owing to its slow rate of acceleration, and would more than offset the elimination of rheostatic losses in the motor control.

Manufacturers of gasoline engines of the size under consideration generally claim 10 hp-hours' output per gallon of gasoline at full load, but will guarantee only 8 hp-hours per gallon of this fuel. In the calculations which follow, no account will be taken of the rapid falling off in fuel economy at fractional loads, so, in using the 8 hp-hour per gallon value, the error, if any, is in favor of the gasoline outfit.

Electric power station performance is well known from numerous published or otherwise available records. The following is typical of 4000-kw turbine, water-tube boiler plant with coal at $1.60 to $1.80 per ton.

Coal	$ .0034
Labor	.0016
Maintenance	.0007
Supplies	.0003
Cost per kw-hour at switchboard	$ .006

A well operated plant with fairly good load factor should encounter little difficulty in producing power at this figure; indeed, many show much better results. For the purposes of this discussion, however, a higher figure, $.0085, will be taken. This value is easily attained by most of the interurban power plants in the middle west.

Transmission efficiencies to the motors will be taken to average as follows:—

	A. C. System, Per cent	D. C. System, Per cent
Step-up transformers	96	96
Line	97	97
Step-down transformers	96	96
Rotary	—	88
Car transformer	96	—
Feeder and trolley network	93½	89
Net efficiency	80	70

Gasoline Electric, Car 62½ tons

62½ × 60 = 3.75 kw-hrs. p. c. m.

3.75 × 25 = 94 kw. av. per trip.

94 kw, 78% of 120 kw, the rating of the generator, and at this average load generator efficiency equals 90% approximately.

Then $\frac{3.75}{.746 \times .90} = 5.6$ hp-hrs. p. c. m.

The engine will develop at full load about 8 hp-hrs. per gal. of gasoline.

With fuel at 10 cents per gal.

Power $\frac{10. \times 5.6}{8}$ = 7c. p. c. m.

Car Crew

Motorman, .21 per hour.
Conductor, .21 per hour.
Mechanic, .33 per hour.

.75

Straight Electric Car, 30 tons

30 × 60 = 1.80 kw-hrs. p. c. m.

1.80 × 25 = 45 kw av. per trip

Power at interurban generating station costs $.0085 per kw-hr at the busses; taking transmission efficiency to the motors at 80% (A. C. system).

Then $\frac{1.80 \times .0085}{80} = 1.91$ p. c. m.

Car Crew

Motorman, .21 per hour.
Conductor, .21 per hour.

.42

$\frac{75}{25} = 3$ cts. per car-mile

Waste, oil, small supplies, .60

$\frac{42}{25} = 1.68$

Allow for sub-station attendance, .01, 1.69 p. c. m.

Waste, oil, small supplies, .55

Summary

7.00	Power	1.91
3	Labor	1.69
.6	Supplies	.55
10.60	Per car-mile	4.15

These are comparative costs per car mile, exclusive of maintenance and of general expense, and are subject to considerable variation under varying conditions. The Union Pacific car, which weighs about 29 tons, has unofficially been stated to consume one-half gallon gasoline per car mile in service involving much fewer stops. The Strang gasoline storage-battery car, weighing approximately 37 tons, consumes, according to official statements of the builders, 0.45 gallon of gasoline per car mile. No statement of service conditions is given, but is inferentially taken from the run from Philadelphia to Kansas City, where the stops were very infrequent, probably less than one in 20 miles.

As a check on the above calculations the gasoline consumption per ton mile works out about as follows:—

	Gallon
Delaware & Hudson car	.0112
Union Pacific car	.0168
Strang car	.0118

It is not intended to compare these three types of independent motor cars, for such comparison would be manifestly unfair, unless one took into account all the factors entering into construction and operation of each of the cars. It is intended to show, however, that the calculated performance of the D. & H. car includes a margin favoring the independent motor car, as compared with the standard electric.

INITIAL INVESTMENTS

To get down to the gist of the whole problem, and to see the influence of the initial investments on a given proposition, we will investigate two cases; the first between the gasoline electric and the standard electric, and the second between these and steam railway service.

The first proposition contemplates the average interurban condition and may represent the competition between two paralleling roads for the local passenger and light traffic business, which is assumed to demand cars at one hour headway from 6 a. m. until 12 p. m., or 18 hours' service. The item of cost and maintenance common to both roads will not enter into the present consideration, and we will assume that the general expense of administration, engineering, taxes, insurance, etc., will be the same in both. We will take the same service conditions as before, i. e., 25 miles of road, stops every three miles, and one hour for the run.

The single-phase system is well adapted to such service, and will be considered first. It would be entirely feasible to operate with a generating plant in the center of the line feeding 6600 volts directly into the trolley, eliminating high-tension transmission and sub-station, and thereby effect a saving in the assumed case of approximately $16,000. But it might be necessary, because of water supply, coal, etc., to build the power house at one end of the line, and thus necessitate a sub-station. In order to be entirely fair to the gasoline car, let us assume this extreme condition.

Two cars will normally handle the service, but for special day requiring half hour headway and for reserve four motor cars and two trailers will be purchased. The normal daily mileage will be 900.

ESTIMATED COST OF STRAIGHT ELECTRIC SYSTEM

Power plant	$45,000
One sub-station	2,000
Distribution system	48,000
Four motor cars and 2 trailers	36,000
Rail bonding	6,250
	$137,250

Interest and depreciation at 10 per cent, $13,725, or $37.60 per day.

ESTIMATED COST OF GASOLINE ELECTRIC SYSTEM

Four motor cars at $17,000	$68,000
Two trailers at $3,000	6,000
	$74,000

Interest and depreciation at 10 per cent, $7,400, or $20.30 per day.

The maintenance of electric cars and plants per car mile can be gotten fairly well from the many published records, but that of the self-powered cars is at present a matter of guess. It will be taken at four cents per car mile, which is roughly one-half the average maintenance charges of steam locomotives per mile.

	Gasoline Electric	Standard Electric
Power	7.	1.91
Car crews	3.	1.68
Supplies	.6	.55
Maintenance, equipment and cars	4.	1.5
Maintenance of plant and distribution system	—	.5
Operating cost per car-mile in cents	14.6	6.05
DAILY COST, 900 CAR-MILE A DAY		
Operation	$131.40	$54.45
Interest and depreciation	20.30	37.60
	$151.70	$92.05

Thus, the difference in favor of the straight electric under the conditions assumed would be $59.65 per day, or approximately $22,000 per year.

Consider now, an existing branch of steam road where the passenger traffic is light. Service must be given, even if without profit. Indeed, many such branch lines are now operated at a loss, so far as the passenger and light traffic is concerned. The problem then is to find the cheapest means of handling the business.

Let us take the same length of line, frequency of stops, etc., as before, but assume that four trains each way per day will handle the business. We will assume that the train crews, when not on the passenger runs, are kept employed elsewhere on the system. The steam service would call for two light locomotives and four passenger combination cars. The self-powered and the straight electric would each require two motor cars and two trailers. The trailers would not be used during the normal service, but would have to be purchased and kept to meet the demands of Sundays and special days.

It is assumed that the roundhouse, repair shop and water tanks would about balance the cost of electric car house and repair shop. Omitting then, as before, all factors of cost and operation common to all three systems, we will have—

ESTIMATED INVESTMENT FOR STEAM SERVICE

Two 45-ton locomotives with tenders	$16,000
Four passenger coaches	16,000
	$32,000

Interest and depreciation at 10 per cent, $3,000, or $8.78 per day.

ESTIMATED INVESTMENT FOR STRAIGHT ELECTRIC SERVICE

Power plant	$27,000
Sub-stations	1,500
Distribution system	48,000
Two motor cars and 2 trailers	21,000
Rail bonding	6,250
	$103,750

Interest and depreciation at 10 per cent, $10,375, or $28.50 per day.

A plant of this size would not produce power so cheaply as the larger ones previously considered. The cost per kw-hour is taken at 1½ cents per kw-hour, hence we have—

	Cents
Power	3.38
Labor (as before)	1.69
Supplies (as before)	.55
Maintenance (as before)	2.
Per car-mile	7.62

ESTIMATED INVESTMENT GASOLINE ELECTRIC SERVICE

Two gasoline electric cars	$34 000
Two trailers	6,000
	$40,000

Interest and depreciation at 10 per cent, $4,000, or $10.90 per day.

The steam train will consist of the locomotive, tender and two cars, giving a train weight of approximately 110 tons. Under the assumed conditions of schedule, stops, weight, etc., such trains will require about 55 watt-hours per ton mile, i. e., .0735 hp per ton mile. In such service, the locomotive would burn about 7 lbs. of coal per hp-hour, and if this coal cost $2.25 per ton, the train mile cost would be approximately—

TRAIN CREW

Engineer	.35	per hour
Fireman	.21	"
Conductor	.30	"
Brakeman	.175	"
	$1.035	

COST OF STEAM OPERATION

	Cents
Power	6.35
Maintenance of locomotive and cars	8.
Supplies	2.
Round-house expenses	1.
Train crew	4.15
Per train-mile	21.5

The daily operating costs, exclusive of those items which are common to all the systems, would then be:—

	Steam	Electric	Gasoline
Operation	$43.00	$15.34	$29.20
Interest and depreciation	8.78	28.50	10.90
Total	$51.78	$43.74	$40.10

As the same equipment and, therefore, the same investment would be needed for a few trips more or less, and applying the same unit operating costs per car mile and the same fixed charges, we get the following:—

Daily Round trips	Mileage	Steam	Electric	Gasoline
Six	300	$73.29	$51.36	$54.70
Five	250	62.53	47.55	47.40
Four	200	51.78	43.74	40.10
Three	150	41.03	39.93	32.80
Two	100	30.28	36.12	25.50
One	50	19.53	32.31	18.20

This brings out clearly, that in the assumed case, the gasoline car is cheapest under six-round trips per day, while the electric system is the cheapest at six trips or more per day. (See Fig. 2 on next page).

Generally speaking, the gasoline car will show a saving over the steam train in light, infrequent service, but when the frequency begins to approximate 2½-hour headway between trains, the electric car is undoubtedly the cheapest and becomes increasingly so with increase of traffic frequency.

EXTERNAL TRANSMISSION CIRCUITS

We come now to what, probably more than any other fac-

tor, including even higher initial investment, has been the greatest stumbling block to the electrification of steam railroads. All other details of electric railroading have easily surmounted the objection of the steam railroad men. It is not the purpose to discuss the important subject of external transmission circuits within the limits of this paper, but it is well to point out that the progressive men in heavy railroad work no longer look upon the electric power conductor with the doubt and misgiving, not to say scorn, with which they regarded it a few years ago. The overhead trolley has demonstrated its reliability and sturdiness on thousands of miles of electric roads from Maine to California, from the Lakes to the Gulfs, in all conditions of weather and seasons. But until very recently, low trolley voltage limited its use to light interurban service. The writer is quite in sympathy with the railroad men's objections to the third rail, which, while it has splendidly performed its functions of showing the possibilities of heavy traction, is for many reasons inadvisable for surface work, although well adapted for subway or elevated roads. The advent of the single-phase system permitting the use of high-trolley voltages, and hence moderate power conductors and bow trolleys, has brought the overhead-trolley conductor into the field of heavy railroading and, with the large eastern roads setting the pace, the early electrification of the present steam lines will inevitably come on.

CONCLUSIONS

Managers of steam railroads entrusted with the direction of large vested interests, are naturally very conservative, and, therefore, slow to make what would appear to be radical changes in their equipment. Therefore, while they realize the limitations of the steam locomotive in suburban and interurban service they will, before stringing the trolley wire over their tracks, try out pretty thoroughly the independent motor car, which holds out alluringly the suggestion of interurban service without power house, without the track bonding and without the external transmission circuit. This try-out will definitely establish the true field of the self-contained car, and, in the writer's judgment, this field will be the very short spurs of existing steam railroads, serving sparse population, making infrequent trips, principally to connect with main-line trains. Take one road, the Burlington for example. The Galena Junction shuttle train, operating on a 5-mile spur, and meeting the more important trains of the main line; and the Dubuque shuttle train, which operates on the 1¼-mile spur from East Dubuque over the Mississippi River bridge, could well use such independent motor cars, unless, indeed, electric power at satisfactory rates can be purchased of the neighboring electric companies.

There is another field, not very wide it is true, but a profitable field which the independent motor car may enjoy with freedom from competition. The writer expects to see the present private cars of our millionaires displaced by the independent-motor car, which can be made as comfortable and luxurious as any of the Pullmans now in service. Its owner may go anywhere that standard gage tracks lead to, regardless of limitations to locomotives or to electric cars.

As to prospective interurban roads which are promoted with the view to using the gasoline or other type of independent motor, it is highly desirable to go slow and investigate. Broadly speaking, if a prospective road is to depend for revenue only on its passenger and light express traffic, and the business only warrants one-half or more hours' headway between cars, it becomes very much of a question whether or not the road will pay or ought to be built at all.

But this brings us into the realm of interurban railway economics, concerning which, much less even than railway engineering, it is not well to generalize. Each individual proposition should be independently examined and passed upon by a competent engineer, who should determine the equipment best fitted for it.

In city service, the independent gasoline car will find only the remotest application. Under certain conditions of power plant arrangement and operation, there may be isolated instances where the independent car might be called upon to handle the "Owl" service in the small hours of the morning. It may also be used on such streets on which the municipality prohibits the laying of tracks. Indeed, such cars are already in operation on Fifth Avenue, New York. In such service, the independent car will probably displace the so-called "trackless" trolley cars, which are in use in some European cities.

In conclusion, the writer believes that the independent-motor car will prove a useful transportation medium. Its field will be distinct from that served by the standard electric system. The likelihood of the independent car is quite remote. Reduction in operating cost of the independent car must come about through cheaper fuel and smaller labor. As we all know, the price of gasoline is constantly increasing—due to the diminishing supply of the crude oil from which it is made. Kerosene engines and alcohol engines are

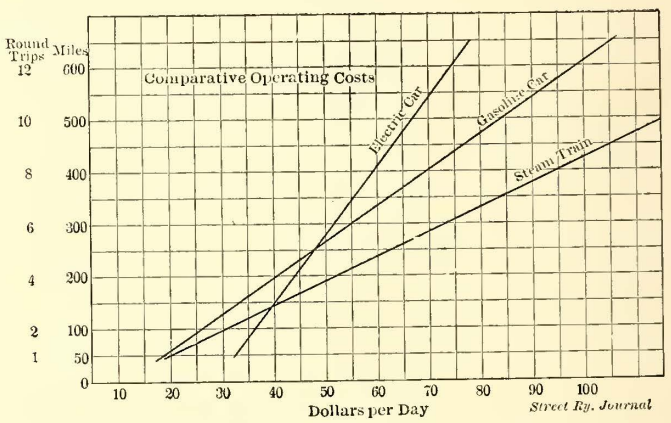


FIG. 2.—CURVES SHOWING COMPARATIVE OPERATING COST OF THREE SYSTEMS OF TRACTION, RUNNING STATED NUMBER OF TRIPS PER DAY

frequently spoken of, but as yet can not compete with the gasoline engines. The reduction in labor expense is not very promising. Advances and improvement in the art of independent-motor car will undoubtedly be made, but at the same time, it must be borne in mind that the electric system will by no means stand still, and if its future progress be judged by that of the past, it will undoubtedly become the preeminent, if not the universal, transportation medium.

In commenting upon Mr. Hild's paper, President Hippee said he did not think three men would be required on a car. He thought the motorman ought to be able to run the engine. A gasoline car, he thought, was no more unreliable than the first electric cars, and these, he said, did not require a third man.

A. P. Jenks, of Chicago, did not think the third man could be dispensed with. The Delaware & Hudson Railroad, he said, was compelled to go abroad for an engine, and it was a rather complicated one. The Delaware & Hudson car weighed 62½ tons, of which weight one-half was in the car body and trucks. The engine was of the high-speed type, running at 425 r. p. m., and developed 160 hp. All the figures he had seen concerning the cost of operation of gasoline cars, he said, were very close to 14.6 cents per car mile.

Mr. Conant thought that a field for the gasoline-motor car, not mentioned by Mr. Hild, was in the development of roads. On a new road frequently it was desired to know what amount of traffic could be depended upon before heavy expenditures were made in electrical equipment. He thought the use of a gasoline-motor car on the road at first would be the cheapest method of determining whether the road would be a financial success.

Mr. Hild stated he had investigated the gasoline-electric motor car problem with a view of using such cars on a road in Illinois and Wisconsin, and had found that there was a difference of $40,000 per year in favor of electrical operation.

Mr. Craft said he had seen some large gasoline engines and that he failed to see how a motorman could take care of the engine in addition to his other duties.

Mr. H. W. Kitto, of Des Moines, did not think Mr. Hild's figures fair. He said the Great Western Railway, of England, had found that motor cars could be run on ordinary roads at very low cost; and if this was so, why could they not be operated on rails to the same advantage. He attacked Mr. Hild's figures as regards the original cost of gasoline-motor cars, saying he failed to see where the money could be put. He thought the weight of such cars could be reduced 50 per cent. With regard to a third man on the car, he thought this could be avoided by using a two-cycle engine, which is very simple in construction, rather than the more complicated four-cycle engine.

Following the discussion of Mr. Hild's paper, W. R. Garton presented a paper entitled "The Mutuality of Interests of the Operator and the Supply Man," of which the following is an abstract:

MUTUALITY OF INTERESTS OF THE OPERATOR AND THE SUPPLY MAN.

In the introduction of his paper, Mr. Garton explained that he would use the term "supply man" to include the manufacturer as well as the supply man, and also the traveling salesman. The author then paid a glowing tribute to electric railway men as a class, pointing out that of necessity the electric street railway man has made for himself a hustling environment, and he not only keeps pace but is generally in the lead. To-day he is usually the liveliest and most wide-awake individual in the community. He has become so filled with the result of his own achievement and the impetus he has gained that those coming into contact with him are compelled to assume much the same attitude. The writer entered a plea for a greater unity of interest between the buyer and the seller, for although the operator is, in a large measure, responsible for the growth of the general field of this industry, yet it is equally true that the supply man is to be thanked for the development of new labor and time-saving productions, directly influencing the earning capacity of electric railway properties, which to-day represent investments of millions of dollars. It is the province of a wide-awake manufacturer, supply man or salesman to bring to the operator's attention the most potent issues, and if the operator will coöperate, by proper selection, he must surely be the gainer. The supply man represents the most active and energetic class of business men dealing with important problems. To-day the average salesman representing this branch of the industry is not only a gentleman of tireless activity, habitual diligence and intelligence, but is possessed of a keen desire to apprise himself of a thorough knowledge and keep pace with the constant changes for the betterment of the art. Therefore he can in many instances be looked upon as in quite a degree an expert in matters of this character. He is constantly schooling himself, gathering information at every turn. This may sound like a conclusion assumed for the sake of argument, but when it is known that he goes from one property to another in quest of knowledge it certainly is fair to assume that he can, if he will, become well versed, and he does. The supply man grasps the situation, applies himself and brings forward a means of accomplishing the carrying out of principles incorporating advanced ideas for the success of his plans, which contemplate improved methods for overcoming weaknesses and simplifying the means of gaining greater proficiency in the operation of the railway, and efficiency in the apparatus, much and always to the interest of the operator and his property.

The salesman who bores the life out of an operator for an order, while he is suffering with a toothache or bothered with some intricate problem which he is to solve, would certainly be most indiscreet, and it is reasonable to suppose that the next time that salesman called he would be turned down and refused an audience, and justly too. There is also need for discretion on the part of the operator. It is not necessary to bore a possible purchaser or freeze a salesman as a rule in order to accomplish the desired purpose. There should be a stronger bond of harmony and a greater community of interest than is general. Such cannot but work for the betterment of all concerned. There must be some give and take on both sides, as we all have our bitter pills to swallow. Every one will probably admit that the supply man and the exhibits have come to be prime factors in the conventions of the electric railway associations. This same contingent, the author believes, forms the financial basis and backbone of the splendid electrical journals published in the interests of electric traction, progress and success. Here the author thinks is one of the sequels and further proofs of the real necessity of one for the other. The operator needs the magazine to aid him in keeping abreast of the times, and the supply man needs it to keep in touch with the operator and to keep the operator in touch with him. The reasonable conclusion must be that coöperation of these two interests through the medium of the electrical journal is truly essential. If all these interests can be drawn into closer harmony with fixed ideas of accomplishing the greatest possible good for all concerned, opportunities of vast import that are in many instances given little or no attention can be taken advantage of, and as a natural sequence beneficial results will often be secured. If the operator has the heart and good will of the supply man, and the supply man the high regard and kindly feeling for the operator that is hoped for, each can constantly render to the other almost invaluable service, which money cannot buy. It should be firmly fixed in the minds of all that electric traction is the biggest, most gigantic and far-reaching question confronting the world to-day. And those active in bringing about a condition of higher standards are true sculptors in the art gallery of life, moulding with each day's efforts and successes, a greater and grander condition for the ennobling of mankind and the betterment of the people.

After the reading of Mr. Garton's paper the convention adjourned until 2 o'clock in the afternoon.

FRIDAY AFTERNOON SESSION

The afternoon session was taken up by the reading and discussion of a paper on "The Standard Car Body and Truck for City and Interurban Service," presented by George H. Tontrup, of St. Louis.

STANDARD CAR BODY AND TRUCK FOR CITY AND INTERURBAN SERVICE

In this paper Mr. Tontrup offered a few suggestions as to the design and construction of car bodies and trucks, and although he realized he was speaking from the standpoint of

the car builder, he felt that possibly he might offer a few helpful hints based upon his interviews with many electric railway men. Inasmuch as most managers have an ideal car of their own, and these ideas on many points reveal a wide diversion of views, the ideal car must of necessity be based upon a compromise, like most other questions pertaining to mechanics and engineering. The present electric car is the connecting link between the old horse car and the modern steam coach. The horse car has almost entirely disappeared, and at the present time the interurban electric car is making fast inroads into the territory of the steam coach. It would be a difficult task to build a car that would accommodate itself to the two extremes, that is, the short city line on the one hand, and conditions approaching steam railroad operation on the other. Hence it is necessary to discuss car design under at least two divisions, namely, city and interurban service. The cardinal requirements for the ideal city car may be divided into the following heads: The handling of passengers, the comfort of passengers, and the maintenance of equipment. Each of these heads can be divided and subdivided, and each division taken as an individual subject for a separate paper, but in a paper under this general heading all must be considered to a certain extent.

As to handling passengers, the principal objection to the double-truck car for dense city service has been the difficulty of loading and unloading passengers quickly, but this objection is fast disappearing. The argument advanced by some of the advocates of the single-truck car was that less time was consumed by the passengers in walking the length of the shorter car to the rear platform. This is perhaps true and might remain a strong objection to the double-truck car if the same oscillation, tetering and unsteady motion when running existed with the double-truck as with the single-truck car. However, the comparative steadiness of motion with the double-truck car enables passengers to leave their seats and walk to the rear platform before the car reaches the destination, and thus passengers will usually be at the rear door ready to alight as soon as the car comes to a stop. In like manner, the conductor can give the signal to start as soon as the passengers are safely on the platform, and the passengers can, with perfect comfort, take their seats after the car has started. As regards the platform, the writer is of the opinion that there should be put one single step, and as low as height of motor, diameter of wheel and curve conditions will permit. The steps should be at diagonally opposite corners only, so that passengers will never attempt to board or leave the car except at the step near the conductor's position. The platform, to further facilitate the handling of passengers, should be as long as possible, consistent with strength and the prevention of sagging. The length of platform may range from 4 ft. 8½ ins. to 6 ft., but experience has shown that for city service the platform should not exceed 6 ft., because a longer platform can be adopted only at the expense of rigidity. The platforms should be provided with a railing running from the step to within, say, 24 ins. of the opposite side, and should also have what is commonly known as a three-quarter vestibule, with folding doors or gates. The entrance from the platform to the body of the car should be a single door and of the accelerator type. By the use of this door, at least three-quarters of the rear platform is available for standing passengers, and passengers can get off and on at one and the same time without serious confusion, thus reducing the time necessary for stops.

The next question that should receive attention is the aisle. The width of aisle not only has a bearing on the handling of passengers, but it is also closely related with the comfort of passengers. When cross seats are used the aisle should be as wide as a comfortable seat will allow. The width of aisle and length of seat are, of course, dependent upon the width of the car, and this is influenced by the distance between tracks, radius of curves and width of street. If these governing conditions are such as to restrict or reduce the width of car, it follows that the only space that can be economized in order to give the greatest width of aisle is at the side walls of the car. To accomplish this the sash should be designed to be raised, thus giving a large part of the sash pocket for increasing the aisle width. In the writer's opinion, a sash that raises has other advantages over one that lowers, in that it is more sanitary, as the sash pocket does not offer a convenient receptacle for refuse and dirt. The city car should have cross seats, except at the end of the car, which should have at the narrow side of the door a longitudinal seat and at the wide side of the door a stationary end seat, which will give seating capacity for three passengers. This arrangement will give a greater standing space in the end of the car, where it is most needed. The cross seats should have corner-grab handles. The ventilators should be arranged in pairs so that one-half or less may be opened in the opposite direction to that in which the car is moving. This method creates a suction from the inside of the car, and at the same time excludes the dust. The question of heating the car is also an important consideration in connection with the comfort of passengers. The manufacturers have succeeded in producing many good types of stoves, hot-water heaters, hot-air heaters and electric heaters, and any of the accepted forms will produce all the heat necessary to maintain a comfortable warmth if the heat is not wasted. In the writer's opinion, the main question is not so much what type of heater to use as it is how to utilize and retain the heat generated. This is a matter governed very largely by climatic conditions, but it is also dependent upon the judgment of the conductor and partly upon the construction of the car. The lighting of the car is largely a question of securing equal distribution and placing the lamps in a vertical position. If the lamps are placed on the walls of the car or in a horizontal position, they not only produce a quivering light, but the lamp films are very much impaired by the vibration of the car.

As to the maintainence of equipment the necessary work that will have to be done in properly maintaining the car body will be largely dependent upon the design of the trucks. An electric car is subjected, when running, to a continuous jarring, and it is essential, from the standpoint of maintenance, that this jarring or shaking should be reduced to the minimum by the use of good trucks. In the matter of trucks it is true, paradoxical as it may seem, that the least one buys for the money, the more he gets; in other words, the fewer the number of pieces comprised in the truck the easier it will be to keep both truck and car body in repair, and only those parts are necessary that will keep the frame true and square, take care of the brake rigging, and make the truck resilient. In the writer's judgment, the use of hot rivets in making trucks is not good practice. Not only are rivets troublesome when repairs are needed, but they cause the parts of the structure to work or grind upon each other when long pieces of dissimilar metals are riveted together, owing to the difference in contraction and expansion of the metals. In regard to resilience, that truck is best that will dissipate the shock or jar caused by depressions in the rails before the shock reaches the body center plate. This calls for a sufficient number of nests of springs and proper distribution of these springs throughout the structure. While the different truck manufacturers have tried nearly every possible combination of springs, it has been proven beyond question that the springs which carry the equalizer should be brought as

close as possible to the journal, which is the first place in which the impact is felt. By placing the springs close to the journal box there will be a tendency to absorb the shock and reduce its effect on the car body.

Mr. Tontrup is of the opinion that the concave and convex side panels have outlived their usefulness and should be discarded. The straight-sided car is stronger and easier to maintain. Furthermore, in case of damage, it requires but the replacement of a few pieces of sheathing instead of a long panel, as formerly was the case with the panel side. A few companies have adopted a sheet steel for the sides of cars. The writer makes a point in connection with the maintenance of cars, by emphasizing the necessity for regularly tightening up bolts and nuts. Cars are frequently operated for months without any one ever thinking to take up the slack on nuts. It is a well-known fact that in tightening up a nut on a bolt after it has been turned as tight as possible with the wrench, if the head of the bolt is given a sharp tap with the hammer the nut will frequently stand another turn or half-turn. This is precisely what takes place when a car is kept in service for any length of time; that is, the bolts all tend to shake loose and, if they are not tightened up frequently, the whole structure will begin to work and grind in all its parts, and will soon need a general overhauling.

The interurban car has much in common with the city service car, and may properly be considered under the three headings of accommodation, speed and comfort to passengers. As to the structure of this car it, like all other structures, depends on the use or purpose intended. The interurban road has reached its present development because of its ability to give a system of single units with frequent schedules and numerous stops. In the writer's opinion, the interurban car has reached abnormal length, and in this respect has exceeded the desirable limit. While it is true that a majestic looking car makes an agreeable impression on the people adjacent to the road, and gives them a feeling of part ownership, still this matter has been overdone Electric cars have been built for ordinary interurban service that measured 60 ft. over all, and the present average is probably 52 ft. over all. This extreme length is inconsistent with the fact that small units and frequent service are what have made the interurban car popular. The writer believes that it is better to have shorter cars and a more frequent schedule. According to his experience the ideal interurban car would be, say, 34 ft. over corner posts and 43 ft. over all, with saloon and smoking compartments. This car should have platforms level with the floor of the body and fitted with double steps. This platform construction is in keeping with the idea of a high-speed car. It gives ample room for the high-speed truck with 6-ft. wheel base and sufficient clearance for motors. It also permits building the center sill of I-beams extending from bumper to bumper. It is believed a car of this type would have sufficient weight to give entire safety when running at high rates of speed. The trucks under an interurban car are, of course, an important part of the equipment. These trucks should be of heavy type with wheel base 6 ft. or 6 ft. 6 ins., which would permit of inside-hung motors. The wheels should be heavy and should have treads and flanges as near the M. C. B. specifications as possible. The interurban car preferably should be operated the same end on going in either direction, but should have a double end brake and electric equipment, the brake and controller on the rear end to be used in case of emergency. The front end should be partitioned off to give a motorman's cab as a precaution against anything that would distract the motorman from his duties. The importance of this cannot be over-rated on a high-speed car where the safety and lives of passengers are largely in the hands of the motorman. The cars should have the steam coach type of roof, as this pattern offers less air resistance than a monitor with bonnet. The sides of the car should be constructed with "W" bracing or double sheating straight sides. As the comfort of the passengers depends greatly upon a wide seat, a good, comfortable, wide seat should be provided, and this can usually be done because there are seldom the same restrictions as to width of interurban cars as there are on city cars. The seats should have high backs with a head rest. All that has been said of the city service cars in regard to heating and ventilation applies equally well to the interurban car.

President Hippee wanted to know why every car builder put in veneered ceilings, or head lining. He said this ceiling was objectionable because a leak in the roof would cause a blister in the ceiling which could not be removed. Mr. Tontrup stated that this ceiling was used because of its good appearance, but that now steel ceilings were being used to some extent as a substitute.

After the discussion of Mr. Tontrup's paper, Mr. Crafts took the occasion to call to the attention of the convention the past work of President Hippee in connection with the formation and development of the association. Two years before, he said, President Hippee had conceived the idea of such an organization, and under his care the association had developed to such a point that the meetings rivaled in interest those of the national convention. All was due to Mr. Hippee, who was retiring from the presidency, and he moved that the association extend a vote of thanks and appreciation to Mr. Hippee. This motion was seconded by F. J. Hanlon, of Mason City, who added that no other man in the State could have done what Mr. Hippee had accomplished. After the motion had been passed, Mr. Hippee responded, thanking the association for its kind expressions, and stating that all his work in connection with the association had been a pleasure.

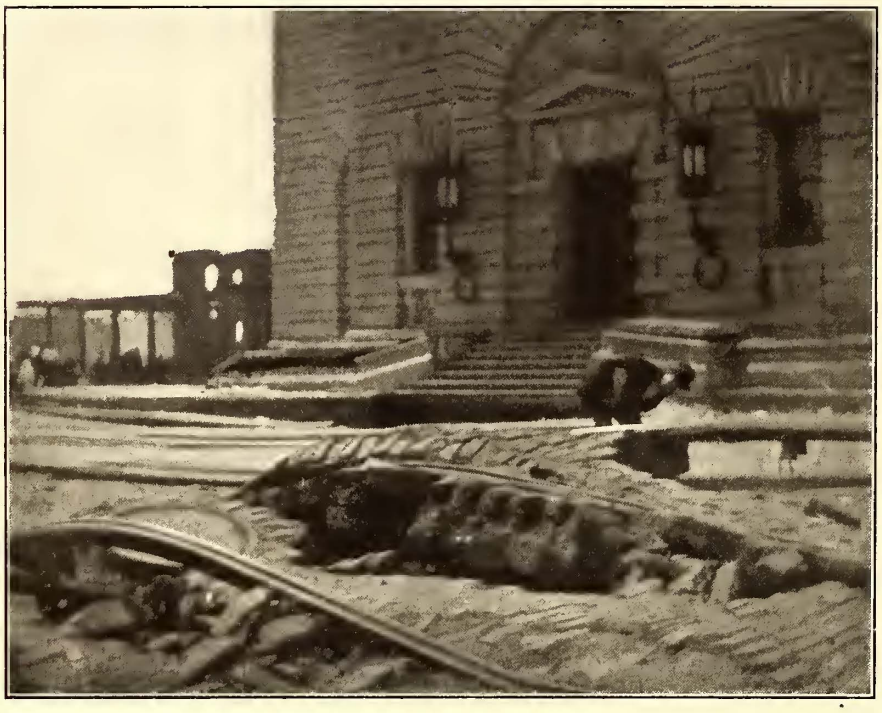
The nominating committee reported the following nominations: President, F. J. Hanlon, of Mason City; vice-president, P. P. Crafts, of Clinton; secretary, L. D. Mathes, of Dubuque. These nominations were accepted unanimously. Mr. Hanlon, in assuming his new duties, said he would do all he could to follow the example set by Mr. Hippee.

Mr. Garton, in speaking for the supply men present, stated that they had thoroughly appreciated the occasion, and wanted to know if the supply men would not be allowed to assist the association financially or otherwise. In reply to Mr. Garton, President Hanlon said the association appreciated the good intention and good will of the supply men, but that the supply men were under other expenses. Secretary Mathes said he considered the supply men as very much responsible for the success of the association, and that they were welcome to attend all the meetings, but that the association was well able to take care of itself financially. Mr. Hippee said the offer to help the association financially had been made by several other representatives of the trade. He considered that they had much to do with the success of the association, and were moreover under heavy expenses in making their exhibits. On motion, by Mr. Hippee, the convention adjourned to accept the invitation of the Inter-Urban Railway Company to an excursion over the lines of the company and supper enroute in the new private car "Iowa." It was decided to hold the next meeting of the association at Clinton, Ia.

The work of connecting the line of the Syracuse Rapid Transit Company with the West Shore Railroad was commenced last week. This improvement is in anticipation of the electrification of the West Shore road, as the cars to and from Utica will pass through Robbers Row on leaving and entering the city.

THE STREET RAILWAY SITUATION IN SAN FRANCISCO

The earthquake that visited San Francisco on the morning of April 18, followed by the most disastrous fire in the history of the United States and lasting over three days, of course, did a great deal of damage to the street railways of the city, although, as outlined in the last issue of the STREET RAILWAY JOURNAL, the damage was not so great as the first reports indicated. As a matter of fact, the loss to the company will not be nearly as heavy as might have been expected, considering the magnitude and extent of the disaster. The officials of the United Railroads of San Francisco now place the loss in physical property at $1,250,000, most of which is covered by insurance.

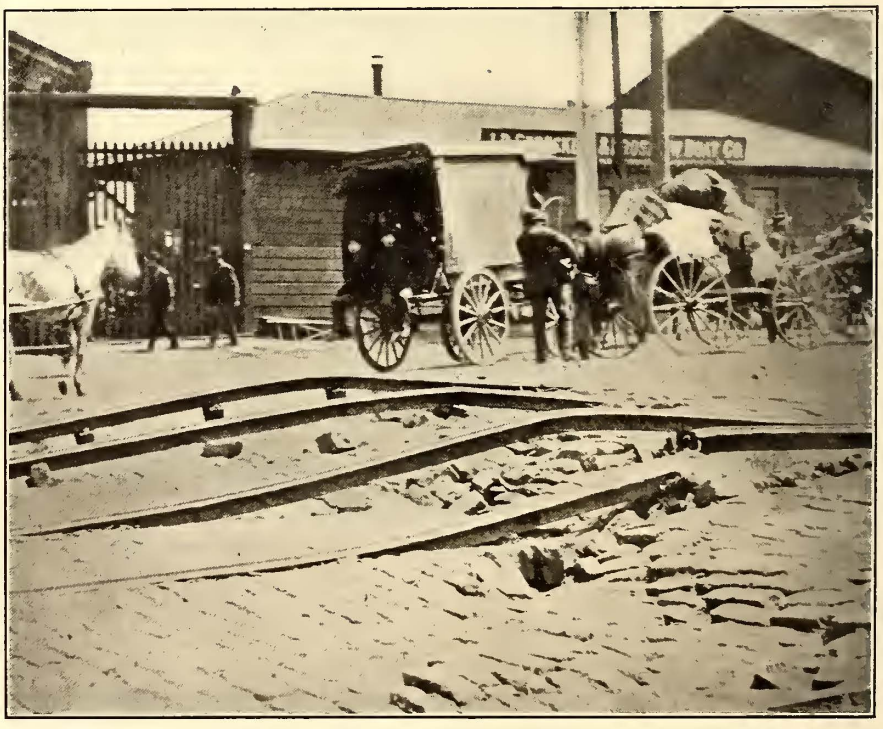


WHAT THE EARTHQUAKE DID TO THE TRACK AND ROADBED OF THE CABLE SYSTEM IN FRONT OF THE SAN FRANCISCO POST OFFICE

The tremors of the quake have passed, the fire has burned itself out and now, with the rising of a new San Francisco, more beautiful and artistic than ever before, steps are being taken as rapidly as possible to place the city in a normal condition.

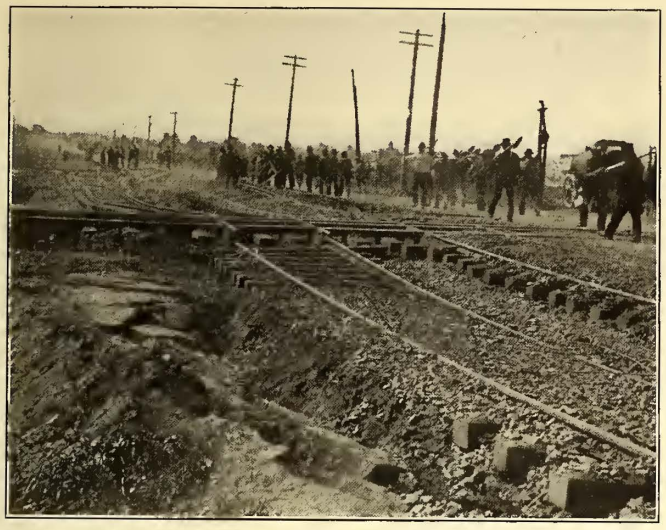
The burned district includes about 2500 acres, or approximately 5 square miles of the city's area, including the entire business, commercial, hotel, and shopping districts, and a large portion of the residential section. The earthquake district, or that section in which the shock did the greatest damage, is for the most part coincident with the heart of the burned district. Within the earthquake and fire area the United Railroads of San Francisco has about 100 miles of track, laid for the most part as double track in 50 miles of streets. Of this mileage, 60 miles was operated by the overhead trolley and 40 miles was operated by cable. The cable lines suffered the most from the effect of the earthquake and fire, as the concrete foundations were badly twisted and broken by the force of the shock. In many cases also the slot rail closed up, either on account of the twisting of the foundations or warping by the heat. Of the electrical lines within the fire area, of course, all the feeder and overhead work was destroyed, although the poles in many cases can be straightened and utilized. So far as can be learned, the electric railway tracks did not suffer materially from warping of rails, although, in a few isolated cases, the tracks heaved as a result of the earthquake and threw the rails out of alignment, but it is believed that all of the electric railway mileage can be very quickly repaired as soon as the danger from tottering walls has been removed and the debris cleared away. Repairs to the cable conduits, however, will be a more serious matter, and it is doubtful if either the city authorities or the railway company will think it feasible to attempt to renew the cable tracks or use the underground conduit. The mayor has already issued a temporary permit for stringing trolley wires on Market Street, which was formerly a cable line, and cars are now run on this line by electric traction.

The cable service was also seriously injured by the destruction of the two cable power houses, which were located well within the burned area. At one of these cable plants were the main repair shops for the system, which were also destroyed. By a curious, and at the same time most fortunate, freak, the two main electric railway power houses escaped serious injury. One of these stations was located across the street from the fire limit, and although the building was discolored by smoke the flames did not reach the structure, and the plant was ready for operation



ANOTHER VIEW, SHOWING TRACKS TWISTED AND BROKEN BY THE EARTHQUAKE, AND WAGONS LOADED WITH REFUGEES, FURNITURE AND MERCHANDISE

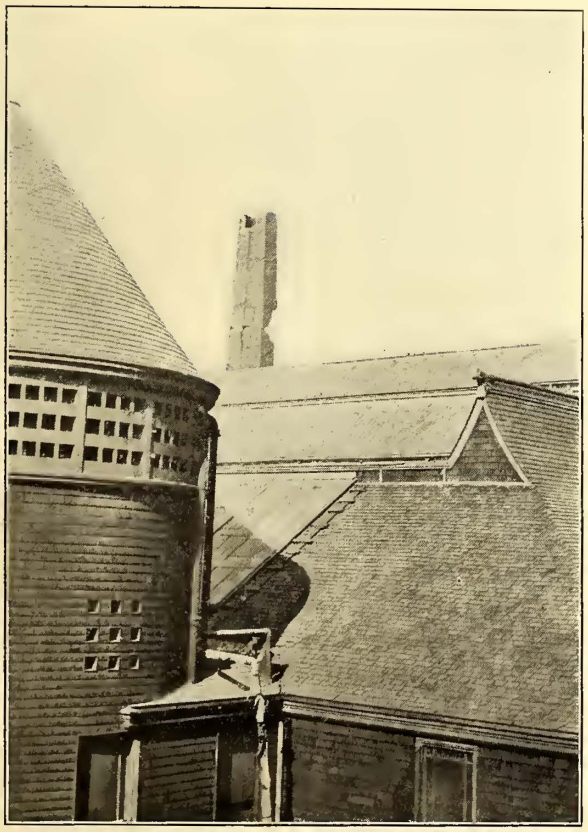
immediately after the disaster. Most of the company's car houses were located outside the fire limits and were not injured in any way. This accounts for the small loss in electric rolling stock, as most of the cars were in the car houses.



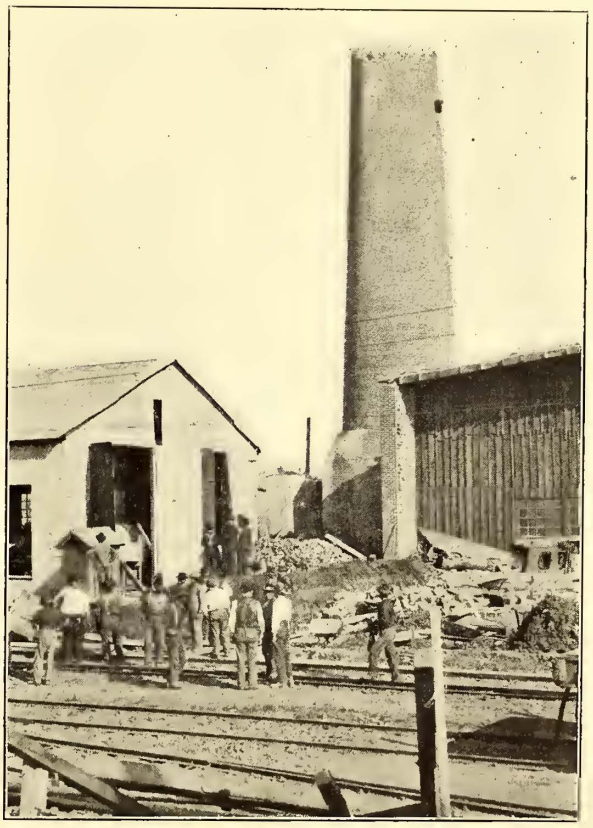
TWO SCENES ALONG THE LINES OF THE OAKLAND CONSOLIDATED TRACTION COMPANY, SHOWING THE UPHEAVAL OF THE ROADBED AND TWISTING AND BREAKING OF THE RAILS

So far as can be learned, only seven electric cars were destroyed.

As in the case of the Baltimore fire, the street railway company was one of the first institutions in the city to rise from the despondency and confusion caused by the double disaster, and after the staff had helped in fighting the fire step by step, the entire organization rallied around the executive officers, and in many cases, while the ruins were still smouldering, the temporary reconstruction work was well started. The financial interests associated with the United Railroads, both in San Francisco and in the East, were among the first to start a relief fund, and the day after the disaster the sum of $75,000 was subscribed jointly to the general relief work by the United Railways Investment Company, Ladenburg, Thalman & Company, Patrick Calhoun, C. Sidney Shepherd and Ford, Bacon & Davis. The company aided further in the relief work by opening four of its car houses and housing and lodging the homeless. By almost superhuman efforts two of the main lines through the very heart of the destroyed district were opened up, and a remarkably good service given. This electric service was of the utmost convenience and help to the citizens and the relief force, as this service for some time



STACK OF PIEDMONT POWER STATION, OAKLAND

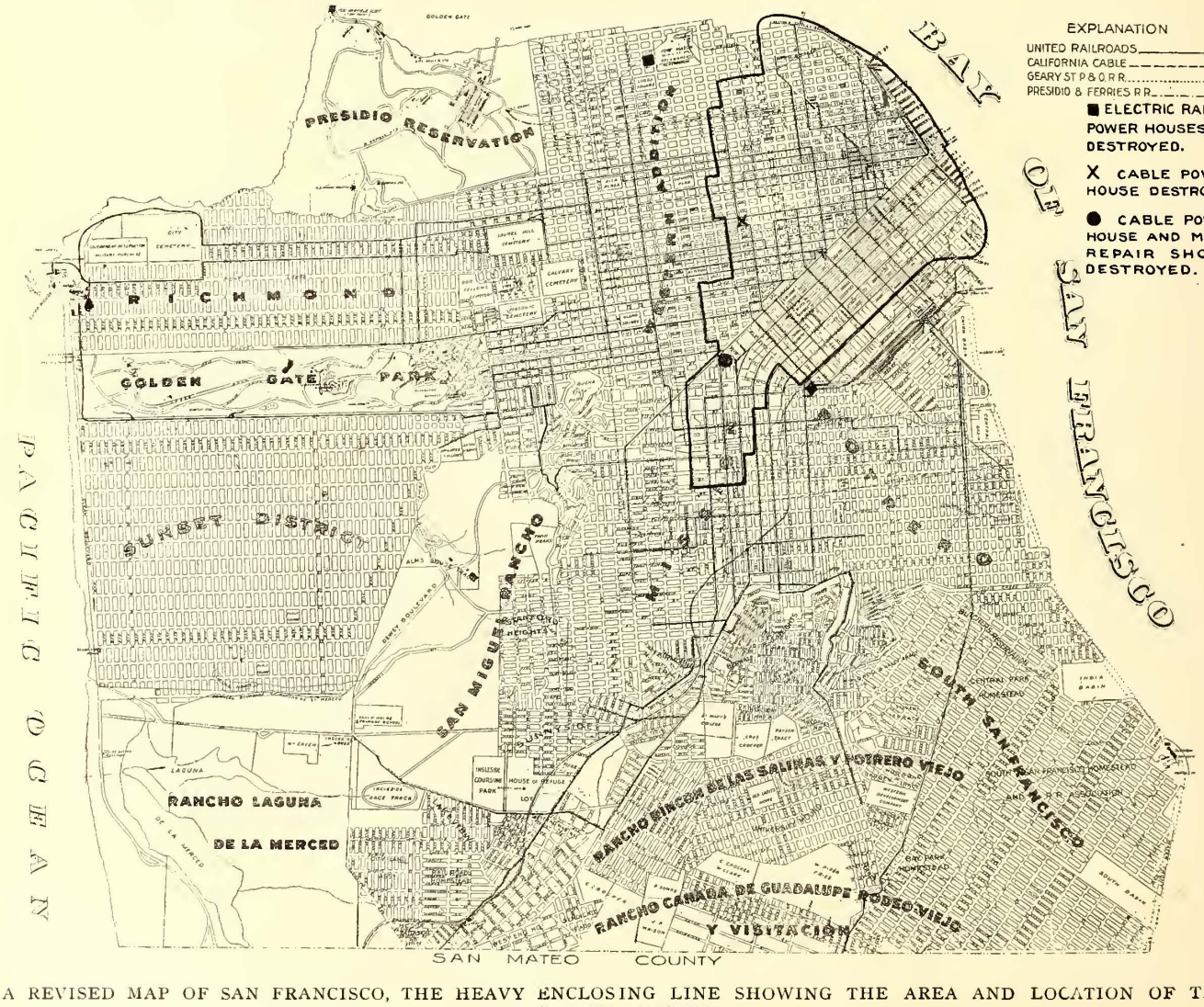


STACK OF YERBA BUENA POWER STATION OF THE KEY ROUTE, OAKLAND

offered practically the only means of transportation through this section of the city. All passengers were carried on the cars free of charge, and it is the intention to give this free service until conditions become more normal. The company will run cars on Market Street by overhead trolley as soon as dangerous walls are removed, namely in a day or two. The day after the fire cars were operated successfully from Broadway down Fillmore Street, through Sixteenth Street to Bryant Street, which is now the crowded district. On April 30 cars were also operated from Sixteenth Street down Mission Street to Market Street. Mayor Schmitz operated the first car as motorman, and Judge Morrow and a distinguished party of citizens were on board. The sight of the cars aroused the greatest enthusiasm among the people, as the operation of these cars provided extremely useful service. On April 30 the company reported that it was ready to operate also on Twenty-Sixth Street to San Bruno Avenue and Dwight Street; Fifth Street and Market Street to Mission Street and Canandage Street; Sixteenth Street and Bryant Street to Kentucky Street and Twenty-Third Street; Fillmore Street to Haight Street and Stanyan Street; Fillmore Street to Sixth Avenue and Calf Street, via. Sacramento Street. This gives service on the present lines of the system over practically the entire city. It is the intention to lay temporary tracks on Market Street, each side of the present tracks, for removing debris.

TRACK TWISTED IN OAKLAND BY THE EARTHQUAKE

The revised general boundaries of the burned district are as follows: Water front from Brannon Street on the east to Jones Street on the north, Jones Street to Chestnut Street, to Hyde Street, to Polk Street, to Filbert Street, to Van Ness Avenue, to Clay Street, to Franklin Street, to Sutter Street, to Van Ness Avenue, to Golden Gate Avenue, to Octavia Street, to Page Street, to Cough Street, to Market Street, to Dolores Street, to Twentieth Street, to Mission Street, to Eighteenth Street, to Howard Street, to Fifteenth Street, to Folsom Street to Eleventh Street, to Bry-



A REVISED MAP OF SAN FRANCISCO, THE HEAVY ENCLOSING LINE SHOWING THE AREA AND LOCATION OF THE DESTROYED DISTRICT

ant Street, to Water front. This district is outlined on the accompanying map.

The only electric power plant injured by the earthquake or fire was that at North Beach, where the roof was broken in and the machinery slightly damaged. The Millbrae and Turk and Fillmore sub-station roofs and sidewalks were damaged by the earthquake, but the machinery is uninjured. The telegram states that the employees fought every inch against fire, day and night, without eating or sleeping.

That the damage to electric railway property was not confined to San Francisco is evident from the reproductions on pages 727 and 728 of scenes in Oakland after the earthquake.

The shock was doubtless as severe on the east side of the bay as in San Francisco. The damage to some buildings was severe, but the total loss was surprisingly light. Nearly all electric railway lines could have been operated continuously had not the management prudently ordered the current kept off the wires until all had been thoroughly inspected. This was done, and all electric roads operated within twenty-four hours.

Three of the accompanying views are of the electric railway tracks of the Oakland Consolidated Railway Company on Webster Street, Alameda. This street is a causeway filled across a tidal marsh—the worst possible formation with respect to stability. The land on both sides has never been filled, so that the roadway has had no lateral support. Here one of the tracks sank 3 ft. or 4 ft. The kinking of the track is due to end pressure buckling the 70-lb. rails. There were several other spots about the same as the one shown.

Another view shows the brick stack of the Piedmont power station, Oakland. This chimney was 136 ft. high; the hole in the side is about mid-height. All above the hole has since been pulled down. This building stands on filled-in salt marsh.

Another view shows the brick stack of the Yerba Buena power station. It was 156 ft. high; about one-third is gone from the top. Some cracks exist in the remaining portion, but the chimney is in a serviceable condition. It stands on swampy ground near the shore of the bay, but has a very substantial pile foundation. The appearance of confusion in the foreground is due to an extension of the engine and boiler rooms, which has been under way for some time.

15,000-KW POWER PLANT FOR LOS ANGELES, CAL.

The Pacific Light & Power Company, of Los Angeles, Cal., has just contracted with Charles C. Moore & Company, engineers, of San Francisco, for a complete steam power plant to be delivered and installed at Redondo, Cal., a suburb of Los Angeles. This plant will be used for supplying power to the entire street railway system of Los Angeles and the various surrounding towns, in connection with the various other power plants and water transmission systems. This plant will have a nominal capacity of 15,000 kw, consisting of three 5000-kw units; the overload capacity of the plant will be about 30,000 ihp. The generating units consist of three McIntosh & Seymour combined double horizontal and vertical compound condensing engines, with grid-iron valves, each direct connected to a 5000-kw fly-wheel type General Electric 50-cycle 18,000-volt alternator. Engines will operate under 175-lbs. pressure, 100 degs. F. superheat at throttle, and 27½-in. vacuum. The engines are fitted with a special equipment of electrical speed-changing devices, and McIntosh patented time-delayed dash pots, to facilitate the synchronizing of alternators and the operation of alternators in parallel under variable load. The division of load between the engine and the speed of each engine will be controlled by the switchboard operator. Each engine has two horizontal high-pressure cylinders and two vertical low-pressure cylinders, as well as two sets of condensing apparatus, one for each low-pressure cylinder, so that in case of breakdown of either side of any main engine, the other side may be operated under an overload.

Wheeler Admiralty surface condensers are to be used throughout. Connected to each condenser there will be one motor-driven Wheeler centrifugal circulating pump, also one Edwards triplex vertical single-acting suction, valveless air pump, motor driven. The air-pump and circulating-pump motors are supplied with power from an auxiliary generator, or may be operated from the main generator. Each main generator has its independent engine-driven exciter. The auxiliary engine and exciter engines are tandem compound non-condensing, supplied by the Harrisburg Foundry and Machine Works. The exhaust steam from the auxiliary engines, together with the various drips and the exhaust steam from the feed pumps, will be used for feed water heating purposes. Steam is supplied by means of eighteen 600-hp Babcock & Wilcox water-tube boilers of forged steel construction, each boiler having an integral superheater to give 125 degs. superheat at the boiler nozzle when operating between 190 and 200 lbs. gage pressure. Each boiler is equipped with fuel oil furnaces and oil burners. Weber steel concrete chimneys will be used. All high-pressure steam piping will be specially designed with rolled-steel flanges and lap joints.

Chapman gate valves will be used throughout, specially constructed for use with superheated steam. Electrically controlled valves will be used at critical points. On the outlet from each boiler there will be one Pearson automatic angle steam stop and check valve. Oil is supplied to the boiler by means of Snow specially constructed oil pumps, and will be heated by means of Goubert multiflow oil heaters. The feed pumps are horizontal duplex compound, outside center packed. The feed water is heated by Goubert vertical multiflow feed-water heaters.

The entire plant is designed on the panel system, and in effect consists of three independent plants of 5000 kw each. It is of particular interest as being the largest power plant ever contracted for as a whole on the Pacific Coast, and one of the largest so placed in the United States. Heretofore, the large steam plants on the Pacific Coast have been used in connection with water-power transmission purposes, merely for purposes of reserve. In this instance it is the intention of the owners to operate the plant continuously on account of the low cost of the production of power. The plant is situated near the oil wells, and oil will be secured at an exceedingly low rate. The economy of the plant is such that power may be produced at a rate and sold in competition with water-power transmitting companies.

One of the novel features of this contract is the provision for the contractors to operate the plant for a period long enough to insure all parts being in proper working order, and then to submit the plant to a ninety-day test under actual working conditions, to determine the compliance with the guaranteed economy of the complete plant. During this test the entire operation of the plant will be under control of the contractors and sufficient data will be obtained to determine individual performance of the various apparatus. The object of this test is not only to determine the amount of bonus or forfeit due, depending upon the economy of the plant, but also to establish a record for the economy of the station, which the company's regular operators are subsequently expected to maintain.

HIGH-TENSION DIRECT-CURRENT RAILWAY BETWEEN COLOGNE AND BONN, GERMANY

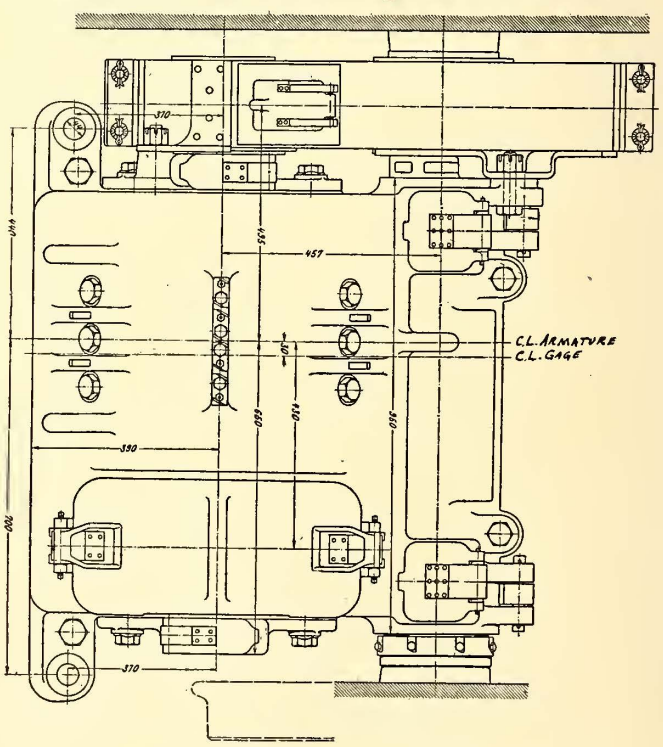
A 990-volt direct-current electric railway has just been completed for operation between the cities of Cologne and Bonn, Germany. The line is 28.3 km (17.6 miles) in length and passes through a number of villages near the Rhine River and through a coal mining territory. Freight is handled in addition to the passenger traffic. At present the line is double track only for a short distance, but the typographical conditions along the right of way are such that there will be no difficulty in double tracking the line all the way whenever necessary. The track is very substantially built, being calculated for wheel weights of 7000 kg (15,420 lbs.) It is proposed to operate the passenger trains up to a speed of 80 km (50 miles) per hour, running two trains each way hourly, carrying up to four cars, with a seating capacity of 250.

A TRAIN OF TWO MOTOR CARS AND TWO TRAILERS ON THE 990-VOLT DIRECT-CURRENT LINE BETWEEN COLOGNE AND BONN

A special difficulty arose in connection with the operation of this line, as the only power which was convenient was the 550-volt direct-current used by the railway systems in Cologne and Bonn. A number of large electrical manufacturers were asked to make bids for the power equipment. One plan of the Allgemeine-Elektricitäts-Gesellschaft contemplated the use of 6000-volt single-phase current for the line running in the open country and 550-volt direct current in the cities. Another plan by the same company involved the use of 800-volt direct current on the interurban section and 550 volts in the cities. A third plan was submitted by the Siemens-Schuckert Company, calling for 990 volts on the open line and 550 for the city. After a careful study of these three proposals, the third was chosen and it was determined to build at Wesseling, midway along the line, a power station capable of generating a transmission potential for 990-volt operation. The reasons for adopting this plan are given as follows:

The use of high-tension single-phase current required the conversion to 200 volts on the car, as well as the fact that the same motor would have to be capable of using direct current on the city sections. Even though the motor should be capable of operating satisfactorily on both a. c. and d. c., it was found that the additional controlling and other apparatus would increase the weight so much above that of the direct-current equipment, that the use of single-phase current would be uneconomical, as compared with straight direct current. Again, the saving in overhead work in transmission, due to the high-voltage single-phase current, was overbalanced by the more expensive car equipment required with single phase. Besides this the use of single-phase current would make it impossible to use storage batteries to prevent possible interruption of traffic. Finally it appeared that the part of the line running in the country, comprising 22 km (13.6 miles), was too short to take full advantage of the benefits of the single-phase transmission, while the use of a high-tension direct current, with the power house located at the center of the system, would prove the most economical and reliable. This road is not the first high-tension d. c. line built by the manufacturers, as the Berlin Elevated Railway has been using 800-volt d. c. motors for some time.

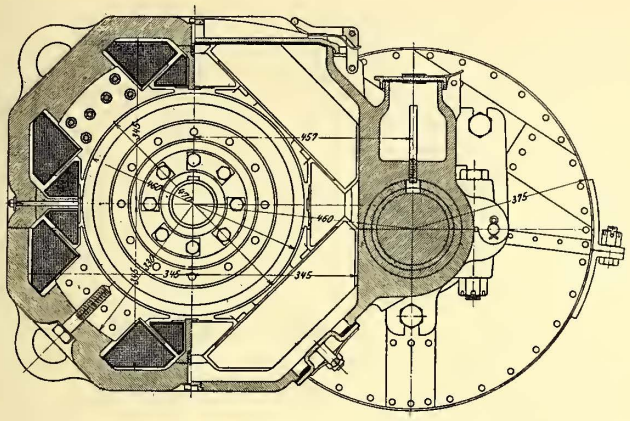
The power-transmission system is divided as follows: In the cities of Cologne and Bonn, current is taken at 500 volts from the terminal power stations, and for the interurban section 990-volt current is taken from the new station at Wesseling. This portion of the line is divided into three feeder sections. The central section receives current directly from the power station at 990 volts, and also from a storage battery. The end sections are supplied with current from the station



VIEW OF 990-VOLT INTER-POLE MOTOR FROM ABOVE

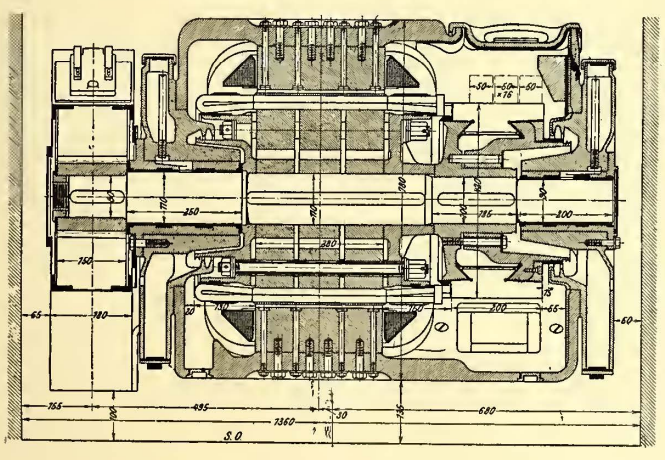
through a 150-volt booster, and are also provided with storage battery auxiliaries. These batteries are each of 330 amp-hours capacity, and float across the line.

Each track is equipped with two trolley wires of 80 sq. mm cross section (160,000 circ. mils), and catenary construction is used. The catenary is supported by steel poles at intervals of 15 m (50 ft.) At the Marienburg and Bonn terminals special section insulators are used to prevent any possibility of the 990-volt current entering the lower-potential line of the city railways. The rails are bonded by two copper bonds of 75 sq. mm section (150,000 circ. mils), and are cross bonded every 100 m (328 ft.) The lighting current for the stations is taken directly from the trolley wire. All auxiliary transmissions, such as telephones, block signaling, etc., are laid in cables, to avoid all interference with the trolley currents.



CROSS SECTION OF INTER-POLE RAILWAY MOTOR

For the freight traffic the railway has five steam locomotives of the type used on the government railroads, and for the passenger service there are at present ten motor cars and ten trailers. The motor cars have special compartments for the motorman, room for twenty-eight passengers in the second-class compartments and twenty-nine in the third-class compartment. The trailers are usually made up of second and third-class compartments, but, if exclusively third class, seat seventy-two passengers. They also have special compartments for mail and express material. The longest allowable train, namely of four cars, is capable of carrying a maximum of 258 seated passengers. The entrances are placed in the center of the sides of the cars. The central compartment is fitted with longitudinal seats and is for smokers. The end compartments have cross seats on one side of the aisle and a longitudinal seat on the other, and are for non-smokers. The doors at the ends of the cars are intended only for the train men, but, in emergencies, may also be used by passengers. All the cars are equipped with Westinghouse air brakes, in addition to the hand brakes. The electrical equipment of each motor car consists of two 130-hp, 990-volt motors, which permits a motor car and trailer weighing 54 tons to attain a speed of 70 km (44.1 miles) an hour. As the multiple-unit system is used, two or more motor cars can be operated with trailers in the usual way.



LONGITUDINAL SECTION OF INTER-POLE RAILWAY MOTOR

The motor is of the interpole type, and has four main poles and four interpoles. The arrangement is shown in the accompanying cuts in which the dimensions are in millimeters. The windings of the interpoles, as well as those on the main poles, are in series with the armature. The armature coils are of flat copper ribbon. Two sets of brushes are used, and the operation of the motors is said to be sparkless. The armature core has four ventilation slots, which make it possible to cool the windings effectively. The hourly rating of the motor at 990 volts is 130 hp at 700 r. p. m. The gear ratio is 1:3.1, and standard gage is used. The control system is operated by a special low-voltage current taken from a storage battery. Current is taken from the trolley wires through two bows on each motor car. The motor compressors for the air-brake system are carried on the trail cars. The heating and lighting of all of the cars is electrical.

This paper is indebted to the manufacturers and to the "Electrotechnische Zeitschrift" for the foregoing particulars and illustrations.

A CONVENIENT FORM FOR INSPECTORS OF MULTIPLE-UNIT EQUIPMENTS

In inspecting the controllers of multiple-unit systems, it is necessary to know what contactors or unit switches should close on each point of the master controller. E. R. Cunningham, electrical engineer of the Inter-Urban Railway Company of Des Moines, Ia., has gotten out the form illustrated to facilitate inspectors in their work. The form shows in a graphical and in a very effective manner what contactors should close on each point. Blue prints of the diagram are supplied to those working with the control system. As multiple-unit control systems are connected in several different ways, the diagram presented is not, of course, correct for all systems.

POINTS	CONTACTORS.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	●	●		●						●				
2	●	●		●						●	●			
3	●	●		●		●				●	●	●		
4	●	●		●		●	●			●	●	●	●	
5	●	●				●	●	●	●	●	●	●	●	●
6	○	○	○		○					○	○			
7	○	○	○		○	○				○	○	○		
8	○	○	○		○	○	○			○	○	○	○	
9	○	○	○		○	○	○	○		○	○	○	○	○

Street Ry. Journal

GRAPHIC ARRANGEMENT, SHOWING THE CONTACTORS CORRESPONDING TO THE PROGRESSIVE CONTROLLER NOTCHES

INTERESTING TRACK WORK IN SAN FRANCISCO

An interesting piece of track work was being undertaken on the Sutter Street cable line in San Francisco by the United Railroads of that city just previous to the recent earthquake and fire, and an account of it was prepared for this paper just before the recent disaster. Although later occurrences will undoubtedly change the policy of equipment in that city, the engineering features of the change are so novel that an account of them is presented.

The Sutter Street line is one over which there was a great deal of discussion on the part of the property owners, who, in their demands for an improved service, requested that an underground conduit system be installed. As an underground system was shown to be not practical at the present time, and as an overhead trolley was objected to, the question was settled for the time being by the railway company agreeing to improve the present cable service.

The first step toward this improvement concerned the track and the new work consisted in making three distinct changes; first, the old light cable rails were replaced by heavy 7-in. steel girder rails in 60-ft. lengths; second, the distance between centers of tracks was widened, and, third, it was proposed to change both tracks from the present 4-ft. 12½- in. to standard gage.

The first operation—that of relaying the track with heavier rails—involved no unusual difficulties. The concrete bed was broken away from around each rail, the iron-plate cross ties were sawed off a few inches, and the new rails were bolted to double angle-iron chains, whose upright connecting plates were bolted to the ends of the cross ties. The form of support may be noted in the accompanying illustration. No change was made in the cable slot.

The matter of widening the distance between track centers, however, was a more difficult operation. The tracks were originally 9 ft. 6 ins., center to center, and while the new rails were being laid it was deemed advisable to widen this distance to 10 ft. This latter is the width between track centers on Post, O'Farrell, Ellis and most of the other streets in the city on which the United Railroads operates, with the notable exception of Market Street, where the distance between track centers is 12 ft.

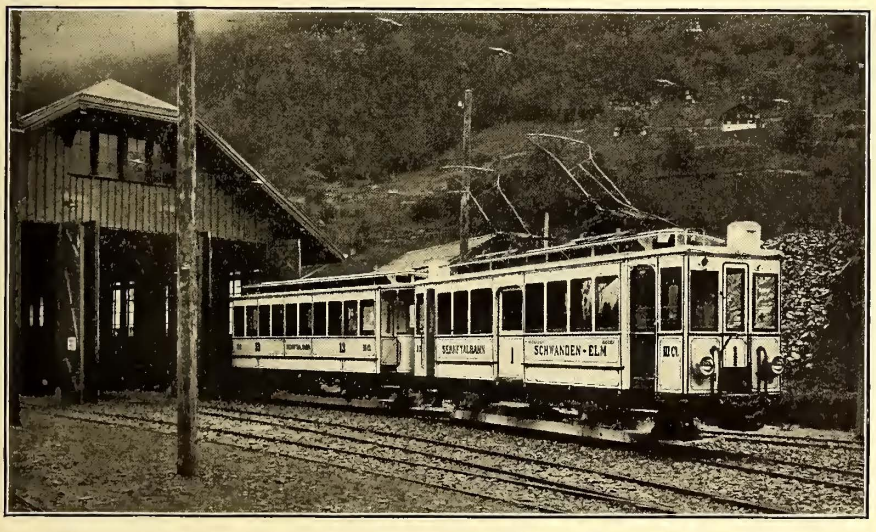
TRACK WORK ON THE SUTTER STREET LINE, SAN FRANCISCO, BEFORE THE FIRE. THE JACKS ARE IN POSITION FOR MOVING OVER THE BED OF THE TRACK

The work consisted in moving the entire massive roadbed, including the cable slot, of the south track, a distance of 6 ins. away from the other tracks. The earth was first removed from between the tracks to a depth of 4 ft., which is the depth of the concrete bed of the track. A similar excavation about 2 ft. wide was made on the outside of the roadbed, to allow space for the moving of the structure. Then, by means of hydraulic and ordinary jacks, braced against the concrete structure of the north track, the solid masonary roadbed of the south track was moved over the required 6 ins. The

accompanying illustration shows a block of the Sutter Street line between Kearny and Montgomery streets, where the roadbed was thus moved. In the foreground may be noted the bend in the track which marks the point up to which the work had proceeded. In setting the jacks they were placed about 5 ft. apart, and the 50 ft. thus covered was worked over at one time, and so on until a whole block was moved over, when the excavations were filled in again. An entire block was thus moved in a forenoon. An interesting fact in connection with the work is that the entire mass of concrete was twisted out of alignment without cracking or damaging the structure in the slightest. The sand foundation under the concrete, of course, made it possible to move the mass in this way where, with a clay or rocky soil, it might not be possible.

So far as known, this is the first place in the United States where such a piece of work has been done. The United Railroads first accomplished the same task recently on Larkin Street in the three blocks fronting on the City Hall, the fact being mentioned in the STREET RAILWAY JOURNAL at the time. The only serious difficulties arise when large sewer or water mains pass through the concrete road bed, but so far the trouble has been successfully met. At crossings, sections of rails were sawed out of the crossing tracks, south of Sutter Street, and afterwards inserted between the two Sutter Street tracks.

It was the plan of the company to reduce the gage of the Sutter Street road to standard gage at night, by shifting the rails at once. With this object in view, the new angle-iron chairs had an inner row of bolt holes, 1½ ins. inside the others, to which the rail bolts were to be be fitted. The pavement blocks were also placed in position alongside the rails temporarily at first, so that they could be easily removed when the time came. These precautions and improvements will undoubtedly be found to be most convenient when the reconstruction of the system, now under way, is farther advanced.



PASSENGER MOTOR CAR AND TRAILER, SERN VALLEY

The Toledo, Fostoria & Findlay Railway Company has contracted for an automobile bus with a capacity of 12 passengers, which will operate between Prairie Deport and Billmans, a distance of two miles.

ELECTRIC RAILWAY IN THE SERN VALLEY

One of the results of the exploitation of the rich water powers in the Alps has been to encourage the building of electric railways between towns whose small population could not afford this convenience if the cost of power were high. The latest of these lines has just been opened for service in the Serntal or Sern Valley, of the Upper Rhine district. This railway is of the standard direct-current type, is 13.9 km long and connects the towns of Elm and Schwanden. The line follows a rather tortuous public road, so narrow and abrupt that a large number of retaining walls had to be constructed besides widening the road in many places. About 8800 cu. meters were blasted out, 19,000 cu. meters of material (two-thirds rock) used for the retaining walls, and eleven metal or stone bridges constructed.

FREIGHT MOTOR CAR AND TRAILER, SERN VALLEY

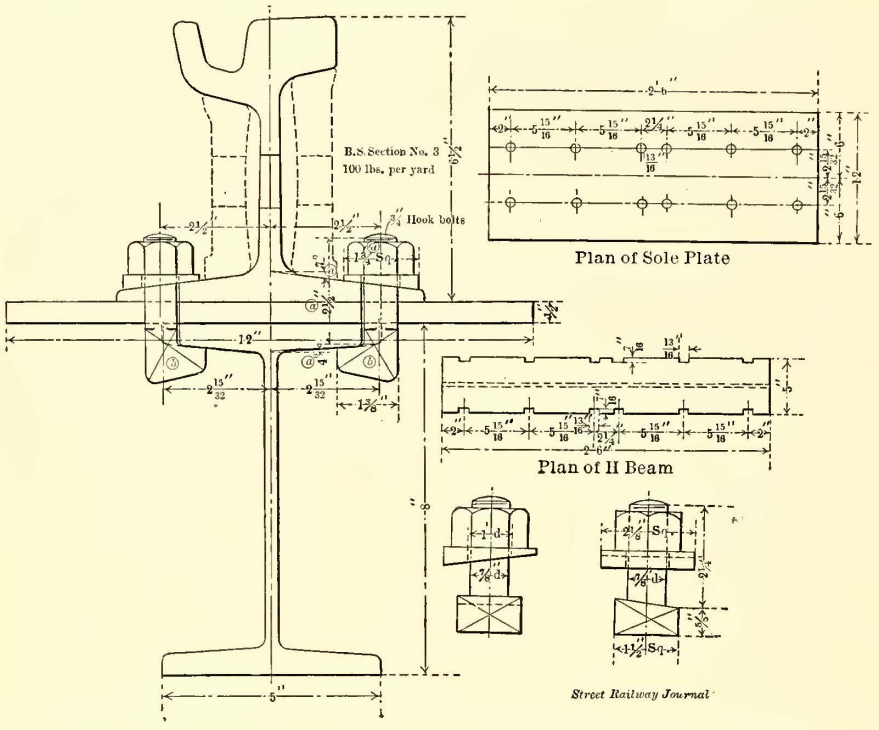
Grooved rails, weighing 32 kg per meter (about 64 lbs. per yard), are used in the villages and at crossings, but T-rail, weighing 25 kg per meter (about 50 lbs. per yard), is laid in 12-meter sections on the rest of the line. A novel feature is the use of metal ties. The type of rolling stock is well shown in the accompanying illustrations. The passenger motor cars consist of three single-truck vehicles, having a car body 9.6 meters long. They are divided into a baggage section and second-class and third-class compartments, seating twelve passengers and six passengers respectively, and having standing room for twelve passengers more. There are also three trailers, each seating forty passengers; a single-truck motor freight car, five covered freight trailers and four open freight trailers. All of the electrical equipment for these cars was furnished by the Maschinenfabrik Oerlikon. The motor cars carry two 65-hp series-parallel motors, each of which is geared for a speed of 25 km an hour on the level. Provision is made for air and electric braking. Current is taken from the line through double bows, as shown.

The hydro-electric power station, which furnishes the power for this line, is near Engi-Vorderdorf. It is equipped with two Bell horizontal spiral turbines of 200 hp, each running at 680 r. p. m., and direct connected to Oerlikon 135-kw, 800-volt, direct-current generators.

RECENT TRACK WORK IN LONDON

Some interesting track construction in which old rails are used for ties has recently been completed in London by the London United Tramway Company.

The rails were laid in 45 ft. lengths, were of the British standard sections No. 3 and 3C. Tie rods, screwed at both ends, were placed 6 ft. 6 ins. apart, except at joints where the spacing was to 6 ft. 9 ins. The accompanying section shows



DETAILS OF LONDON TRACK WORK, REINFORCED JOINT USED IN NEW WORK BY THE LONDON UNITED TRAMWAY COMPANY

the joint adopted. A steel channel, 30 ins. long x 5 ins. wide and 6 ins. deep, weighing 30 lbs. per ft., and a steel plate, 30 ins. long x 12 ins. wide x ½ in. thick, are fastened to the rail by 2½-in. x ¾-in. hook bolts. The attachment is made by the hooks of the bolts fitting into slots made in the top flange of the channel, and fastened through holes in the plate and bottom flange of the rail, and the nuts screwed down on to a bevel washer. The bolts are made of mild steel, and are threaded for a length of 1½ ins. from the nut. The rails were then bonded with two No. 0000 Crown bands, 32 ins. in length.

Another interesting feature connected with the track construction relates to the ties, which were spaced 9 ft. apart, and consisted of 6 ft. lengths of old tramway girder rails, with a depth of 6 ins. and a flange of the same dimension. These rails were embeded in the concrete foundation with the flange uppermost, and were firmly fastened to each rail by means of two ⅞-in. bolts with bevelled washers.

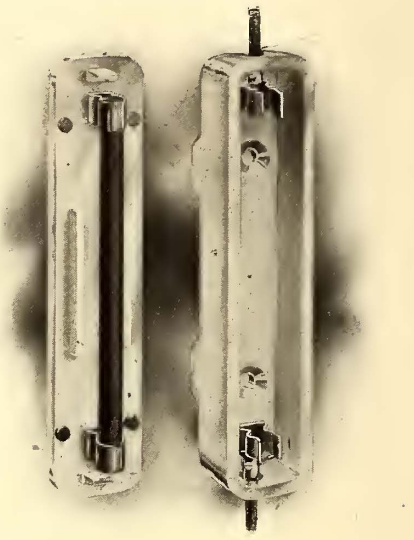
After the track laying and bonding had been completed, the track was concreted in. When this had set, it was covered by a floating 1⅛ ins. thick, and surfaced so as to provide the proper camber for the paving. The blocks were then thoroughly grouted with cement grout (2-1).

The contractors for the work were J. G. White & Company.

The Detroit United Railways will receive from the Cincinnati Car Company in a short time ten interurban cars for limited service on the Rapid Railway, Flint Division, and later on the Detroit, Monroe & Toledo Shore Line. Each car is 57 ft. long, and will be driven by four 100-hp motors.

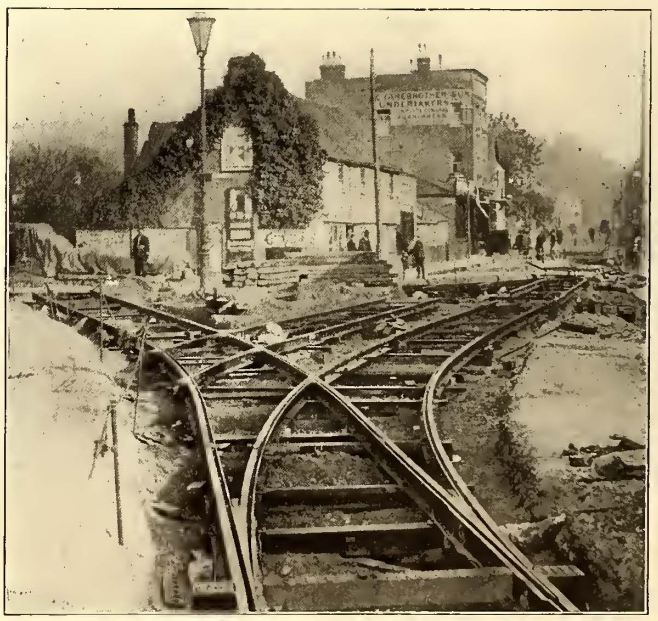
A NON-GAP LIGHTNING ARRESTER

The usual type of lightning arrester is made with some form of air gap, the idea being that the high-potential lightning discharge will easily leap across the gap to ground, but that the line potential is not powerful enough to follow it. A distinct departure from this style of lightning arrester is the one now made by the Woolley Electric Company, of Clayton, Mo. The essential part of this new arrester consists of a rod of very high ohmic but non-inductive resistance cut in directly between the line and the ground without any intervening air gap whatever, so that it allows a constant flow of part of the line current through it to the ground. It is claimed



GAPLESS LIGHTNING ARRESTER

that the construction of the rod is such that, while it limits the flow of the line current to a decidedly negligible quantity,



JUNCTION OF KINGSTON ROAD AND LONDON ROAD. SHOWING METHOD OF LAYING STEEL TIES

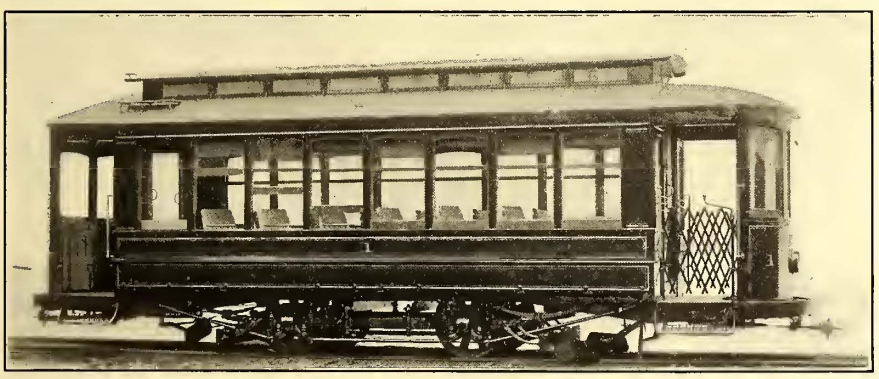
for instance, 1-60 of an amp. on 550 volts, it does not in any way impede the lightning discharge, offering to it, as a matter of fact, a dead short-circuit to ground. The rods are of like composition throughout, and will neither heat nor fuse

on account of the small line current or the severe lightning discharge. It is stated that the resistance will remain constant under any conditions of operation. One reason why this arrester is claimed to be superior to the air-gap type is the fact that in the latter the lightning change must build up to a potential high enough to discharge itself over the gap, and, of course, until this discharge takes place the high potential is liable to go down the line and injure the electrical apparatus in connection with it.

The discharge rod is mounted in a porcelain box, so arranged that the removal of the cover will also remove the rod for inspection, the cover being held in place by spring clips. The outside dimensions of this box are 2⅜ ins. x 2¾ ins. x 10⅜ ins., and for car-line use is enclosed in a wooden box. The indestructibility of the rod, the fact that it is non-arcing and its absence of moving parts naturally make the maintenance and replacement costs almost nothing. This arrester, which its manufacturer calls "Type C. C.," or constant current, has been in continual service during the last two seasons on a number of electric railway lines. Among the companies using it may be mentioned the St. Louis & Suburban Railway Company, which, in a recent letter to the manufacturer, states that the twenty-five which it installed on its switchboard at the main power station and at points along the line had given very satisfactory service, and that recently it had purchased 125 more to install at other points.

NEW EQUIPMENT FOR POUGHKEEPSIE

Poughkeepsie lies on the east bank of the Hudson River, 73 miles north of New York. It is on the New York Central & Hudson River Railroad, and communicates with the New York, West Shore & Buffalo Railway by ferry from Highland, and with the Hartford & Connecticut Western Railroad by the Poughkeepsie, Hudson & Boston Railroad (37 miles). Well laid out, with regular and shaded trees and abundantly supplied with water, Poughkeepsie is a pleasant place of residence, and it enjoys a special reputation for its educational



ONE OF THE NEW GROOVELESS POST, SEMI-CONVERTIBLE CARS USED BY THE POUGHKEEPSIE CITY & WAPPINGERS FALLS RAILWAY

institutions, Vassar College, the earliest and one of the greatest women's colleges in the world, being within a short distance from the city. Two miles north of the city, on an eminence above the Hudson, stands the Hudson River State Hospital for the Insane. In the summer the river front presents an especially busy appearance, with its numerous excursion boats and other pleasure craft. The steamers of the New York & Albany line touch at Poughkeepsie and the rowing course, where the intercollegiate contests are held each year, starts at the Poughkeepsie Bridge. From the river one can board a car on the main line of the Poughkeepsie City & Wappingers Falls Railway and be taken direct to Vassar College, if desired, which lies 2½ miles east of the city, and is the terminus of this branch of the railway system. Two other lines extend through the city, and a suburban line runs to the village of Wappingers Falls, which is situated on the river, about 8 miles south of Poughkeepsie. The entire railway system comprises about 18 miles of track.

At the time of the fire, which occurred at 12:30 a. m. on Feb. 11, the equipment of the road consisted of thirteen

POUGHKEEPSIE OPEN CAR

single-truck closed cars, eight single-truck open cars, one 40-ft. double-truck closed, and one 42-ft. open car. The entire plant, consisting of car houses, power and lighting station, which were adjoining, was destroyed by this fire, and, with the exception of one car, which had not yet come into the car house, the entire rolling stock of the railway company suffered in a like manner. To tide them over in their misfortune cars were borrowed from the United Traction Company, of Albany, and a rotary converter was ordered, shipped by express and erected, so that use could be made of the alternating current generated by the local lighting company, and by Monday, Feb. 9, eight days after the fire, the energetic efforts of the company were rewarded by seeing the operation of the road once more resumed.

Cars of the groveless post, semi-convertibe type, built by the J. G. Brill Company, are to compose the major portion of the new rolling stock, and the six cars which have recently been put in operation are of this type, and their measurements are as follows: Length over the end panels, 28 ft. 4 ins.; length over the vestibules, 30 ft. 4 ins.; width over the sills, including the plates, 7 ft. 10½ ins.; width over the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 1¾ ins.; distance between the centers of the posts, 2 ft. 5 ins.; height from the rail over the trolley board, 11 ft. 9¼ ins.; side of the side sills, 5 ins. x 8 ins; size of the end sills, 4½ ins. x 8 ins.; thickness of the corner posts, 3⅝ ins.; thickness of the side posts, 3¼ ins.; length of the seats, 36 ins.; width of the aisle, 22 ins. The cars are finished in cherry; ceilings of decorated birch; spring cane seats, and other Brill specialties, such as sand boxes, gongs, etc.

Trucks of the 21-E type are used under the car bodies, and have a wheel base of 7 ft.; diameter of the wheels, 33 ins. The car builder now has in the course of construction for this road seven additional semi-convertible cars, six measuring 18 ft. 3 ins. over the bodies, and one 28 ft. Open cars, built by the American Car Company, of St. Louis, have also been placed on these lines, the dimensions being as follows: Length of the car body over the crown pieces, 28 ft. 8⅜ ins.; width of the car body over the sills, 6 ft. 3 ins.; width of the car body over the posts at the seat ends, 7 ft. ½ in.; side sills, 3¾ ins. x 7 ins.; sweep of the posts, 5 ins. Type 21-E trucks are also used under these open cars, with wheel base of 7 ft.

SOME RECENT INSTALLATIONS OF DIESEL ENGINES IN ENGLAND

The Diesel engine, of which a great deal has been heard in this country, has been installed in several electric traction stations in England, notably at Rothesay, in the Island of Bute, in the Lye sub-station of the Dudley & Stourbridge Tramways and at the Yardley station of the Birmingham Tramways Company. An interior view of the latter station is shown in the accompanying engraving. This station contains four Diesel engines of 100 kw each, each directly connected to a generator.

Figures for three months show the load factor of this station to be 31.5 per cent, and the amount of Texas crude oil used per kw-hour is 0.66 lbs., which at 52s. 6d. (14.60) per ton, equals 0.1836d. (0.3672 cents) per kw-hour. The total operating expense during the same period amounted to 0.437d. (0.874 cents) per kw-hour. During February, 1906, the load factor increased to 50 per cent, and during that month the total operating expenses amounted to 0.362d. (0.724 cents) per kw-hour.

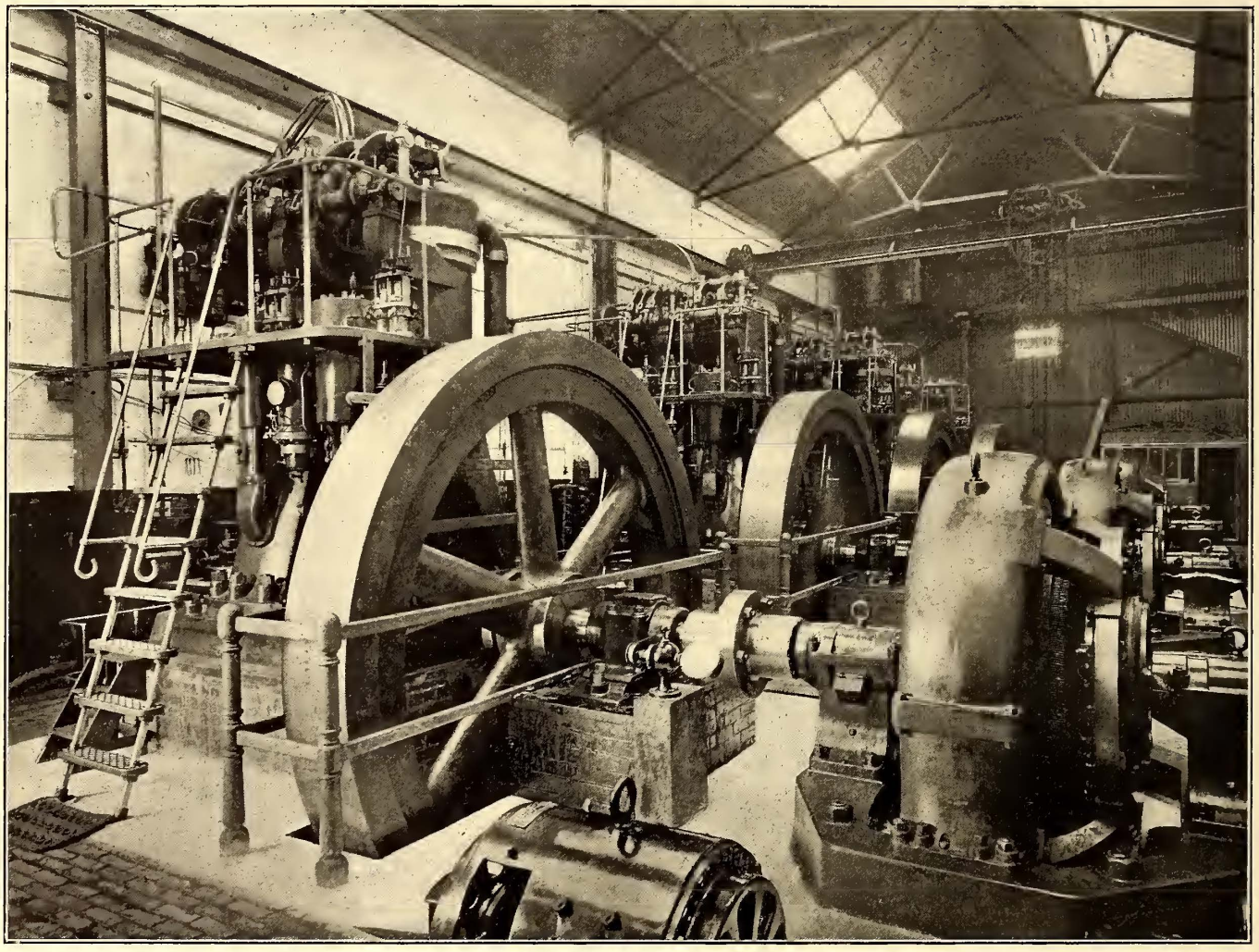
The total cost of the plant, with switchboard, cables, pump, water-cooling tower, tank and building, amounted to £10,539, (or $126.50, per kw). Owing to reduced manufacturing expense, it is stated that the present cost, inclusive of buildings, would be £800, or $9.60 per kw less. At 10 per cent on the investment, the interest, with the present output, would be 0.388 cents per kw-hour. The tenders on a steam plant, exclusive of buildings, for the same station was £9,195.

The total cost for a 28-day period in June, 1905, and output of 68,920 kw-hours, was as follows:

Fuel	0.185d.,	or 0.370 cents per kw-hour
Oil, waste, stores	0.044d.,	or 0.088 cents per kw-hour
Repairs and Maintenance,	0.038d.,	or 0.076 cents per kw-hour
Wages	0.161d.,	or 0.322 cents per kw-hour
Salaries	0.014d.,	or 0.028 cents per kw-hour
Total,	0.442d.	0.884

STREET RAILWAY MEN CONTRIBUTE TO SAN FRANCISCO FUND

A number of employees of the Washington & Canonsburg Railway Company, of Washington, Pa., recognizing that there must be many cases of suffering and want among the street railway employees of San Francisco, have contributed the sum of $41.50, through the United Railroads of San Francisco, with the stipulation that this money is to be sent direct to the families of the street railway men of San Francisco. Robert R. Reed, general manager of the Washington & Canonsburg Railway Company, in forwarding this money on behalf of the men, requested that, if opportunity arose, it should be applied to some specific case of hardship which might arise. The Washington & Canonsburg Railway Company is part of the Pittsburg Railways Company, of which James D. Callery is president, and which is controlled by the Philadel-



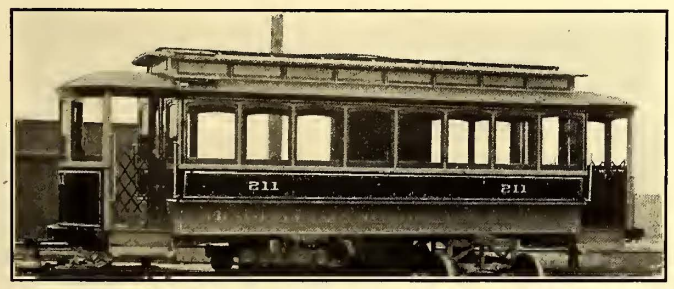
POWER STATION AT MANCHESTER, USING DIESEL ENGINES

phia Company, of which Judge J. H. Reed is president.

The following is the list of subscribers to the fund: James Kent, superintendent; C. R. Lacock; C. Z. Brownlee; J. P. Summers; J. J. Stephens, M. Watson; W. B. McBride; I. J. Duvall; E. S. Mitchell; John Stollar; Thomas Dacey; W. W. Mitchell; J. V. Patterson; Ray Crosland; R. N. Markley; O. I. Gilbert; J. O. Parker; C. M. Carson; D. L. Gray; R. V. Noble; Joseph Thompson; E. C. Vankirk; J. B. Horne; H. H. Dille; J. H. Lightner; H. R. Hewitt; John Loughman; S. B. Anderson; A. Martin; F. V. Hill and George T. Hallam.

CLOSED CARS FOR BINGHAMTON RAILWAY COMPANY

The first electric railway in the State of New York was installed by the Washington Street & State Asylum Railroad Company, of Binghamton, which now forms a part of the Binghamton Railway Company. This latter company is energetic and enterprising, and its present railway system has been well planned. The tracks of the company cover about 45 miles, and the roadbed is of a heavy and substantial standard. About 80 cars are in service, and it was only within the recent past that the road increased its rolling stock to the extent of eight new ten-bench open cars, built by the J. G. Brill Company, and also two very handsome semi-convertible passenger and smoking-car bodies, also constructed by the Brill Company. Binghamton has a population of 40,000, and, together with Port Dickinson, Lestershire, Endicott and Union, four neighboring towns reached by the lines of the company, the district directly served has a population of about 10,000, in addition to the city. The city is most favorably situated for street railway business, being at the junction of the Chenango and Susquehanna rivers, and branches out in four directions. The officials of the Binghamton Railway Company have paid particular attention to developing the terminals of the different lines, Ross Park, operated by the railway company, and which is the pleasure resort of the city, being the most important terminus. This beautiful park, which is about 1½ miles from the center of the city, comprises 100 acres of natural wooded country, and thousands of visitors from Binghamton and nearby towns are attracted during the season. Another park that is well patronized is Casino Park, owned by the railway company. Binghamton is a manufacturing city of some note, and a commercial and



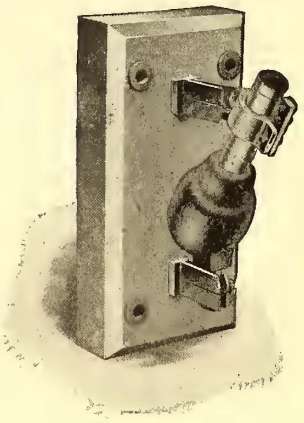
CLOSED CAR FOR THE BINGHAMTON RAILWAY COMPANY

shipping center for an extensive agricultural and factory neighborhood.

The accompanying illustration shows one of the new cars which have recently been put in operation on the lines of the Binghamton Railway Company. The details of the cars are as follows: Length over the end panels, 22 ft.; length over the crown pieces, 31 ft. 5 ins.; width over the sills, including the plates, 6 ft. 3 ins.; width over the posts at the belt, 7 ft. 6 ins.; sweep of the posts, 8 ins.; distance between the centers of the posts, 2 ft. 9¼ ins.; height from the floor to the ceiling, 7 ft. 10 ins.; height from the track to the under side of the sills, 2 ft. 5 ins.; height from the under side of the sills over the trolley board, 8 ft. 9⅜ ins.; height from the track to the platform step, 1 ft. 4¾ ins.; size of the side sills, 3¾ ins. x 5¾ ins.; size of the end sills, 4½ ins. x 6¾ ins.; size of the sill plates, ½ in. x 7 ins.; thickness of the corner posts, 3¾ ins.; thickness of the side posts, 1¾ ins.; length of the seats, 21 ft. 6 ins.; width of the aisle, 3 ft. 2 ins. The cars are finished in cherry, and have ceilings of three-ply birch.

HIGH-POTENTIAL FUSE HOLDERS

The General Electric Company has perfected a new device in the shape of a high-potential fuse holder. These fuse holders are designed to protect 2300 and 6600 volt systems, but can be made to suit special requirements for higher voltage. They supersede the "expulsion" type, and will be used in the future on all General Electric switchboards requiring high-potential fuses. The device is of small size, and is said to be capable of rupturing more energy under short-circuit conditions than any other similar device heretofore placed on the market. The body of the holder consists of an insulated metallic chamber, into the upper end of which is screwed a fibre tube. That part of the fuse located in the chamber is of smaller cross section than the remainder, to insure rupturing at that point. The expansion of the gases formed by the area in the chamber expels the fused metal and effectually opens the circuit. New fuses can be readily inserted in the holder by removing a screw plug located in the bottom of the bulb.



HIGH POTENTIAL FUSE HOLDER

The holder is connected in circuit by means of blades fastened to either end, which fit into clips mounted on a base or switchboard panel. The advantages of this method of support will be readily understood. Spare fuse holders can be kept on hand ready for the instant replacement of ruptured fuses. The complete device is compact, substantial, easy to handle, and may be located in any convenient place. The holder can be supplied in groups of two, three or four, mounted on bases or in single elements without bases for switchboard mounting.

It is recommended that 2300-volt holders be spaced on 12-in. centers and 6600-volt holders on 18-in. centers; unless barriers are use between them, in which case these distances can be made 5 ins. and 8 ins., respectively. The ampere rating corresponds to the continuous current-carrying capacity, and the rupturing point is approximately 60 per cent greater. Fuses for operating on small overloads can be made to order. The 2300-volt and 6600-volt fuse holders are made to carry 100 amp. fuses, or smaller sizes. Holders of both voltages are furnished back connected for switchboard use without base, and either back or front connected on base singly or in groups with barriers.

The Long Island Railroad Company is laying an extra track across the Flushing Meadows, so that its Port Washington Branch will be double tracked from Long Island City to Main Street, Flushing. The company has plans for electrifying that part of its system, and has been widening its right of way.

PORTABLE RECORDING GAGES

The value of recording pressure gages as a powerful factor in promoting safety and economy has long been recognized. Many users have, however, felt the need of a light, compact, portable recording pressure gage, and particularly an instrument which is so well made and free from delicate mechanism that an ordinary workman can manipulate it successfully with

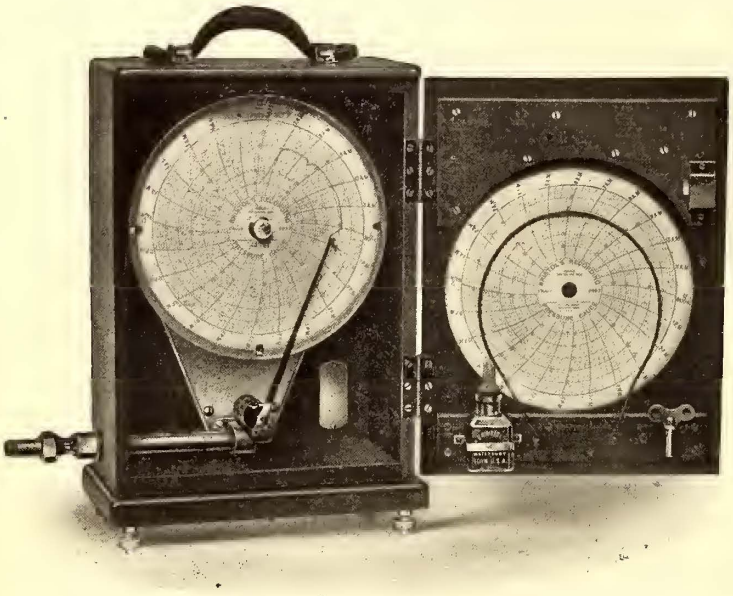


FIG. 1.—PORTABLE GAGE FOR PRESSURES EXCEEDING 5 LBS. PER SQUARE INCH

reasonable care. To cover these requirements, the Bristol Company, of Waterbury, Conn., has placed upon the market a modification of its well-known recording gage.

In these portable gages, the metal case has been omitted the pressure tube and clock for driving the chart being mounted on a light aluminum back, which is in turn mounted in a handsome wooden carrying-case designed with special reference to ease in handling and making connections to the source of pressure.

For recording pressures which may exceed five lbs. per sq. in., the type illustrated by Fig. 1 is employed. A special flexible connection with unions, is supplied to facilitate connecting to piping at various angles. When a permanent installation is unnecessary, this instrument could be used to advantage, as, for example, on boiler tests, water mains or fire protective systems where a few accurate and continuous records would settle disputes or lead to better service.

For gas pressure, draft or light vacuum, the gage illustrated by Fig. 2 is adapted, since it is capable of recording pressures as low as 1-20 in. head of water. Connection is readily made by means of a rubber hose to nipple, which projects through the side of case. A simple clamping device is employed to hold the pressure tube rigidly, when the gage is being transported.

The portable gages above described weigh about one-third as much as the standard form gages mounted in a carrying-case, which has been used heretofore as a substitute. Both forms are furnished with leveling screws to facilitate adjustment of the instrument. Provision is also made for carrying a supply of charts and ink with each gage.

Members of the mechanical engineering department of the Ohio State University have arranged to make an efficiency test of the power station, sub-stations, lines and cars of the Columbus, Buckeye Lake & Newark Traction Company.

MEETING OF THE AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION

A meeting of the American Street & Interurban Railway Manufacturers' Association was held in New York, April 27, to elect permanent officers of the association, make arrangements for the Columbus convention next October, and adopt a permanent constitution and by-laws. Upon invitation, Messrs. Ely and Swenson, of the American Street & Interurban Railway Association, were present. The former, upon request, outlined the work which the American Association and its different committees were doing, and referred particularly to the municipal ownership committee and the committee on standardization of equipment. The work of the latter committee was of particular interest to the manufacturers present, and it was the general sentiment that this work was most timely and important. The secretary then described the work which was being undertaken by the insurance committee. The fields of the other committees were also described in detail, and the president was congratulated upon having secured such representative and well-known men to serve. The association then took up the subject of its revised constitution and by-laws and adopted the articles presented by the committee on this subject. The following officers were then elected: President, James H. McGraw, president McGraw Publishing Company, New York; vice-president, Charles C. Pierce, General Electric Company, Boston; treasurer, E. H. Baker, Galena Signal Oil Company, New York; secretary, George Keegan, Interborough Rapid Transit Company, New York. The adoption of Columbus as

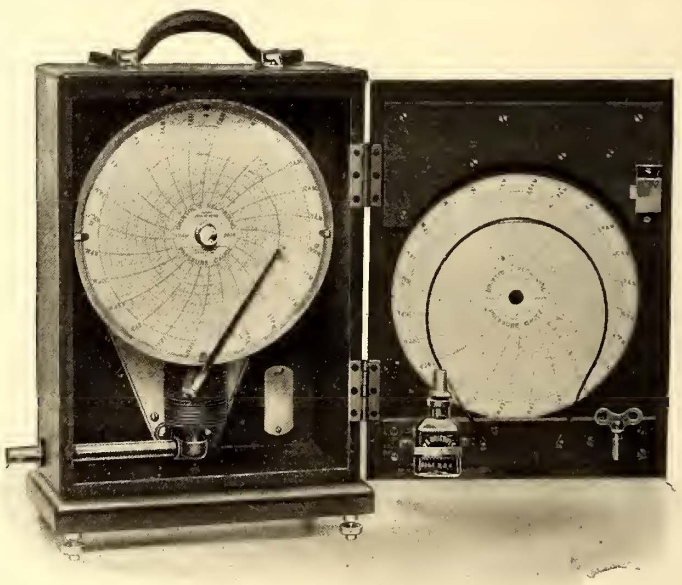


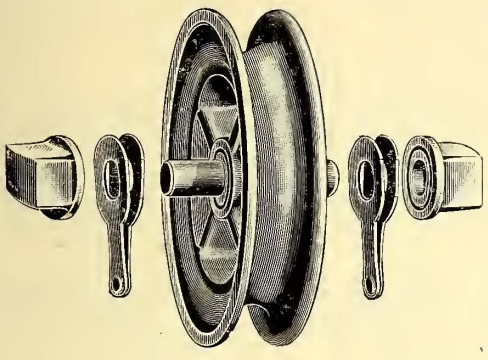
FIG. 2.—GAS PRESSURE OR LIGHT VACUUM GAGE

a convention city by the American Association was enthusiastically received. A committee was appointed by the president to take up the preliminary work of the association's work in connection with the convention. This committee will meet in Columbus soon, with one from the American Association.

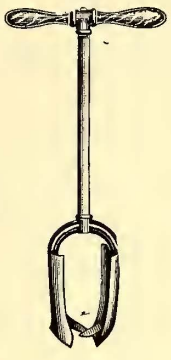
In the evening the members of the executive committee, with Messrs. Ely and Swenson, of the American Association, Frank Hedley, general manager of the Interborough Rapid Transit Company, and J. F. Calderwood, vice-president and general manager of the Brooklyn Rapid Transit Company, were entertained at dinner at the city club house of the New York Yacht Club.

IMPROVED TROLLEY WHEEL AND HARP

The Liberty Bell Company, of Bristol, Conn., maker of the well-known Liberty trolley harp, described in the STREET RAILWAY JOURNAL of June 4, 1904, is now manufacturing for the 4-in. and 6-in. sizes of this harp a special trolley wheel. The harp is so constructed that it does not revolve on a through pin or axle, but is held in place on a shaft between spring-connected bearing blocks. The result is that the wheel is prevented from moving sideways when rounding a curve, thereby avoiding arcing and the usual grinding contact which tends to shorten the life of the wheel and wire. In general, it is claimed for this company's wheel that it will prove more durable and economical, because it has no bushing, has wider bearings, runs steadier and has better contact



TROLLEY WHEEL AND BEARING BLOCKS

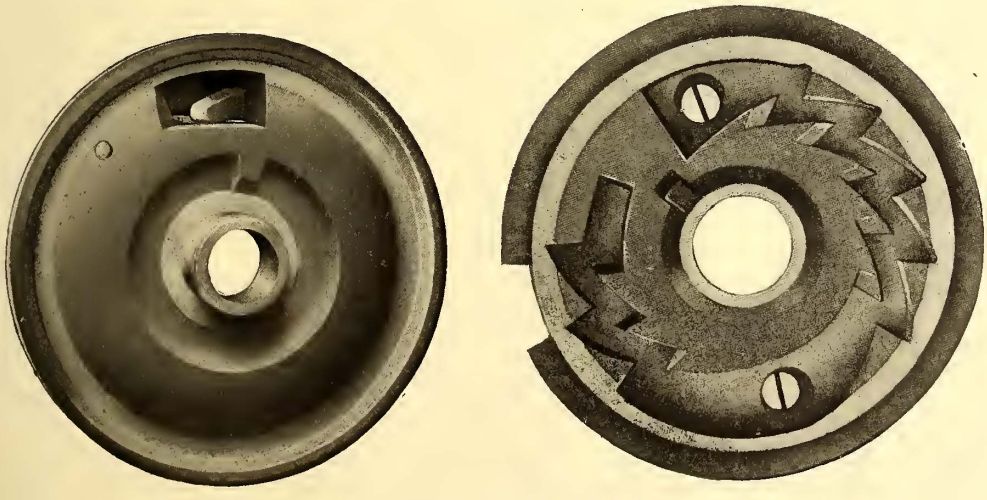


POST-HOLE AUGER

than others. For high-speed electric railways or other lines, where the conditions are unusually severe, the company offers its special Liberty cushion harp No. 12, with 6-in. wheels, of the type mentioned above.

A SIMPLE CONTROLLER REGULATOR

The necessity for some automatic means for checking the extravagant consumption of current by careless motormen has been often admitted by railway managers, but most of the corrective devices offered have not fulfilled their promises of saving power without introducing other evils, such as complicated mechanism and lack of flexibility to comply with schedule requirements, particularly on crowded city lines.



TWO INSIDE VIEWS OF CONTROLLER REGULATOR, SHOWING THE SIMPLICITY OF THE CONSTRUCTION

To meet the needs of electric railways and others using electrical machinery, the Equipment Protection Company, of New York, has placed on the market the Barrett controller regulator. It consists of a stationary, malleable-iron plate which is attached to the controller cap, and provided with camming and arresting teeth; a malleable-iron cover which, when placed in position, locks to the stationary plate; and a heavy tool-steel pawl which is actuated by gravity and adapted to engage the teeth of the stationary member for a brief interval at each "point" as the controller handle is advanced in applying the current. The simplicity of this regulator is well shown in the illustrations of the interior. There are but three parts, and no springs, dash-pots, cogs, rollers, exposed pawls or experimental features of any kind. There is nothing to get out of order and lubrication is unnecessary. The company is not making any extraordinary claims as to the exact saving insured by this regulator, but it is, nevertheless, confident that it will save its initial cost many times a year.

AN ECONOMICAL POST-HOLE AUGER

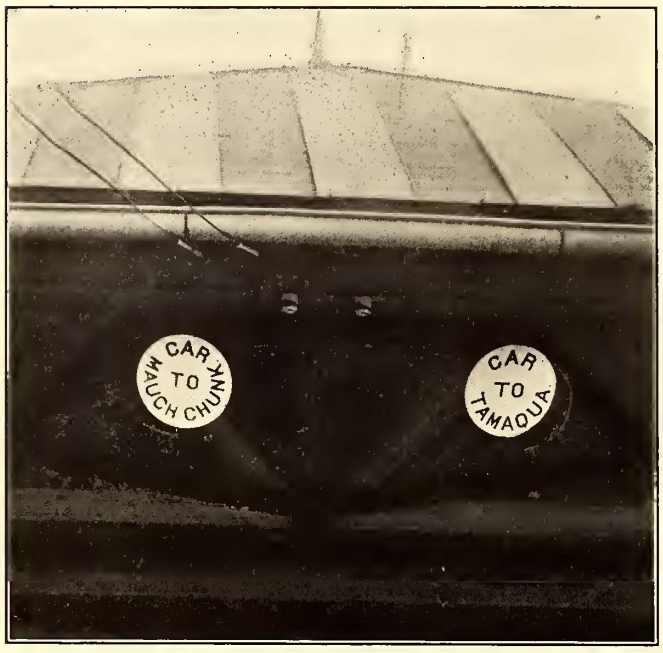
For several years past Iwan Brothers, of Streator, Ill., have manufactured a simple post-hole auger which has been found a convenient tool whenever a considerable number of holes must be dug for poles, posts, etc. As will be noted from the accompanying illustration, this auger is very simply constructed, the bowl being formed by two blades of crucible steel riveted to a strong malleable arch. The two blades have notched edges for interlocking, and, therefore, can hold each other firmly in place. The total length of the sizes from 3 ins. to 10 ins. is 4 ft.; 12 ins. and 14 ins., 6 ft. These lengths will answer for all ordinary purposes, but where deeper holes are required longer pipe can be attached. The 12-in. and 14-in. augers are fitted with 1-in. pipe and all the other sizes with ¾-in. Their weight varies from 9 lbs. to 24 lbs. each.

Little pressure is needed to operate this auger, except in very hard ground, as the two sets of cutting blades grip very quickly. It is made to bore in all kinds of ground, aside from solid rock, and will also take up gravel and small stones.

The Brooklyn Rapid Transit Company is making plans for building one of the most important new lines that it has constructed for several years. The new route is to extend from Brooklyn to Jamaica, and will be established by the extension of the Myrtle Avenue elevated line to Lutheran Cemetery at Middle Village, where free transfers will be given to the Metropolitan Avenue cars for Jamaica. Practically, all the necessary consents of property owners have been secured, and it remains only to get the authorization of the Queens County authorities. The proposed route will consist of an extension of the Metropolitan Avenue line along the Williamsburgh and Jamaica turnpike from Middle Village to Jamaica, connecting at the Lutheran Cemetery with the extension of the Myrtle Avenue elevated line, and will terminate there. With the free transfer from the elevated to the surface line, it will be possible for patrons to ride all the way to Jamaica for a single fare. In effect, there will be a direct route by trolley from the Eastern District of Brooklyn to Jamaica, with a transfer connection.

ELECTRIC INDICATING LANTERN

About one year ago the Eureka Automatic Electric Signal Company, of Tamaqua, Pa., installed for the Tamaqua & Lansford Street Railway Company two Eureka indicating lanterns at the railway company's Manila Grove Pavilion.



ELECTRIC INDICATING LANTERNS USED AT PARK PAVILION

These lanterns, which show in both directions, have been found to be a great accommodation to passengers. Persons wishing to leave the grove on the east bound or west bound cars need not go to the depot to wait, but can remain on the pavilion or in the grove until the proper indicating lantern is illuminated by the approaching car they are awaiting. These lanterns are connected in series with blocks of Eureka automatic electric signals, and are so arranged that they are aglow only when cars are approaching the grove. Thus persons wishing to take cars in either direction are given ample notice and may walk leisurely to the depot, boarding the car with little delay.

Persons about to leave the grove often asked, "How soon will the next car leave for east and west?" This question is no longer asked, as any one, by means of the lanterns, can know with positive certainty the approach of east or west bound cars. When cars leave the Grove, the lanterns are automatically cut out. Indicating lanterns of this type would also be a great accommodation in large stores, hotels or places of amusement, where people could remain until the last minute before taking cars. The only cost of maintenance is that required for the renewal of incandescent lamps, possibly once or twice a season.

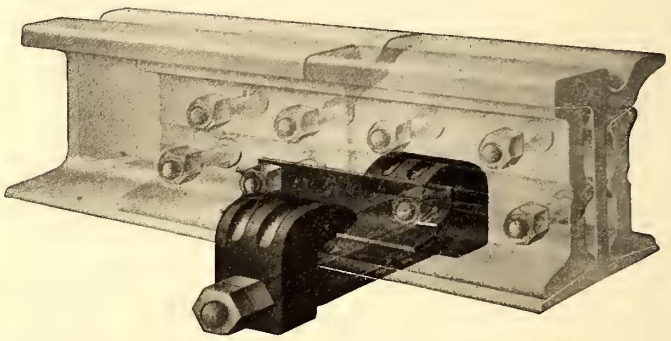
A document has been filed in the Hudson County Court House, Jersey City, recording the leasing of the land owned by the Public Service Corporation at Hudson Street and Hudson Place, Hoboken, desired for the terminal of the Hoboken branch of the tunnel that has been constructed between Morton Street, Manhattan, and Fifteenth Street, Jersey City.

REDUCED RATES IN OHIO

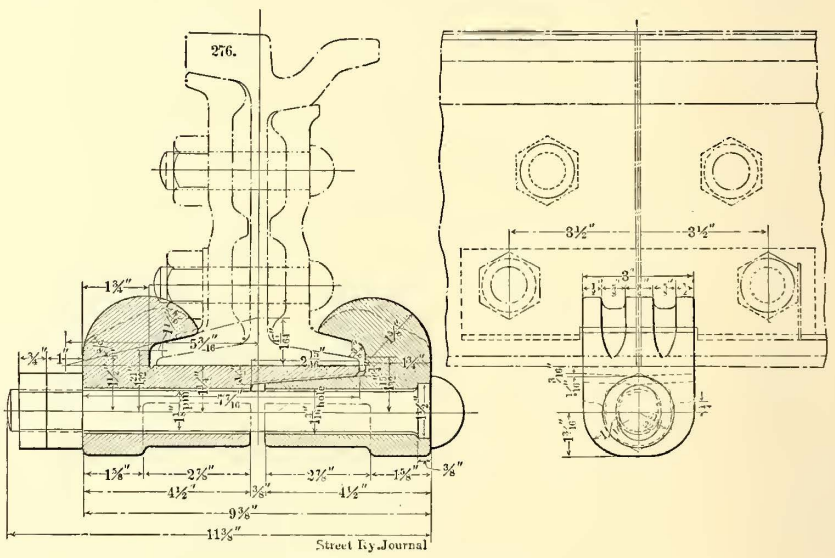
The Schoepf syndicate, which has recently acquired the Appleyard properties, has announced a considerable reduction in rates on the lines between Columbus and Dayton, the reduction being especially marked on round-trip tickets. This is to meet the competition of the Big Four road between these points. The steam road has reduced its rates as a result of the recent 2-cent fare bill in Ohio, and it makes no extra reduction on round-trip rates.

A SIMPLE RAIL-JOINT

The McConway & Torley Company, of Pittsburg, which manufactures malleable and steel castings, as well as several standard railroad couplers, is now actively pushing a rail joint for street railway use which can be applied to the regular patterns of splice bars used with the A. S. C. E. rail sections. The object of this device is to hold the jointed parts level, so that the ends of the rails will not be battered, as in the case with the unsupported joint. This joint is very simple in construction, as it consists of only two complementary parts, which when bolted together can be made to clamp the rail base and splice-bars in a very efficient manner. It is not by any means an untried contrivance, but is said to have been in satisfactory service for a long period on several lines whose operators are now using it in large quantities. One of the accompanying cuts has been prepared to exhibit this joint in plan and elevation, while the other shows its appearance when applied in service.



JOINT APPLIED TO RAIL



DETAILS OF RAIL JOINT

APPREHENDING WIRE THIEVES

The loss of wire and bonds by copper thieves is an annoyance which periodically strikes nearly every city and interurban company in the country; especially the latter class of roads. In many districts it is apparent that there are bands of thieves who make a business of stripping wires from poles or removing bonds from fish plates, and either melting it and then disposing of it or selling it in bulk to junk dealers. The daring of some of this class of thieves is something astonishing. Frequently there have been cases where a gang of men with a wagon and ladders and equipped with all the appliances of legitimate repairmen, have taken down thousands of feet of wire in broad daylight and escaped with it unquestioned by people who saw them and supposed they were employees of a company. In a great many cases men of this character are ex-wiremen who know their business, who have carefully planned arrangements for getting away with and disposing of their booty, and whose skill and sang-froid makes them difficult to apprehend. Probably a larger percentage of losses, however, comes from men and boys who are hard up and occasionally venture forth at night with a cold chisel or a pair of pliers and carry away a few soldered or unprotected bonds or a few hundred feet of wire in some isolated place. At 12 cents to 15 cents a pound for scrap copper, a few hours' work at night yields a comparatively good income, even though carried on only occasionally. Losses of this kind are less annoying to traction companies by reason of the intrinsic value of the material carried away than they are by reason of the loss of current due to grounds, the disruption of traffic through insufficient voltage and the loss of time and expense in finding the break and repairing it.

The majority of roads when they suffer from losses of this kind, either get the local police to take up the matter or hire a detective agency to follow it up. In either case the percentage of recoveries of property and conviction of thieves is usually very low, because it is difficult to identify the property, wire being all alike, and because, as stated, the thieves usually operate only periodically in a certain neighborhood. Some few large systems employ detectives exclusively in this work, but with the great majority of roads losses are so infrequent, or so small, that it would not pay to follow this course.

While the growing tendency of interurban lines to consolidate or to co-operate and work together in matters of traffic and operation, it would seem that a great many losses of the kind described could be avoided by several companies in a district clubbing together and hiring a man to make a business of discouraging wire thieving. If the plan was followed up in a number of districts these men could co-operate and render each other great assistance by exchanging information as to the operation of gangs of thieves or of individuals, and by securing evidence and making arrests. Steam roads employ such men and their methods of co-operation annually save thousands of dollars. The great importance of good current conditions to electric roads makes it especially important that some such plan be put in force.

Some valuable and interesting suggestions along this line are furnished by Charles H. Kelso, of Cleveland, who is employed by the Everett-Moore syndicate almost exclusively in the work of apprehending wire thieves who annoy those properties. Incidentally he attends to other matters of a private nature, such as securing evidence in accident cases, following up thefts of freight, etc., and he is withal a very important cog in the organizations of these properties. He has been remarkably successful in securing convictions, breaking up gangs of thieves and in recovering property. In the six years he has been employed in this work he has secured the conviction of twenty-seven wire thieves, with sentences of from one year to seven years, and has recovered thousands of dollars worth of property. Unquestionably the chief reason for his success is that he has made a study of the methods of this class of criminals, has a wide acquaintance among men likely to engage in such work and among junk dealers likely to buy such material; in a word, has devoted his attention exclusively to such work. His jurisdiction extends over the Cleveland, Painesville & Eastern, the Northern Ohio Traction & Light Company, the Lake Shore Electric Railway, Toledo Railways & Light Company, and a number of telephone companies controlled by this syndicate. Frequently he does work for other companies in this district. He has devised a system of private marks for each of these companies. Rail bonds and other copper and brass parts are stamped with this mark in a manner which is scarcely noticeable, while wire is also privately marked. A simple device is attached to each reel, so that as the wire is unreeled it is given a slight nick at intervals; the distance between nicks varying for different roads. These marks are hard to detect but they afford almost indisputable evidence in identifying property and in securing convictions against dealers who buy such property. A wide acquaintance with police and court officials also aids in the work. He has a large collection of descriptions and photographs of men who have been engaged in such work, and when a robbery takes place he is frequently enabled to find that a certain well-known crook has been seen in that district and he gets after him. On occasions he has followed men from place to place all over the country, and finally apprehended them. Men who engage in such work frequently have distinctive methods of operating, and Mr. Kelso's familiarity with these methods has enabled him to locate the criminal where an ordinary detective would be at a loss to find a clue. Mr. Kelso prides himself upon being the watchdog of the properties of the Everett-Moore syndicate. He says that the thieves are afraid of him and that of late they are confining their depredations to roads not protected by his watchful eye. As evidence of this, he points to the fact that one summer a year or two ago he took a vacation, and in an unguarded moment mentioned an intended trip to a newspaper man who gave him a personal item. He says he had just got comfortably settled down to a good quiet rest at an obscure resort when he received a flood of telegrams from a number of managers to come home quickly and get after a flock of wire thieves that had descended upon all parts of the system. Since then he has taken no vacation.

TRAFFIC CIRCULARS IN BOSTON

For the convenience and instruction of the rapidly growing body of people who appreciate the delights of trolleying through eastern and southern Massachusetts, southern New Hampshire and northern Rhode Island, the passenger department of the Boston & Northern and Old Colony Street Railway Companies has now in the process of publication three descriptive folders, one of thirty-six pages for the lines and connections of the Boston & Northern system, one of twenty-four pages for the lines and connections of the Old Colony system, and one embodying brief facts concerning the parks, groves, seashore resorts and other places of outdoor recreation along the lines and connections of both companies. The folders will have striking cover designs, will be illustrated and artistically arranged on a fine quality of paper, so that they will be of value as souvenirs, as well as for the interesting and helpful matter that they will contain.

LONDON LETTER

(*From Our Own Correspondent.*)

The report of the National Electric Construction Company, Ltd., which is closely associated with the Dolter Electric Traction, Ltd., is interesting because it shows that a good deal of surface contact work is at present being carried out in England—a fact which is well enough known, but is interesting when seen in the annual report of a company. It appears that the equipment of the tramways between Rotherham and Mexborough and the tramways at Torquay are both making excellent progress. Both of these installations are being equipped on the Dolter system. Within the last few weeks, also, the Dolter Electric Traction, Ltd., has received a contract for laying the surface contact system on the Front at Hastings, but this contract is unfortunately subject to the consent of the Hastings Council, which is extremely slow to move in the matter.

The scheme for linking up the Bournemouth and Poole district with Canford Cliffs and the Havens and connecting Studland and Swanage more closely with the district of Bournemouth, has had to be abandoned on account of the opposition to the necessary conveyor bridge over the Channel which divides the North and South Havens. No one disputes the fact that electric tramways in this direction would be a great benefit to everyone in the vicinity, and would have opened up a beautiful country for pleasure purposes as well as giving facilities to the residents in the country portions for reaching the town of Bournemouth. The town of Poole is, after all, a harbor, and the custodians of that harbor naturally object to anything that can possibly interfere with the free coming and going of ships. The Light Railway Commissioners have therefore rejected the scheme for the present.

The electrification of the tramways in the city of Birmingham is rapidly proceeding, as some of the old steam routes will at an early date become the property of the Corporation. The new tramways are also well in hand, and the contractors who are at present engaged in the work are pushing forward as rapidly as possible. Many new contracts have recently been let, so that by the end of 1906 most of the work of conversion and most of the new work will be completed. It is expected that on Jan. 1 next the remaining steam cars in the city of Birmingham will be replaced by electric cars all over the city. The tramways committee expects to make the change during the night of the last day of 1906, and the first day of 1907 should see something like 200 new electric cars in service.

The city of Leeds, under the able management of J. B. Hamilton, has made another record in the conduct of its tramway affairs. Not only has it taken in a larger amount and carried a larger number of passengers, but has been able to do this with a considerably reduced car mileage. During the past year the tramway cars have carried over 69,000,000 passengers and have run about 7,000,000 miles, the receipts amounting to about £309,000. This means an increase of £14,676 over the previous year's receipts, and an increase of about 9,000,000 in the number of passengers carried. It will thus be easy to pay over the £52,000 which has been promised for the relief of rates for the past year.

The new system of electric tramways for the Corporation of South Shields has just been put into operation. The work was commenced about June of last year, the contractors being Underwood Brothers for the permanent way and Dick, Kerr & Company for the overhead equipment. The overhead equipment consists chiefly of side bracket poles supporting grooved trolley wire. Forest City bonds have been used entirely on the track construction. The cars have all been built by Hurst, Nelson & Company, Ltd., with British Westinghouse equipments and Brill trucks. The electric current for the operation of the system is supplied from the Corporation's electricity works, where two 500-kw Dick-Kerr generators have been installed.

It seems likely that the tramway dispute in Manchester between the tramways committee and the tramway men will be settled without a strike. The chief cause of the trouble has been the application of the men for payment of time and a half for Sunday labor. A number of meetings and conferences have been held, and it would now appear that arbitration will settle the question, though it looked for a time as if it would be impossible to arrive at this conclusion. The Manchester tramways committee has had under consideration the election of a chairman in succession to Councillor D. Boyle, who recently resigned the position in consequence of having become managing director of a company which proposes to run a motor omnibus service in the Manchester suburbs beyond the electric tramways area. The committee's choice has fallen unanimously on Mr. Wainwright, who has been for many years deputy chairman, and Alderman Bowes has been elected deputy chairman. Mr. Wainwright has been a member of the City Council for nearly sixteen years, and has been on the waterworks, tramways and finance committees, though most of his particular work has been devoted to the interests of the tramways.

Perhaps the most striking fact that would appear to a stranger visiting London at present, would be the number of motor omnibuses which are now plying in almost every thoroughfare. It is not much more than a year since really practical motor omnibuses began to ply in London thoroughfares, although for several years previous to that experimental motor omnibuses were in operation, chiefly for the purpose of getting statistics of operation. It would appear that the horse omnibus is doomed, a fact which will not be regretted by many, although it must be confessed that one's nerves will have to get more accustomed to the motor omnibuses before they are absolutely popular with everyone. There are perhaps plying in London now some four or five hundred motor omnibuses, and it is estimated that over a thousand more are on order for delivery as soon as they can be manufactured. The motor omnibuses are all doing good business in London, though whether they will eventually pay is a question open to some doubt, and it seems evident that they will not pay to the extremely large extent that was expected of them at first, as repairs and maintenance, especially of the rubber tires, have been heavier than was expected. Their popularity steadily increases, however, as they have the happy faculty of getting over the ground quickly, and can outdistance horse omnibuses so completely that there is almost no comparison. Even the tube railways will have to use all their endeavors to encourage traffic, as even they cannot accomplish a journey in many minutes less time than the motor omnibuses, when one takes into consideration the getting to and from a particular station and the necessary descent to and ascent from the platform.

The Hon. Arthur Stanley, M. P., has been made chairman of the Lancashire United Tramways, Ltd., and is devoting his energies to the completion of this extensive system of tramways stretching between Liverpool and Manchester. As will be remembered, this system has not been successful financially, but has been practically reorganized recently with fresh capital, and when the connecting links are completed it is hoped with new enterprise and new management to make a success. The lines at present commence at the boundary of Liverpool and pass by way of Prescot, St. Helens, Hindley and Atherton to Bolton. Another line connects by way of Boothstown, and from there a line via Worsley is being made to connect with the Salford Tramways, which in turn connect with the Manchester system. The Farnworth Urban District Council has, in the meantime, entered into an arrangement with the South Lancashire Tramways Company whereby its system of electric trams will be operated by the company, it forming one of the most important connecting links in the new system between Liverpool and Manchester. The work of making the actual connecting links is rapidly progressing, and it is hoped that in August the whole system will practically be completed.

The service of tramcars between St. Leonards and Bexhill has now been commenced, this line forming part of the Hastings Tramways. It will undoubtedly prove a popular line and form a new method of transportation between the two watering places. When a decision has been arrived at, however, for the electrification of Hastings Front, the system will undoubtedly be very much more effective, but so far no actual desicion has been arrived at by the Hastings Council, although the Hastings Tramways Company has made a definite contract to equip the Front with the Dolter surface contact system, as announced elsewhere in this letter.

The London County Council has not given up its pet proposal to secure powers from Parliament to run tramway cars over the Thames bridges, and this bill has now been read for a second time in the House of Commons without very much opposition. This, of course, does not mean that the field is won, but it is a considerable step in the right direction. Captain Hemphill, the new chairman of the highways committee, stated that the Royal Commission had advised a large increase in the direction of the tramway sections, and stated that there were only about 30 miles of electrified tramways in the County of London at present, and that as there were only 115 miles of tramway in the vicinity of London where there ought to be at least 300 miles, it was obvious that the work of electrification would have to be expedited. It is interesting to note that the tramways north of the Thames leased to the Metropolitan Tramways Company for the past few

years, have now been retransferred to the London County Council, under the terms of the new arrangement whereby the agreement is terminated now instead of four years hence. There will be as little change as possible in the traffic organization, but the work of electrification will be commenced immediately, the first stage of about 22 miles of single track having already been put in hand. It is expected that the electrification of the whole of this northern system of tramways will involve an expenditure of about £5,000,000, but the Council is entering upon the work without the slightest hesitation, believing that the increased traffic will make this expenditure a good paying proposition. The lines affected are about 50 street miles in length. The London County Council is to be congratulated in its action about the tramways. It had to pay £80,000 for good will on the business for four years, but as the system was getting to be absolutely intolerable under the old slow horse-car condition, something drastic had to be accomplished. The County Council is also endeavoring to get permission to construct a new tramway, which will, of course, be electric, from Cricklewood through Edgware Road to the Marble Arch, as has been frequently stated in these columns. Much opposition has been encountered, but the standing orders committee of the House of Lords has now allowed the bill to proceed. It is also interesting to note that the immense generating station which the London County Council has been building at Greenwich for the past two years is now rapidly approaching completion, and it is expected that early in May it will be ready for furnishing power for London County Council purposes. When the station is completed, it will be a huge one, containing about 40,000 hp, although at present only a portion of the power will be available. It is situated at Greenwich, opposite the Isle of Dogs, and extensive pier accommodations have been provided, so as to allow the discharge of coal. Cranes have been installed to discharge 20,000 tons of coal in a day. The engines are by Musgrave, of Bolton, while the Electric Construction Company, of London and Wolverhampton, has furnished the generators. The boiler house is equipped with Stirling boilers.

Again the most interesting question is that of furnishing electric power in bulk to London. It will be remembered that last year a most comprehensive bill, called the Administrative and County bill, was put forward by a party of Newcastle financiers, of which C. H. Merz was the electrical engineer, but which failed to get through before Parliament rose. The London County Council has awakened this session, on account of the fact that this administrative and county bill very nearly passed, and has this year promoted a very similar bill in Parliament for the furnishing of electrical power to the whole county of London. The recent change in the government has undoubtedly helped it, and there seems little doubt but that this bill will actually go through unless stopped in the House of Lords. It has already passed the second reading in the House of Commons, whereas the administrative and county bill and the additional Electric Power Supply Company's bill (St. Neot's scheme) have not gone so far as their promoters would have liked. During the discussions these two bills, however, have been given a *locus standi* before a hybrid committee, so that they will be discussed incidentally along with the London County Council bill. There will be other bills considered by the same committee, so that practically the whole subject of furnishing electric power in bulk to London will be discussed. The discussion on the second reading was an interesting one. McKinnon Wood stated that the London County Council was not anxious to kill private enterprise, but it did want to oppose private monopoly; that he considered the bills in Parliament at present were just as strongly opposed by the already existing private companies as by the London County Council. It was simply a question to be decided as to whether the necessary supply of electricity in bulk at a low rate should be entrusted to the central municipal authority rather than to private enterprise. He claimed that the bill was not a new one, but that for certain reasons it had not been brought forward in such a strong way as it was presented now. He fully thought that the existing electrical enterprises would be protected in any scheme which the London County Council would promote. The Council was in a particularly good position to furnish current in bulk, as it would shortly by using 37,000,000 of units for tramway supply, and its existing station at Greenwich would soon be in a position to turn this out. If private enterprises were to secure a valuable monopoly of this kind, in some future year such monopoly would have to be purchased in the same way as £50,000,000 had to be paid to the water companies, and examples had already been made in the electric lighting business when Marylebone had to buy out a company for the sum of £1,200,000. Lloyd George, president of the Board of Trade, also made some interesting remarks, chiefly reassuring in character, and stated that all power bills would receive careful consideration in the hybrid committee. He insisted, however, that the government did not accept the view that municipalities were not capable of managing electrical enterprises, and considered that most of the borough Councils who were furnishing electric current in London at present were doing so profitably.

The eleventh annual convention of the Incorporated Municipal Electrical Association, of which J. E. Edgcome, of Kingston-on-Thames, is president, this year will take place during the week commencing June 18, in London. There will be papers on the commercial development of electricity undertakings, boiler-house plant, steam turbines, depreciation of machinery and other interesting subjects, though the titles of the papers of the contributors have not yet been communicated.

At the last smoking concert of the season of the Electro-Harmonic Society, held at the Holborn Restaurant, an interesting presentation took place, when two massive silver bowls were presented to Messrs. Alabaster and Gatehouse, and a handsome silver inkstand to Mr. Izard, as an acknowledgment of the services which these gentlemen had rendered to the society, and to mark the end of the twentieth session. The presentation was made by Colonel Crompton, who read a letter from Sir William Preece, regretting that he could not be with his friends that evening on account of doctor's orders. Colonel Crompton alluded in a happy manner to the great success which had followed this social gathering for so many years, and for the excellent work which Messrs. Alabaster, Gatehouse and Izard had done for the society. Each of the recipients replied, Mr. Alabaster giving a brief sketch about the formation of the society, and Mr. Gatehouse stating that he had commenced his musical career at the age of sixteen, and that although he had played at over a thousand concerts in a purely amateur way, this was the first acknowledgment of his services that he had ever received. The concert was then resumed and a pleasant evening was spent, terminating a successful session. A. C. S.

AFFAIRS IN CHICAGO

Mayor Dunne has suggested plans for improving the transportation service and rehabilitating the traction system that may bring about harmonious action between his followers in the City Council and the Aldermen who have opposed municipal ownership. The suggestions were made in a letter to Chairman Werno, of the local transportation committee, and are supposed to embody the ideas of Special Counsel Fisher as well as the Mayor. The Mayor admitted that immediate municipal ownership is impossible until the legality of the Mueller law and the ordinance providing for the issue of $75,000,000 of street railway certificates have been tested. While this is being done he proposed that steps be taken to improve the service, consolidate the traction systems, and rehabilitate their properties.

The Mayor's suggestions to Chairman Werno contain the following propositions:

That the traction companies shall agree upon a price for their properties at once.

That the city shall agree to pay the price agreed upon and pay back all the money put into improvements, with a fair return on the investment, when it takes over the properties.

That the companies shall be given indeterminate licenses to operate their cars, terminable on reasonable notice whenever the city desires to purchase, this right to be exercised at any time.

That the companies shall consolidate all their systems into one, if possible, and the consolidated company deal with the city.

That a definite term bond may be allowed to be issued if the companies find it impossible to borrow money for rehabilitation under an indeterminate license.

That if the companies refuse to agree to the terms proposed, then arrangements shall be made with some other company to operate cars on the streets to which the city is entitled to possession by reason of expired franchises.

That immediate steps be taken to test the validity of the Mueller law and of the ordinance authorizing the issue of $75,000,000 of street railway certificates.

The South Side street car men have ratified an agreement with the Chicago City Railway whereby an increase of 1 cent an hour for all men who have been in service for a year is secured. This means 25 cents an hour instead of 24 cents, and will affect between 2000 and 2500 men. In return for this concession by the company the men have waived a demand for a 10 per cent increase for car house employees. Working conditions are to remain the same as those of last year.

No attempt will be made before July 1 by the United States Government to enforce the law providing a fine of $10,000 a month for failure to lower the tunnel structure to 22 feet below the water level. This is the gist of the decision announced by Secretary Taft. The Secretary's conclusion is based on the desire of the War Department to give Chicago sufficient time to arrange for future use of the tunnels by the street railway companies, after the decision of the United States Supreme Court on the petition for rehearing in the ninety-nine-year franchise case shall be known. It is assumed by the Secretary that this decision will be given by June 1, so that a month after that date will be available for beginning the actual lowering of the tunnels or for making new arrangements with the street railway companies. A virtual promise further to extend the time for completing the work, if a beginning is made by July 1, is contained in the Secretary's statement.

Reasons for asking a rehearing of the Chicago ninety-nine-year franchise case were presented to the United States Supreme Court Thursday, April 26, in petitions by the Chicago Union Traction Company and the Chicago City Railway Company. Oral arguments are not allowed before the court on such motions, and the hope of the petitioners therefore rests in their written statements. The Union Traction Company outlines eleven reasons why the rehearing should be granted. The Chicago City Railway Company filed a separate petition for rehearing through its attorney, John P. Wilson, of Chicago. This petition contains seven chief points in support of its argument for a rehearing.

THE MEXICO SALE

F. S. Pearson, of New York, has been electe president of the Mexican Tramways Company, and is the heau of the syndicate referred to in the Street Railway Journal of April 14, as having purchased the street railway system of Mexico City from the former owners, Wehrner, Beit & Company. Those associated with Mr. Pearson in this purchase are a number of English, French and American bankers who differ from the principal holders of the Mexican Light & Power Company, the owners of the Necaxa power plant, although some of the same European interests are represented in both companies.

The sale is said to have been effected for $11,250,000 gold, but the actual cash paid for the property is $6,250,000 gold, the purchasers assuming the payment of about $2,000,000 gold, of debentures, as well as the mortage bonds of $6,000,000 Mexican money, of the company that preceded the present one. Mr. Pearson was to leave for Mexico City, May 5.

It has not been stated when the new company will take actual charge of the street railway property, but it is believed that the payments will be soon be made, and that the transfer may take place within the next couple of months.

At the time W. W. Wheatley, presidcnt and general manager of the Tramway Company, was in New York last year, a statement was published from liim giving in outline the plans of the company for securing power from the Mexico Light & Power Company, and reviewing briefly the situation in Mexico City at that time. Dec. 2 was the date of publication of the issue in which this interview was contained.

THE SPOKANE-PEND D'OREILLE COMPANY ARRANGING TO BUILD

The Spokane-Pend d'Oreille Rapid Transit Company, of Spokane, Wash., is rapidly arranging the preliminaries preparatory to constructing its proposed line. Surveys have been completed, right of way secured and terminals bought at a cost of $90,000.

The line, which will be operated by the single-phase system, will run for 30 miles through the center of the irrigated valley of the Spokane River, which is largely sub-divided into 5 and 10-acre tracts, and will pass through the irrigated districts and towns of Opportunity, Greenacres, Otis Orchards, Sucker Lake and East Greenacres. At Moab it will secure the large business of the Newman and Sucker Lake districts. At Rathdrum the business of Fish and Spirit Lakes and the Spirit Valley will be secured. The eastern 15 miles of the road will run through a fine tract of cedar, larch, fir and pine timber, as yet almost untouched. Between Spokane and this point the road will connect with the Oregon Railway & Navigation Company of the Union Pacific system, the Spokane International branch of the Canadian Pacific Railroad system and the Coeur d'Alene branch of the Northern Pacific system, thus giving three transcontinental connections for the large timber areas around Lake Pend d'Oreille. At the terminus is the large lime, cooperage and saw-mill plants of the Washington Brick, Lime & Manufacturing Company, with a capacity of 500 barrels of lime per day. Around the lake are a number of promising mining districts of silver, copper and gold, among them "Lakeview," "Granite Creek" and "Blacktail." Sandpoint, Hope, Ellisport, Clarks Fork and Idlewild, a beautiful summer resort, are all near the lake. As to power, the company has arranged to purchase 1000 hp from the Washington Water Power Company, to be taken from its new power station at Post Falls, Idaho, and at Rathdrum, thc county seat of Kootenai County, about midway of the Rapid Transit Company's line. The officers of the company are: C. H. Reeves, president; J. J. Browne, first vice-president; D. K. McDonald, second vice-president; J. Grier Long, treasurer; R. A. Hutchinson, general manager; Mark F. Mendenhall, secretary; Jas. C. Cunningham, W. S. McCrea, Harry A. Rhodes, trustees.

ANOTHER RULING BY MASSACHUSETTS COMMISSION JUSTIFYING INCREASE OF FARE ON INTERURBANS

In an order issued by the Railroad Commissioners of Massachusetts last week, by which the petition of Melrose against an increase of fares on the Boston & Northern Street Railway is disposed of, the Commission clearly sets forth the fact that interurban street railways cannot be maintained on a fare that yields less than 1 cent per mile, and adds that the rate of 5 cents, between Melrose and Boston, a distance of about 9 miles, is lower than that charged by any interurban line in the country, taking the service into consideration. The full text of the Commission's order, summarizing briefly the whole situation, follows:

Several months ago the Boston & Northern Street Railway Company increased the cash fare between Melrose Highlands and Boston from 5 to 10 cents, at the same time placing on sale at certain places 10-trip tickets at 75 cents.

The question is whether the increased fare is excessive.

An examination of the figures presented and of the returns of this and of other companies and an investigation of street railway conditions without as well as within this commonwealth conclusively shows that no company can carry passengers 9 miles for 5 cents over an interurban railway constructed, maintained and operated like this, and at the same time out of earnings pay anything in the way of a fair return upon investment.

In populous centers where a large and frequently changing patronage fills and refills the same car, low fares yield a profit that cannot be realized upon railways which for the most part carry passengers long distances through smaller communities.

The average cost of transporting passengers upon the ordinary interurban railway, with its long-distance riding, is necessarily greater than upon the city railway with its heavy traffic for short distances. When, as in some instances, a railway is both urban and interurban in character, it is the great volume of constantly changing traffic within the city limits which makes possible the 5-cent fare upon the long-distance lines.

Again, in comparing railways, whether urban or interurban, in different sections of the country, the expense of roadbed and equipment, rate of wages, cost of heating and climatic conditions all have an important bearing upon fares. In Massachusetts the required standard of roadbed and equipment is expensive and costs of operation are high.

The fare between Melrose Highlands and Boston was formerly 10 cents, but some years ago was reduced to 5 cents in the expectation that the cities of Chelsea, Everett, Malden and Melrose would furnish in the riding for short distances a patronage similar to that of a large municipality. The company now faces the fact that this expectation has not been realized.

In our belief there is nowhere to be found an instance where a service like that upon this railway between the points named is being successfully performed under like conditions for a 5-cent fare. Upon interurban railways in the West, where fares are almost wholly governed by mileage, the average rate is higher than upon our railways, the common rate being not less than 1¼ cents a mile, often 1½ cents a mile.

We know of no ground upon which we could declare that the fares under consideration between Melrose and Boston are excessive or unreasonable. Any such finding would be against the evidence and indefensible.

This is not the case of an experiment with a fare upon the promise of which a location has been granted and which presents the question as to how long an experiment with it should be continued. The original increase proposed by the company was from 5 to 10 cents. Upon the suggestion of the board in a former order the 10-trip ticket at the rate of 7½ cents a trip was introduced.

In our opinion, however, these tickets have not been brought within the convenient reach of patrons. To place them on sale at a few fixed points is not enough. The only way in which the tickets can be always available is apparently through placing them in the hands of conductors for sale upon the cars, and we recommend that this course be taken.

HALF BILLION FOR NEW SUBWAYS IN NEW YORK

Important facts concerning the cost of construction, equipment and operation of New York City's future subways were brought out last week in the testimony of George S. Rice, chief engineer of the Rapid Transit Commission, at a hearing before a special commission recently appointed by the Supreme Court to determine whether or not certain projected lines are needed, and if the city has available funds for building and equipping these lines.

Particular attention was given to the Third Avenue subway, and other projected lines were taken up after Mr. Rice had given all the figures asked for concerning Third Avenue. Mr. Rice stated that the cost of building and equipping the Third Avenue subway would be $39,000,000, the construction costing $26,000,000 and the equipment $13,000,000. It was estimated, he said, that the line would carry 600,000 passengers daily, and that if operated by the city the cost would be 60 per cent of the gross receipts, based upon 600,000 passengers daily. That would amount to about $11,000,000 a year. If operated by a private corporation the cost would be only 50 per cent of the gross receipts. He said the present subway was being run on that basis, and it was practically certain that municipal operation would cost more than private operation.

As to the total cost of construction and equipment of the nineteen subway routes now approved by the Rapid Transit Commission, Mr. Rice said it would be $450,000,000, construction costing $300,000,000 and equipment $150,000,000. Equipment, he said, would cost slightly less than $1,000,000 a mile. He gave the following estimates of the cost and equipment of the several principal projected lines: Third Avenue, $39,000,000; Seventh and Eighth Avenues, $40,000,000; Lexington Avenue, $44,000,000; First Avenue, $28,000,000.

Mr. Boardman, speaking for the Rapid Transit Commission, said: What this city needs is a comprehensive scheme of transit, another route on the East and West Sides, a connecting line between the two, and a route to Brooklyn that will utilize the two bridges. It would be nonsense for the city to undertake anything but a comprehensive scheme of improvement.

SUMMER SCHOOL FOR ARTISANS AT THE UNIVERSITY OF WISCONSIN

The sixth annual session of the Summer School for Artisans, held under the direction of the College of Engineering of the University of Wisconsin, begins June 25, and continues for a period of six weeks. Courses of study are offered in the following subjects:

1. Engines and Boilers.—Lectures and laboratory courses covering the theory, construction, management and testing of steam engines, boilers, gas engines and gas producers, refrigerating machines, etc.

2. Applied Electricity.—Lectures and laboratory courses covering the theory of direct and alternating-current dynamos and motors, the operation and method of testing electrical machinery, batteries, transformers and other apparatus, photometry and calibration of instruments.

3. Mechanical Drawing and Machine Design.—Elements of applied mathematics, courses in mechanical drawing and machine design adapted to the preparation of the students.

4. Materials of Construction, Fuels and Lubricants.—Lectures on the properties of materials accompanied by laboratory tests; lectures on fuels and lubricants with laboratory tests on the heating value of coals and efficiency of lubricants.

5. Shop Work.—Practice with hand tools, wood and metal working machinery, and in blacksmithing and pattern making.

6. Manual Training.—Lectures and laboratory courses adapted to the requirements of manual training teachers.

The instructional force is taken from the regular faculty of the College of Engineering, and the entire laboratory and shop equipment belonging to the college is used by the students in the summer school. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work, so that the student may take advantage of all the preparation he has obtained. The school offers to those unable to take a regular four years course an opportunity of obtaining a working knowledge of the methods of testing and in the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. Correspondence students have found the school of value in giving an opportunity for laboratory practice along the lines in which they have had theoretical instruction. A bulletin describing the work of the School for Artisans in detail will be sent on application to Frederick E. Turneaure, dean, College of Engineering, Madison, Wis.

NEW YORK ALDERMEN CAN NOT GIVE FRANCHISES

The Court of Appeals has sustained the act of the last Legislature taking from the Board of Aldermen of New York City the power to grant public franchises and reposing it in the Board of Estimate and Apportionment. The bill passed on by the court was enacted because the Aldermen would do nothing with the application of the New York Connecting Railroad for a franchise. This company is dominated by the Pennsylvania Railroad, which laid out a route over a private right of way for a railroad from the Bushwick section in Brooklyn across Queens to Ward's and Randall's Islands, and thence over a bridge to a junction with the New Haven road at Mott Haven. The franchise application came before the Rapid Transit Commission, and is still there, as the Mayor thinks that the proposed terms are not fair to the city. One objection to the road's franchise is that it involves the building of an embankment for a long distance crossing city streets, and that in the course of time the city may have to remove the tracks. As soon as the Legislature passed the law last spring companies desiring franchises made haste to get their applications before the Board of Estimate and Apportionment. The merits of these applications were duly considered by the board, and then referred to committee pending the final disposition of the suit brought by the Aldermen to test the constitutionality of the act. Some of these franchises are as follows:

Southern Boulevard Railway Company, four extensions.

New York City Interborough Company (Belmont), thirteen extensions and five alterations in routes.

New York & Portchester Railway Company.

Nineteen routes laid down by the Rapid Transit Commission.

New York Connecting Railroad Company.

Union Railway Company, twenty-two routes in the Bronx.

Nassau Railway Company in Brooklyn.

SALE OF PORTLAND (ORE.) RAILWAY SYSTEM

The statement is confirmed that E. W. Clark & Company, of Philadelphia; J. W. Seligman & Company, of New York, and the Portland General Electric Company, have purchased, in the interest of the Portland Railway Company and the Portland General Electric Company, the controlling interest of the Oregon Water Power & Railway Company.

The Oregon Water Power & Railway Company has in operation about 72 miles of railway, consisting of a line running from First and Couch to Canemah, above Oregon City, about 18 miles; a line running from East Oak and East Water Streets along the river front to Sellwood, and thence through Powell's Valley to the power plant at Cazadero on the Clackamas River, about 40 miles; a line running from Second and Madison Streets to the Mt. Tabor reservoir, about 6 miles; and a line running from the city to Lents Junction, about 8 miles. An extension to Fairview and Troutdale and the Columbia River, of about 10 miles, is under construction.

The Portland Railway Company owns and is operating about 118 miles of road, and with the 72 miles of constructed lines and the 10 miles of the Troutdale extension of the Oregon Water Power & Railway Company operated in connection with them, will make a system of nearly 200 miles of railway.

It can be stated authoritatively that a number of important suburban extensions are already contemplated, and that the entire electrical output, which is estimated at 50,000 hp, will be under the direct control of the Portland General Electric Company. The water power properties, electric plants, sub-stations, transmission lines, etc., of the Oregon Water Power & Railway Company will be operated in connection with the electric generating and distributing systems of the Portland General Electric Company. The completion of the power plant on the Clackamas River, at Cazadero, will be pushed as rapidly as possible. It is expected that by Sept. 1 of this year 15,000 hp will be delivered in Portland from the Clackamas plant.

The Portland General Electric Company is now furnishing all of the electric current for the operation of all lines of the Portland Railway Company, and will hereafter supply such additional power as may be necessary to operate the present lines of the Oregon Water Power & Railway Company and all extensions of the same.

THE 1906 CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION

Announcement is made by Elmer M. White, secretary, that the tenth regular annual convention of the American Street and Interurban Railway Accountants' Association will be held in the city of Columbus, Ohio, during the week beginning Oct. 15, 1906. At this early date, of course, only the bare outlines of the programme can be given.

As the "Question Box" has been of much help to many of the members during the past two years, it will be continued, and a special blank for questions is being sent to all of the members.

There will be a paper read treating the use of curves or the graphic method of showing results, by C. F. Bryant, auditor of the Connecticut Railway & Lighting Company, Bridgeport, Conn. Another paper will consider the routine of construction accounts, by S. P. Young, comptroller of the Public Service Corporation of New Jersey, Newark. The supject of depreciation and appreciation as applied to electric railways will be led by Robert N. Wallis, treasurer of the Fitchburg & LeominsterStreet Railway Company, Fitchburg, Mass. This subject has been ready for discussion for many years, and it is planned to make this effort the most comprehensive possible along certain lines. The meeting at which this question is to be considered will be open only to those representatives of members presenting proper credentials.

HOLDING COMPANY FOR NEWMAN PROPERTIES IN THE SOUTH

It is reported in financial circles that it is proposed to form a holding company with $20,000,000 common stock and same amount preferred to take over the street railway and light properties controlled by Isadore Newman & Son, of New Orleans and New York, embracing systems in Memphis, Nashville, Birmingham, Knoxville, Little Rock and Houston. The stock issues of the properties amount to $8,745,000 common and $13,000,000 preferred. A schedule is submitted to the stockholders giving a basis of exchange.

MAYOR McCLELLAN ACCEPTS ELSBERG BILL

Mayor McClellan, of New York, announced last Thursday that he had signed the Elsberg Rapid Transit bill, and had returned it to Albany, with a memorandum of his approval. The bill now goes to Governor Higgins for final action. In his memorandum of approval the Mayor said:

"By the enactment of this bill many radical changes will be made in the existing rapid transit law. As the bill now stands, there is but one clause to which any serious objection has been offered. This relates to the section limiting the length of future leases to twenty years with the privilege of one renewal for twenty years in addition. It has been urged that such a term is too short to prove attractive to responsible bidders, and that the investment of private capital in an enterprise of this kind under such conditions would be impossible. I fail to see, however, any substantial reason for believing that this limitation will have such an effect.

"It cannot be said that a forty years' lease of an underground road in the city of New York would prove wholly uninviting to private capital. I say forty years' lease advisedly, for I regard a twenty years' lease, with the privilege of a renewal of twenty years thereafter, as amounting to nothing more than a naked lease for twenty years. If it should prove that private capital will not be offered under these conditions, and that the city by itself cannot construct and equip these new roads, it will be perfectly feasible to apply to the next Legislature for a satisfactory amendment to this law."

The New York State Board of Railroad Commissioners has removed its New York offices from Whitehall Building, 17 Battery Place, to rooms 5094-7 Metropolitan Life Insurance Building, 1 Madison Avenue. The offices will be open during business hours each day.

LOUISVILLE SYNDICATE BUYS JACKSON PROPERTY

A Louisville syndicate, composed of Attilla Cox, John L. Helm, George Gaulbert, J. W. Gaulbert, William Jarvis, Henning Chambers, Oscar Fenley, C. E. Claggett, Harry Weissinger and S. S. Bush, have purchased the electric railway and lighting properties at Jackson, Tenn., a rapidly growing town of 23,000. The new company, which will be called the Jackson Electric Company, will at once add 7 miles of track to the 3½ miles acquired, and abandon the present power plant and rebuild on up-to-date lines at a new location. Particular attention will be given to lighting and power. A suburban line will be built to Bemis, 3 miles distant, which is a model manufacturing town patterned after Pullman. S. S. Bush, who built and is general manager of the Pascagoula Street Railway & Power Company, of Scranton, Miss., is also general manager of the Jackson Electric Company, and will build and manage it, with his general offices for both companies at Louisville, Ky. The same syndicate owns both properties.

PEEKSKILL SYSTEM SOLD

The Peekskill Lighting & Railroad Company, capitalized at $1,400,000, which furnishes gas and electricity to Peekskill and the adjacent territory and operates 10 miles of electric railway, has been acquired by the interests controlled by F. A. Stratton, of Mount Vernon, and it is rumored that it will be merged into the Northern Westchester Lighting Company, of which Mr. Stratton is president, and which is capitalized for $2,00,000.

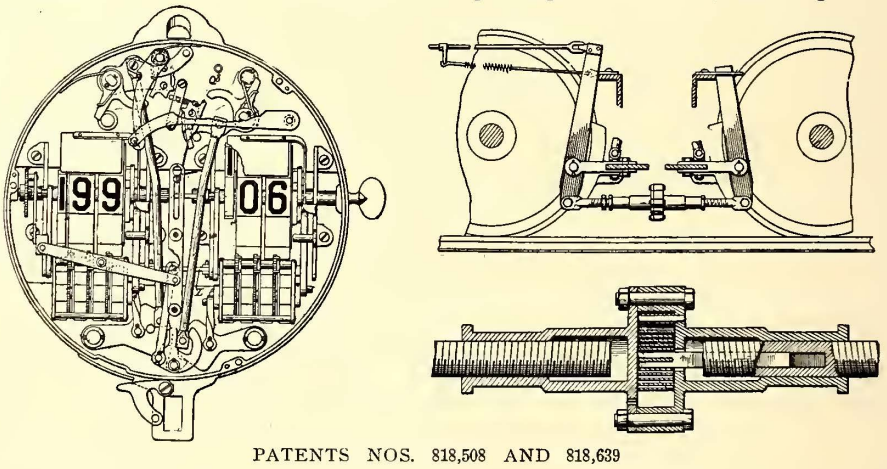
After closing a deal a new board of directors were elected, with Mr. Stratton as president, and they took immediate steps to contract for a new plant and several other improvements and additional machinery. The Peekskill electric railway system will be extended to Ossining, for a connection with the proposed lines of the Hudson River & Eastern Traction Company. This will give the people of Peekskill an almost direct connection with the county seat at White Plains and the eastern side of Westchester County.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED APRIL 24, 1906

818,495. System of Operating Railroad Switches; Aldred K. Warren, New York, N. Y. App. filed June 24, 1905. Apparatus at a central station for operating track switches, consisting of a plurality of keys which directly work the switch levers in an oil bath. At the same time certain magnets move switches on miniature tracks in front of the operator so as to show the condition of the actual track.



PATENTS NOS. 818,508 AND 818,639

818,508. Fare Register; Arthur H. Woodward, Chicago, Ill. App. filed Sept. 27, 1901. Details of a fare register for recording both cash fares and transfers.

818,509. Hundred Indicator; Arthur H. Woodward, Chicago, Ill. App. filed Oct. 10, 1903. See patent 818,508.

818,515. Electric Signal System; Victor W. Bergenthal, Chicago, Ill. App. filed July 21, 1904. A block system in which

lamps are cut in by the engagement of the trolley wheel with suitable contacts adjacent the trolley wire.

818,561. Switch; Edward P. Robbins, Mansfield, Ohio. App. filed Oct. 20, 1905. A pair of contact-shoes arranged one on each side of the trolley wheel, and adapted to be engaged by contacts adjacent the trolley wire in circuit with a pair of solenoid coils which move an armature directly connected to the switch point. At the same time signal lights are displayed to indicate the position of the switch point.

818,631. Trolley Wire Support; James H. Lane and Uriah Culnick, Newark, N. J. App. filed May 4, 1905. Comprises a member having horizontally projecting flanges and arms depending from the central portion thereof and adapted to be bent inward to embrace the usual trolley wire.

818,639. Brake; William G. Price, Kingston, N. Y. App. filed Dec. 23, 1903. Means for reducing the amount of movement necessary for applying the brake-shoes to the wheels, consisting of a turnbuckle and spring for actuating the same.

818,640. Car Truck; William G. Price, Pittsburg, Pa. App. filed Nov. 12, 1904. A movably mounted bolster having transoms arranged at the sides thereof, and spring arms interposed between the transoms and bolster for frictionally resisting movement of the bolster.

818,641. Slack Adjuster; William G. Price, Pittsburg, Pa. App. filed Feb. 11, 1905. Means for automatically taking up slack produced by the wear of brake-shoes, comprising a movably-mounted rod, a casing inclosing the same, and means for supplying balls between the rod and the end of the casing.

818,744. Signal Apparatus; Clarence W. Coleman, Westfield, N. J. App. filed Feb. 6, 1906. Mechanism for operating a three-position semaphore arm consisting of an electric motor and gear connections therefrom to the main rod of the semaphore arm. A special lever and switch arrangement is used so as to insure the required movement of the semaphore arm under different conditions.

818,773. Switch-Throwing Device; John H. Mayer, New Kensington, Pa. App. filed Dec. 21, 1905. The movements of the switch point is accomplished by levers on the car, which engage tappets in the roadbed, which are mechanically connected to the switch point. The movement of the switch closed different lamp circuits.

818,795. Railway Signaling Device; Charles H. Smith, Lebanon, Pa. App. filed March 30, 1905. A signal system for single-track trolley roads, consisting of a semaphore and switch-box at each turn-out, with a lever which is moved by the car contactor into one of two extreme positions. At each turn-out there is a solenoid magnet with two armatures, which establish certain lamp circuits according to the position of the operating arms.

818,797. Fender; John Stawartz, Homestead, Pa. App. filed Aug. 16, 1905. Comprises a pair of cushioned jaws which close over and retain any object encountered by the fender.

818,824. Device for Actuating Switches; Anderson Fuller, Amsterdam, N. Y. App. filed Jan. 30, 1906. A depending treadle on the car engages a lever in the roadbed which is mechanically connected to the switch point.

818,855. Railway Signal System; Alfred L. Ruthven, Topeka, Kan. App. filed Sept. 1, 1905. Designed to notify the engineer or motorman of the presence of another car or train on the same track, and whether the train is moving in the same or in the opposite direction. Special trolley circuits are provided which include alarm devices in each train, and circuits along the roadbed are also operative to indicate the direction of the respective trains.

818,873. Guard Rail for Street Cars; Edward P. Danbridge, Philadelphia, Pa. App. filed Dec. 7, 1905. The guard rail is suspended in vertical slots by cables adapted to be wound and unwound on a drum to raise and lower the guard rail.

818,900. Car Wheel; Aaron Mast, Annapolis, Mo. App. filed Jan. 5, 1906. The tread of the wheel is wound with wire.

818,935. Combination Strap Hanger; Samuel S. Brooks, Brooklyn, N. Y. App. filed June 3, 1905. A combined strap hanger, signal bell and register ringer.

818,947. Shoe Contact; George H. Fretts, Springfield, Mass. App. filed May 13, 1905. An insulated shoe for trolley wires suitable for purposes of track switches and the like and consisting of metallic plates bolted to the trolley wire and holes beneath the bolts, so that the latter may drop to the ground in case they become loosened and not interfere with the passage of the trolley wheels.

819,012. Compound, Which Forms an Emulsion with Water to be Applied to the Surfaces of Roads or Other Places; Edward Hardcastle, Stockport, England. App. filed Jan. 2, 1906. Consists of coal-tar creosote and resinate of soda holding pitch or asphaltum in solution, which forms an emulsion with water, for the purpose of preventing the formation of dust and allaying it.

819,032. Fluid Pressure Brake; William P. A. Macfarlane, Chicago, Ill. App. filed Nov. 4, 1905. Reduction of auxiliary-reservoir pressure in the operation of restoring the train-pipe pressure for the purpose of releasing the brake is accomplished by venting some of the auxiliary-reservoir pressure into the train pipe, with the result that the train-pipe pressure is augmented and the main air-drum on the locomotive thereby assisted, and at the same time the degree of pressure necessary for the release of the brakes is reduced.

PERSONAL MENTION

MR. G. E. BENDER, who for a number of years has been assistant secretary of the Cleveland, Painesville & Eastern Railroad Company, with headquarters at Willoughby, Ohio, has resigned, and will be associated with the new banking and brokerage firm of Borton & Borton, with offices in Cleveland.

MR. RAY RONK has been appointed auditor of the Lake Erie, Bowling Green & Napoleon Traction Company. Mr. Ronk entered business as a bookkeeper with the Detroit & Toledo Shore Line, and later became auditor of the Detroit, Monroe & Toledo Short Line, which was recently acquired by the Detroit United Railway.

MR. JOHN H. MILLER, general manager of the Springfield Railway Company, of Springfield, Ohio, has assumed charge, temporarily, of the People's Railway Company, of Dayton, which is without any operating head, due to the recent deaths of both General Manager Breen and Superintendent Kelley. Both of the properties mentioned are controlled by the American Railways Company, of Philadelphia.

MR. EDWARD BRILL has been elected treasurer and Mr. M. Herman Brill secretary of the J. G. Brill Company, to succeed Mr. James Rawle, whose election to the presidency of the company was announced in a recent issue of this paper. Mr. Edward P. Rawle has been elected assistant treasurer of the company. The following offices of the company are without change: Mr. John A. Brill, vice-president; Mr. Samuel M. Curwen, general manager, and Mr. William H. Heulings, Jr., assistant secretary.

MR. A. STAVENOW, chief traffic manager of the Grosser Berliner Strassenbahn and the Western & Southern Berlin Suburban Railway, has just arrived from Germany to make a study of traffic handling in the large American cities. He expects to visit Buffalo, Boston, Philadelphia and several other Eastern cities. He is particularly interested in the subjects of schedules, fare collection and accounting, car storage and employees' benefit associations. Mr. Stavenow has brought with him an ingenious street railway map of Berlin in relief, all of the lines being shown by layers whose thickness varies in accordance with the traffic density.

MR. R. W. BAILEY, of East St. Louis, has been appointed superintendent of properties for the new East Side Corporation, which has consolidated the East St. Louis & Suburban with the Alton, Granite & St. Louis lines, to succeed Mr. J. F. Porter, in charge of the Alton lines. Mr. Bailey has been given charge of the Alton electric lighting and gas system and the street railway, the interurban lines operated by the Alton, Granite & St. Louis and the Edwardsville, Alton & St. Louis Companies. He will have his office at Alton. Mr. Porter will complete the work of reorganizing the Alton Water-Works Company and then go elsewhere to look after the interests of J. G. White & Company.

MR. FRANK A. POLHAMUS, formerly superintendent of the New York & Long Island Traction Company, has been appointed assistant trainmaster of the Long Island Railroad, in charge of operations of the company's trolley lines, comprising the Ocean Electric Railway at Far Rockaway, Glen Cove Railroad at Glen Cove, Huntington Railroad at Huntington, Northport Traction Company at Northport, and the Nassau County Railway at Sea Cliff. Mr. Polhamus entered electric railroading some eight years ago as a conductor on the Lake Shore Electric Railway, at Cleveland, Ohio. After serving four years in that capacity he was appointed superintendent of transportation of the New York & Long Island Traction Company. This position he held three years, subsequently being appointed general superintendent of the same company. Mr. Polhamus will have his headquarters at Long Island City, in the offices of Mr. F. Hartenstien, superintendent of transportation.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., Mar. '06	71,580	41,287	30,293	22,667	7,627
	1 " " '05	67,113	38,166	28,948	22,917	6,031
	3 " " '06	211,235	120,745	90,490	68,001	22,490
	3 " " '05	192,890	110,720	82,171	68,751	13,421
ALBANY, N. Y.						
United Traction Co	3 m., Mar. '06	415,431	250,317	165,114	86,581	78,533
	3 " " 05	402,737	234,813	167,924	86,241	81,683
	9 " " '06	1,314,156	847,755	466,401	259,744	206,657
	9 " " '05	1,292,987	756,715	536,272	259,558	276,714
AURORA, ILL.						
Elgin, Aurora & Southern Tr. Co	1 m., Feb. '06	37,062	21,513	15,549	8,989	6,560
	1 " " '05	31,390	20,825	10,566	9,133	1,432
	8 " " '06	344,803	186,248	158,555	74,162	84,394
	8 " " '05	305,387	173,889	131,498	74,306	57,192
BINGHAMTON, N. Y.						
Binghamton Ry. Co	1 m., Mar. '06	21,567	11,570	9,816	7,437	2,380
	1 " " '05	18,989	10,686	8,303	6,048	2,254
	9 " " '06	214,938	111,851	103,087	65,573	37,514
	9 " " '05	191,989	102,591	89,398	62,915	26,484
CHAMPAIGN, ILL.						
Illinois Traction Co	1 m., Mar. '06	215,751	*124,258	91,492	------	------
	1 " " '05	178,265	*98,047	80,218	------	------
	3 " " '06	658,567	*365,014	293,553	------	------
	3 " " '05	540,006	*295,392	244,614	------	------
CHICAGO, ILL.						
Aurora, Elgin & Chicago Ry. Co	1 m., Feb. '06	38,549	25,733	12,816	------	------
	1 " " '05	23,099	18,898	4,201	------	------
	8 " " '06	443,259	237,059	206,200	------	------
	8 " " '05	316,899	175,224	141,674	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Mar. '06	40,453	22,219	18,234	------	------
	1 " " '05	30,290	15,144	15,146	------	------
	3 " " '06	120,490	65,963	54,527	------	------
	3 " " 05	78,716	44,686	34,029	------	------
CLEVELAND, O.						
Cleveland, Painesville & Eastern R.R. Co	1 m., Mar. '06	15,450	*9,869	5,581	6,843	†1,261
	1 " " '05	14,134	*9,135	4,999	6,679	†1,680
	3 " " '06	45,239	*27,585	17,653	20,200	†2,546
	3 " " '05	38,689	*27,843	10,846	20,016	†9,170
Cleveland & Southwestern Traction Co.	1 m., Mar. '06	42,321	27,311	15,010	------	------
	1 " " '05	37,219	24,635	12,585	------	------
	3 " " '06	128,606	81,841	46,765	------	------
	3 " " '05	102,385	70,335	32,050	------	------
Lake Shore Electric	1 m., Mar. '06	53,459	*30,321	23,138	20,404	2,733
	1 " " '05	56,973	*35,450	21,523	20,404	1,119
	3 " " '06	165,215	*100,691	64,524	61,212	3,311
	3 " " '05	145,850	*95,771	50,079	61,212	†11,133
DETROIT, MICH.						
Detroit United Ry	1 m., Mar. '06	427,521	*262,720	164,801	93,634	71,167
	1 " " '05	382,722	*236,178	146,544	90,285	56,259
	3 " " '06	1,224,686	*747,273	477,413	278,173	199,240
	3 " " '05	1,060,095	*676,453	383,642	276,693	106,949
DULUTH, MINN.						
Duluth St. Ry. Co	1 m., Feb. '06	50,348	29,722	20,626	17,450	3,176
	1 " " '05	43,451	25,334	18,116	16,711	1,405
	2 " " '06	104,772	63,444	41,328	34,986	6,342
	2 " " '05	91,044	53,243	37,801	33,441	4,361
FINDLAY, O.						
Toledo, Bowling Green & Southern Tr. Co	1 m., Mar. '06	26,083	*14,581	11,502	9,715	1,787
	3 " " '06	78,063	*44,648	33,415	29,896	3,519
FT. WAYNE, IND.						
Ft. Wayne & Wabash Valley Tr. Co	1 m., Feb. '06	71,951	44,529	27,423	------	------
	1 " " '05	62,020	38,891	23,130	------	------
	2 " " '05	152,097	92,260	59,837	------	------
	2 " " '04	130,586	81,998	48,589	------	------
FT. WORTH, TEX,						
Northern Texas Tr. Co	1 m., Feb. '06	49,566	35,124	14,441	9,942	4,499
	1 " " '05	36,423	25,571	10,852	8,482	2,371
	12 " " '06	683,605	410,457	273,148	120,425	152,723
	12 " " '05	572,279	331,452	240,827	109,679	131,148
HANCOCK, MICH.						
Houghton County St. Ry. Co	1 m., Feb. '06	12,676	13,676	1,001	3,824	†2,824
	1 " " '05	12,144	12,223	†79	3,402	†3,482
	12 " " '06	167,757	167,588	168	44,571	†44,402
	12 " " '05	201,735	137,478	64,257	40,988	23,270
HOUSTON, TEX.						
Houston Electric Co.	1 m., Feb. '06	39,269	27,811	11,458	7,729	3,729
	1 " " '05	30,918	20,204	10,715	8,496	2,218
	12 " " '06	534,170	329,146	205,025	104,522	100,503
	12 " " '05	368,769	315,969	52,800	98,317	†45,516
HUDSON, N. Y.						
Albany & Hudson R. R. Co	1 m., Mar. '06	21,181	*15,512	5,669	8,796	†3,127
	1 " " '05	20,381	*15,461	4,920	7,021	†2,101
	9 " " '06	257,641	*194,097	63,544	48,796	14,748
	9 " " '05	228,139	*175,287	52,852	47,021	5,831
MANILA, P. I.						
Manila Elec. R. R. & Lt. Co., Railway Dept	1 m., Mar. '06	42,500	22,500	20,000	------	------
	2 " " '06	82,750	42,000	40,750	------	------
	12 m., Dec. '05	347,317	165,235	182,182	------	------
Total, all depts	1 m., Mar. '06	72,500	38,648	33,852	------	------
	2 " " '06	143,100	73,493	69,607	------	------
	12 m., Dec., '05	724,649	369,979	354,670	195,109	159,561
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co	1 m., Mar. '06	277,476	140,030	137,446	89,017	48,429
	1 " " '05	254,131	131,285	122,847	74,101	48,745
	3 " " '06	812,834	405,948	406,886	259,328	147,558
	3 " " '05	746,614	389,890	356,724	219,644	137,079
Milwaukee Lt., Ht. & Tr. Co	1 m., Mar. '06	44,854	19,561	25,292	24,503	790
	1 " " '05	39,310	19,786	19,525	19,051	473
	3 " " '06	130,641	57,309	73,332	68,193	5,138
	3 " " '05	111,689	58,854	52,835	56,367	†3,532
MINNEAPOLIS, MINN.						
Twin City R. T. Co	1 m., Mar. '06	418,250	198,056	220,194	109,708	110,486
	1 " " '05	361,732	172,766	188,966	97,325	91,641
	3 " " '06	1,206,501	592,418	614,082	329,125	284,957
	3 " " '05	1,034,303	518,361	515,942	291,975	223,967
MONTREAL, CAN.						
Montreal St. Ry. Co	1 m., Mar. '06	235,307	156,458	78,848	39,663	39,185
	1 " " '05	209,231	159,004	50,227	22,646	27,581
	6 " " '06	1,406,322	928,632	477,691	178,625	299,066
	6 " " '05	1,236,445	860,883	375,563	118,451	257,112
OAKLAND, CAL.						
Oakland Traction Consolidated	1 m., Feb. '06	118,997	62,938	56,059	35,678	20,380
	1 " " '05	100,354	56,576	43,778	30,818	12,960
	2 " " '06	240,620	131,462	109,158	71,357	37,800
	2 " " '05	205,027	118,097	86,930	61,303	25,628
San Francisco, Oakland & San Jose Ry. Co	1 m., Feb. '06	48,084	19,828	28,256	17,746	10,510
	1 " " '05	41,170	15,429	25,741	13,009	12,732
	2 " " '06	96,393	42,629	53,764	34,243	19,521
	2 " " '05	81,551	31,834	49,717	25,587	24,130
OLEAN, N. Y.						
Olean St. Ry. Co	1 m., Feb. '06	8,173	3,971	4,202	2,726	1,476
	1 " " '05	6,616	3,908	2,708	2,693	14
	8 " " '06	85,900	42,641	43,259	21,302	21,957
	8 " " '05	75,782	37,417	38,364	21,206	17,158
PEEKSKILL, N. Y.						
Peekskill Lighting & R.R. Co	1 m., Feb. '06	9,133	*5,610	3,524	------	------
	1 " " '05	7,767	*5,323	2,444	------	------
	8 " " '06	87,905	*46,521	41,385	------	------
	8 " " '05	79,571	*45,511	34,060	------	------
PHILADELPHIA, PA.						
American Rys. Co	1 m., Mar. '06	195,856	------	------	------	------
	1 " " '05	176,801	------	-----	------	------
	9 " " '06	1,423,047	------	------	------	------
	9 " " '05	1,252,342	------	------	------	------
ST. LOUIS, MO.						
United Railways Co. of St. Louis	1 m., Mar. '06	707,482	*456,559	250,923	198,026	52,897
	1 " " '05	683,190	*458,164	225,026	199,129	25,897
	3 " " '06	2,043,485	*1282307	761,178	595,244	165,934
	3 " " '05	1,843,022	*1298702	544,320	598,472	†54,152
SAN FRANCISCO, CAL.						
United Railroads of San Francisco	1 m., Feb. '06	563,906	------	------	------	------
	1 " " '05	516,966	------	------	------	------
	2 " " '06	1,164,116	------	------	------	------
	2 " " '05	1,060,337	------	------	------	------
SAVANNAH, GA.						
Savannah Electric Co.	1 m., Feb. '06	45,821	29,247	16,574	10,904	5,670
	1 " " '05	39,491	23,677	15,814	10,554	5,260
	12 " " '06	600,844	359,854	240,991	128,395	112,595
	12 " " '05	546,634	317,728	228,906	126,479	102,427
SEATTLE, WASH.						
Seattle Electric Co	1 m., Feb. '06	216,944	143,435	73,508	27,266	46,243
	1 " " '05	179,925	121,573	58,352	24,880	33,472
	12 " " '06	2,636,568	1,709,131	927,437	292,130	635,308
	12 " " '05	2,341,363	1,615,222	726,141	298,812	427,329
SYRACUSE, N. Y.						
Syracuse R. T. Co	1 m., Mar. '06	88,221	50,365	37,856	22,386	15,470
	1 " " '05	77,153	44,913	32,240	20,471	11,769
	3 " " '06	253,632	144,304	109,328	66,237	43,091
	3 " " '05	219,935	130,410	89,525	61,117	28,408
TERRE HAUTE, IND.						
Terre Haute Tr. & Lt. Co	1 m., Feb. '06	54,902	36,196	18,706	12,632	6,074
	1 " " '05	40,746	30,698	10,048	9,098	950
	12 " " '06	657,500	428,978	228,522	127,408	101,114
	12 " " '05	574,927	369,628	205,300	113,002	92,297
TOLEDO, O.						
Toledo Rys. & Lt. Co	1 m., Feb. '06	142,811	*75,165	67,646	42,804	25,842
	1 " " '05	133,405	*69,231	64,174	42,819	21,355
	2 " " '06	301,865	*158,313	143,552	84,594	58,958
	2 " " '05	284,349	*145,321	139,028	85,520	53,508
UTICA, N. Y.						
Utica & Mohawk Valley Ry. Co	3 m., Mar. '06	199,844	123,901	75,943	44,964	30,979
	3 " " '05	173,625	126,775	46,850	44,104	2,746
	9 " " 06	662,772	378,651	284,121	134,728	149,393
	9 " " '05	588,040	392,007	196,033	132,983	63,050