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Track Depreciation

The past two weeks have witnessed the removal of the paving around a piece of track in St. Louis which is of considerable historical interest. This track is located in North Broadway, and was laid just ten years ago with electrically-welded rail-joints. A large number of the joints in this track proved defective during the summer of 1894, immediately after they were laid, owing to the fact that the weld was not really complete. Many of the defective joints were cast welded the following fall, at the same time that the first piece of cast-welded track ever laid was placed at the southern end of the Broadway line. This track on North Broadway, since the imperfect joints were repaired, has remained in very good condition during the ten years that it has been in use. The paving having been removed for the purpose of shifting the track, with reference to the center of the street, an excellent chance was afforded to study its condition and form some conclusions as to track depreciation. In this track the joints have lasted as well as the balance of the track. The rail wear has been simply that of the rolling down and wearing off of the rail head. The rails, which were girder, were laid on braced tie plates, on ties without tie-rods. They have kept gage well, and the ties are apparently in good condition. The rail heads have in some places worn down until the wheel flanges touch the tram, but the number of such worn places is not considered yet sufficient to necessitate relaying the track.

The traffic over this line was comparatively light when the track was first laid, as it was started as an electric extension and feeder of the old Broadway cable line, with single-truck cars about 9 minutes apart. Just what the average has been for the ten years of its life would be difficult to determine, owing to changes in management and to traffic conditions, but it would probably not average more than a car every 5 minutes during the business portion of the day. The line has had maximum traction trucks running over it for the greater part of its life. This example of track depreciation is interesting, because it represents about as near average conditions as can be obtained, and it is simply a case of track wearing by virtue of the wheels that have passed over it without any complications introduced by defective joints, poor ballast, spreading of the gage, or any of the other diseases caused by poor construction, which frequently cause the wearing out of a track before its time.

The Gas Engine Situation

Among the papers read at the recent convention of the National Electric Light Association was one upon gas engines, which is deserving the attention of every power producer. We have repeatedly written of internal combustion engines in their relations to large power production, and with every succeeding year the subject gathers importance. Most Americans when gas engines are mentioned call to mind the picture of a little wheezy, thumping machine, mostly fly-wheel and base, staggering and halting under its load, and altogether unworthy of serious attention. But the subject has now assumed grave importance, and no amount of contemptuous neglect will suffice to push it into the background. The paper in question sets forth the present state of the art very clearly, and shows that even at the present time the internal combustion engine must be reckoned as a formidable competitor of the steam engine in central station working. Broadly, the situation is this: For a given electrical output the fuel cost for an internal combustion engine is just about one-third the same as for a steam engine. Suppose that next year a steam engine were produced which gave the brake horse-power-hour on between 4 lbs. and 5 lbs. of steam, how long could our present engines and turbines stay in the game, even at half the original cost of installation? Yet this saving is an accomplished fact with internal combustion engines, according to the performance tests which have been published.

But the idea is unfamiliar, the engine looks strange and misshapen, and the producer used in connection with it does not resemble our familiar boiler, and, therefore, the average engineer looks at it askance and moans that it is impractical or experimental, or something else that he does not quite understand. In spite of this the internal combustion engine is coming steadily into use in large units. The difficulties of regulation once considered serious have been, for the most part, overcome, so that even a railway load is being successfully handled in several instances, and there is not the slightest reason to sup-

pose that the general principles of good government cannot be applied to such engines as successfully as to steam turbines or water-wheels. Of course, the mere unfamiliarity of the apparatus will, for a time, count against it, especially since its manufacture in large units has been hitherto mainly European. It needs the active competition that comes from vigorous exploitation to give it the prestige that counts for more than intrinsic merit in certain stages of an art's development.

It is now certain that large internal combustion engines will be actively pushed on the American market within the next year or two, and the immediate result of this activity will be not only to bring the engines into use but will reduce the somewhat high cost, which is the chief valid argument against the type. If the steam turbine had not been taken up and pushed by several huge manufacturing concerns in this country it would still be considered an interesting freak, and the public would have still doubted its practicability. The same effects will follow the exploitation of the internal combustion engine on a large scale. There is no good reason why its cost should remain at anything like present figures, although it is relatively bulky and heavy in its usual form. In the long run the advantage is likely to remain with the prime mover, which demands the least fuel for a given power, save in cases where extreme lightness and compactness have a large direct value aside from sentiment. At equal efficiencies the cheaper machine will win out, as when the steam turbine competes with an engine of the ordinary sort. But to-day even in sizes as low as 100 hp responsible makers are willing to guarantee the brake horsepower on 1.25 lb. of coal in the producer, and in such a condition relatively large first cost is justified. As the cost of fuel rises and the current rate of interest on investments diminishes, by so much the more does the scale turn in favor of the prime mover of great thermodynamic efficiency. The internal combustion engine, therefore, must be reckoned with from now on an important factor in power production.

The Trifling Delay

There are many minute details which go to make up the sum total of time required to make a round trip in street and elevated railway service. It is difficult to predict or to theorize in advance as to the effect that a change in any one of these details will have on the whole running time. A most interesting illustration of this occurred recently on a certain street railway line operating on a very fast schedule in a large city. The motormen had been in the habit of starting the cars with a jerk; a habit, no doubt, partially brought on by a desire to start quickly and partly due to carelessness. The cars were equipped finally with a device for limiting the rate of turning on current. It soon came to be reported around that it was easier to maintain schedule time with the cars equipped with the restricting devices than with those not so equipped. While such a result might have been predicted by an electrical or mechanical engineer on the theory that there would be less slipping of wheels, even the most ardent advocates of the device failed to predict the real reason given by the conductors of the cars after the device had been put in use. This was that in very many cases when feeble persons, or persons carrying children, were boarding the cars, a conductor could feel safe in giving a go-ahead bell much sooner if he knew that the car would not start with a jerk than he could if he were tolerably certain that the car would be started so abruptly that a feeble person must be either seated or supported to prevent an accident. The cars on this line had several steps from the car floor to ground, and the conductors did not feel safe in starting the car with a woman climbing the steps, because of the liability of a jerk which would throw her to the ground. Here was a factor in the time-table which had been entirely unthought of, and it is likely that there are many more such.

A few years ago the Minneapolis plan of placing gates, operated by the motorman, on all cars, and opening them only when the cars are at a dead standstill, was suggested. Immediately it was argued that there must be a considerable loss of time on a car equipped with these gates, as compared to the ordinary car, for the reason that often a car will not come to a full stop for an able-bodied man if it has not gates. As a matter of fact, the cars equipped with the Minneapolis gate make the same schedule as they did before they were so equipped. It may be a little more difficult to keep them on schedule, but the fact remains that they make it year in and year out. Time is lost in some stops, because of the gates no doubt. In other cases there is a gain. For example, a motorman may think he will not need to come to a full stop to take on an active looking man. He may finally have to stop after drifting at slow speed for several feet, and in the long run may loose more time than if he had stopped promptly in the first place. The whole problem is full of factors little considered.

Another case where theory and practice did not correspond was as regards the comparative schedule time that could be made by long as against short cars in city service. Street railway men operating in large cities, many of them, held the theory for a long time that a long car in such service would necessitate a slower schedule than a short car, because of the time required for persons to get from the middle of the car to the step. This argument might hold in an easy-going small town, where passengers expect to remain seated until the car stops. But in large cities the argument is absolutely worthless, simply because the majority of people will be at the car step ready to get off the moment the car stops, without regard to whether the car is 10 ft. or 60 ft. long. More passengers must get off the long car at transfer points, it is true, but this delay is compensated for by the wider doors and longer platforms of the long cars.

On elevated roads a small factor of the delay of trains at stations is due to the bell signals commonly used. On a six-car train, if the rear guard is the last man to close his gates, a delay of from 3 seconds to 5 seconds is caused, simply by the length of time taken to signal by "two bells" from one guard to the next the length of a six-car train. This loss of time does not occur at each stop unless the rear guard is especially slow about getting his passengers loaded and unloaded. It would be exaggeration to say that the loss of time in this way is very great, but it is one of the small items that go to swell the total of time lost. We have already referred in this paper to the possible saving in time in elevated service by the use of a side aisle, side entrance car of the type recently adopted by the Illinois Central in Chicago. With our present rapid rates of acceleration and braking the only hope for any important further reduction in schedule speeds lies in reducing the length of the station stop.

The New York Aldermen

Time-honored traditions have become reversed during the last year, and particularly during the last two weeks, by a remarkable spectacle which has been exhibited by the New York Board of Aldermen. Since the time when the memory of man runneth not to the contrary, Aldermen, according to the popular idea, have been ever prone to sacrifice the interests

of the city to those of corporations, and award the latter franchises over public streets for inadequate compensation. This idea must now be changed in view of the extended hearing which has been conducted by the Board of Aldermen in New York to prove that they have not demanded money for attending to a neglected duty. The New York & Portchester Railway Company has been before the Board for more than a year to secure its approval of its franchise for a high-speed electric railway connecting the Borough of the Bronx with Mt. Vernon, Portchester and other suburban cities along the Sound. The road has the endorsement of all the residents of these places, as expressed through their authorities and in frequent indignation meetings which have been held as a result of the holdup in the Board of Aldermen. The franchise has also been approved by all of the representative bodies of citizens in the Borough of the Bronx which have taken action upon it, by the Merchants' Association of New York, and by other distinguished bodies of citizens, all of which have urged the Aldermen to grant the franchise or give some good reason for not doing so. This the body has refused to do up to the present time. As a substitute it has a held a public hearing to prove that no one has offered to pay any of the members for passing the franchise, and that no member has offered his influence for private compensation. This may be admitted, but a question which cannot be so easily answered is, why is a road which is so greatly wanted by the public at large refused consideration, and will the Aldermen permit the people whose property will be affected by the construction of this road have something to say about it?

Automobiles and Street Cars

In a recent address before the Economic Club, of Boston, John Brisben Walker, editor, automobilist, social reformer, poseur and advocate for all generally unpopular causes, denounced earnestly all modern methods of rapid transit upon tracks. With 5000 automobile 'buses, on which he would probably not be unwilling to furnish estimates, he would do the entire rapid transit business of greater New York, and relegate all street cars to the ash heap of civilization. His plan would, unquestionably, be good for the automobile business, but where would the public come in? In spite of Mr. Walker and other automobile boomers there are still many, yes very many, persons who have to use the streets for other purposes than scorching, and the effect of 5000 huge automobiles trying to get down town all at once is something in which the walking public has more than a passing interest. Of course, no proper chauffeur admits that the pedestrian has any rights, or that any vehicle less massive than a steam roller deserves the slightest consideration, but considering the trouble from blockades already existing, one must look with reprobation on unconditional surrender to the Vermilion Peril. The promiscuous use of an indefinite number of public automobiles, however useful it might be as a stimulant for the manufacturer, is utterly impracticable on city streets as at present constituted. Vehicles enough even partially to replace the street cars now in use would render the streets utterly impossible for any other kind of traffic, a phase of the matter which would-be reformers do not seem at all to realize.

If passenger traffic is to be attempted with a large number of capacious high-speed vehicles, not confined to any track, the conditions become incompatible with the use of the streets by pedestrians or by any other vehicles. At considerably increased cost and danger to life and limb it would, doubtless, be possible to carry a very large volume of traffic by automobiles if a clear way were provided. To attain anything like the speed reached on underground electric roads, however, the way must be absolutely clear of all other traffic, and all the vehicles using it must work at the same general level of speed. Granted this complete surrender of a street, or system of streets for rapid transit, the way could still be most efficiently utilized by laying out a four-track or six-track electric car system, since the power available for fast running and rapid acceleration can be taken from a trolley wire far more readily than it can be generated on the vehicle, and much less power would be required for the same service than if the tracks were abolished. The street car replaced the omnibus by reason of the ease with which large numbers of passengers could be conveyed on tracks which both gave easier traction and checked blockades. For the same reasons the electric car will hold the supremacy as a traffic carrier against any system of vehicles running on roadbed inferior to track, and running without the control given by the confinement to a track. Fancy the disastrous results of a huge automobile omnibus breaking down in the thick of the morning rush. A breakdown on a track is bad enough, although the next car generally comes quickly up and helps the cripple, but in a tangle of flying automobiles a break means a blockade, and probably three or four 'busses piled into a mass of shattered woodwork and humanity drenched in blazing gasoline. If a whole street is given up to the purposes of rapid transit, immense carrying power is gained as a matter of course, but it can best be gained by fast electric trains. The viaduct proposition has, in fact, often been made, but it has steadily been rejected on account of the enormous cost of condemning the necessary property. Costly as a subway is, it is cheap compared with a viaduct, and viaducts of immense cost are what Mr. Walker's proposition requires.

No man, with a reasonable knowledge of mechanics or of the properties of prime movers, can fail to recognize the limitations of the self-propelled vehicle in cases where large power is necessary. There are, of course, hosts of automobile cranks who believe anything they are told by the manufacturers, and when Mr. Vanderbilt, or some other notoriety, breaks a record at Palm Beach, immediately jumps to the conclusion that railway trains will soon be a thing of the past, forgetting how large an amount of New York Central dividends it takes to keep Mr. V's automobile racing stable in commission. Of course, few rational persons take Mr. Walker very seriously, and in this land of free speech any one who desires can get into his soothsayers' togs and set up in business as a prophet. But the matter has a somewhat serious side, in that loud talking, however foolish, is heard by many people, and out of the many is believed by some. A sufficiency of talking about automobile omnibuses will set some enthusiast, with more funds than discretion, at trying it on, and then there will be trouble as long as the money holds out. The electric roads need not concern themselves about the direct competition involved, but there will probably be many instances in which a franchise, really needed for public convenience, will be held up by a bluff, based on an automobile line that nobody really means to establish. The game has, in fact, been tried with some success, and it behooves the electric roads to stand together and fight the humbug to a finish. Particularly to be blocked are all attempts to raise the speed limit for automobiles beyond that permitted for electric cars. If vehicles on a definite track are held down to 15 m. p. h. it is gross injustice to permit automobiles, which are far more dangerous to vehicles in general, to run at any higher speed. A public automobile should certainly be kept to the limits which other public vehicles have to respect.

THE LEICESTER CORPORATION ELECTRIC TRAMWAYS

On May 18 the newly constructed Leicester Corporation electric tramways were formally opened for public use by Councillor Samuel Flint, the chairman of the tramways committee. Leicester, which has a population of about 220,000, is one of the last of the large English cities to adopt electric traction. The street railway system in the city, which was then being operated with horses by a private company, was purchased by the municipality late in 1901 for £134,000. E. George Mawbey, M. I. C. E., was appointed engineer; E. Manville, of Kinkaid, Waller, Manville & Dawson, consulting engineer, and E. Lucas, operating manager. Steps were immediately taken to convert the lines to electricity and the necessary contracts were placed.

LEICESTER TRAMWAYS—CLOCK TOWER JUNCTION, SHOWING SPECIAL WORK

TRACK CONSTRUCTION

The tramway system authorized by Parliament comprises 19½ miles of double track and 3½ miles of single track, being equivalent to over 42 miles of single track. The track construction was commenced in April, 1903, and notwithstanding the abnormally wet weather which has prevailed throughout most of the period of construction, the total length of track which it was decided to carry out immediately, amounting to about 33 miles, was completed in April last, and the remainder is in hand.

Generally speaking, the routes comprised in the scheme are moderately straight, with no excessive grades, the steepest being 1 in 16 for a distance of about 50 yds. It has been found necessary, however, to lower the roadway under seven of the railway bridges, in one case as much as 2 ft., in order to obtain sufficient head-room for double-deck cars.

The sharpest curve on the system is 37 ft. radius to the center of the track. A minimum radius of 40 ft. for all curves was aimed at, and with one or two exceptions this has been attained. The distance from center to center of tracks with side pole construction is 8 ft. 1 in., giving 3 ft. 4½ ins. from gage edge to gage edge between tracks, and for center pole construction 10 ft. 11½ ins., giving 6 ft. 3 ins. between tracks. The gage of the track is 4 ft. 8½ ins.

The rails, which are in 45-ft. lengths, weigh 100 lbs. per yard for the straight track, the grooves being 1⅛ ins. wide. The curve rails weigh 105 lbs. per yard, the grooves being 1¼ ins. wide. Both rails are 7 ins. deep and 7 ins. across the flange. The angle plates weigh 54 lbs. per pair, and are 2 ft. in length, each being drilled for six 1-in. diameter bolts. Cooper patent base plates are used on all joints, being secured to the rails with twelve ¾-in. diameter steel rivets except on special track work, where bolts are used. The tie-bars, 2 ins. x ⅜ ins., are placed 7 ft. 6 ins. apart. The composition of the steel for the rails is as follows:

Carbon, between 0.4 per cent and 0.55 per cent.
Manganese, under 1.00 per cent.
Phosphorus, not to exceed 0.07 per cent.
Sulphur, not to exceed 0.07 per cent.
Silicon, not to exceed 0.07 per cent.

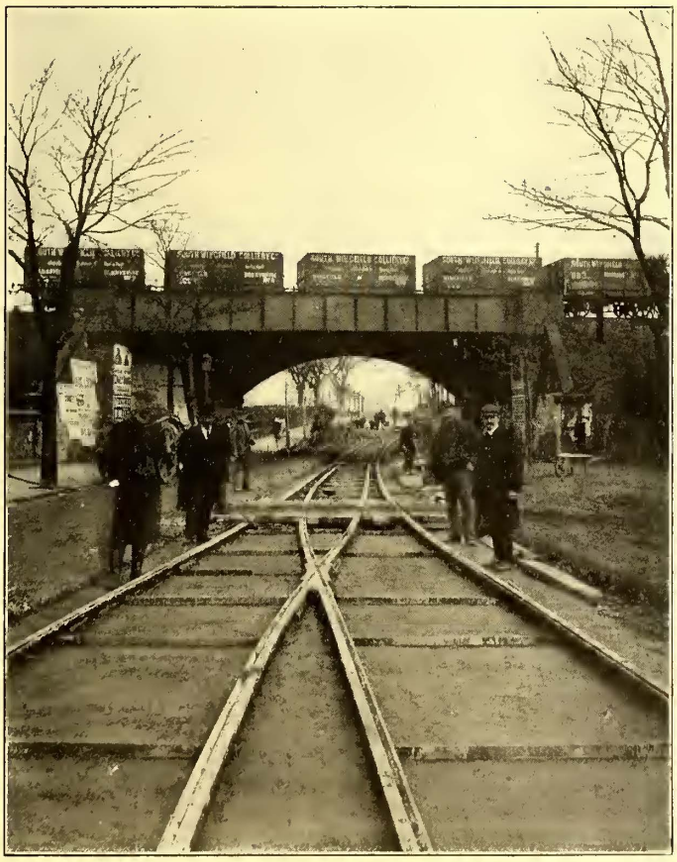
The composition of the steel for the fish-plates is similar to the above, except that the carbon is between 0.25 per cent and 0.35 per cent.

In laying the track the ground was excavated to the required depth, and the rails laid and packed up to the required level on wedge-shaped blocks of concrete, 10 ins. square at the base and 8 ins. square at the top. Where bad ground was met, or

the surface worked up owing to inclement weather, these blocks were again supported on circular blocks of concrete, 6 ins. thick and 18 ins. in diameter, to distribute the weight over a greater area. When the rails were leveled up, a concrete foundation, composed of six parts of granite and Destructor clinker to one part of best Portland cement, was then laid, a space of about 1 in. being left under the rails for packing, great care being taken to make the concrete perfectly solid for a space of 6 ins. on each side of the flange of the rails. The space between the concrete and the rails was then very carefully packed by means of beater picks with 6 to 1 fine concrete in a semi-dry condition. The total depth of concrete under the rails is 7 ins., and under the paving 6 ins.

Ample provision has been made for the drainage of the track. In addition to a liberal supply of drain boxes on all the tracks, all the switches have a 4-in. diameter spigot cast on to the drainage box, which is trapped and connected to the sewer. The drains from these boxes pass through a disconnecting chamber in which a slit pit is formed before being connected to the sewer. Generally speaking, the track has been paved with 5-in. x 3-in. granite blocks from the local quarries, except in the center of the town, where 9-in. x 4-in. x 3-in. hardwood blocks were used. The granite blocks were laid on a bed of gravel and grouted up with pitch. The wood blocks were laid on 1 in. of cement screeding. The rails were supplied by the North Eastern Steel Company; the bolts, nuts, tie-bars and copper bonds by R. W. Blackwell & Company, Ltd., and the special work by Hadfield's Steel Foundry Company, Ltd. All of the switches and crossings furnished by this latter company are provided with manganese steel renewable centers.

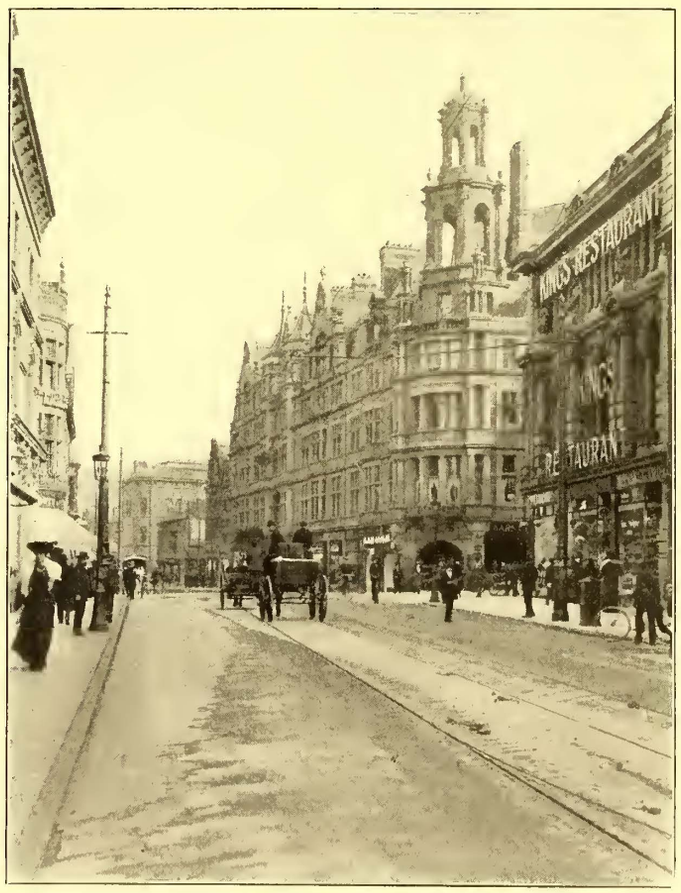
The most important piece of special work on the system is that at the Clock Tower Junction, illustrated in two of the accompanying engravings. This is said to be the largest tramway junction in the United Kingdom. Its total weight is over 100 tons, but it was so carefully designed that it was laid by the Corporation staff in ten days.



AYLESTONE ROAD, WITH GAUNTLETED TRACKS

The bonds used are of the solid copper Crown type of No. 0000 B. & S. gage. Two bonds are inserted at each rail-joint. The track is cross bonded every 40 yds., and the two tracks every 80 yds. Where special track work occurs the castings are connected to adjacent rail ends by 30-in. bonds, and are also bridged by long bonds joining rail to rail.

COMPLICATED OVERHEAD EQUIPMENT AND SPECIAL WORK AT CLOCK TOWER



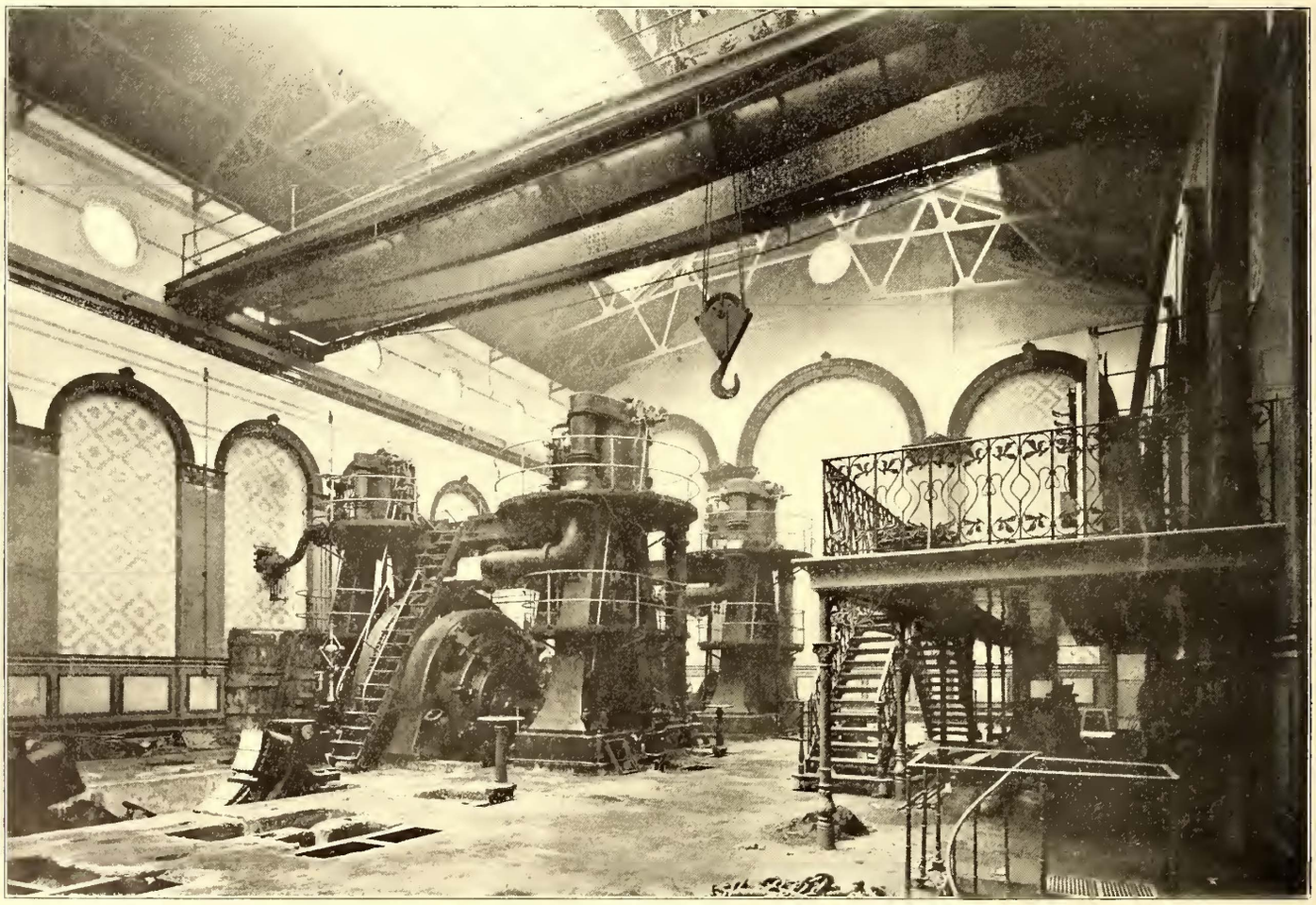
SPAN POLE CONSTRUCTION—GRANBY STREET

ENGINES AND GENERATORS

The engines are of Messrs. Yates & Thom's vertical cross-

compound Corliss condensing type, having cylinders placed at opposite ends of the crank shafts with the crank shafts at right angles. The cylinders are 22 ins. and 44 ins. diameter respectively, 3-ft. stroke, and the engines are intended to run at 95 r. p. m. The normal load of the engine is 500 kw, with a steam pressure on the top valve of 160 lbs. per square inch. The high-pressure cylinder is steam jacketed with boiler pressure steam. In addition to the ordinary governor, which is a very sensitive one, the engine is fitted with a special safety stop, which will operate in case the engines reach a speed of 10 per cent above the ordinary working speed. It will also stop the engine in the event of any failure of the governor gear, although it does not interfere with the engine taking excessive overloads, even beyond the full range of the cut-off gear. The flywheel is 16 ft. diameter and weighs about 25 tons.

A very complete system of lubrication has been supplied to



GENERAL VIEW OF ENGINE ROOM, MAIN POWER STATION

these engines, consisting of two ram pumps worked by a drag shaft from the main cranks, and delivering oil under pressure to all the main bearings about the engines.

Each engine is directly coupled to a Dick, Kerr 500-kw direct-current railway generator.

SWITCHBOARD

The switchboard, which was also supplied by Dick, Kerr & Company, consists of twenty-five panels of white marble, controlling, besides the three 500-kw generators, a negative feeder booster set of 20-kw capacity, a positive feeder booster set of 60-kw capacity, an automatic reversible battery booster set of 40-kw capacity, the station lighting and motors and the distribution. The general arrangement of the switchboard and the diagram of connections are shown in the illustrations.

CONDENSING PLANT

The condensing room plant consists of a surface condenser capable of dealing with 25,000 lbs. of exhaust steam per hour, and was manufactured by the Mirrlees Watson Company, of Glasgow. The exhaust steam from the several engines is led into a common exhaust main running to the condenser house, with a branch for free exhaust, controlled by an automatic atmospheric relief valve. Before reaching the condenser the exhaust steam passes through an oil separator, manufactured by the Klein Company. The surface condensing plant consists of a set of twin electrically-driven Edwards air pumps and a centrifugal circulating pump, both driven by a double-wound series parallel motor. The condenser, which has 2500 sq. ft. of cooling surface, is designed on the counter-current system, the exhaust steam and cooling water each passing twice through the full length of the condenser and in opposite directions. Suitable baffle and diverging plates are arranged so as effectually to distribute the steam over the entire surface of the tubes. The air pumps have barrels 18 ins. diameter by 10-in. stroke, and run at a speed of 100 r. p. m. The centrifugal pump is capable of delivering 1500 gals. per minute, regulated by means of a series parallel controller. A small plunger pump is carried on the air pump bed-plate, and driven from a crank disc mounted on the end of the crankshaft. There is another small pump driven by chain gearing, which draws the oil and water from the oil separator and discharges same into the waste oil tank.

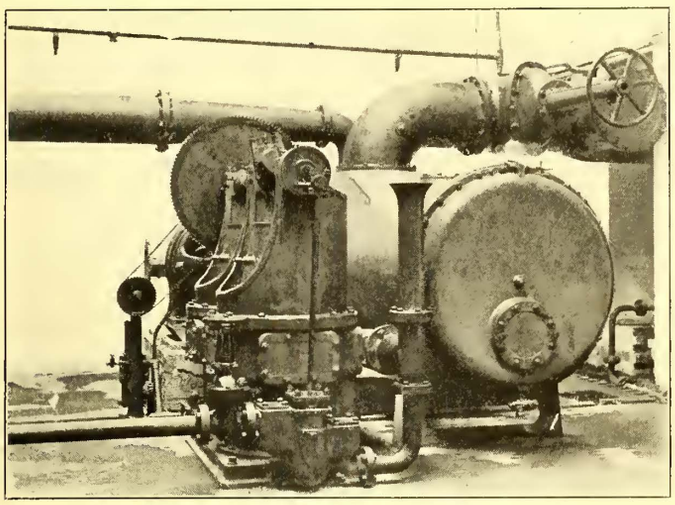
THE BATTERY AND BOOSTER

The battery is composed of 240 cells of the standard Tudor pattern, type No. 413 HF 19. It is capable of giving 600 amps. for one hour, or 900 amps. for short periods, and can be charged normally at 270 amps., or at 450 amps. for short periods. The cells are in lead lined wood boxes, resting on glass oil insulators. The stands are entirely of pitch pine without any metal fastenings, and rest on large porcelain oil insulators. The battery is used in connection with a reversible booster controlled by means of a Thury's patent regulator. This booster has a smooth armature core and tangential field coils. As the arma-

ture winding is placed as near as possible to the periphery, and as the field iron is reduced to its possible minimum amount, the machine is most sensitive, and is claimed to act almost as quickly as the load peaks occur.

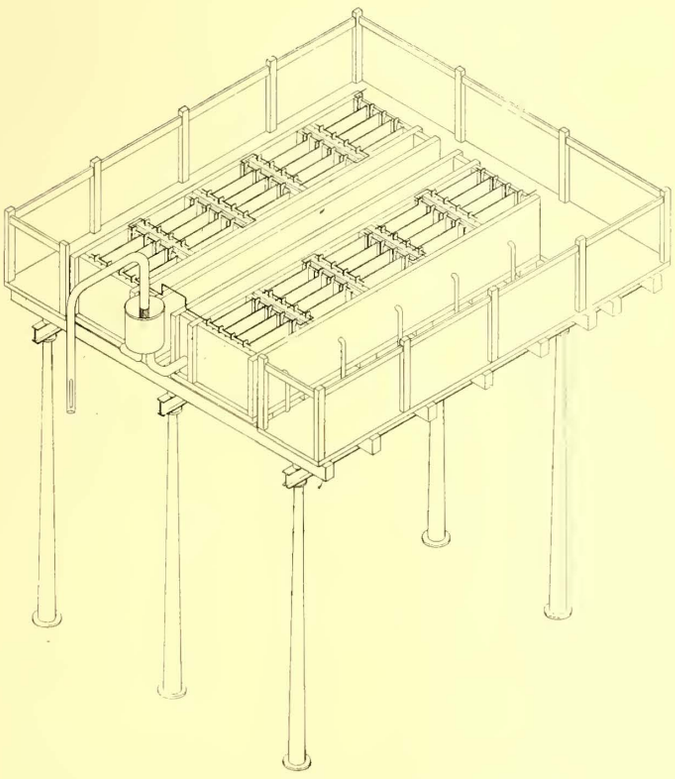
BOILERS AND PIPING

Passing now to the generation of the steam there are four boilers, made by Yates & Thom, of the Lancashire type. Each



SURFACE CONDENSERS IN POWER STATION

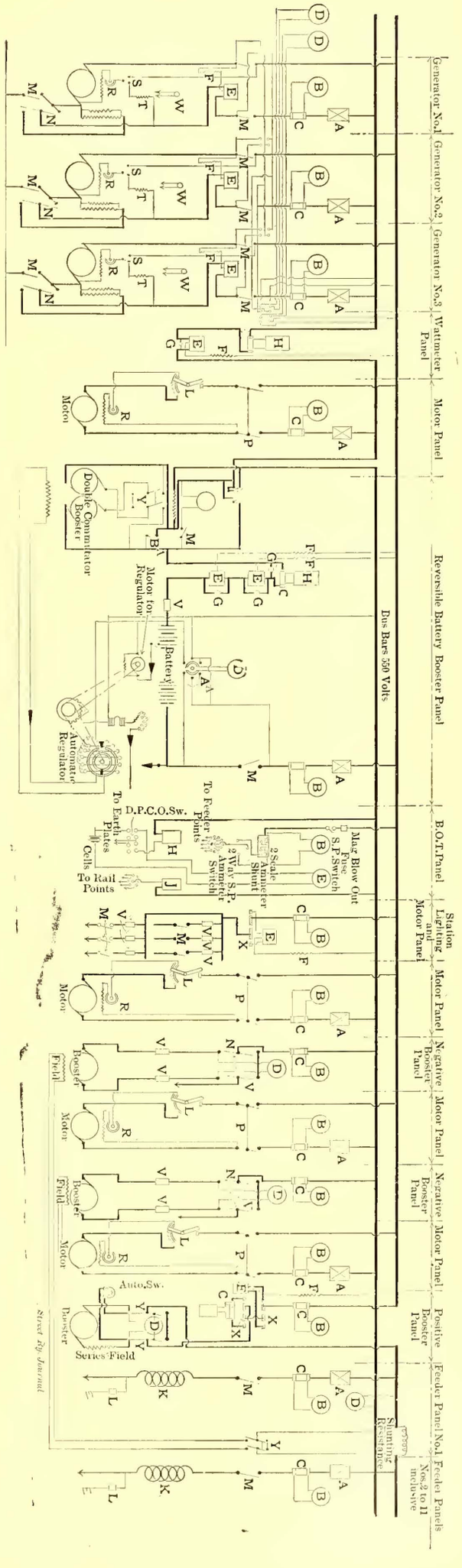
boiler is 33 ft. long by 8 ft. 6 ins. diameter, with two flues, each 3 ft. 5 ins. diameter, constructed for a working pressure of 160 lbs. per square inch, the shell plates being 13-16 in. thick, flue plates 19-32 in. thick, and the end plates ¾ in. thick. The steam piping is of wrought steel with flanges welded on. The piping



ISOMETRIC PROJECTION OF ELECTRICAL TREATMENT TANKS

is in the form of a ring main so that the supply of steam to any engine can still be maintained even if portions of the range may be temporarily out of action.

The feed pipes are of wrought steel with flanges screwed on, the ends of the pipes being riveted over in the recesses formed in the face of the flange, the arrangement admitting of the feed being maintained to any or all the boilers either direct or through the economizer, being measured on its way through



A Circuit Breakers
B Ammeters
C Ammeter Shunts
D Voltmeters
E Wattmeters
F Wattmeter Resistance
G S. C. Plug Switches
H Recording Ammeters
J Recording Voltmeters
K Kicking Coil
L Motor Starters
M S. P. S. T. Switch

DIAGRAM SHOWING SWITCHBOARD CONNECTIONS

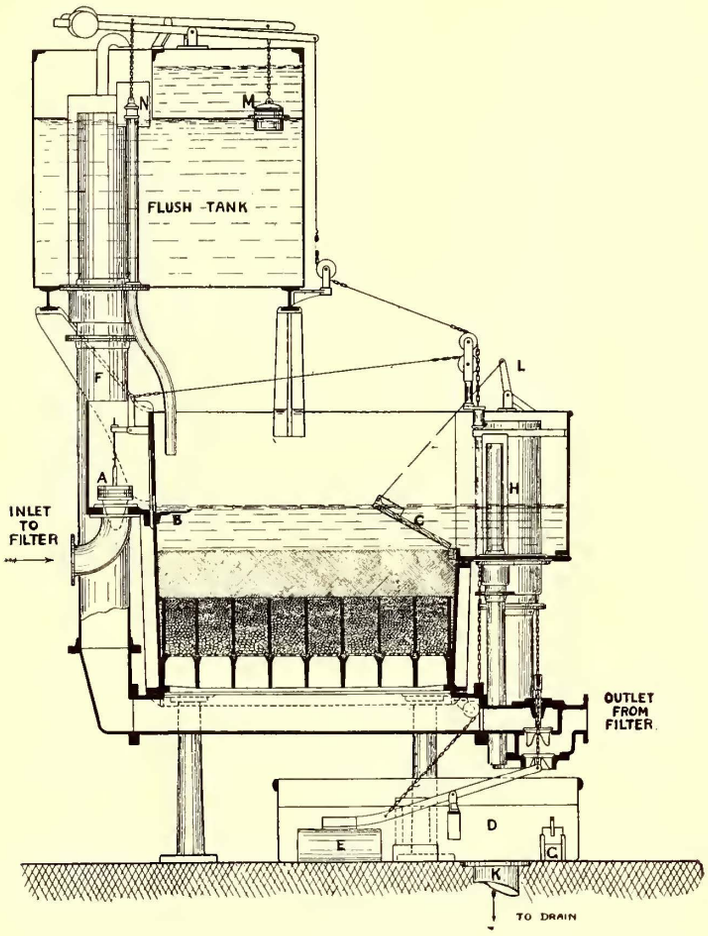
REFERENCES

N S. P. D. T. Switch
P D. P. S. T. Switch
R Reg. Field Resistance Switch
S Field Switch
T Non-Inductive Resistance
V S. P. Fuses
W Pilot Lamps
X Short Crg. Isolating Links
Y D. P. C. O. Switch
Z 3-Way D. P. Switch
Aa Voltmeter Switch
Bb Reverse Current Cut-Out

meters in the usual manner. The feed is taken from the hot-well supply from the surface condensers before mentioned, and in order to get rid of the emulsified oil a special treating plant has been installed.

SEPARATION OF OIL FROM CONDENSED STEAM

The separation of the oil from the condensed steam is effected by the Davis-Perrett patent electrical process. As is well known, oil in condensed steam is largely in a state of emulsion, so as to be incapable of being separated by mechanical filtration. In this process the water passes through a series of tanks in parallel, and is subjected to the action of an electrical current, the result of which is to immediately destroy the emulsion and form a flocculent precipitate, which can then be easily removed by subsequent filtration, leaving the water absolutely pure.



END SECTIONAL ELEVATION OF SELF-CLEANSING FILTER

The diagram on page 833 indicates the arrangement of the electrical treatment tanks, while the sectional drawing above indicates the construction of the filter.

The bottom of the filter is cellular, each cell being divided vertically into two parts, and the division plates being perforated allow the water to pass through. The upper part of the cells contains stones which support the sand, first the larger stones and then the smaller stones upon which the sand rests. The lower part of the cells forms an air space and trap.

The water enters the filter at the point A B, through holes in the side plates of the filter by the bend pipe indicated. The water passes through the sand medium and stones, and leaves the filter by the outlet valve. The outlet valve is shown closed, but during the filtering operations it is, of course, open, to allow the water to leave the filter.

As the surface of the filter becomes coated with impurities the level of the water gradually rises, owing to the fact that it enters the filter more rapidly than it passes through the sand. When it reaches the top it overflows a syphon pipe, H, shown on the drawing, and through this syphon it descends rapidly into the float chamber, D, underneath. In this float chamber is a float fixed on to a lever. The water raises this float, and by so doing it closes the outlet valve by which the unfiltered water escapes from the filter, and at the same time allows the water from the flush cistern above to flow down very rapidly into the underside of the filter.

The water descending with considerable force presses upon the air in the underside of the cells, forcing the air up through the sand, which is thus broken up and is thoroughly washed by the water as it rises up through the medium. The sand would escape from the filter except for a board, C, extending right across the filter, and which being fitted with a float rises up as the water rises in the filter, and prevents the sand from passing out of the filter. When the flush water is exhausted the operation of washing is complete. The water escapes from the float chamber, D, and the float, E, falls again to the bottom of the chamber. The outlet valve is again open, and the ordinary operation of filtering is proceeded with. The whole operation only takes about three minutes, and while this is going on the collecting tanks are sufficiently large to receive the water passing from the electrical tanks, so that the continual passage of the water is not interfered with.

When the filter resumes filtering operations after the wash it empties the collecting tanks from the amount of water accumulated during the wash.

The feed pumps were manufactured by Hall & Sons, and are of the vertical direct-acting type.

POWER-STATION BUILDINGS

The power station has been erected centrally to the system on Belgrave Road, and is well situated for the delivery of coal either by barge (the canal basin running alongside the boiler house), or by rail. The buildings are faced externally with red sandstock bricks with stone dressings, copings, etc.

The station comprises engine room, boiler room, pump room, condenser room, battery room, test room, engineer's office, general office, inquiry office, mess room, fitting shop, stores, engine house lavatory and office lavatory. Bath rooms have been attached to the two latter.

The engine room is 118 ft. x 60 ft. and 40 ft. high to the eaves. It is lighted mainly from the top by means of patent glazing, which has also been used in the fitting shop and battery room. The only side lights in the engine room are bull's-eye windows above the traveler rail.

The room is lined internally up to the height of the traveler

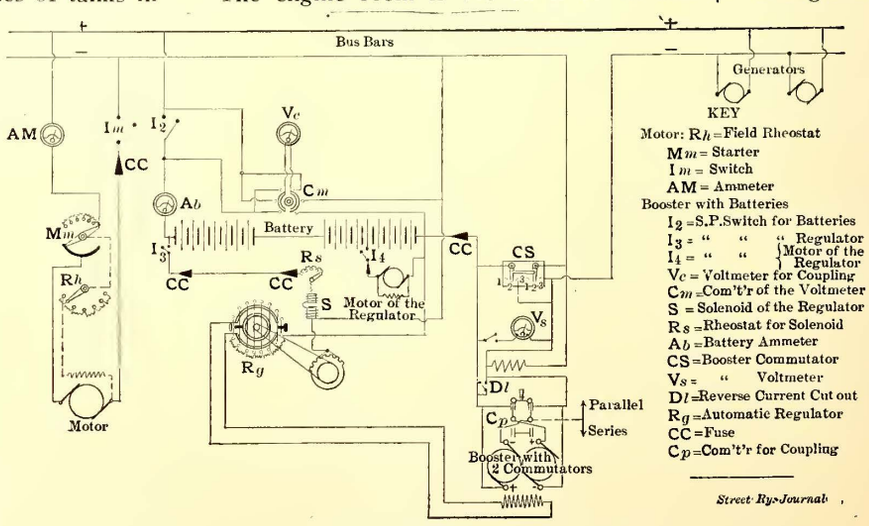


DIAGRAM OF BOOSTER CONNECTIONS FOR STORAGE BATTERY

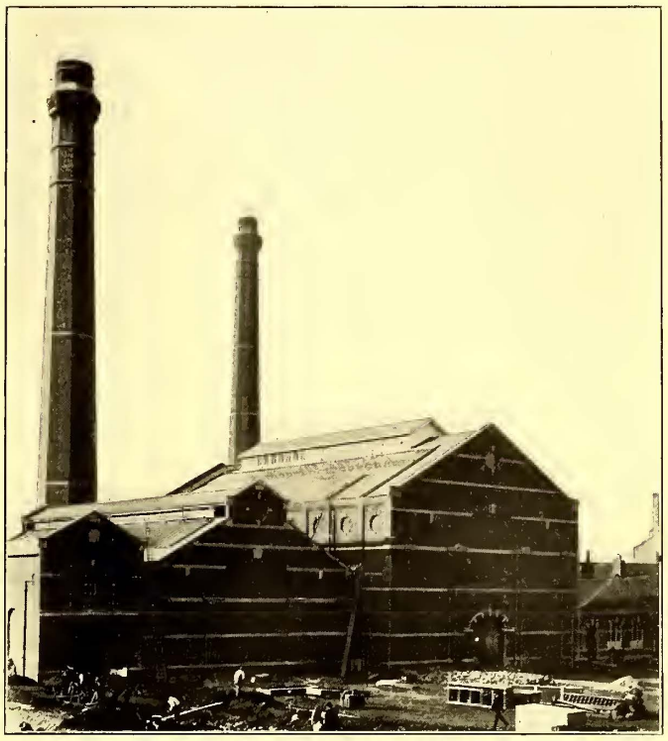
rail with glazed tiles having patent keyed backs, moulded tiles being carried up to a height of 6 ft. to form a dado. Moulded tiles are also carried round all the arches, with moulded faience blocks under the traveler rail. This tiling gives the room a very fine appearance. The entrance hall and the floor in the engine room, except the space reserved for the extra set, have been laid in mosaic.

The boiler room is 108 ft. x 77 ft., and a stoking floor, 18 ft. wide, extends its full length with an ash tunnel under. At present the stoking floor is covered with a temporary corrugated iron roof. The question of the coal supply to the boilers, when a larger number have been installed, has been very carefully considered, and the boiler room has been so arranged that when the coal is delivered by barge alongside it will be lifted by a crane fixed at the northwestern end of the boiler house into a conveyor, and conveyed into the coal bunkers. The conveyor will be continued round and through the ash tunnel for the removal of the ashes.

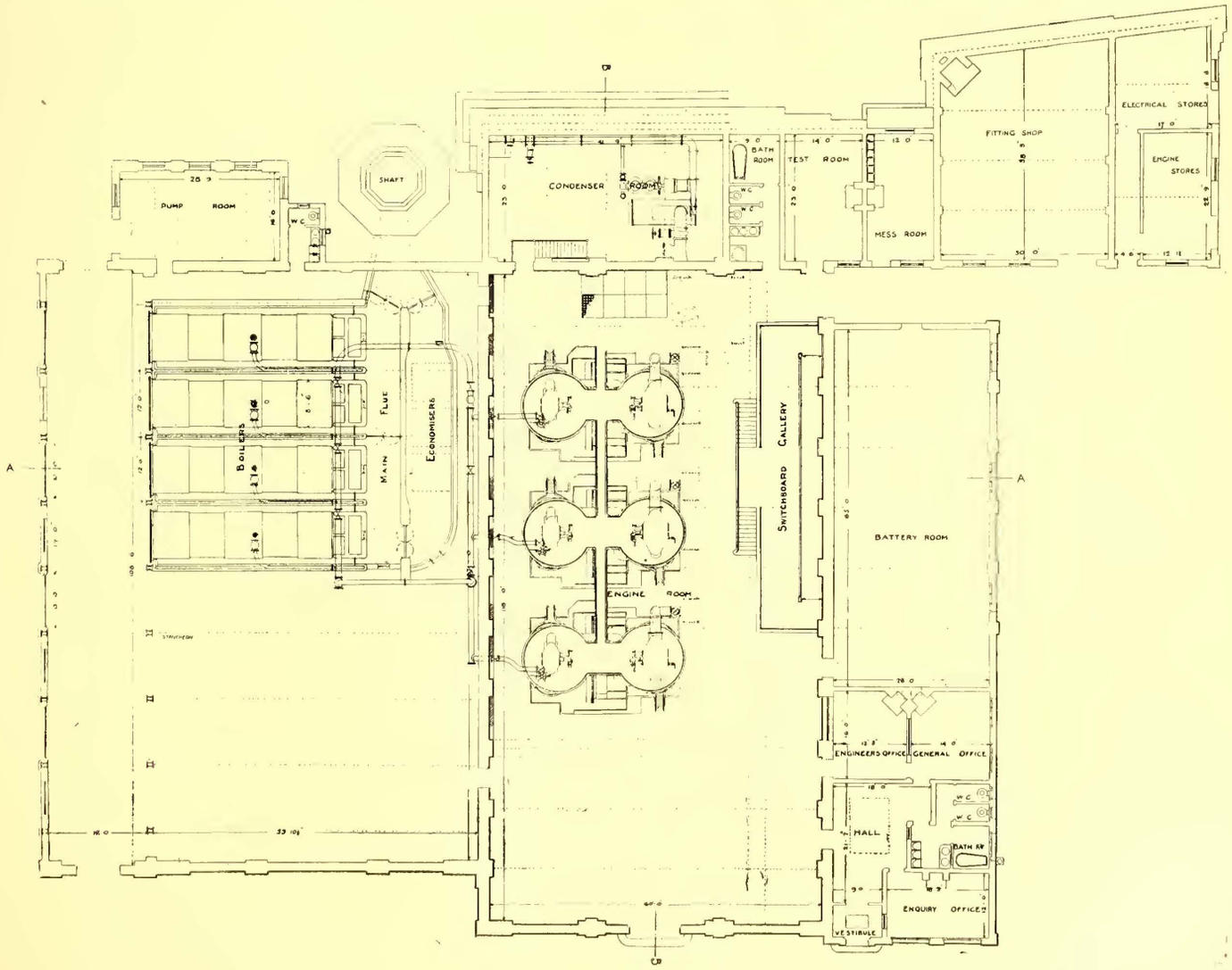
The boiler house is lighted principally from the roof by means of patent glazing. Windows have also been inserted in the southwestern elevation. Kinnear rolling shutters have been inserted in the doorways opposite the fronts of the boilers.

The condenser room is 42 ft. x 23 ft. The floor is 11 ft. below the level of the engine room floor. It is lighted entirely from the roof, and is provided with a 5-ton overhead traveling crane. The battery room is 65 ft. x 28 ft., and 12 ft. high to the eaves. All of the roof trusses, except those for the battery room and offices, are constructed of flat steel bars and plates throughout, except the rafters, which are of T-section.

The chimney is octagonal in shape, faced with pressed bricks. The foundations are carried down to a depth of 17 ft. into the solid red marl. The stack is 186 ft. high, the external diameters being 20 ft. at ground level and 11 ft. at the top. The internal flue is 8 ft. 6 ins. in diameter throughout. It has an independent firebrick lining 9 ins. thick for a height of 70 ft., the remainder



FRONT ELEVATION OF GENERATING STATION



PLAN OF POWER STATION

being 4½ ins. thick. For a height of 110 ft. to the top the cavity is omitted. The cast-iron core is constructed in eight sections, each section weighing about 1 ton.

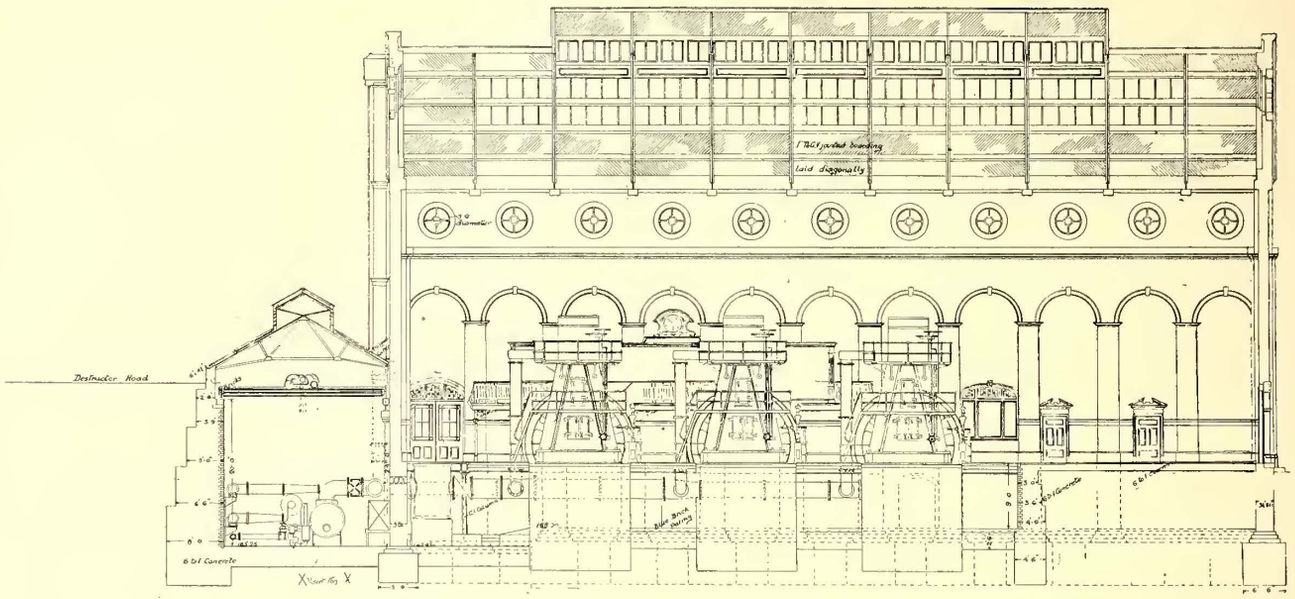
MAIN CAR HOUSE, ABBEY PARK ROAD

The main car house stands on a site of about 4¼ acres, in close proximity to the generating station. As will be seen from the plan it does not abut on the main road, a space 100 ft. deep having been reserved for building purposes. It consists of the car house proper, fitting shop, carpenters' shop, painters' shop, armature room, blacksmiths' shop, brass and general stores, mess room, recreation room, caretaker's house, offices, committee room, boiler house, stables, cart shed, motor house, men's lavatory, oil stores, etc. The buildings are, like the generating station, faced with red standstock bricks and stone dressings.

The car house proper consists of three bays, each 35-ft. 1½-in. span and containing three tracks, accommodating altogether fifty-five cars. The rails are supported throughout on piers, thus forming pits 4 ft. 6 ins. deep under the whole area, excepting for a short space at each end. The entrances to the car house and to the shops are fitted with Kinnear rolling doors.

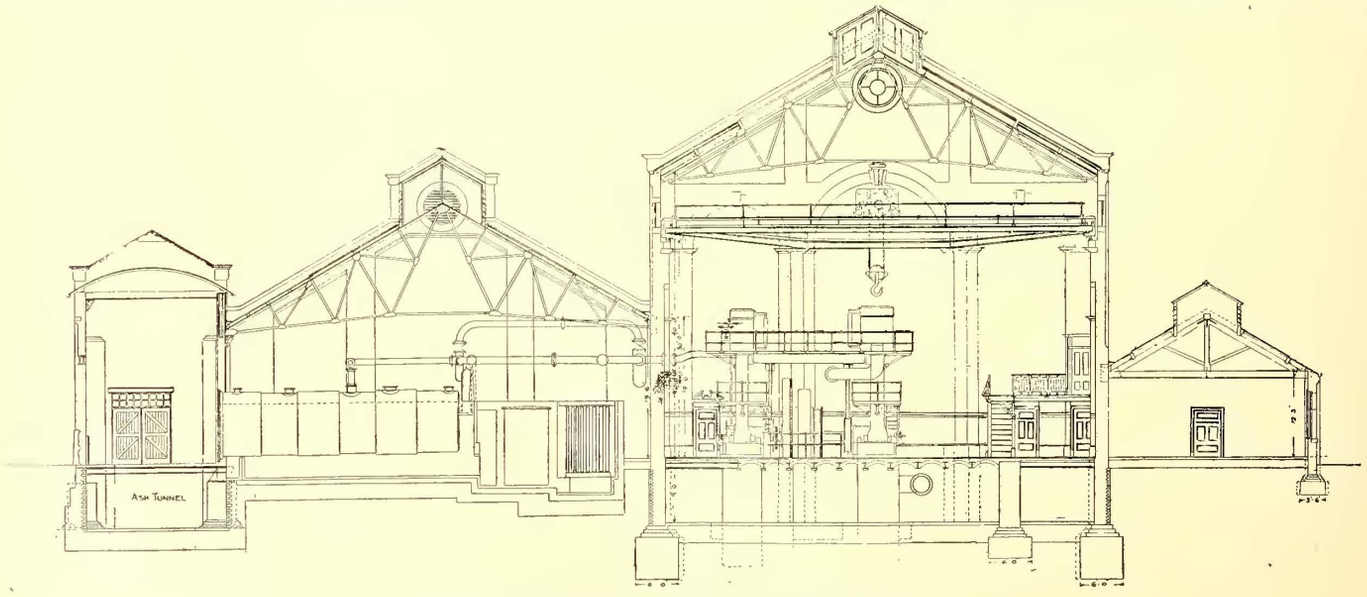
The fitting shop averages 130 ft. x 41 ft. 6 ins., and is 25 ft. high to the eaves. It contains two tracks, the rails for which are supported on piers as in the car house proper. This shop will accommodate eight cars.

On one side of these shops space has been reserved for installing a complete equipment of electrically-driven machine tools, the greater portion of which are to be laid down immediately, including a 12-in. and 6-in. lathe, wheel-turning lathe, radial drill, etc. Provision has also been made for an electrically-driven overhead crane.



LONGITUDINAL SECTION OF MAIN GENERATING STATION

The carpenters' shop is 80 ft. x 35 ft. 4½ ins., containing two pits. The painters' shop, which is an extension of the carpenters' shop, is 70 ft. long. Space has also been reserved in these shops for a complete equipment of woodworking machines and the necessary benches. These two shops are divided by two Kinnear rolling doors, and together will accommodate ten cars, making altogether in these shops a total accommodation for seventy-three cars. The stores and workshops are heated on the low-pressure hot water system.



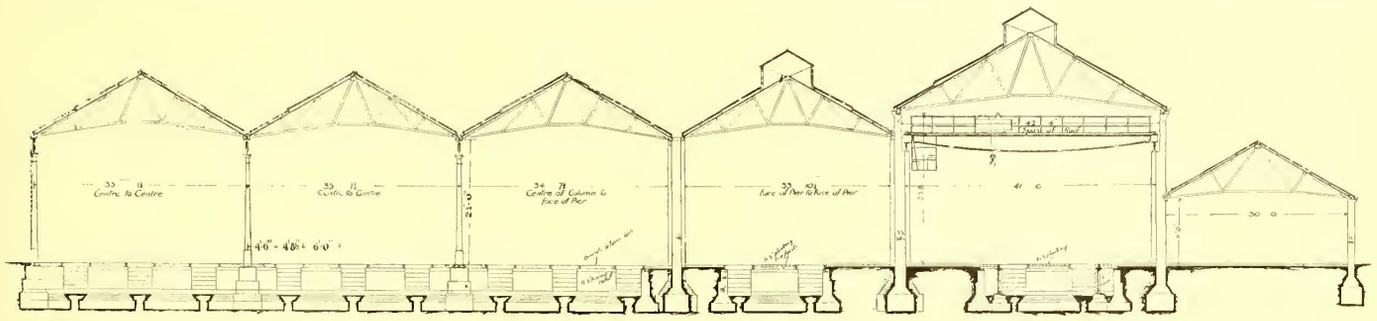
CROSS-SECTION OF MAIN GENERATING STATION

Two small district car houses have been erected on the same lines as the main car depot, one in Narborough Road and one in London Road; each of these contains two tracks with pits under, and will accommodate six cars; an office and small mess room are attached to each.

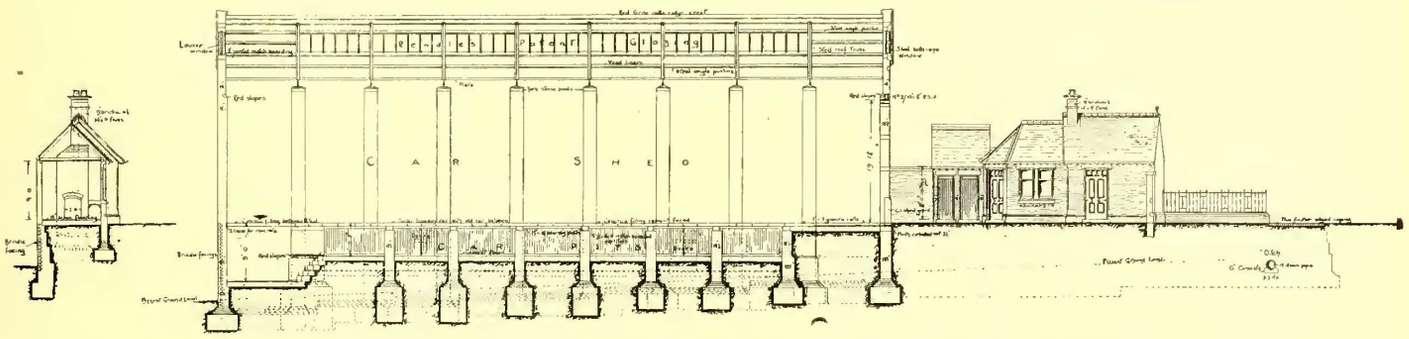
CARS

The cars are of the double-deck single-truck type with reversed stairways. They were supplied to the number of fifty-nine by Dick, Kerr & Company, Ltd., and were built mainly to

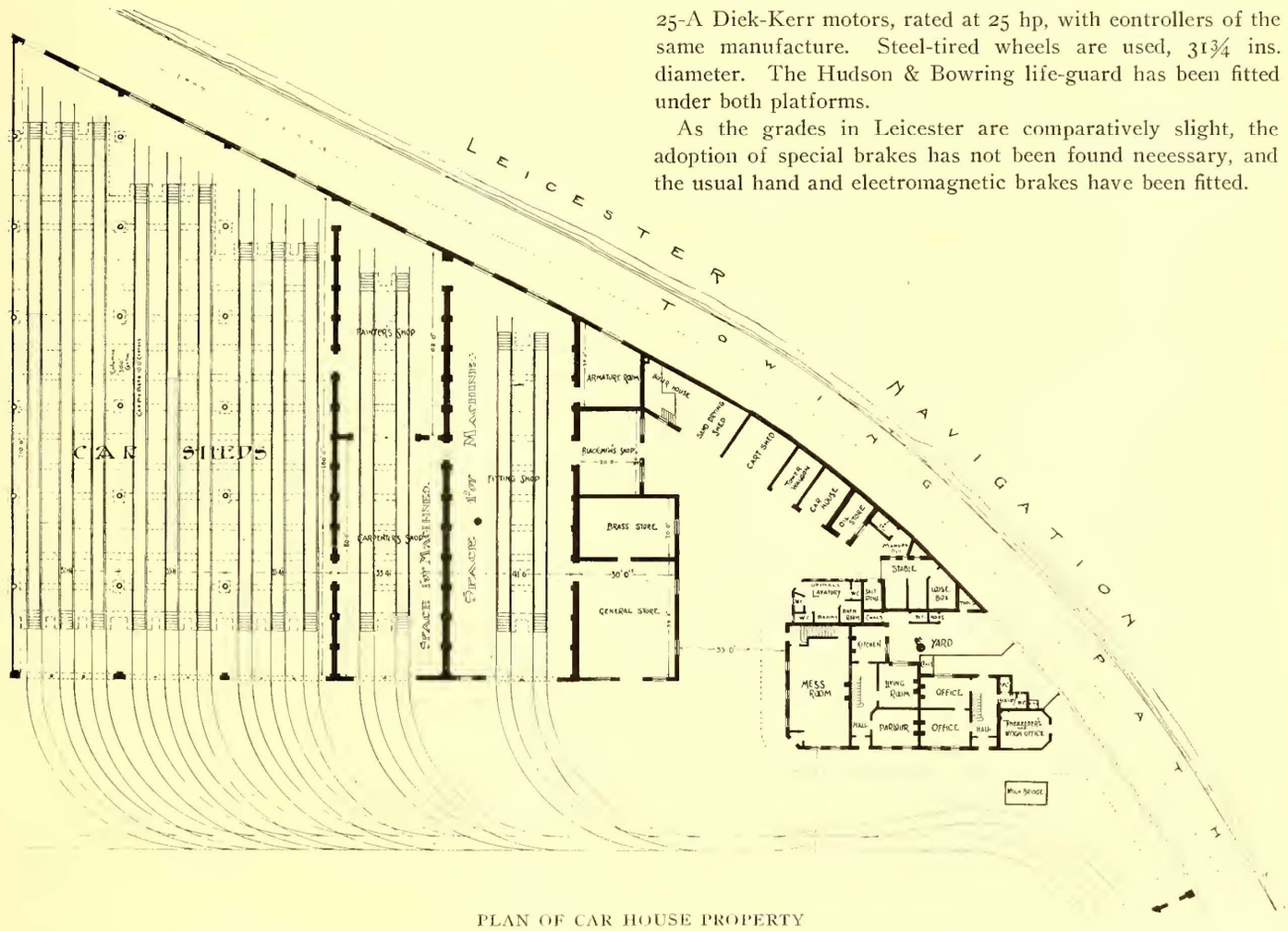
the design and specification of Mr. Mawby. The seating capacity is twenty-two inside and thirty-four outside, and over all dimensions 27 ft. 6 ins. over fenders by 6 ft. 10 ins. width over



CROSS SECTION OF MAIN CAR HOUSE



LONGITUDINAL SECTION AND SIDE ELEVATION OF LONDON ROAD CAR HOUSE



PLAN OF CAR HOUSE PROPERTY

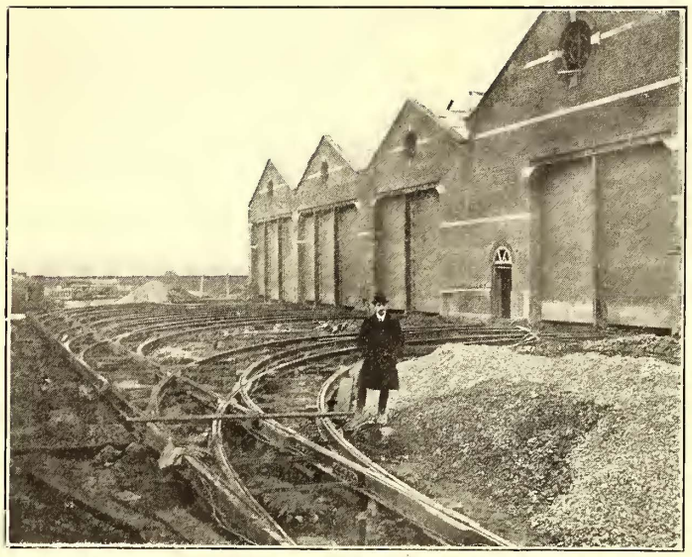
sills. The illustrations and photographs show clearly the general appearance of the car, also the interior and exterior decorations. The floor frames are of well seasoned oak. The platforms are supported on four steel angles which are bolted to the underside of the main flooring. A system of truss rods is provided to keep the car bodies from hogging, and also to pull up the platforms should they show a tendency to sag.

The cars are mounted on 21-E Brill trucks, which carry two 25-A Diek-Kerr motors, rated at 25 hp, with controllers of the same manufacture. Steel-tired wheels are used, 31¾ ins. diameter. The Hudson & Bowring life-guard has been fitted under both platforms.

As the grades in Leicester are comparatively slight, the adoption of special brakes has not been found neeessary, and the usual hand and electromagnetic brakes have been fitted.

On several of the cars a new patent type of folding step, to be known as the "Leicester Folding Step," has been fitted for practical trial to meet the suggestions of the Board of Trade, who point out that the efficiency of the life-guard is often impaired by the steps, which are liable to strike a person falling in

front of the cars before the life-guard can come into action. This step is designed to fold up when the gate is closed, and is so made that it is practically impossible for it to be raised when the gate is open, while owing to the automatic device with which it is provided it is equally impossible to keep the gate closed without having the step raised. This arrangement over-



ENTRANCE TRACKS AT MAIN CAR DEPOT

comes any difficulty which might arise from passengers attempting to leave the car at the forward end before there has been time to get the step into place.

The interior woodwork of the car is of quartered oak, and the decorations of embossed and quartered oak. Over the side windows is a fine cornice of embossed mouldings, and all panel work in the doors and partitions has been fielded. Over the end doors there is an ornamental head-piece extending up to the underside of the roof boards, and on each side of the doors are ornamental casings. The ceiling is of three-ply bird's-eye maple veneer, and the inside seats and backs are of three-ply perforated veneer. The seats are left bare without carpeting, as it is considered to be a more cleanly and sanitary arrangement. The windows in the end doors have the Leicester coat of arms engraved on them.

Special means have been adopted efficiently to ventilate the interior of the cars, as shown by the illustrations. The effect of this construction and arrangement of ventilation is that the interior of the car is constantly provided with a circulation of fresh air, a hinged sash on each side of the end door in each end of the car being provided. These sashes are also provided with perforated louvre panels on the outside. An exhaust for the foul hot air has been provided by a recess made in the roof of the car, which is just above the hinged windows. This recess not only connects direct with the interior of the car, but also with the roof space between the millboard ceiling and the main deck, and this space, which in ordinary tramcars is a dead air space, without means of escape, is thoroughly ventilated by this arrangement. If required, a further outlet for the hot air in the top of the car may be provided by perforating the millboard ceiling to connect with this space and indirectly with the ventilators on the outside of the car. This exhaustion of the air by the ventilators through the recess roof space cannot be closed, so that the escape of the foul hot air must take place continually, whenever the car is in motion, and without dangerous or annoying draughts.

The top deck is fitted with special "dry" seats of the multi-slat type. The reversed stairways at either end of the cars are of a special improved type, by which the view of the motorman is much less obstructed than in the old form.

The cars are lighted by a number of electric lamps mounted in handsome polished brass fittings; other lamps are erected in destination indicators, so that the point to which a car is traveling can be easily ascertained at night.

Mechanical bells are used, operated by means of a brass rod running the entire length of the car, and fitted with lever handles. The bells can also be operated from either end of the top deck.

The cars are painted chocolate and cream, a combination of color which is at the same time durable and pleasing to the eye; the paint work is relieved with gilt decoration and scroll work, and on the center panel of each car is represented the arms of the Corporation.

OVERHEAD ELECTRICAL EQUIPMENT

The overhead equipment has been designed and arranged with a view to obtaining the greatest possible immunity from breakdown, also that the fittings should appear as artistic as possible. The design of the center, span and side-bracket pole ornamentation, which is original, and which is shown by the illustrations herewith, was prepared by Mr. Mawbey in conjunction with the Leicester Art School. Span-wire construction has been adopted generally, but where streets and roads are wide enough center poles have been introduced. In the center of the town, where suitable attachments could be obtained, poles have given way to rosettes, except at junctions, these being erected on poles throughout. Each center pole has been fitted with two incandescent gas lamps, and the base is protected by a neat elliptical guard curb. Side bracket arms have been used on one short length to the number of nine, each 17 ft. 6 ins. long, also on the siding to the power station.

MAIN CAR DEPOT—ABBEY PARK ROAD

The weight of the straight-line poles is 840 lbs., and that of the curved and anchor 1180 lbs. The total length is 31 ft., made up of three sections shrunk together. The poles are planted

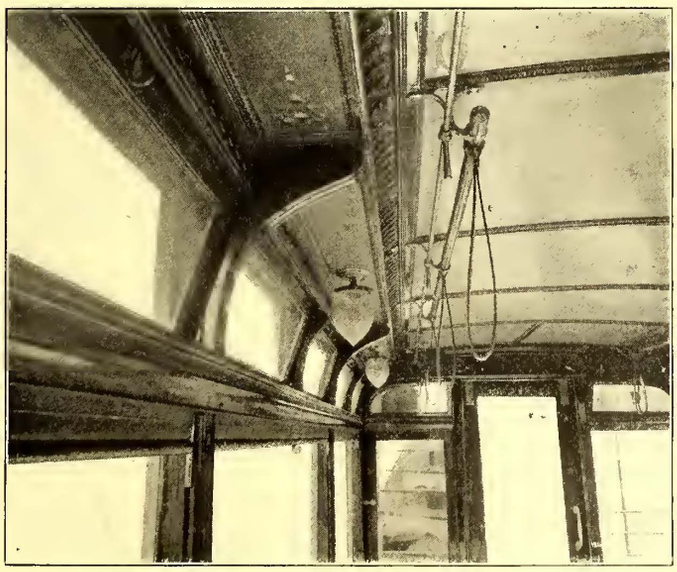
6 ft. in the ground, the foot resting on a concrete template 6 ins. thick, which in turn is bedded on 6 ins. of cement concrete. The pole bases are 6 ft. 6 ins. high, the greatest diameters being 16 ins. and 18 ins. respectively for the two sizes.

The trolley wire is No. 000 B. & S. gage throughout, except at the car houses, which are wired with No. 0; and the span and guard wire are of galvanized steel, 7-12 and 7-16 respectively. Flexible suspension and double insulation have been adopted throughout. "Ætna" insulation and line fittings of extra strong design have been used throughout, the insulator bolts being of drop forged mild steel, screwed ¾ in.

Eighteen-inch ears have been used on the straight and 24-in. on the curves throughout. Special double and single pull-offs have been used on all junctions and curve work, the distance between the bolt and the eye being 5 ins. Galvanized iron thimbles have been used wherever eyes have been spliced in either span, pull-off, anchor or guard wires.

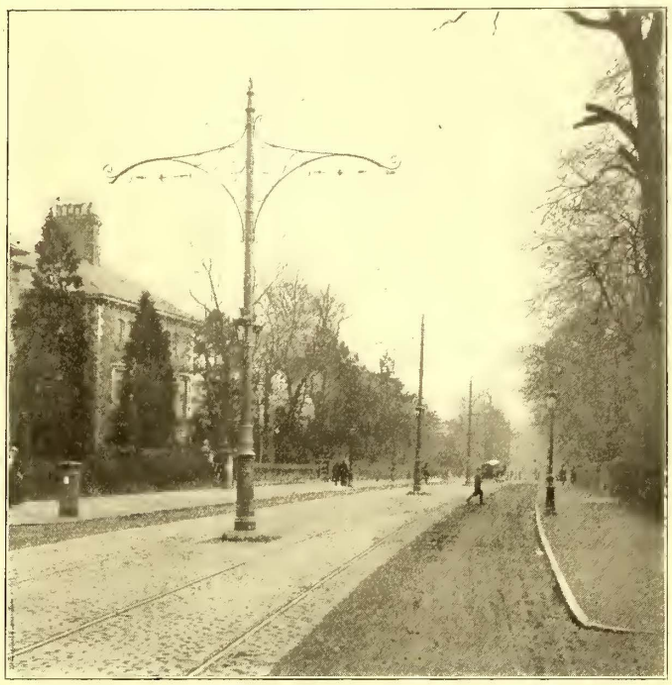
Straight under-running section insulators are fitted at each half-mile section, and the feeders are connected to the line at these points. The connecting cable between the section and feeder pillars and the line is 61-20's, insulated with pure and vulcanized rubber, lead covered and double braided, and is carried from the pillar to special drawing-in boxes at the foot of each of the section poles, and thence up the inside of the pole, the pole being bushed with gun-metal bushes top and bottom. From the top bushes of the pole the cables are carried out to the trolleys along the span or bracket, as the case may be, and served with P. & B. tape, a copper ferrule being sweated to the end of each cable and clamped into the section insulator.

In the car houses the trolley wire is carried in a pitch pine troughing running the entire length of the shed, and suspended from roof trusses by wrought-iron clips. The main car house is supplied by a separate feeder direct from the power station, arranged so that when the rest of the system is shut down the cars in the car house may be run off the battery. Where the lines pass under railway bridges the trolleys are carried in troughing suspended from the underside of the bridges in such a manner that it is impossible for a passenger, even by leaning over the car rail, to touch the "live" wire.



VIEW OF UPPER PART OF CAR, SHOWING METHOD OF VENTILATION

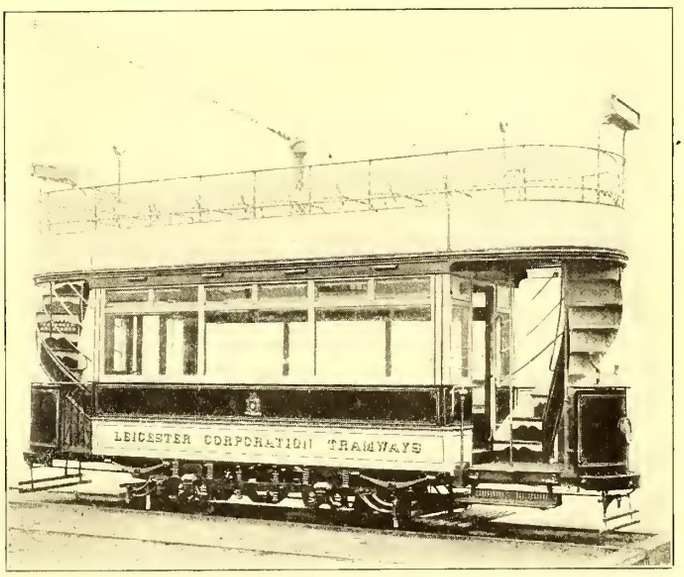
Four sizes of section and feeder pillars are used. These are fitted with white marble panels, which carry the various quick-break switches, kicking coils and safety fuses for automatically disconnecting the overhead line in case of failure. The feeders are connected up to the main switchboard at the power station through automatic circuit breakers, which are set to cut out any one of the feeders should a short circuit occur on any of the sections supplied by that feeder, thus ensuring that should a trolley wire break on any portion of the line either the fuses in the nearest section pillars would "blow,"



CENTER POLE—LONDON ROAD

or the circuit breaker at the station would open, rendering that portion of the line dead.

Each pillar is also fitted with a Garton lightning arrester, and an ebonite panel carrying the test and telephone terminals. All holes in the panels are fitted with ebonite bushes and washers.



SIDE VIEW OF STANDARD DOUBLE-DECK CAR

A specially designed telephone shutter, operated by a separate key, has been fitted to each pillar, arranged so that it is unnecessary to open the pillars in order to use the telephone, the jack being inserted from the outside, thus obviating the danger of anyone accidentally coming in contact with the "live" fittings in the pillar when using the telephone.

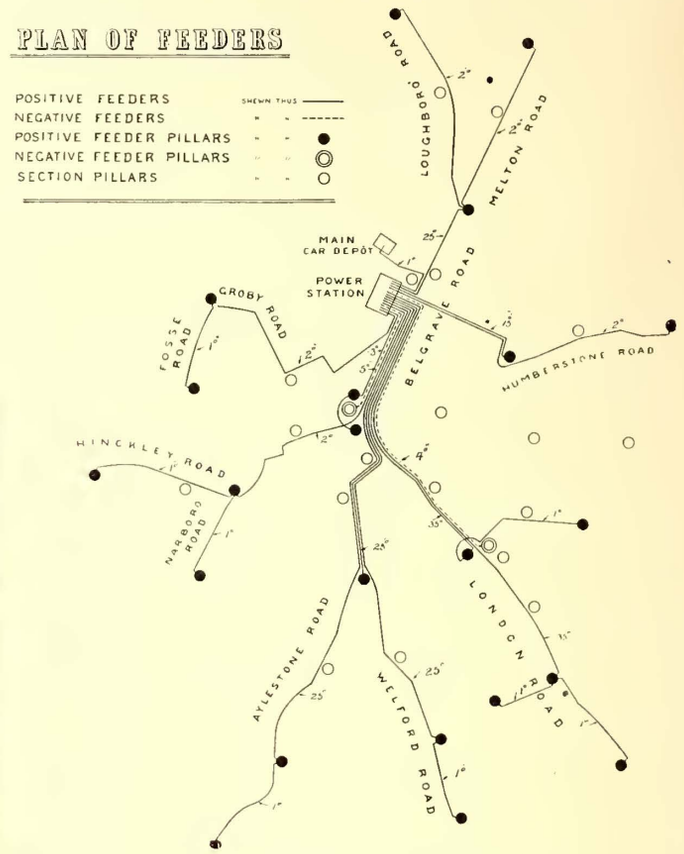
The telephone instruments are carried on the cars, one being supplied to each car.

Two negative feeder pillars are erected to meet the present requirements, one at the Clock Tower and the other at Highfield Street, approximately 1100 yds. and 2700 yds., respectively, from the power station. They contain the usual instruments to meet the Board of Trade requirements.

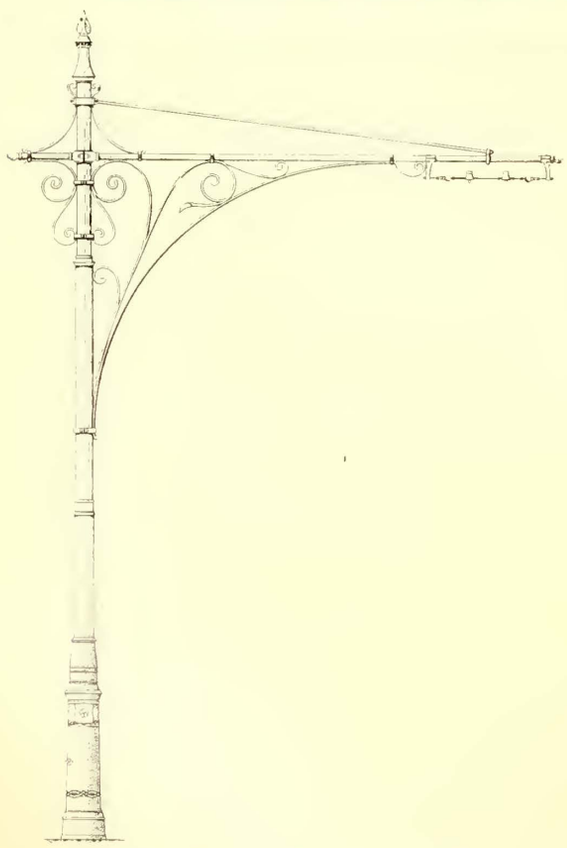
All section and feeder pillars, and the poles up which the

feeder cables have been carried, are bonded direct to the rails by a 0000 copper bond, to prevent the possibility of their becoming "alive" owing to breakdown of the insulation at these points.

SIDE BRACKET POLE—VICTORIA PARK ROAD

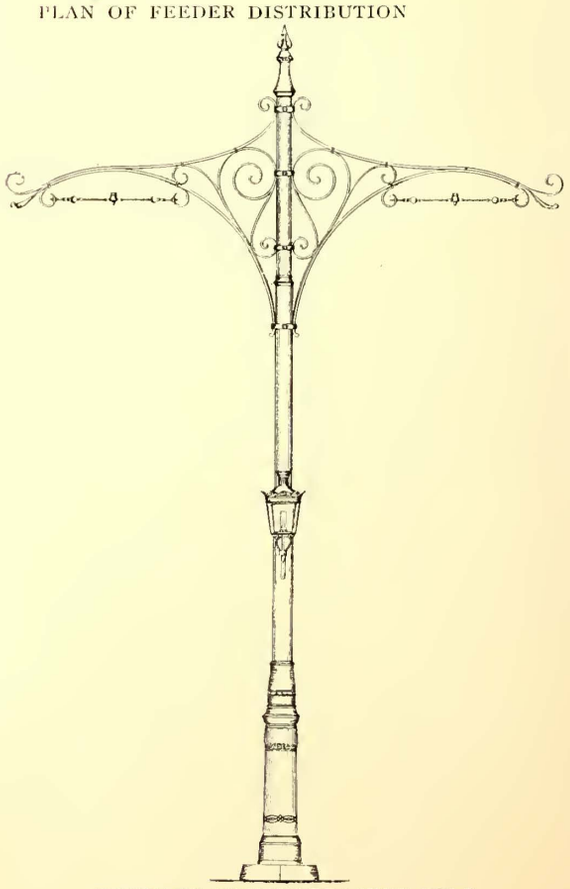


PLAN OF FEEDER DISTRIBUTION



STANDARD SINGLE-BRACKET POLE

SPAN POLE



STANDARD DOUBLE-BRACKET POLE

The whole of the equipment, including poles, wires, section and feeder pillars, etc., has been supplied and erected by R. W. Blackwell & Company, Ltd., London.

FEEDER CABLES, ETC.

All of the cables in connection with this work were supplied and drawn in by W. T. Glover & Company, Ltd., of Manchester. Stoneware conduits are used, and are of the patent self-centering type with composition joints, supplied by T. Wragg & Sons, Ltd., of Swadlincote. The total quantity of conduits supplied was equivalent to about 80,000 yds. of single way. Throughout the entire system the conduits are laid at the side of the track. The cables are single conductors, insulated with diatrine impregnated paper and lead covered, jointed by means of lead sleeves wiped on to the lead of the cables. At intervals

of approximately ¼ mile the lead covering of the cables is earthed to the rails by means of bare copper bonds, as a preventive against electrolysis.

Three negative feeders have been carried out to different points of the system, and are connected to the rails through special feeder boxes, having the necessary Board of Trade instruments mounted therein. Each cable bears a brass label in every box, denoting its size, voltage and termination. The sizes of the feeders range from .1 sq. in. to .5 sq. in., the total length being over 20 miles. A complete system of telephone and pilot cables is also drawn into separate ducts along each feeder route, and connected up in every feeder and section box.

All lead-covered cables terminate in the basement of the power station, connection being made to the switchboard with fire-resisting cable of Glover's latest type. In addition to the feeder cables terminating on the switchboard with fire-resisting cable, the whole of the back connections and cable work in the station is also of this description.

All of the feeders and pilots were submitted to a pressure test of 1000 volts alternating current for one hour. They were then tested for insulation resistance.

RE-EXAMINATION OF STREET RAILWAY EMPLOYEES FOR DEFECTIVE SENSES

BY RAY R. RIDEOUT

In the last few years we have seen many improvements and changes for the better in the operating methods of electric railways. Where a few years ago street railway companies were content with the passenger traffic of our large cities and towns, we find them to-day, in many instances, reaching out and becoming active competitors of the steam railroads for long-distance travel. This means that on many of our interurban roads cars are run at a very high rate of speed as compared with that of several years ago. With the increased speed the responsibility of those who man the cars becomes greater, and with the greater responsibility comes the question of what safeguards the companies are taking to make sure that the men are reasonably capable of performing their duties in a safe manner.

Steam railroad companies, one after another, have adopted the system of regularly examining their employees to ascertain whether their color perception, vision and hearing are in such condition as to allow them to continue their work in safety, and a similar system of examinations, conducted by the writer, has been established on the elevated division of the Boston Elevated Railway Company. The methods employed in this department were described in a recent issue of this paper.

On most electric roads acute color perception is not essential; but vision, in which the percentage of deterioration is far greater than in color perception, is a very important factor. Under the present conditions a man is given an examination when coming with the company, but in most cases is never again re-examined. After a time his vision may become so defective that he would be unable to see an obstruction on the track, an open switch or a passenger boarding the further end of his car until too late to prevent an accident. Unless he becomes nearly blind, the matter probably never would be brought to the attention of his employers.

On steam roads, test glasses are used, and many applicants who would be afflicted with short-sightedness as they grow older are rejected, while on electric roads this practice is not generally in use; therefore, opportunity for serious defects is greater on electric railways.

A large number of the street railway companies of to-day have been formed by the consolidation of smaller companies, many of them old horse-car lines, on which the applicant for a situation was not required to pass any test before entering the service, in which case he is actively engaged in operating a car without ever having been examined. If the management of any road that has been in operation for ten years or over should conduct an examination of their motormen and conductors, they would undoubtedly learn some very interesting facts. It is very doubtful if any up-to-date road would entrust the safety of its patrons in the hands of those whom they know are utterly disqualified; but how are the officials to know whether this is being done if their employees are never examined?

The rolling stock, wires, track and power house must undergo a thorough inspection regularly, but the men, on whose alertness and quick perception so much depends, are allowed to go on year after year with never a question as to their physical qualifications. Under these conditions serious accidents may be caused by defective senses, but attributed to other reasons, and the company remain ignorant of the true facts.

It is reasonable to assume that regular examination, conducted by a conscientious examiner, would be to the advantage of the men as well as to the company, for under the present method a man's senses may become so defective that he cannot perform his work satisfactorily, resulting in his discharge, while, if this defect had been known to his employers, they could have given him suitable employment, thereby retaining him in the service. There are good positions with every railway company where faithful employees who have become disqualified for car service by defective senses may be employed with safety. If a man is allowed to go on in his own way he might be utterly unaware of his failing senses, and continue to do that which would aggravate his particular trouble; but if, upon examination, defects were found, the examiner could advise him as to the proper course to pursue, and in many cases avert serious trouble.

It is a well-known fact that at the present time railway corporations are interesting themselves in their employees in a manner that was not thought of a few years ago. That they are supplying them with free literature, gymnasia, finely furnished lobbies, are helping to maintain insurance and social organizations, and doing much to promote their physical, mental and social welfare are facts of common knowledge. It seems to the writer that another step in the right direction would be the periodical examination of men employed where acute senses are necessary to the safe performance of their duty.

GERMAN STREET RAILWAY ENGINEERS IN AMERICA

A party of prominent German street railway engineers and managers reached New York last week on a three weeks visit to this country, partly to visit the St. Louis Exposition and partly to inspect American street railway conditions. They consist of Messrs. Koehler, managing director of the Grosse Berliner Strassenbahn; Peiser, chief engineer of the Grosse Berliner Strassenbahn; Rötelmann, managing director of the Süd-Deutscher Eisenbahn Gesellschaft, of Darmstadt; Poetz, managing director of the Strassen Eisenbahn Gesellschaft, of Hamburg; Schultz, of the German military railways, and Freiherr von Bodenhausen, manager of the Westphalischer Stahlwerk, of Bochum, and also one of the directors of the Strassen Eisenbahn Gesellschaft, of Hamburg. The party expects to visit Milwaukee, Chicago, Buffalo, Boston and a few other cities during their visit in this country.

The new Trinidad (Col.) Electric Railroad is doing a splendid business, especially on the line between Sopris and Starkville. The business is so much greater than was anticipated that the equipment of the road will be at once doubled.

RECENT ELEVATED PRACTICE IN BERLIN

BY JOHN P. FOX

The electric elevated and underground railway in Berlin has already been described and illustrated in the STREET RAILWAY JOURNAL, June 7, 1902, Oct. 13, 1900, etc., but a recent visit, with study of details, has brought out some new points. The elevated line not only presents features of great value to those interested in urban rapid transit by trains, but it suggests a

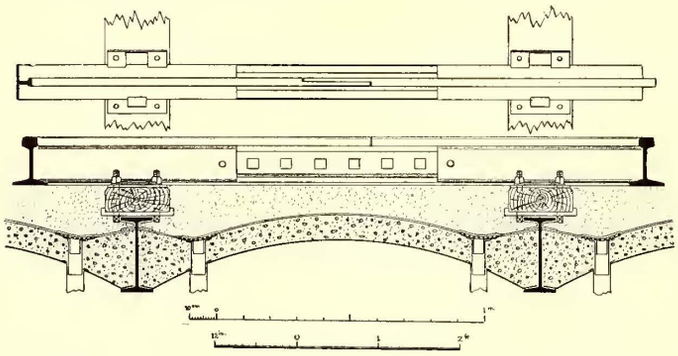


FIG. 1.—EASTERN SECTION, STANDARD FLOORING, LONGITUDINAL SECTION AT OUTSIDE RAILS, WITH PLAN OF RAILS

means of providing express service with surface cars and a solution of the problem of getting interurban cars quickly into and through cities without using the street surface, condemning land, or involving grade crossings. For if an elevated railway can be built complete for less than $300,000 a mile, so clean, decorative and sheltering as to be regarded a positive ornament and benefit to streets, so quiet as to avoid all damages and allow fine residential property to increase in value because of its convenience, it would seem almost worth while for some cities, if interurban companies could not afford the entire expense, to build and rent similar light elevated lines and get the heavy cars off the streets, to the benefit of all concerned.

In view of the growing prejudice against elevated railways in the United States, the solution of the noise problem is important, because, while subways have their places, the fact that elevated lines can be built for far less cost, with less disturbance and more quickly, affording pleasanter and quieter riding than subways, tends to make them desirable wherever possible. It is interesting that the same effectual remedy for noise should have been adopted independently in New York, Berlin and Paris—and that is ballast, on a solid floor, as used by the New York Central engineers on the Park Avenue viaduct, by Siemens & Halske on the elevated line in Berlin, and by the Paris municipal engineers on the viaduct along line No. 2, north, of the Metropolitan Railway. In a recent experiment in this country, where a stretch of elevated track was ballasted, an expert on sound found the total noise from trains reduced apparently 50 per cent, the actual reduction working out at from 80 per cent to 90 per cent. A test of experts on sound in this connection showed that practically none could detect a reduction in sound if less than 30 per cent; but while to reduce noise appreciably requires a great actual diminution, experience seems to have conclusively shown that even the worst conditions on elevated roads can be effectively remedied by the use of ballast, and attention is again called to Berlin and the rise in value already referred to of fine residential property along the elevated line.

Noise received special attention in Berlin from the outset. The flooring of the first part built, the eastern section of the road, did not prove as quiet as desired, though felt was tried as a deadening under the rails, and concrete and gravel filled in the space between the ties over the steel plate floor (Fig. 1). So for the western section, as described and illustrated in the STREET RAILWAY JOURNAL for June 7, 1902, the ties are imbedded in ballast with most satisfactory results (Fig. 6). Some of the well-known experiments tried on the eastern section to get reduction of noise are illustrated herewith. Fig. 4 shows how felt was placed on each side of the rails and held in place by pieces of wood about 1½ ins. thick, with bolts through the track. In Fig. 7 ties of steel and wood rested on fine sand in transverse steel troughs over the I-beams. In Fig. 8 the 3-mm floor plates, which vibrated somewhat, were lined underneath with arches of cork blocks. In Fig. 3 car

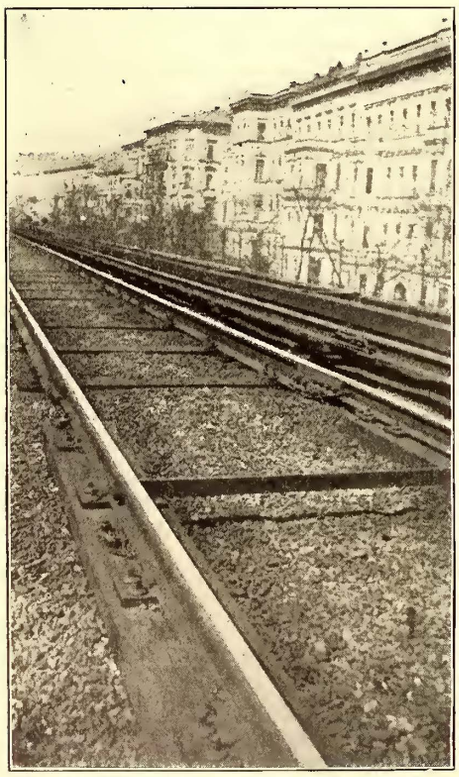


FIG. 2.—STRINGERS ON EASTERN SECTION

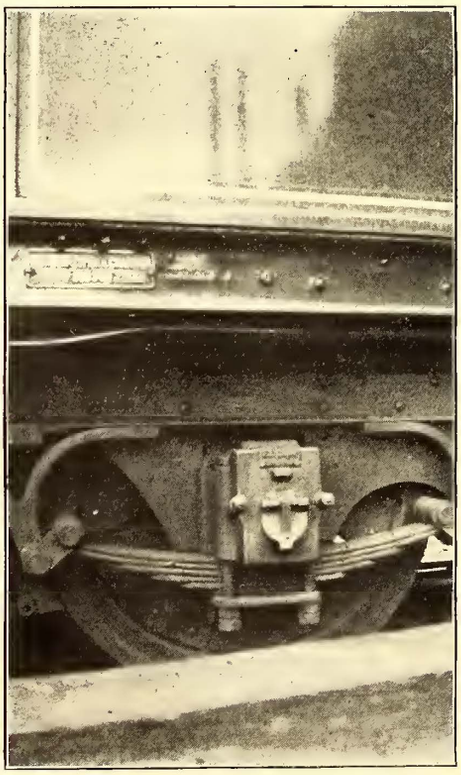


FIG. 3.—WOOD-FILLED CAR WHEELS

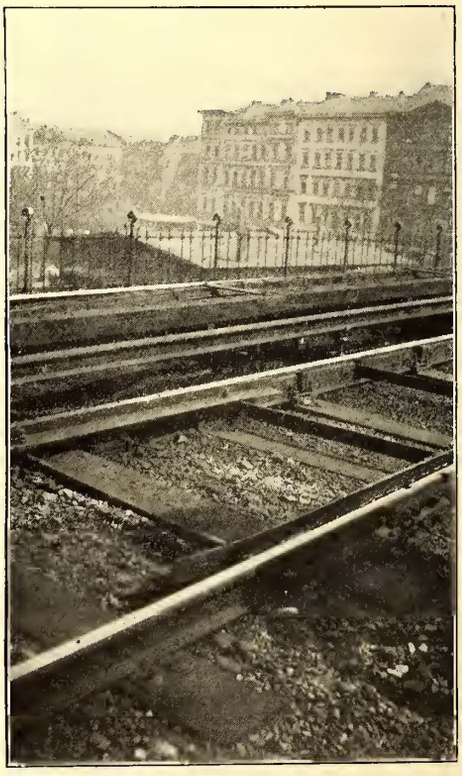


FIG. 4.—FELT EXPERIMENT, EASTERN SECTION AT BEGINNING OF WESTERN

wheels were filled with wood, though wood-centered wheels were not tried, for fear they would not stand the strains from motors and braking. None of the foregoing methods seemed effective compared with that illustrated in Fig. 2, where low rails are laid on deep wooden stringers, which again rest on the transverse I-beams. The cutting of the rails into the stringers is avoided by the use of a kind of chair or tie-plate. Fig. 11 shows the latest track construction on the western section. Noiseless joints have been obtained with Haarman rails (Figs. 1 and 5), whose eccentric webs, alternating in position with each rail, overlap with their full thickness at each joint. Creeping of rails is prevented by shoulders on the tie-plates, which engage the fish-plates or other special pieces bolted to the track, as in Fig. 9. To prevent creeping of ties in the ballast groups of ties are connected by stringers. Deflection of curves from expansion and contraction is prevented by the diagonal bracing between the rails. The writer found the gravel ballast exceptionally clean, free from dust, iron rust and oil. On Bülow Strasse the Berlin elevated structure is seen at its best, Figs. 14 and 16. Passing trains are hardly noticeable, either underneath or in the houses. The engineers decided, as the result of much experience with bridges, that the structure would vibrate less if the lower chords of the trusses were carried down to the ground, avoiding the weak spot at the junction of posts and trusses found in ordinary elevated construction. The use of the arch shape made it unnecessary to anchor the posts with expensive foundations, the structure on Bülow Strasse consisting of a kind of succession of tables, with the four legs inclined

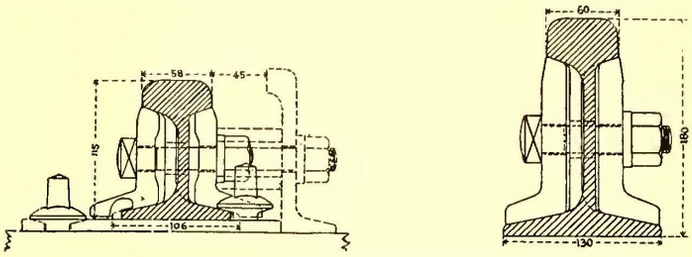


FIG. 5.—SECTIONS OF HAARMAN RAILS, WESTERN AND EASTERN SECTIONS

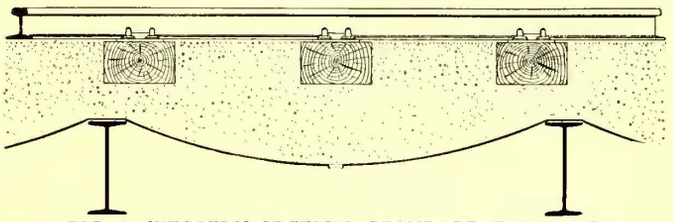


FIG. 6.—WESTERN SECTION, STANDARD FLOORING, LONGITUDINAL SECTION

and allow water to get at the I-beams, a thing impossible with the latest flooring. Where the trusses of street bridges have their lower portions imbedded in the concrete of the footwalks (Fig. 12), it has been found corrosion occurs from water standing on the footwalk, and waterproofing will cover all steel just above the concrete.

The tight floor, apparently supported by arches, all painted

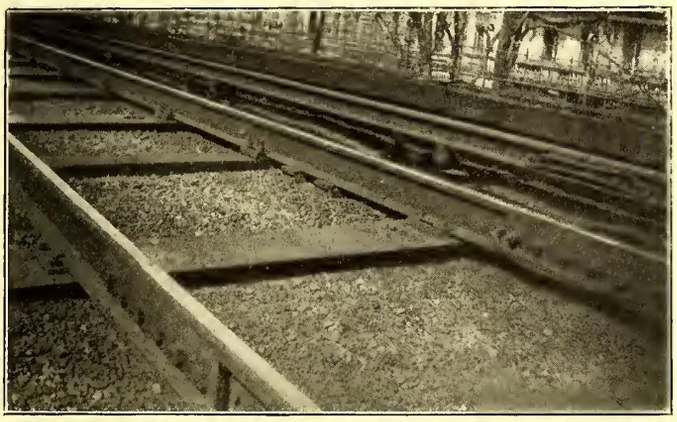


FIG. 7.—STEEL AND SAND TIES, EASTERN SECTION

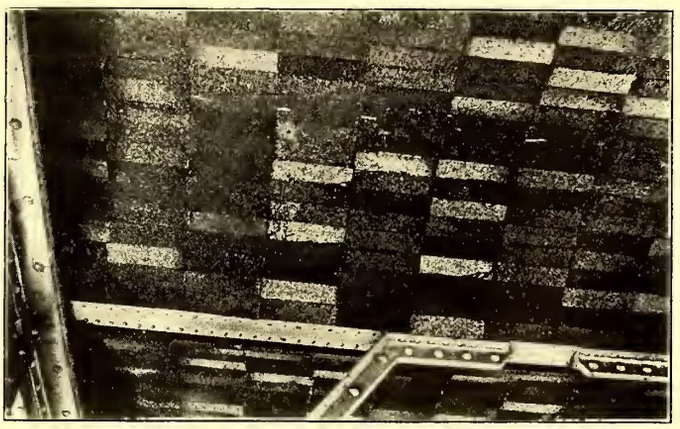


FIG. 8.—CORK ARCHES UNDER FLOORING, EASTERN SECTION

FIG. 9.—TRACK ON SOUTH END OF TRIANGULAR JUNCTION

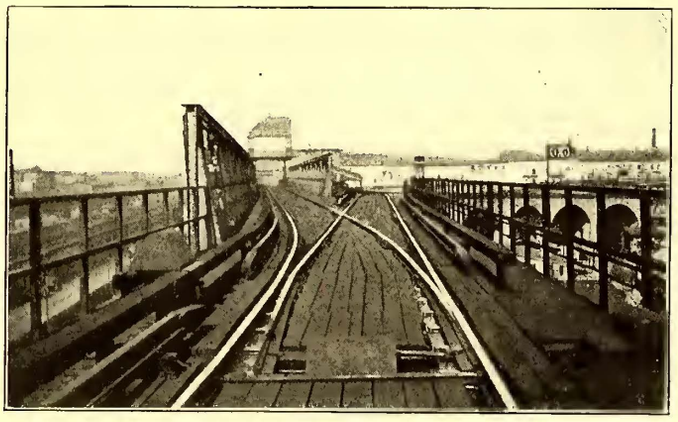


FIG. 10.—ELECTRIC SWITCH ON SOUTH END OF TRIANGULAR JUNCTION

out at the bottom for greater rigidity, and simply resting on the bases. Two longitudinal trusses suffice where four are generally used. The flooring (Fig. 6) is the most perfect for drainage that the writers knows, 7-mm steel plates being hung between the I-beams, the water draining from the hollows into longitudinal gutters underneath. On the eastern section (Fig. 1), any removal of tie-bolts tended to injure the waterproofing a light gray, almost white, forms such an attractive shelter over the grass-bordered walk, that the elevated on Bülow Strasse is called the umbrella of Berlin, and every one goes under it, from cab drivers to children, in hot or wet weather. The ride above, in handsome, noiseless cars, between rows of trees and fine houses, over a beach-like roadbed, is so attractive that when the train passes down into the subway, no matter how

used one is to underground travel, the first impression is a disagreeable one. Expensive as the western section appears the total cost complete per mile with track, but without conductors,

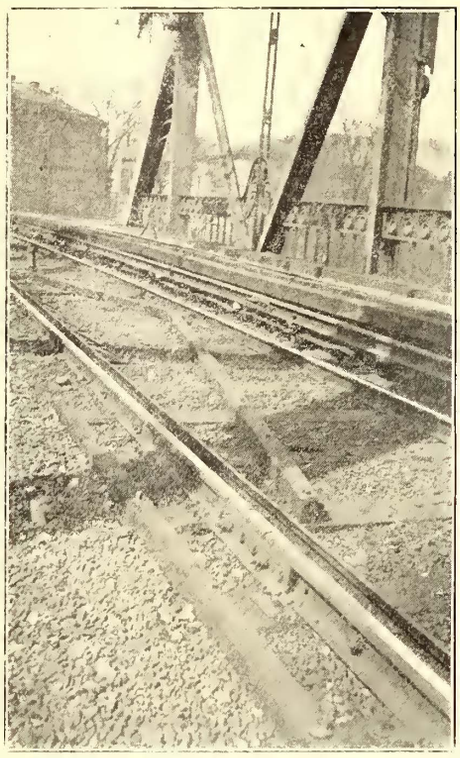


FIG. 11.—FLOORING ON BRIDGE OVER LANDWEHR CANAL, WESTERN SECTION

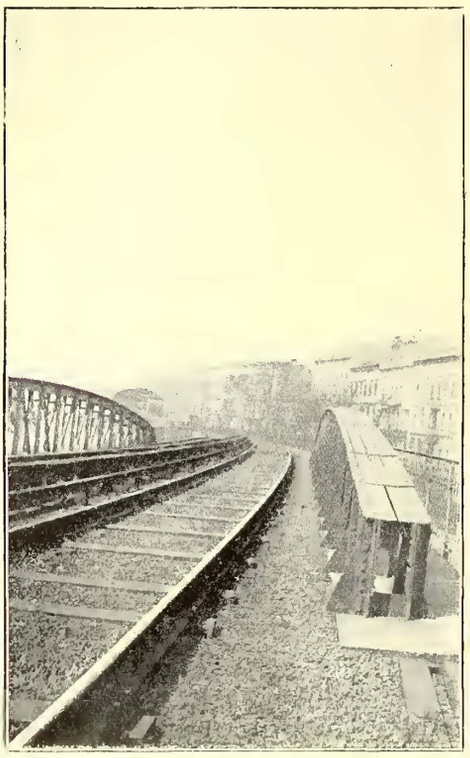


FIG. 12.—BRIDGE OVER GROSSBEEREN STRASSE, WITH STANDARD ROADBED OF EASTERN SECTION

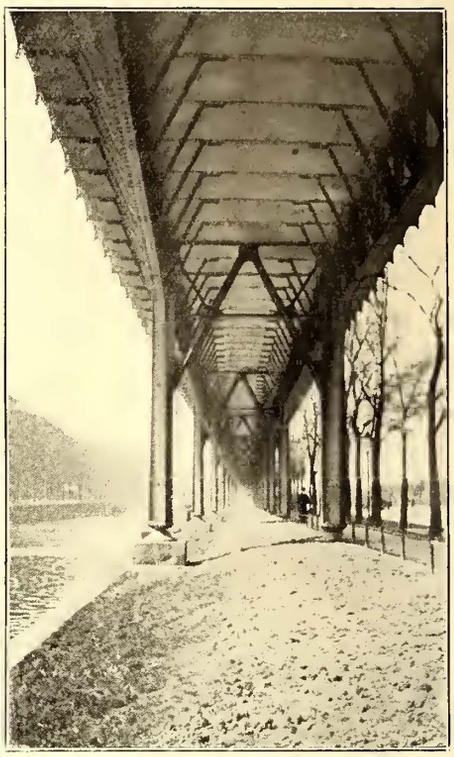


FIG. 13.—UNDER THE STRUCTURE ALONG HALLESCHES UFER, EASTERN SECTION

was only about $297,210 a mile. By adopting light cars, a fairly light steel structure was possible, in spite of the weight of the floor plates and the ballast, the latter amounting on the western section to about 2575 lbs. per lineal foot of double-track structure, out of a total weight of 4079 lbs. per foot, the steel work, including floor plates, weighing 1109 lbs. per foot. Motor cars without passengers weigh about 20 tons, trail cars 15 tons.

If a solid floor does shut some light off from the street directly underneath, it also shuts off water, sparks and falling objects, the latter sometimes involving serious damages. Such a floor would really in itself never deprive abuttors of light, and, if painted white underneath, like the Park Avenue viaduct, leaves the street at least about as light as the ordinary elevated structure, which quickly gets dark at every point. Snow has given no trouble on Park Avenue, never having required removal even where through spans are used. The greater safety and convenience of a ballasted floor are obvious, the safety of employees and workmen being specially looked after in Berlin, where the space between the ties is never left open, the timbers

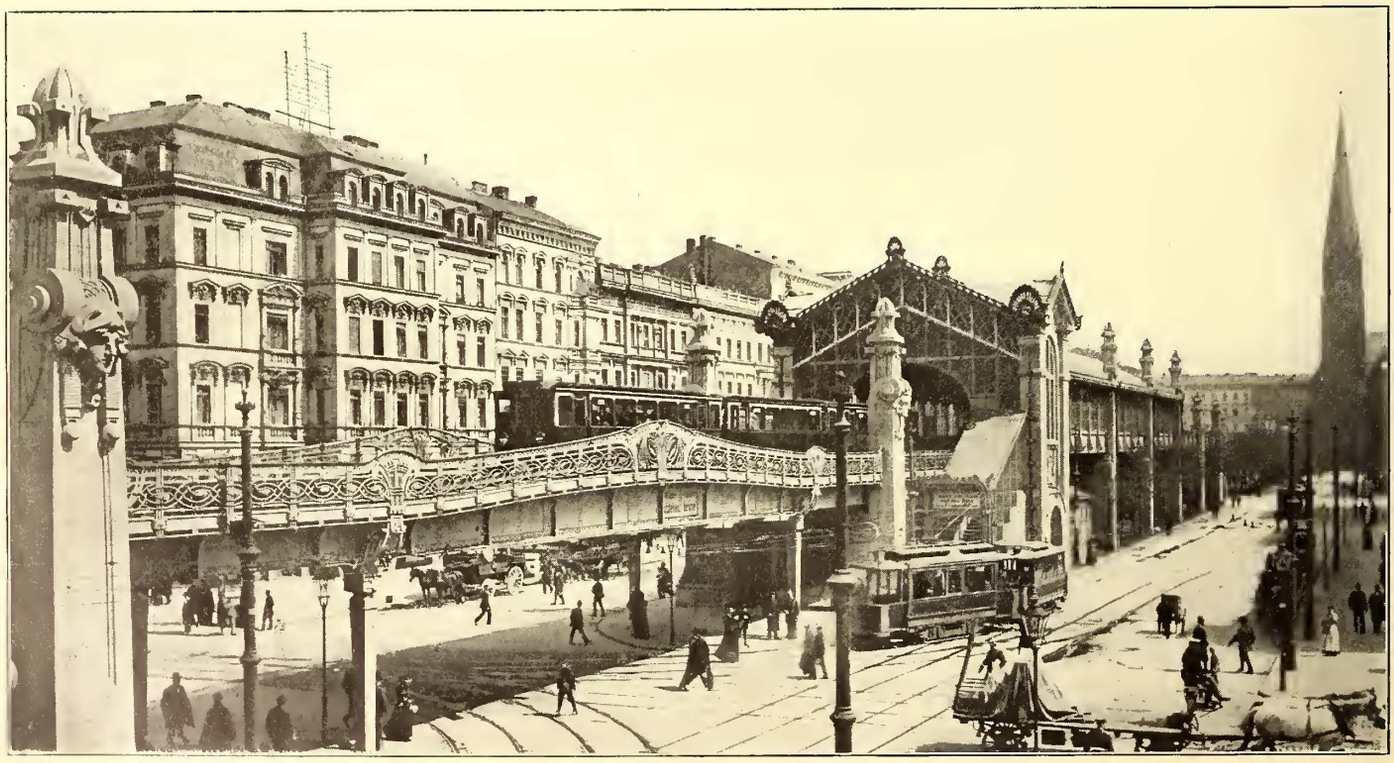


FIG. 14.—BULOW STRASSE STATION, EXTERIOR

guarding the third rail are very heavy and strongly supported, footwalks are very safe, one incline between the tracks even

FIG. 15.—INCLINE ON KLEIST STRASSE BETWEEN SUBWAY AND ELEVATED

having vertical posts for men to take hold of when trains pass (Fig. 15).

Much of the prejudice against elevated roads is due, not to the design of a structure, but to its dark or dirty appearance. A solid floor and white paint, perhaps, should be enough to meet this objection, but Siemens & Halske, in Berlin, took no chances, ornamenting in some way every foot of the structure along public ways, calling in many and well known architects to design monumental stations and bridges over the streets. The Berlin structure may seem too decorative to an American, but it was surely a judicious policy to make the entire work a positive ornament to the city. The new line had to build up its traffic mostly, perhaps, by enticing passengers away from the electric surface cars of a progressive and public spirited company, already giving the public unusual facilities. So, for this reason, if for no other, the Elevated & Underground Company made its stations and cars unusually attractive and convenient for the passengers.

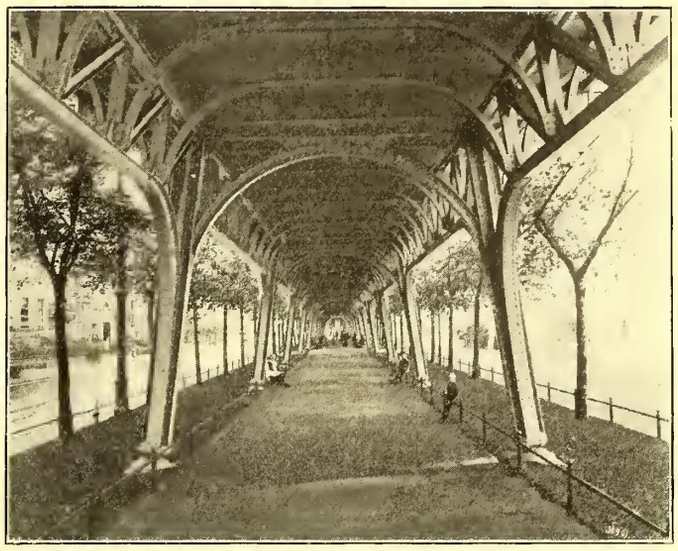


FIG. 16.—UNDER THE STRUCTURE ON BULOW STRASSE

The stations, with the exception of one on a curve, have their sides enclosed and glazed, and the unusual feature of roofs completely spanning both platforms and tracks (Fig. 20), even approaching stairs and passageways being enclosed from the weather (Fig. 14). This seems an improvement over the American plan of having exposed platforms combined with waiting rooms, for passengers use waiting rooms comparatively little, and, with platforms completely protected from the weather, they are more ready than otherwise to take trains promptly. The Berlin plan, then, is to have the entire station a waiting room, the seats being sheltered from draughts by

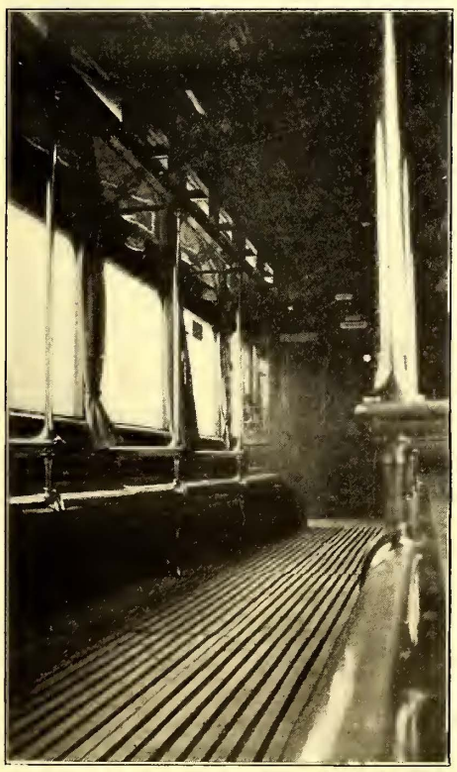


FIG. 17.—INTERIOR THIRD-CLASS MOTOR CAR

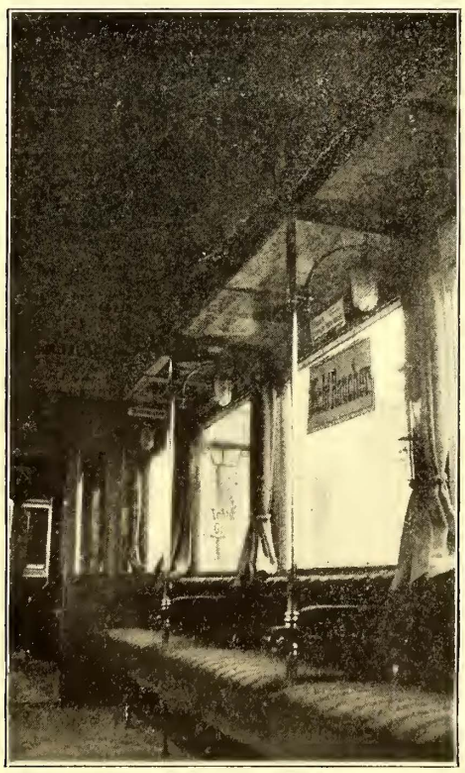


FIG. 18.—SECOND-CLASS CAR FROM NON-SMOKING COMPARTMENT

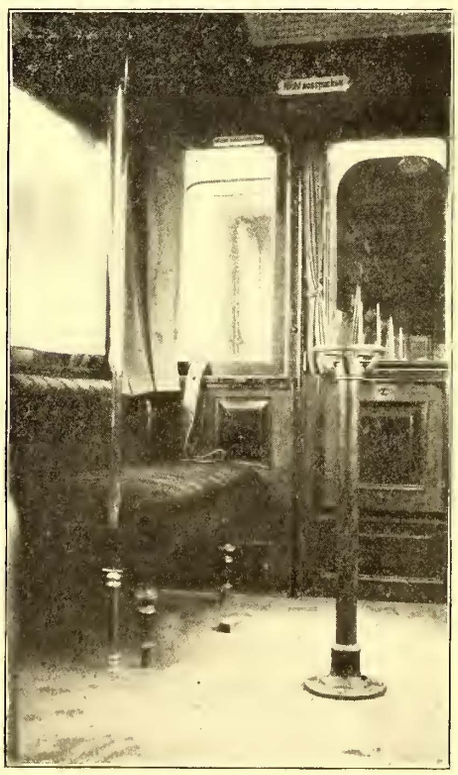


FIG. 19.—END OF SECOND-CLASS CAR, WITH CIRCULAR GRAB-HANDLE AND FOLDING SEAT ON DOOR

wooden screens. Toilet rooms are unnecessary, as public ones can be found on the street below. Stations are completely fireproof, with roofs of corrugated iron and floors of artificial stone. Everything is scrupulously clean, but plain, all money for ornament being wisely spent on the exterior. Only four-car trains are needed now, so the station roofs are only long enough to cover four cars, but they can be extended any time to the full length of the platforms. A clock over the tracks faces both ways. Stairways and passages are wide and free from turnstiles. Some of the platform edges are of white material, like the admirable custom found in London. Every station has train indicators, each sign being like those on the trains, viz., with destination name on a background of the route color, in the subway being brightly illuminated. Station names in the subway are painted on the opal glass of every arc light recessed in the side walls. Ticket offices are usually found on the street level, and an excellent device for economizing in wages is the ticket slot machine, into which one drops a 10 pfennig piece (2.4 cents) and a third-class ticket automatically comes out, without even having to pull a handle. It is surprising that such a practical and saving affair has not been introduced in this country, in view of its successful use in Berlin, by the State railways before the elevated, the ticket machines on the Berlin Metropolitan line even supplying four kinds of tickets at different prices, and giving back change, delivering, two years ago, over a million tickets a month.

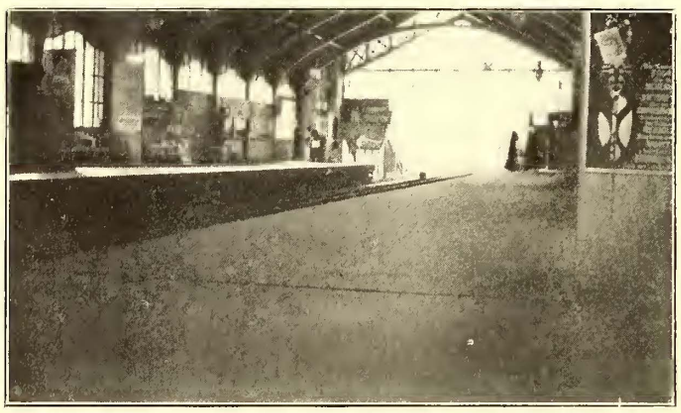


FIG. 20.—BÜLOW STRASSE STATION, INTERIOR

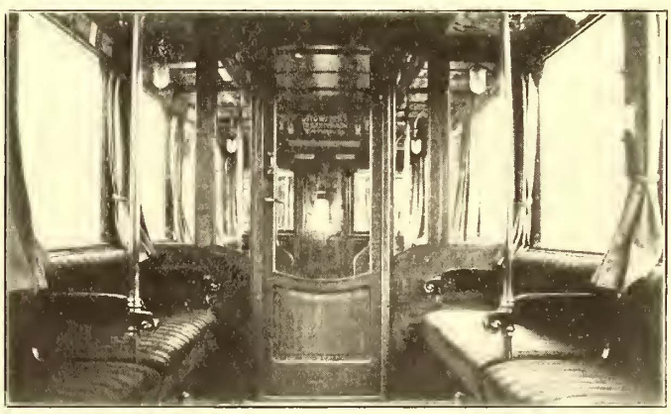


FIG. 21.—SECOND-CLASS CAR FROM SMOKING COMPARTMENT

The Berlin cars have some very remarkable and important features. The three-car trains consist of a third-class smoking motor car at one end, a third-class non-smoking car at the other end, and a second-class trailer between, divided by a glazed partition and door into smoking and non-smoking compartments. At the rush hours, another third-class car, a trailer, is added. In the third-class cars (Figs. 17 and 22) one can ride about 7 miles for 10 pfennigs (2.4 cents). The seats are of polished wood, light and dark, quite as comfortable as rattan. Why the second-class cars (Figs. 18, 19 and 23) are so called is not apparent, for they are really parlor cars, with a fare of 15 pfennigs (3.6 cents). These cars are the highest class cars run, as there are no "first-class" cars.

The most attractive feature of both classes is the post and arms between every three seats. The posts are greatly superior to straps to hold on to, and would be most useful in American cars, being more quickly grasped than straps, easier to hold, and affording a firmer support. The arms in Berlin give every two passengers out of three a corner to sit in, and much of the day there is a passenger in every corner. Such division of the seats does away with all moving along. Both classes of passengers are allowed 20.6 ins. of space apiece. All the incandescent lights are softened with prism globes, a custom also almost universal in English electric cars and greatly superior to the use of naked lights. Each car has an emergency lamp ready for use. Electric heaters are placed under the seats.

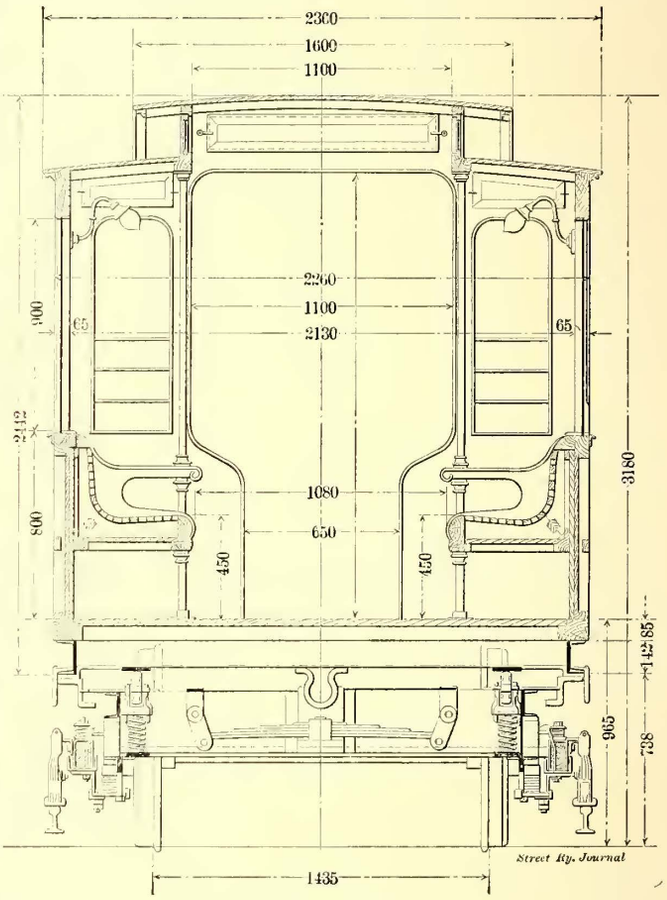


FIG. 22.—SECTION OF BERLIN ELEVATED AND UNDERGROUND MOTOR CAR

In the monitor roof the transoms in the front half of each car or compartment open out, so as to force air in, the rear half so as to exhaust the air. The windows in the ends of the cars can be opened any desired amount (Fig. 19). The ceilings are low, but that seems no objection where the means of ventilation are so satisfactory. The side windows are of plate glass, 60 ins. x 35 ins., too large, perhaps, to suit some Americans; but to the writer the size added much to the attractiveness of the cars, for, with window ledges just the right height for elbows, one could sit in a comfortable corner and enjoy riding in a noiseless car through magnificent avenues, lined with splendid buildings. American elevated cars have seats too wide for comfort, and especially for looking out of windows behind. Neither is rattan so comfortable or attractive as the luxurious Berlin seats, upholstered with crimson corduroy or red leather. With the smooth red carpeted floor, the abundance of highly polished metal in posts, arms and handles, the finely designed woodwork, all the work of the latest designers,

no American Pullman can really surpass what is called second class in Berlin.

The economy of the Berlin car can be seen not only in the low cost of the elevated line, but also of the subway, where a headroom was possible of only 10 ft. 10 ins. from rail to roof beams, and a width of 20 ft. 6 ins. between side walls. While cross seats are desirable as acceleration increases they were not possible with the width allowed in Berlin; but the longitudinal seats, as found there, seem fully equal to cross seats, especially as there are no jerks in starting or stopping. Indeed, there seems little need of the many handles with which the cars are supplied, so frequent that a firm support is always within reach from the time one enters a car until he is seated (Fig. 23). Passengers open and shut the doors themselves, there being only one guard to a train. This custom seems perfectly safe, as people are used to it on the steam roads, and then on the elevated line there is no hurry or crowding. In spite of the ease of traveling and a speed limit fixed at 31 m. p. h., one found an average speed of 15 m. p. h., though the stops averaged 25 seconds, the running being the smoothest and quietest of any electric road known to the writer. The cars have no platforms, end doors being only for emergency uses. The abolition of the inside door found in this country is an excellent improvement, the glazed partitions with projections to protect the feet of passengers giving ample shelter from draughts in winter when the side doors are open, especially as the stations are completely enclosed. Our car platforms ought to be so completely vestibuled as to make the inside door unnecessary, especially as the latter allows an opening wide enough for only one person to pass in or out at once, where the Berlin arrangement allows two. With side doors of double width, as in Paris and Berlin, and by the Berlin plan of having all passengers enter at the rear and leave at the front end of cars, our present circulation could usually be doubled.

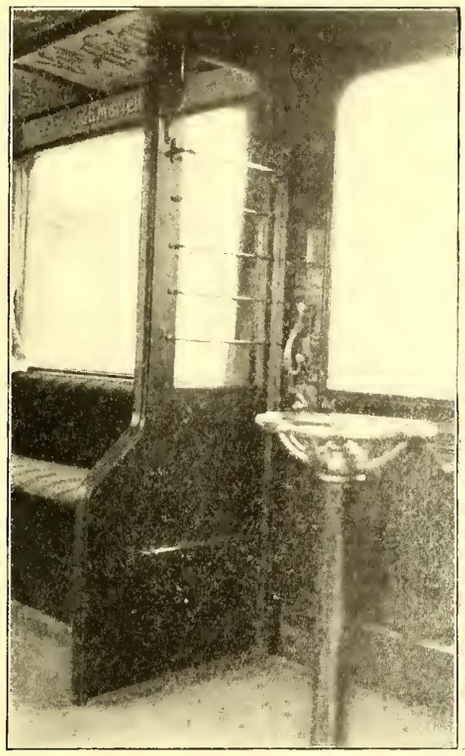


FIG. 23.—VESTIBULE OF SECOND-CLASS CAR, WITH CIRCULAR GRAB-HANDLE

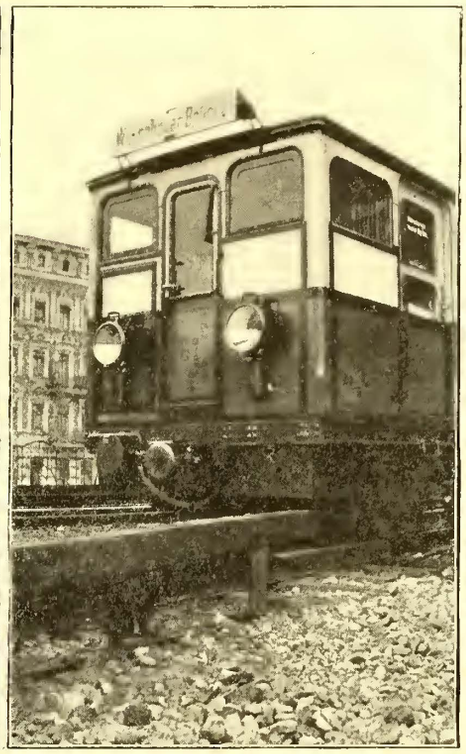


FIG. 24.—FRONT END OF THIRD-CLASS MOTOR CAR

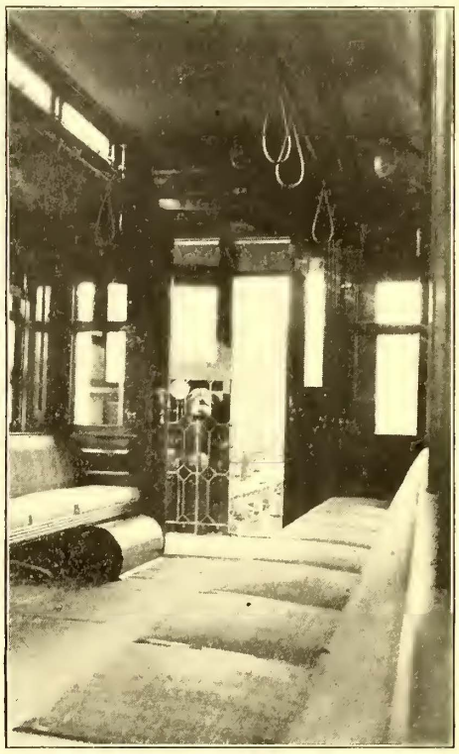


FIG. 25.—MERSEY RAILWAY, DESTINATION SIGN

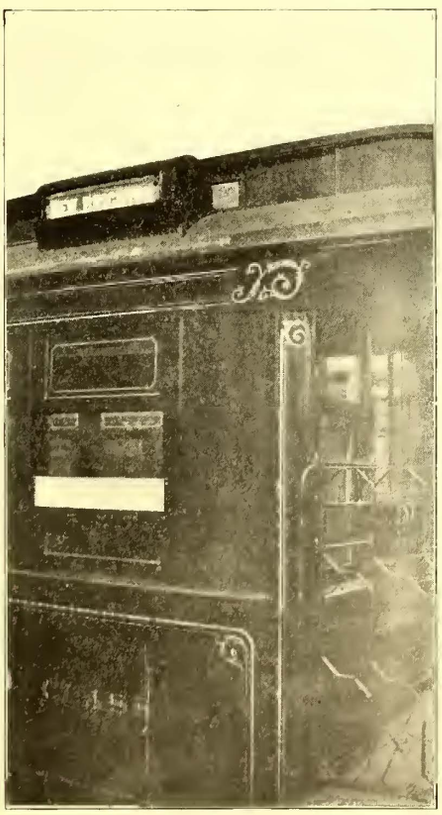


FIG. 26.—MERSEY RAILWAY, FIRST-CLASS CAR

The exterior of the cars is plain (Fig. 24), but tasteful color and cleanliness make the trains attractive. Each headlight has a white lamp and a red lamp inside, the white lights being turned on at the front of the train, the red at the rear. The large triangular destination signs have three names painted on them, each on a background of the route color, so that, with the indicators in the stations, no time is lost by passengers having to ask a guard where a train goes to. The Mersey Railway cars also have signs well adapted for America—blue and white enamel names on a cylinder (Fig. 26), which is revolved inside the car by an arm over a dial (Fig. 25).

Although the shortest radius is 262 ft., roller side bearings are found on the trucks, being used even on the surface cars in Berlin. It is curious that such bearings are not more used in this country to reduce track wear, especially in view of their successful use on the cars of the Brooklyn Bridge, where, with about forty curves of 100 ft. radius to be taken every hour, and no elevation of the outer rail possible, their introduction on the motor trucks not only stopped derailments, but prolonged the life of the rails on curves and cross-overs to an average of two years from a previous minimum of even sometimes less than six weeks when locomotives were used.

VIRGINIA PASSENGER & POWER COMPANY'S YOUNG MEN'S CHRISTIAN ASSOCIATION

BY S. W. HUFF

The Street Railway Journal has contained notices of plans for the organization of a Street Railway Young Men's Christian Association among the employees of the Virginia Passenger & Power Company, of Richmond and Petersburg, Va., and it has been suggested that a more extended notice of the formal organization and launching of this work might be of interest.

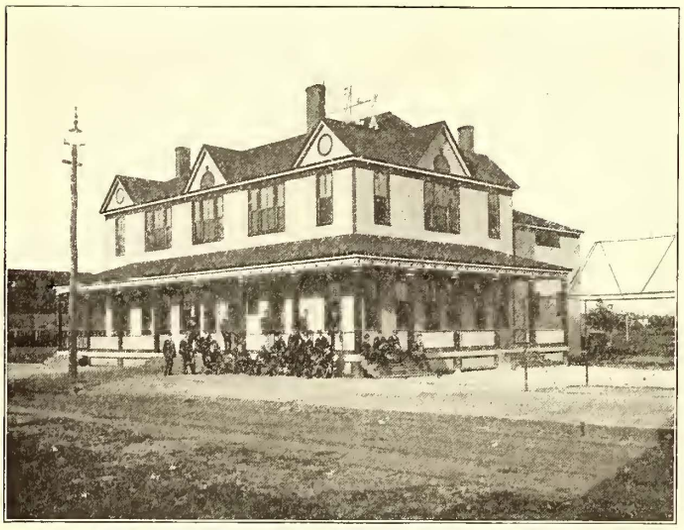


FIG. 1.—ASSOCIATION BUILDING IN RICHMOND

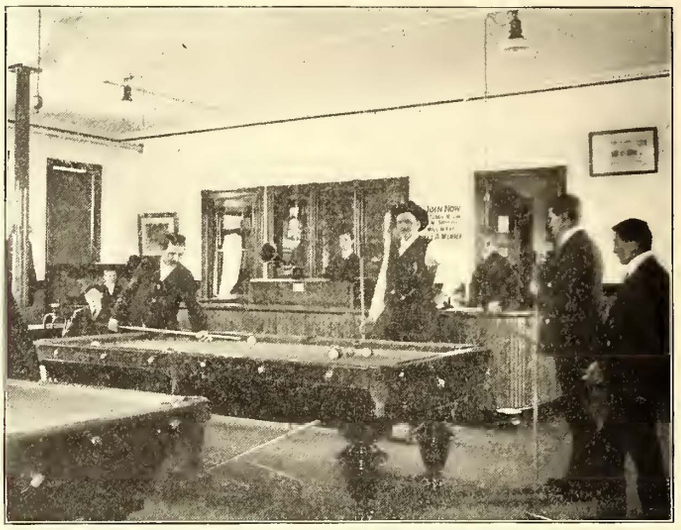


FIG. 2.—GENERAL RECEPTION ROOM.

It will be recalled by some that about a year ago the Virginia Passenger & Power Company was in the midst of a very bitter and hard-fought strike, with the result that its lines are now being operated by non-union men—a combination of strikers, strike breakers and men who came into the employ of the company after the strike. The company resolved not to countenance any organization among the employees that would bring to the front unwise and radical leaders, but it also realized the necessity and the justice of providing some kind of acceptable home for its men, and, at the suggestion of the principal owner, Frank Jay Gould, the matter was taken up with the officials of the Young Men's Christian Association, and plans mapped out for the organization of such an association among the employees of the company.

Some years back there was a beneficial association among the employees of the Richmond Traction Company (one of the operated companies) and a club house was constructed for them at an expense of about $10,000. Before this building could be completed the street car men's union became thoroughly entrenched among the employees of the company. The beneficial association, or club, was abandoned, and the club building was never used until the strike of last summer, when it was employed for the lodging of strike breakers.

It was found that this building, with some remodeling and improving, was well adapted for the use of the association, and accordingly the company undertook its improvement and the furnishing at an expense of about $5,000. This appropriation was generously augmented by a contribution from Miss Helen Miller Gould of a library, consisting of about 1500 volumes, as well as a music box, talking machine and a number of attractive pictures and mottoes for the decoration of the building, and from Frank Jay Gould of a number of books and a pool table.

The building as remodeled is shown in Fig. 1, and, as will be seen, is of a neat cottage type which well befits its location, near the Reservoir Park, the city's main center of attraction during the summer. The general reception room, in which is located the secretary's desk, pool tables, games, etc., is shown in Fig. 2.

The reading room, which is provided with all the standard periodicals and a number of daily papers of interest in this section, is illustrated in Fig. 3. The library, which adjoins the reading room and which has been so very generously stocked by Miss Gould with books, is shown in Fig. 4, and the general assembly room in Fig. 5. This hall seats about 300 people.

The last, but in reality first in the minds of the employees, is the bath room, as shown in Fig. 6. This, it will be noted, is a handsomely tiled room, provided with hot and cold water and all the most modern appliances for a luxurious bath. Immediately above the bath room is the locker room.

The building throughout is furnished in a substantial and handsome manner and is brilliantly lighted by Nernst lamps.

On April 23 this building was formally opened by three receptions—one in the morning for the "late straight" men, one in the afternoon for the "swing" men, and the final opening at night for the "early straight" men, and men from the shops, power houses, lines and office and other employees who were unable to attend either of the previous receptions. At this night meeting addresses were made by several prominent Young Men's Christian Association workers, among those from a distance being Messrs. Lougee, Williams and Millar, of the international committee, as well as a number of local people. The building was formally turned over to the employees by the general manager of the company and accepted in responses by

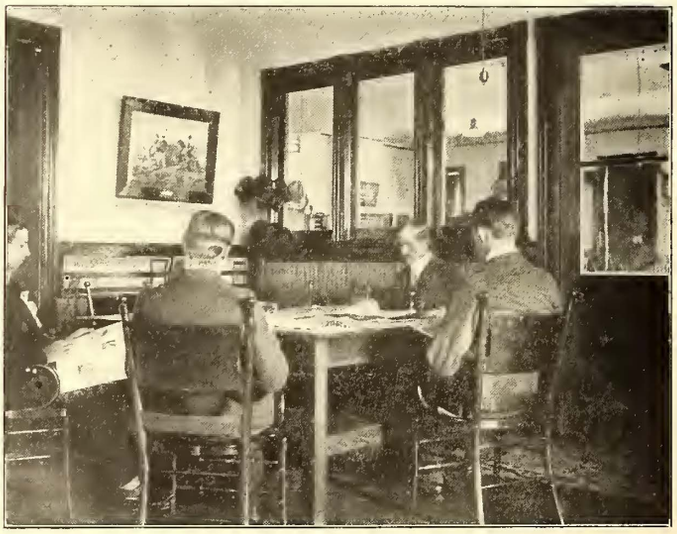


FIG. 3.—READING ROOM.

the men themselves. Miss Gould made the trip from New York to be present at this opening, and with the party of ladies accompanying her from New York and ladies from the families of officials of the company, received the men and their

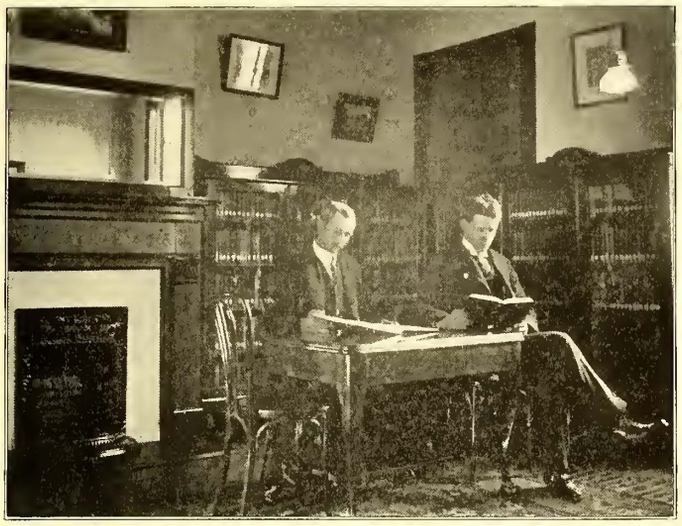


FIG. 4.—THE LIBRARY

families. The receptions were largely attended and the utmost good feeling prevailed.

The following quotation from an afternoon paper is expressive of this good feeling:

IT'S "MISS HELEN" ON THE CAR LINE NOW.

Presto, change!

The building where, not so many months ago, the call of the trumpets echoed and the jangle of side arms was to be heard, where the walls were covered with racks of rifles and shot guns and men paced uneasily all night and all day, not knowing what the hour would bring forth—this building is to-day as handsome and as cozy a resort for men with Christianly feeling one for the other as ever was dedicated to the broad cause of the Young Men's Christian Association.

A little lady with a smiling pair of eyes and a good, strong handshake for all, was the presiding genius of this new and welcome

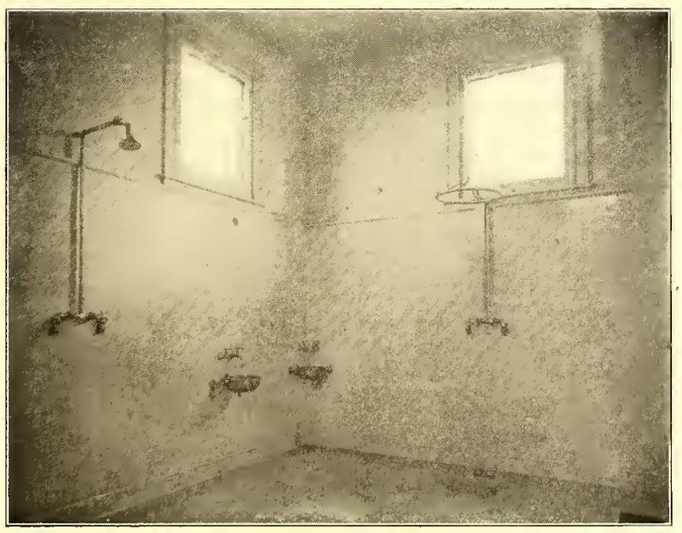


FIG. 6.—BATH ROOM

change of affairs. The half hundred and more of the employees of the company assembled to meet Miss Helen Gould, showed how they felt and appreciated the new and goodly order of things.

The handsome parlor car, especially prepared for the visitor, whose reputation is national for her good works and her deep love for humankind, was named the "Virginia." The men have changed it, and when it approached the new Y. M. C. A. Building at the Reservoir this morning, they hailed it as "Miss Helen's Car." It is safe to say that it will always be "Miss Helen's car," and that in Richmond Miss Gould will always be "Miss Helen."

The work thus most auspiciously launched is moving along smoothly and successfully, 440 members having been enrolled out of an available membership of 700. The management is more than pleased with the result and the bearing which the

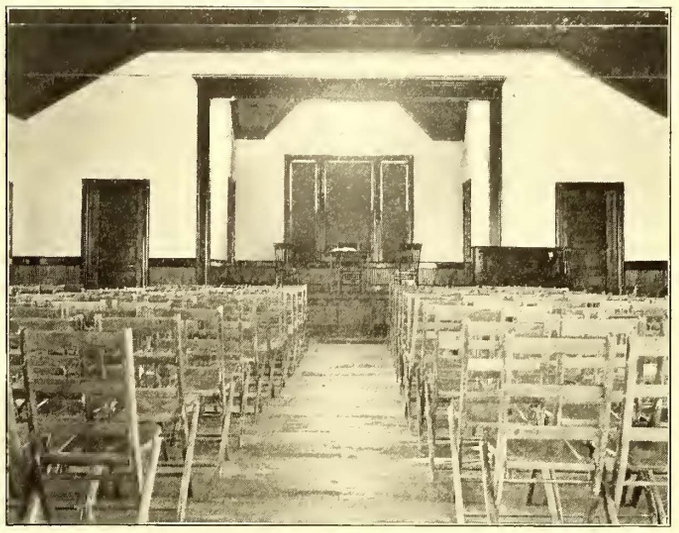


FIG. 5.—GENERAL ASSEMBLY ROOM

association seems to have upon the personnel of its employees. Everywhere it is remarked that the employees of the Virginia Passenger & Power Company seem to feel a deep interest in the welfare of the company. This is only natural, as the men feel that the company has shown an interest in their welfare in a substantial way, and, as a rule, men respond in kind to an interest of this sort unless prevented by some undue and vicious influence, which, it is believed, is not present to any considerable extent among the employees of the Virginia Passenger & Power Company at this time.

The management believes that the money which the company has invested in this building and equipment ($15,000), and the amount which it proposes to contribute toward the maintenance of the work (practically $2,000 per year) is well spent.

It is not unusual to see gathered around the same piano Protestants and Catholics, strikers and strike breakers, the old and the young, singing the same songs or hymns, and all united in one fellowship. It is believed that this mingling of car men, shop men, power house men, line men, track men, office men and officials, all on the same level, along social, religious and educational lines, will work incalculable good for each class and result in a much improved service for the company from each man in his particular sphere of action.

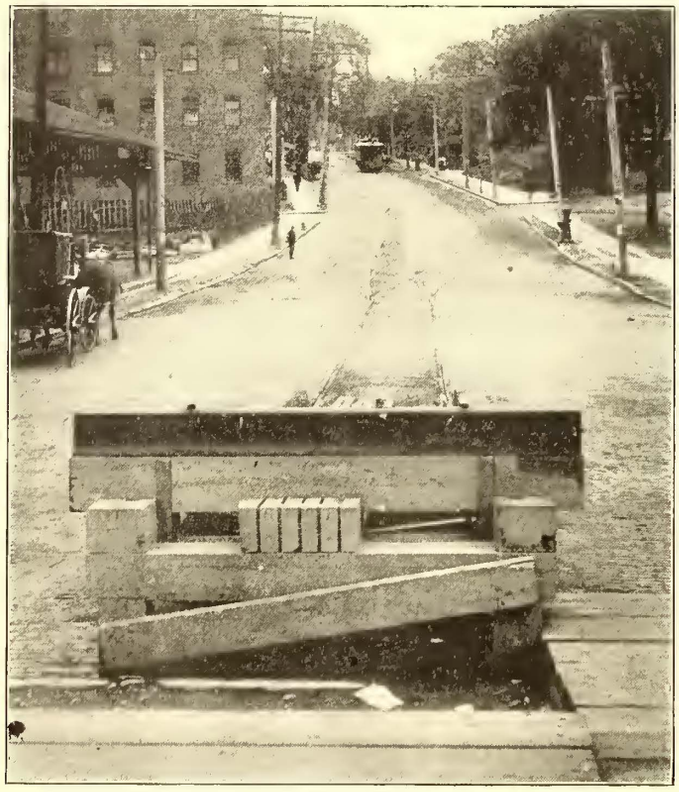
RACE SEPARATION IN COLUMBUS, GA.

H. S. Reynolds, manager of the Columbus Railroad Company, of Columbus, Ga., writes as follows:

"I note in your issue of May 7 an article entitled 'Race Separation in San Antonia, Tex.,' in which it is stated that the street railway company there has proposed a new plan for race separation which promises a solution of the problem. The statement that the plan is new is not exactly correct, as practically the same arrangement has been in vogue in this city for the past three years, the slight difference being that the first seat full of darkies are obliged to take the rear seat, whereas white people can occupy any of the other seats, they not being compelled to take the front one, as is proposed in San Antonio. Also when the car is nearly full it does not make any difference which color first occupies the last vacant seat, but the whites are given the preference. Our conductors are authorized and required by city ordinance to designate to passengers, both black and white, where they shall sit, and we have little or no trouble in the working out of this arrangement."

AN EFFECTIVE EMERGENCY CAR STOP FOR USE AT THE FOOT OF A DANGEROUSLY STEEP HILL

The accompanying engravings illustrate an interesting safety precaution in the form of an emergency car stopping device.



REAR VIEW OF CAR STOP

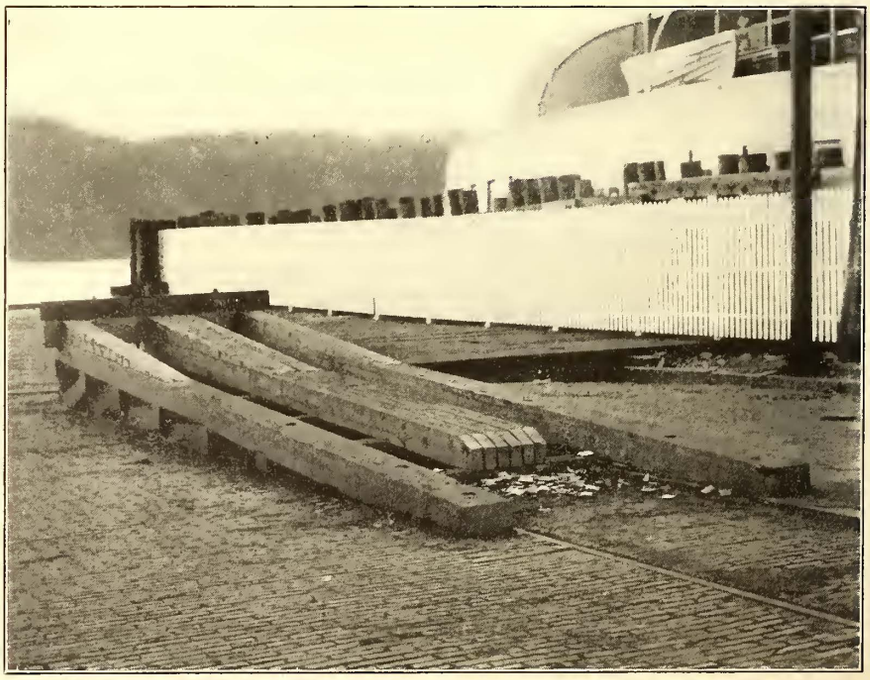
It was designed for the protection of runaway cars on a very steep hill, due to slippery rails, ineffective braking, or other possible cause. The device is of an unusual although simple design. Its effectiveness is not apparent from a hasty examination of the views, but it is the result of a long and careful study of the possible methods of protecting this grade, which is of a particularly dangerous character. This scheme is in use by the Poughkeepsie City & Wappingers Falls Electric Railway Company, at the Hudson River terminal of its Main Street line in Poughkeepsie, N. Y.

The Main Street line in Poughkeepsie is operated over a treacherous piece of track leading from the landing of the Hudson River ferry up to the business portion of the city, which lies upon a very high level. From the Court House down to the ferry landing the line is one continuous stretch of down grade—nearly a mile in length. The latter end of this grade, as it approaches the river, is one of the steepest sections of the slope, and cars are required to make their terminal stop immediately at the foot of this incline, with no length of level track for proper stopping facilities. In the photograph showing a rear view of this emergency stop the general character of this grade may be seen. As will be noticed the line is double-tracked to within a short distance of the terminal, where the two tracks come together at the switch. The dangerous character of this grade may be understood from the fact that in several instances cars have gotten beyond control, owing to the slippery conditions of rail and other causes. Fortunately, however, only one serious accident has resulted here. In this case a car got beyond control and ran to the foot of the hill at a very high speed, crashing through the landing shed upon the dock at the river's edge and going off into the river, carrying with it the motorman and several passengers. The car went down into 40 ft. of water, the depth at that point, and although some of the passengers were seriously injured all were rescued.

As a result of this accident a great deal of study was given to the best way of stopping a runaway car, but it was with difficulty that any remedy was reached which did not seem to provide a more dangerous condition than would obtain if it were omitted. The use of a bumper block would have meant sure death to everyone in the case of a runaway car. At one time a large heap of dirt and ashes was located directly at the end of the track in order that a runaway car might thus be held from going off into the water, and later this was supplemented by several large logs which were chained in a position crosswise of the track near the terminal. This arrangement offered serious obstruction to a runaway car; but its dangerous as well as unsightly character led to the design of the inclined-plane car stop illustrated.

The stop finally selected is remarkable for its extreme simplicity as well as effectiveness. It consists merely of a short incline built up of rough timbers, as shown, and so located that a runaway car will slide up upon it, the lower parts of the truck frame coming in contact with and riding upon the side timbers. The effect of this is to cause the car to be lifted off of its wheels and slid along upon the timbers until the momentum of the rapidly moving car is expended in the friction of sliding. The framework of the slide is strongly and stiffly built, and is anchored securely to the track. The character of construction is clearly shown in the front view.

Recently an opportunity was afforded for severely testing the device. A large amount of slippery mud had been washed upon the rails by street cleaners, and a car descending the grade became unmanageable and ran away. The brakes would not hold the car on account of the condition of the rails. The car was going at a comparatively high rate of speed when it reached the terminal and ran on to the emergency stop. Its speed was, perhaps, not so high as might have been the case with released brakes, or in case of an icy rail, but was sufficient to have occasioned another very serious accident if the inclined plane stop had not been in place. The result was that



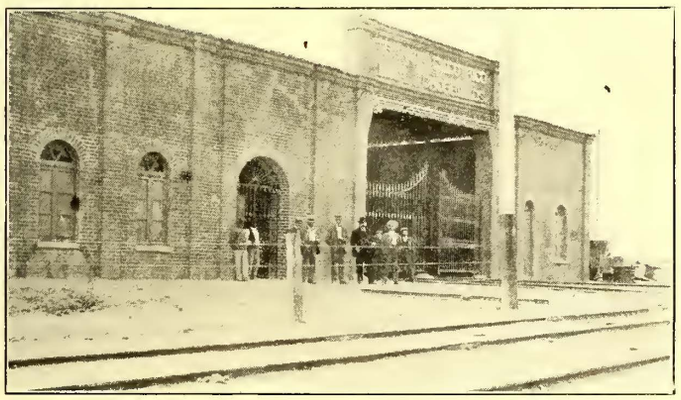
FRONT VIEW OF CAR STOP

the car made the incline and slid upon it easily, coming to a gradual and gentle stop. The effect upon the passengers was hardly more severe than would have been the case in the event of a stop on a level by reversing of the motors, and no inconvenience was caused. Later on, when it was desired to place the car in service again, another car was coupled to it and easily dragged it off of the incline onto the track without assistance, and the car was immediately placed in service without the necessity of repairs.

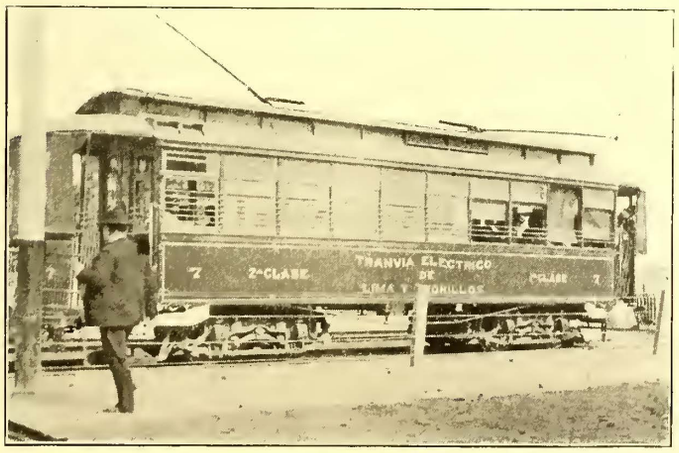
Too much cannot be said in favor of this method of providing for possible accidents of this nature, which are inevitable where extremely steep hills are surmounted. This hill is of a very severe nature, no level space being afforded for the purpose of comfortably and safely stopping the cars; it is practically necessary to stop the cars while still on the hill. The danger is enhanced owing to the hill ending directly at the water's edge, and the case is rivaled by only a few similar instances in other cities where surface lines upon steep hills approach busy steam railroad crossings at the foot of the inclines, making serious accidents inevitable in case of runaways. The photograph, unfortunately, does not indicate clearly the character of this grade, but by reference to the view looking up the hill the steepness may be judged by comparing the height of the crest of the hill with the adjoining factory building.

FIRST ELECTRIC RAILWAY IN PERU

The construction of the first electric traction system in Peru —the Lima-Chorillos Railway—is now completed. The road



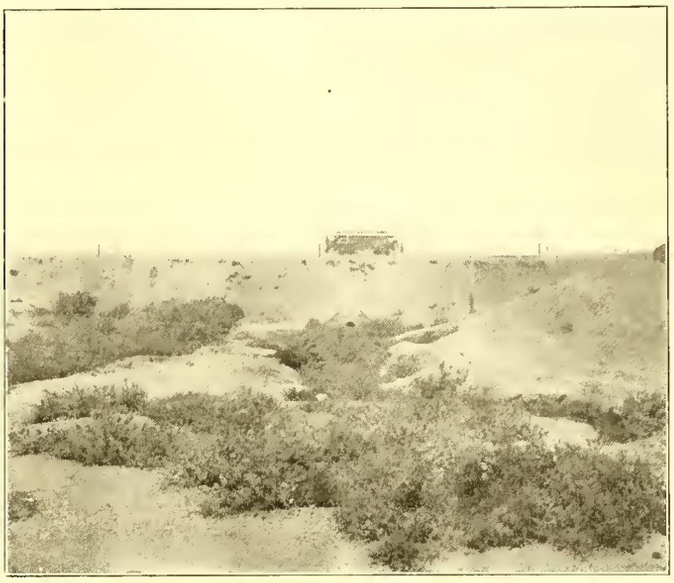
MAIN CAR HOUSE, LIMA



CONVERTIBLE CAR

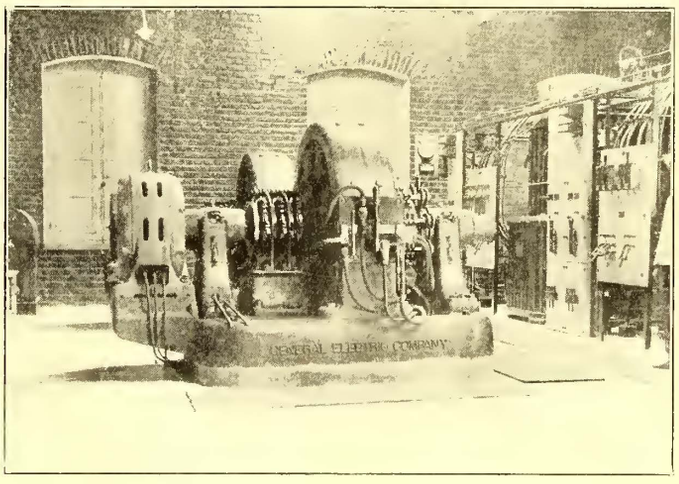
contains about 20 miles of track, and runs between the capital city of Peru and Miraflores, Barranco, Buenpastor and Chorillos, all popular seaside resorts. American equipment is utilized throughout. Power to operate the system is derived from the hydraulic plant of the Compania Santa Rosa Limitada, which also lights Lima, and is located about 35 miles from that city. The equipment includes General Electric generators and Pelton water-wheels. An 800-kw set has recently been ordered.

Semi-convertible cars are used, as this type of car has been



LONG HILL ON THE LIMA-CHORILLOS ROAD

found to be very satisfactory in countries where there are sudden climatic changes, as it can quickly be converted from an open to a closed car to furnish shelter from wind or rain. The rolling stock consists of ten of these cars, supplied by the John Stephenson Company, and divided into two compartments, one for first-class passengers and the other for second-class passengers. The partition separating the two compartments is movable, so that it can be placed in any position desired. The cars are equipped with the automatic emergency car lighting system of the Federal Electric Company, described in the last



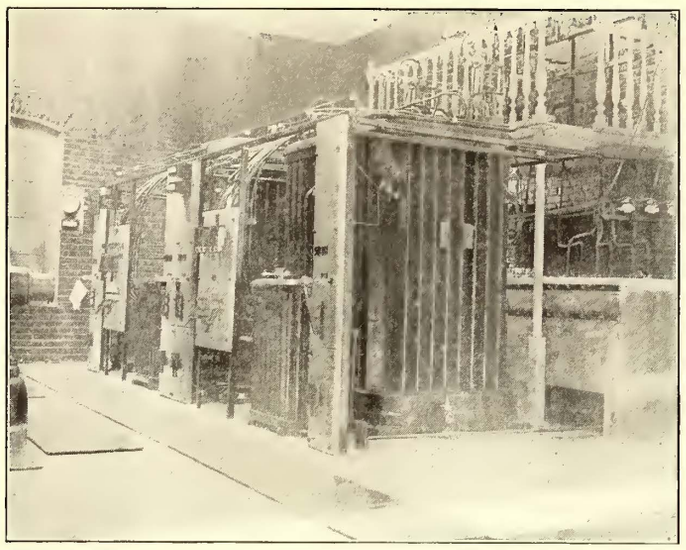
INTERIOR OF SUB-STATION

issue, by which the lamps remain lighted even if the trolley leaves the wire. The cars have 28-ft. bodies, are 8 ft. 4 ins. wide and 36 ft. over all, and were described in the STREET RAILWAY JOURNAL for Sept. 19, 1903. They are mounted on Peckham 14-B3X trucks, and are equipped with two G. E.-57 motors, each with K-11 controllers. Sterling power brakes are used.

The overhead line consists partly of span and partly of flexible bracket construction. The trolley wire is No. 0000, and General Electric No. 0000 rail-bonds are used.

The Lima-Chorillos Railway is being operated by Peruvian capitalists. A. W. McLimont, an old Thomson-Houston man,

had charge of the construction of the system. The same interests which control the Lima-Chorillos road are building an



VIEW IN SUB-STATION—LIMA

electric railway between Lima and Callao, its port. This line will be about 10 miles in length. The General Electric Company received the contract for the construction and equipment.

DO NOT FAVOR REGULAR EXCURSIONS

The interurban roads of Columbus will have nothing further to do with the efforts of the merchants of that city to work up special trade excursions. Their plan was to give a single-fare ticket to Columbus to any person buying $10 worth of goods in the aggregate from members of the association, or a round-trip ticket to purchasers of more than $20 worth. Some of the roads favored the plan, while others did not. None of them agreed to the terms requested by the association, which proposed that the roads give the association the benefit of reduced rates, issue tickets containing the association's coupons, and permit the ticket agent at Columbus to figure up the amounts of goods purchased before issuing the association ticket. The roads argued that it would be better to run their own excursion and give the public throughout the country the reduced rate, and let the association give a ticket to a circus or some other amusement place. The roads agreed, however, to issue the association's receipt to those who paid cash fare and asked for receipts. As a matter of fact the roads were compelled to give some form of receipt to those that asked for them. As the result of the excursion, the roads have been between two fires. The country merchants and country newspapers accused the interurbans of assisting in a movement designed to carry trade away from the small towns, while the city merchants and city papers denounced the roads for refusing to co-operate with the plan to bring business to Columbus.

The majority of the interurban managers were fully aware of the troubles that such excursions are likely to create. The Columbus interurbans are doing a large amount of package-freight business, consisting largely of goods for the country merchants, and it has been found, too, that the bulk of the passenger receipts comes from people going in and out of the small towns. While such excursions might result in increased traffic for the time being, it is claimed by experienced traffic men that the reaction generally overshadows the temporary gain, not only because people stock up with goods that they might have made two or three trips for under ordinary conditions, but because the promotion of such excursions by a railroad invariably gains for it the ill will of the shopkeeper in the smaller town, and this feeling is apt to be spread broadcast by a biased press.

NOTES ON THE SAN DIEGO AND CORONADO RAILWAY SYSTEMS

San Diego, Cal., is a growing city of about 23,000 population, situated at the southernmost part of the State, on the Pacific Coast, and close to the Mexican border. It has 17 miles of electric railway, owned and operated by the San Diego Electric Railway Company. Less than a mile across San Diego Bay, on a narrow strip of land facing the ocean, lies Coronado Beach, a resort, which, with its tent city and famous tourist hotel, has become known throughout the country as a popular all-the-year-round watering place. In Coronado an electric railway, slightly over 2 miles long, is operated by the Coronado Railroad Company, and makes connection with a ferryboat which plies between San Diego and Coronado. This boat is operated by the San Diego & Coronado Ferry Company. All three companies are controlled and operated by practically the same interests. Some of the interesting features of both railway systems will be described in the following notes:

DOUBLE-DECK CORONADO CAR

Probably the most conspicuous characteristic of the Coronado Railroad is the large double-deck car shown in Fig. 1, which is used throughout the summer and whenever the traffic warrants it. This car is of Brill manufacture, and is 41 ft. in length over all. It has a seating capacity of eighty, and can carry 150 people. The roof of the upper deck is 20 ft. above the rails, and the trolley wire is placed 4 ft. above that. The car is mounted on Brill maximum-traction trucks, equipped with two G. E.-67 35-hp motors. Complete it weighs 13 tons. The ordinary hand brake is provided, and in addition the car is

FIG. 1.—DOUBLE-DECK CORONADO CAR ON PALM-BORDERED AVENUE.

equipped with a simple but efficient rope brake. This latter brake consists of a hemp rope, wound one complete turn about a 16-in. cast-iron drum, that is mounted on the small idle axle of the truck. With this brake the car can be quickly brought to a stop, and although the rope has to be replaced at intervals varying from one to three months, the construction on the whole is an inexpensive but effective one. The rope on the drum is kept lubricated a little, so that it will not tighten up of itself when running loose.

This car has been in use by the company for about five years, and for the conditions under which it is operated serves the

purpose very well. These conditions are that it make trips every 20 minutes between the ferry dock and the hotel and tent city. Its capacity is generally sufficient to handle the crowd, whereas a single-deck car would have to haul a trailer most of the time. At periods, however, when the resort season is at its height, even the capacity of the double-decked car is exceeded, and trailers have to be put in service, as shown in Figs. 2 and 3. Of these three illustrations, Fig. 1 is a view on the palm-bordered avenue leading up to the hotel from the ferry dock, Fig. 2 is a general view of Tent City, with the Hotel Coronado in the distance, the ocean on the left and the bay on the right, and Fig. 3 shows a train unloading at the Plaza in the center of Tent City.

Power for the Coronado Railroad is furnished from a steam plant located near the hotel, for which it also supplies power and light, as well as lights for all of the tents and grounds.

FERRYBOAT

Last summer the new ferryboat, "Ramona," shown in Fig. 4, was put into service for the travel across the bay. This boat is 130 ft. over all, has a draught of 6 ft. and a gross tonnage of 575. It has a carrying capacity of 1000 people, with seats for 400. It is equipped with two high-pressure, surface-condensing, direct-acting engines, giving 720 ihp at full pressure, and driving the boat at a speed of 14 m. p. h.

REBUILDING OF SAN DIEGO CARS

The present management of the San Diego Electric Railway Company has been engaged for the last year or more in putting its entire rolling stock and shop equipment in good operating condition. An important change in the rolling stock has been in converting some of its old cable cars, like that shown in Fig. 5, to the combination California type of car shown in Fig. 6. This latter car, which may be said to represent the company's present standard, is 33 ft. over all in length, and is mounted on two 27-G Brill trucks, equipped with two G. E.-52 motors. The car has glass ends and longitudinal seats in the open ends as well as in the closed compartment. In rebuilding these cars the roofs of three old cable cars were used to cover two of the rebuilt cars. The body was strengthened by a steel plate the entire length of the outside side sills, as shown in Fig. 6.

The general construction of this type of car with open ends has been found to give it an appearance, when viewed as a whole, of being higher in the center than at the ends. In other words, the ends seem to drop down, and in some few cases they actually do so. To obviate this tendency the side plates have been given a gradual incline from where the closed body ends to the end of the car. The total rise in this distance of about 10 ft. on each end is only ¾ ins., but it is just sufficient to make the car appear to the eye to be perfectly straight.

Hand brakes of the ratchet type are used on the cars, the hand lever working between two semi-circular racks with a pawl that fits into both. The company has found the double rack to be much more efficient than the single one, as it gives even and uniform bearing for the pawl and does not tend to twist the lever out of position.

SHOP FEATURES

There are several problems that the San Diego Electric Railway Company has met in the operation of its shops, which, doubtless, often require careful consideration by other companies operating systems of about the same size. The management found that in order to do its own repair work properly it required a carpenter, a painter, a blacksmith and a machinist. To have good work done wherever it was necessary, these men had to be experienced and capable. However, there was not

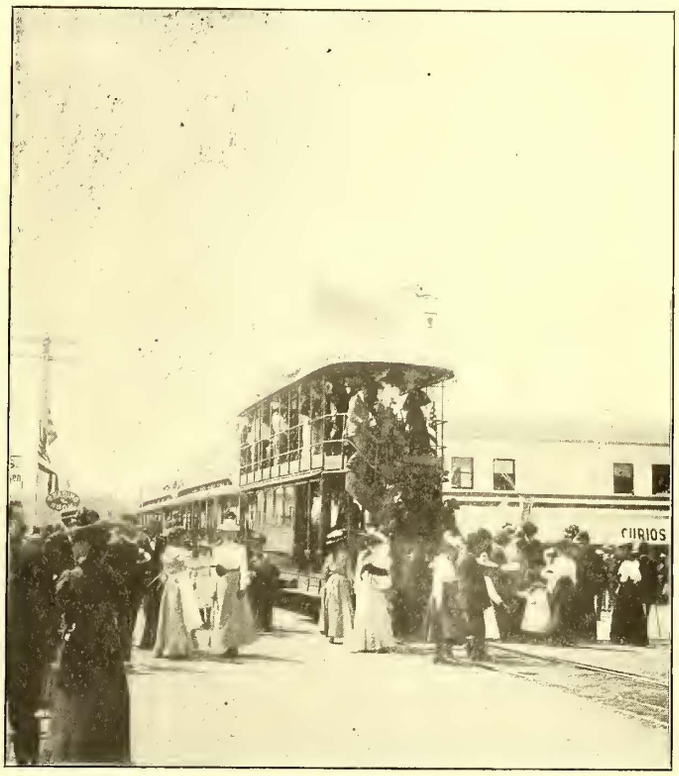


FIG. 3.—TRAIN UNLOADING AT THE PLAZA, TENT CITY—CORONADO

enough work of simply the repair nature to keep these men employed continuously, and as it would not do to hire a carpenter or a painter simply when there was work for them, and thus

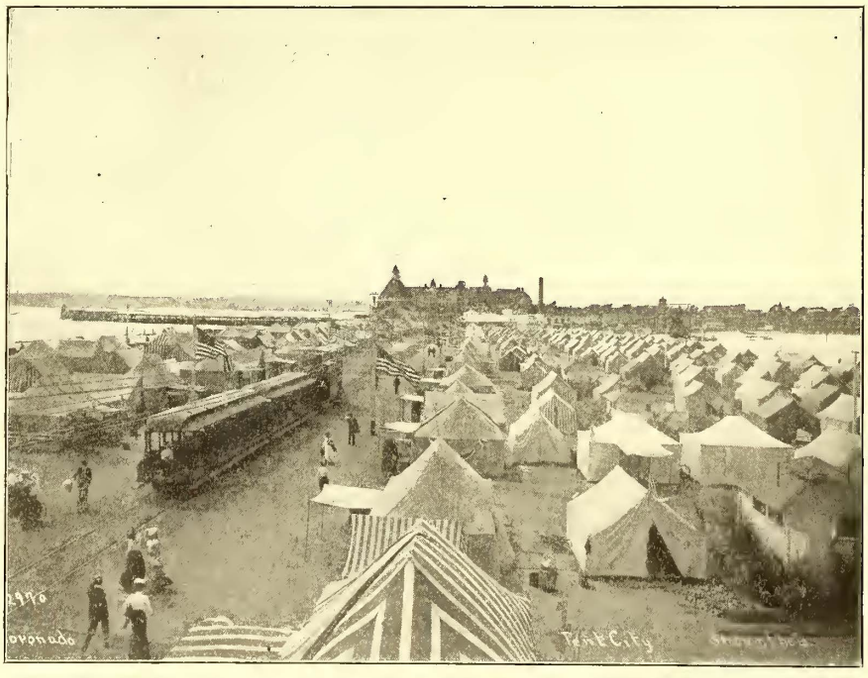


FIG. 2.—CORONADO, SHOWING TENT CITY AND HOTEL IN DISTANCE—ALSO TRAIN WITH DOUBLE-DECK CAR AND TWO SINGLE-DECK TRAILERS

be unable always to secure men experienced in car work, it was finally decided by the company to rebuild its cars and also to build new ones complete. This plan was successfully put into practice, with the result that skilled mechanics are kept constantly in the employ of the company, thus becoming familiar with its work and methods and turning out work with economy and despatch. Although it costs the company about as much to build a car as one constructed in the East, with freight charges added, the plan of building its own cars is considered

advantageous, since the company is able to build its cars exactly to suit its own local requirements. In the San Diego shop are also made all the heavy repairs for the Coronado Railroad and what work is needed for the power stations or other mechanical equipment for the allied corporations. However, no jobbing work is done in competition with local machine shops.

A factor that has helped considerably to bring the shops to

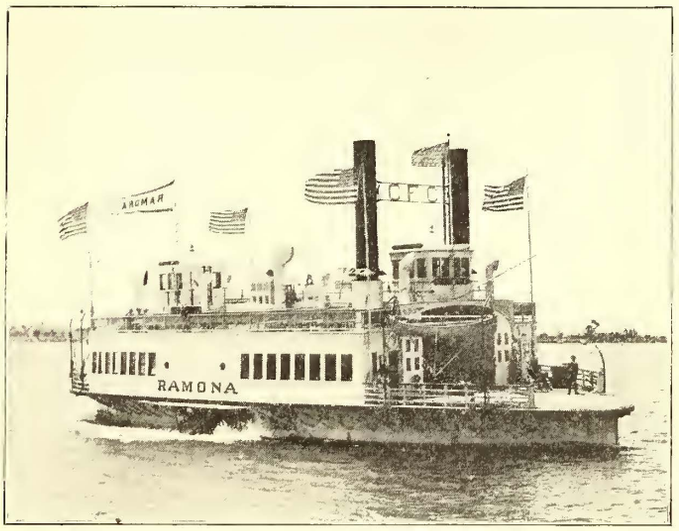


FIG. 4.—FERRYBOAT RAMONA, PLYING BETWEEN SAN DIEGO AND CORONADO.

their present state of economical operation is the policy of making all the tools and apparatus possible when it will save buying manufactured ones, or will lighten the labor of the repairmen. This policy has been developed carefully and successfully under the supervision of the company's chief electrician and master mechanic, Homer MacNutt. None of the devices described below is patented.

FIELD-WINDING MACHINE

Probably the most original apparatus in use in the shops is the field-winding machine illustrated in Fig. 7. The form for the field coil is screwed on to the extended axle of a 16-in. ground-friction wheel, which in turn is driven by a 5-in. friction wheel at the end of a cone pulley shaft. This shaft is

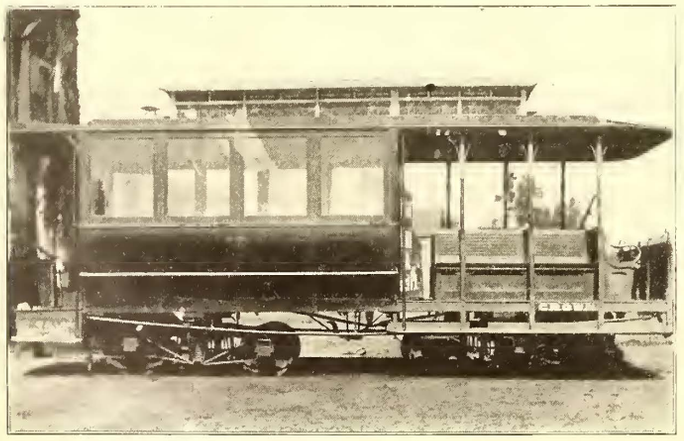


FIG. 5.—CABLE CAR USED TO FORM CAR SHOWN IN FIG. 6

normally held by a spring so that the friction wheels do not engage. When it is desired to revolve the coil the foot lever is pressed down, and this, through the medium of rods, pulls the smaller friction wheel into engagement with the larger one. When winding the heavy wire on field coils it is necessary to stop frequently so as to keep the coil in proper shape, and some form of brake is required to keep the coil from slackening or unwinding when the power is taken off. For this machine a very positive brake was devised in the shape of two dogs, which bear on the outside grooves of the large friction wheel. These dogs are hung a little above the center on independent axles, and when the wheel stops they hold it positively against reverse motion. One dog would probably be sufficient, but two are used, so as to increase the reliability of the action. Not the least important part of the apparatus is the revolution counter connected by a rod to a crank pin on the end of the large friction wheel shaft. This registers each revolution of the coil, and the operator does not have to keep track of the number of times mentally. An ordinary engine register is used for the counting device.

ELECTRIC ARMATURE OVEN

In Fig. 8 a view of one side of the main shop room are shown a lathe and thirty-lamp testing rack, and at the right an armature oven served by a swinging jib crane. Mention should be made of this oven on account of its simple construction and the ease with which the armatures are placed in it. The oven is constructed of concrete, about 4 ft. x 5 ft. ground dimensions, and 3 ft. high, with 8-in. walls. The heating coils, consisting of about 5 lbs. of No. 20 iron-tinned wire wound on grids, are placed below the floor level in a small pit, so that all the space in the oven is available for baking. The current required at 500 volts is 5 amps., and an armature can be baked thoroughly in 24 hours. A wooden door, hung with a counter-weight, covers the oven, as shown in the illustration.

The crane that serves the oven was built in the shops, and has a 12-ft. arm, on which travels a Weston triplex block. The armatures are hoisted by a steelyard arrangement with wire rope loops that are passed around the ends of the axle and hook onto the cross-piece of the steel yard.

PINION PULLER AND ARMATURE TRUCK

Fig. 9 shows a device gotten up for removing pinions from an armature shaft quickly and without injuring the pinion or the end of the shaft. It consists of a special 1½-in. x 1½-in. forging, rectangular shaped, with one end open enough to fit over the axles back of the pinion. The jaws formed by this opening bear on the rear face of the pinion. A round cap is used to fit over the thread on the end of the axle and bear against the shoulder of the axle. A slightly tapered key is then driven down in slots provided for that purpose in the cap and end of the forging, and the pinion is quickly forced off its taper. The cap protects the thread as well as the center marks on the

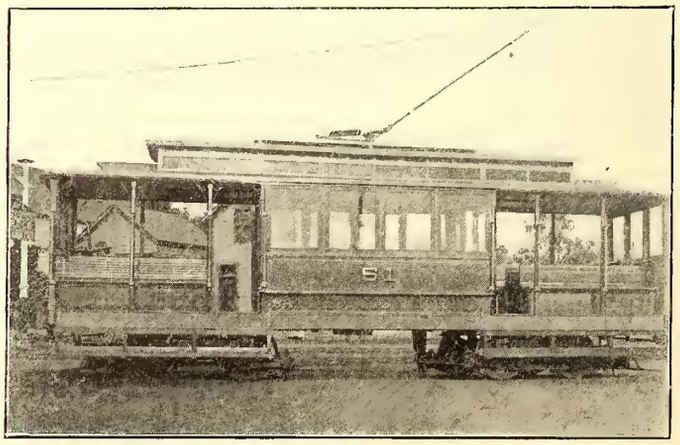


FIG. 6.—CABLE CAR REBUILT INTO ELECTRIC CAR

end of the shaft. The rectangular piece is held in place by an iron strap that fits over the pinion. As the company has pinions all of one size this puller fits them all; in the case of pinions of different sizes probably two pullers could be made to fit all.

The armature truck shown in Fig. 9 is of simple construction, and has a fifth wheel on the front axle so it can be easily moved about.

ARMATURE HORSE AND BAND WINDING DEVICE

The style of armature horse used by the company is illus-

trated in Fig. 10. This horse is mounted on truck casters, and has a swinging tray for holding tools. As shown in the picture it is fitted up for winding bands on the armature. A crank fitting over the pinion is used to turn the armature, while the band wire is pulled through a screw hand vise, that is held by means of a leather strap to a car clamp that passes under the floor of the horse and clamps on top of it at the back. This clamp fits loosely and can be easily moved sideways, so as to be kept directly under the band. The wire passes through wooden blocks held by the jaws of the vise, the latter being screwed just tight enough to give a good tension on the wire. This device is quite simple and inexpensive, and has served its purpose admirably. In order to illustrate the arrangement better in the photograph, a white insulated wire was fitted over the armature instead of the smaller iron wire used for band wiring.

ADJUSTABLE KNOCK-DOWN HORSE

An adjustable knock-down horse that is found useful in many places is illustrated in Fig. 11. It consists of two two-legged, or "A," horses, with an iron bar, ¾ in. x 4 ins., fitting into clamps at the tops. This bar is pinned in at each end with two taper pins put in from opposite sides, so that the bar cannot work loose. Traveling on the bar is a pulley which supports a tackle that may be used for any purpose decided. Different lengths of bars may be used for the horse as conditions may require. One use to which this horse is put with good results is in removing armatures and motors from the trucks of single-truck cars, a few of which the company still has in service. As these motors have to be removed through the car floor, one end of the horse is stationed inside of the car and over the trap-door in the floor, while the other end is placed outside on the platform. With this arrangement the motor can be easily raised and moved to the platform, whence it can easily be carried to any part of the shop desired.

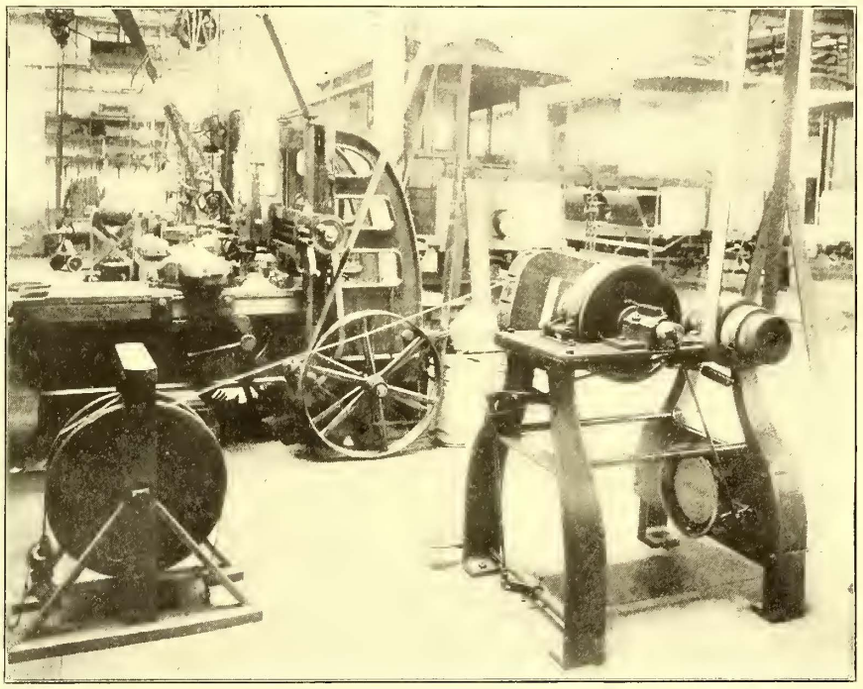


FIG. 7.—FIELD-COIL WINDING MACHINE

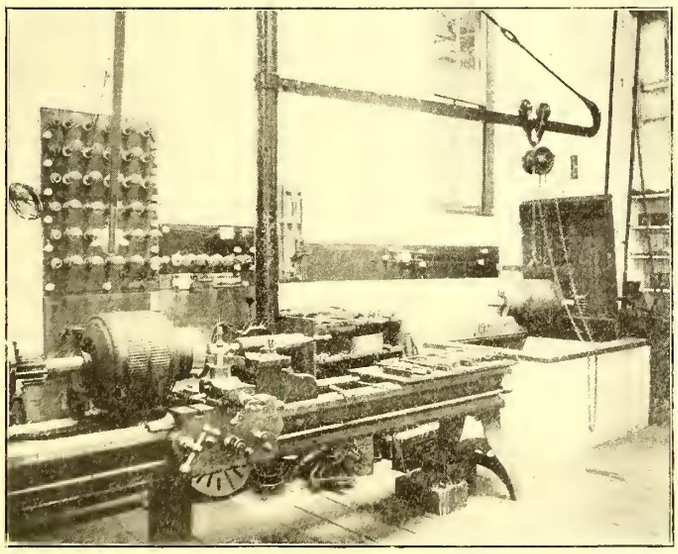


FIG. 8.—SCENE IN SHOPS, SHOWING LATHE, TESTING RACK, ARMATURE OVEN AND SWINGING CRANE

ARMATURE JACK

The armature jack shown under the horse in Fig. 11 does not differ materially from many in use throughout the country, but, from the fact that it is homemade, it deserves to be mentioned. It is formed of a piece of 6-in. iron pipe, secured to the truck by a flange on the bottom. In the top is driven, or shrunk, a cast-iron nut with a shoulder resting on the end of the pipe. In this nut runs an ordinary jack screw with a saddle or armature rest on top. The screw is turned by a rod or a hand wheel. The jack being mounted on truck casters it can be moved about anywhere in the pit.

CAR-LIFTING ARRANGEMENT

When it is desired to lift one end of a car so that a truck may be removed the arrangement illustrated in Fig. 12 is used. A hydraulic jack on a special horse is placed on each side of the car, and the two jacks are used to raise the car by means of a timber placed under the car and through the horses. When the car is lifted to the desired height the timber is held by iron pins.

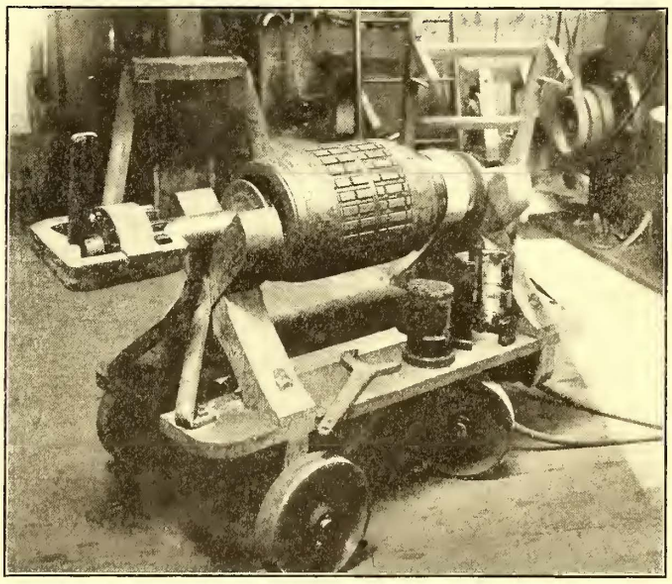


FIG. 9.—PINION PULLER AND ARMATURE TRUCK

OPERATING FEATURES

Some features in the operating department of the company are of interest. One of these is the liberal policy in the handling of the men that has been adopted on recommendation of Wm. Clayton, vice-president and managing director. On two occasions during the last two years the company has voluntarily

increased the wages of the trainmen. On July 15, 1902, the wages were raised from 20 cents to 22 cents an hour without being forced by any movement, it being deemed advisable to make the increase so as to conform more closely with the rates prevailing on the Pacific Coast at that time. Then a few months ago, after there had been considerable agitation in San Francisco and Los Angeles and other Western cities on the wage question, the wages of the San Diego men were again voluntarily raised by the company, this time to conform with the Los Angeles rate, which is 22 cents for extra, 22½ cents for regular, 23½ cents after five years, 24½ cents after ten years, and 25½ cents after fifteen years. The period of service of the men was made to date back through the preceding companies that operated in San Diego, before the present interests took hold. As a result of this broad policy the company has been free from any union and its employees work in harmony with the management.

Besides the two electric railway companies and the ferry company there are five other allied corporations in San Diego and Coronado controlled by the same interests and under practically the same management. It has been found advisable to have a mechanical board and an electrical generation and transmission board made up of the heads of departments to sit on matters of importance or of general interest to all companies. The chairman of both of these boards is the chief electrician, and the other members comprise the chief engineers of the stations and the ferryboat, electrician of the hotel company, etc. When necessary the civil engineer of the hotel company sits with the mechanical board.

There is also a board of control, made up of the vice-president, auditor, superintendent and counsel of the companies. This board confers on matters of general policy as affecting the interests of the companies, and when the matters are of a mechanical or electrical nature they are referred in turn to the other boards. After, for example, the mechanical board has carefully considered a problem, and its report is made to the vice-president, if there is need of further investigation the whole matter is submitted to the company's consulting engineer for final consideration and report. In this manner much of the preliminary investigation that a consulting engineer often has to make is saved with its necessary expense, and the engineers of the companies are made to feel that their advice is of value. Of course, it is only such matters as the remodeling of a power station, or something of equal importance that is referred to the consulting engineer.

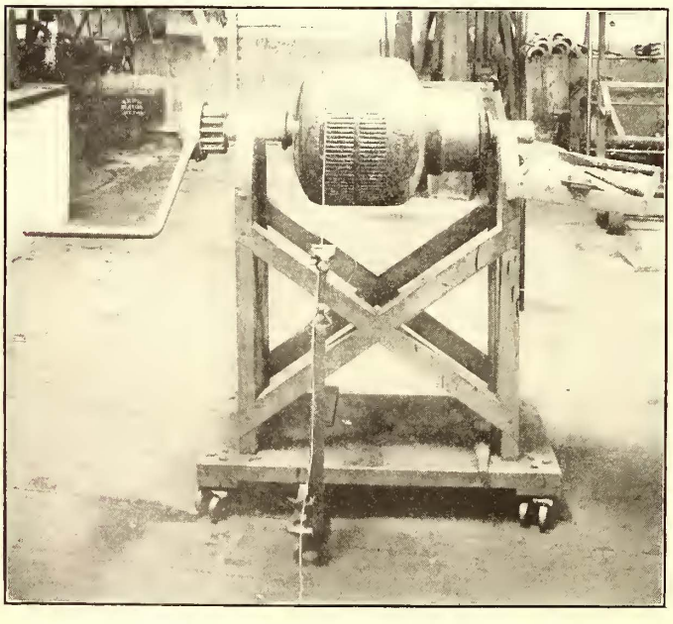


FIG. 10.—ARMATURE HORSE AND BAND-WINDING DEVICE

One effect of this careful attention to the mechanical and electrical details of the system has been the reduction of the operating cost of the main power station in San Diego. Although it is a belted plant, without modern generators, current is delivered to the switchboard at a cost of 1.1 cents a kilowatt-hour, not including interest and depreciation. Features that help this economical operation are the use of a storage battery on the peak loads and the burning of oil with an improved burner, which atomizes the oil by air pressure. It is also of interest to note that a burner is placed at the rear of the boiler furnace as well as one at the front, thus giving a uniform flame.

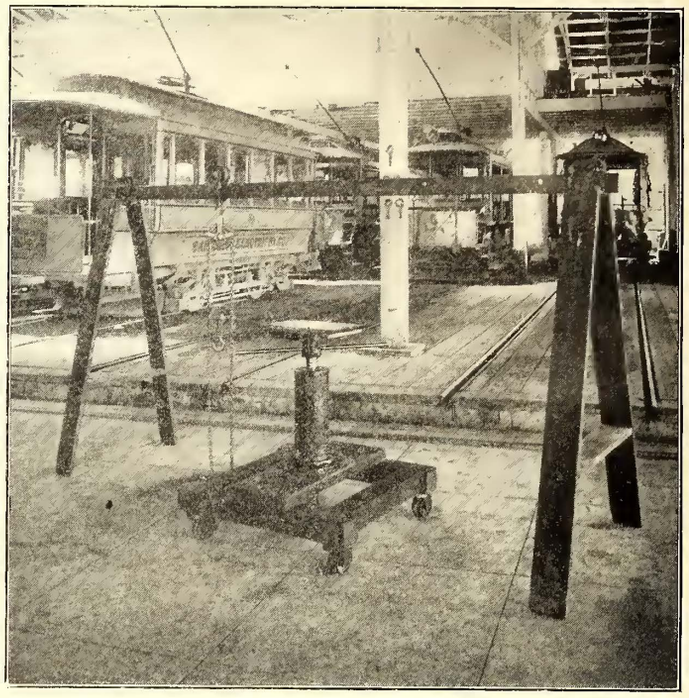


FIG. 11.—ADJUSTABLE AND KNOCK-DOWN HORSE AND ARMATURE JACK

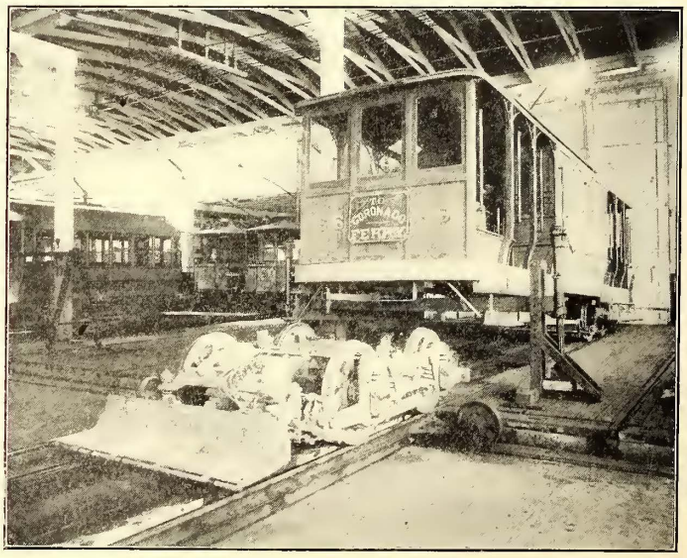


FIG. 12.—CAR LIFTING ARRANGEMENT—SAN DIEGO ELECTRIC RAILWAY COMPANY

With attention to such details as this the company is enabled to operate its cars at a gross expense of 11.97 cents per car mile. In the matter of car oiling the company has recently adopted Galena oil for all purposes, journals as well as motors, with a net cost of 7.9 cents per 1000 car miles, or about 1 cent per car per day.

A very complete system of reports on the various properties is made up monthly in the office of the vice-president and managing director, to be submitted to the president and directors. These include an operation report which is accompanied by an itemized report listing materials and supplies used and labor charged, so that any unusual item in the operation report may be quickly traced and explained. Mr. Clayton also sends in with the report a personal report, which precedes the other in importance and calls attention to important work of the month.

A vertical filing system has been devised by Mr. Clayton for preservation of office correspondence and records that has several good features. All correspondence referring to a certain subject is placed in an envelope of letter size, such envelopes being numbered consecutively and filed vertically in a large drawer. Then these envelopes are indexed in a subsidiary index which is made up in the loose leaf form. Each page has columns for the envelope number, date of correspondence, location (whether in the file or one of two or three vaults), "Subject" and "Remarks." Under "Subject" is cited briefly the nature of the correspondence, the explanation being sufficient to determine exactly the nature of the contents of the envelope, while under "Remarks" is given further information if necessary. Then a Schlicht's standard expanded index is used to index in abbreviated form all the subjects alphabetically.

When one is desirous of looking up a matter, reference is made to the expanded alphabetical index, which, under a certain head, such as "Transfers," may give four or five numbers of envelopes. Of course, reference could be made directly to these envelopes, but the subsidiary index is provided to save time, as by quickly referring to the numbers in this special index the number of the envelope desired is quickly determined. The pages of the subsidiary index, being loose, can be easily removed and kept up to date, new pages being inserted as necessary for new subjects or additions to the existing ones. The subsidiary index is the special feature that makes the system valuable and convenient for reference.

The officers of the San Diego Electric Railway Company include the following-named gentlemen: President, A. B. Spreckels; vice-president and managing director, William Clayton; secretary, treasurer and attorney, Harry L. Titus; general superintendent, B. M. Warner; purchasing agent, George Holmes; auditor, A. H. Kayser; chief electrician and master mechanic, Homer MacNutt. The Coronado Railroad Company has the same officials except that J. D. Spreckels is president. Charles McLagan is chief engineer of the San Diego Company.

SHOP KINKS ON THE WESTERN OHIO

G. H. Kelsay, master mechanic of the repair shops of the Western Ohio Railway Company, at Wapakoneta, Ohio, has recently added to the equipment of his shop several interesting devices. The accompanying plan (Fig. 5) shows the arrangement of the various tools in the shop as well as the various departments in the building, which includes the despatcher's office, motormen's and conductors' room, store room, oil house, etc.

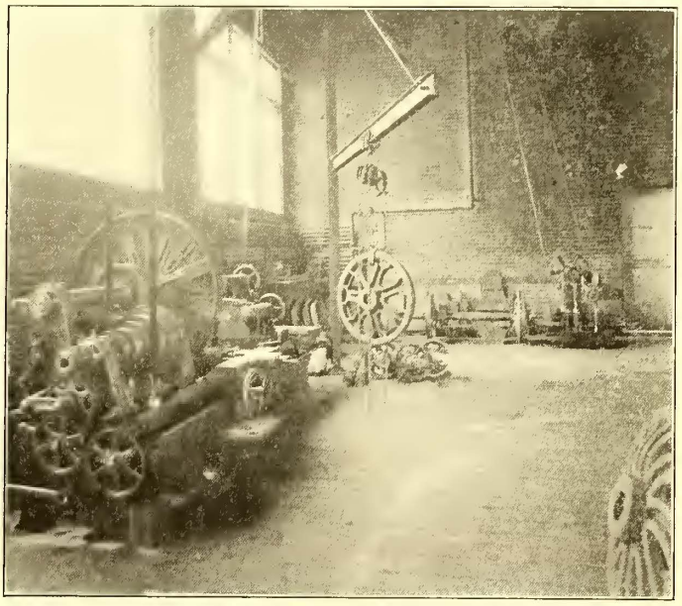


FIG. 3.—WHEEL LATHE AND GRINDER SERVED BY JIB CRANE

One of the most ingenious appliances in the repair shops is the transfer table shown in Fig. 2, and is designed to remove the trucks from the car body by taking them out at the side, which requires less time than hoisting the car and taking them out at the end. The table is also designed to hoist the car body as well as to move sideways. This is accomplished by fitting the table at the center with a pneumatic lift, having a vertical motion of about 10 ins., and which works telescoping in a frame dropped from the main frame of the transfer table. The lower end of this hoist can be seen in the view underneath the table. Air for operating the pneumatic hoist is taken from a 100-in. tank, which supplies the various pneumatic devices in the shop.

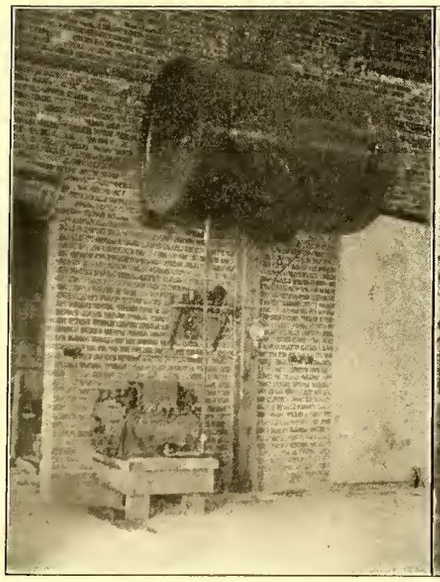


FIG. 1.—COMPRESSOR AND RESERVOIR

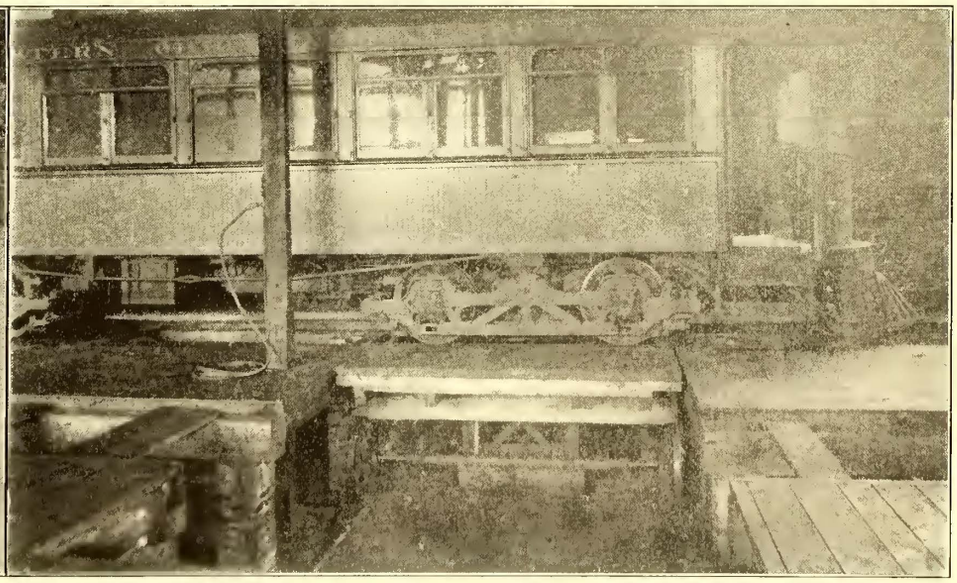


FIG. 2.—TRANSFER TABLE AND HOIST FOR CHANGING TRUCKS

In removing a truck from a car the truck is first located at a central position on the table. The table, truck and end of the car are then hoisted about 10 ins. Two 6-in. x 6-in. planks are then slipped under the end sills of the car to support the car

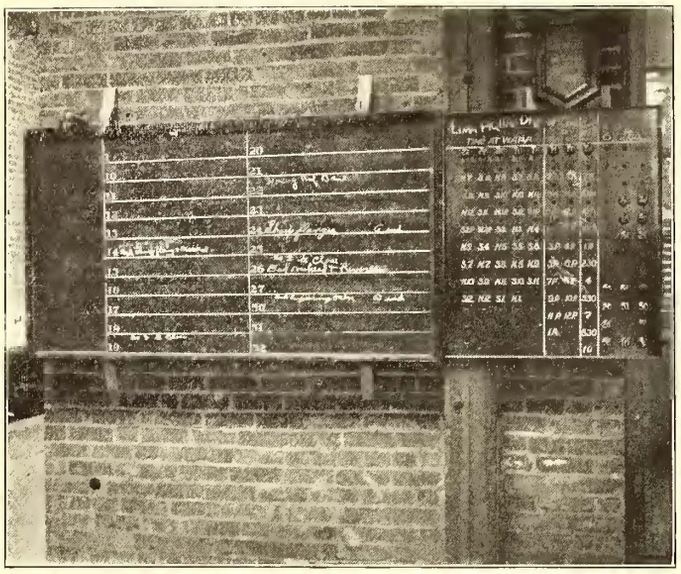


FIG. 4.—BLACKBOARD FOR RECORDING PROGRESS OF CARS IN SHOP

body, and rest on a frame work across the pit track. The transfer table is then dropped to its normal position, the brake rods and cables disconnected and the transfer table, with the trucks, are pushed out. As the transfer table is light and runs easily, it was not thought necessary to install machinery to move the table. All inspection and cleaning of trucks and motors, except the daily inspection, is done by removing the trucks in this way. If any extensive repairs are required the truck is run on to another truck and a new truck is substituted.

Air is used extensively in shop work, and in the view of the transfer table can be seen one of the air plugs with hose attached. The air compressor outfit (Fig. 1) is located in the front part of the shop, and consists of a 7-hp Christensen motor-driven compressor, supplying a 100-in. tank suspended from the roof. The compressor motor is controlled by the usual automatic starting switch. It is the intention to build a testing table adjoining the compressor outfit for testing gages, valves and whistles.

Wheels are bored on a double-spindle McCabe lathe, 26-in. and 48-in. swing. The illustration (Fig. 3) shows a wheel ready to go into the lathe. Boring wheels in a lathe saves a large investment for a boring mill, and the tool may be kept busy with other work as well. They are able to turn out wheels at a very fair rate; the best time made in centering wheel, boring and taking it out was 55 minutes, the wheel being faced and bored to 5 ins. from a 4½-in. sand core. Adjoining and at right angles to the lathe mentioned is a heavy wheel press, and a 3000-lb. swing crane covers both tools. The center of the shop is covered by a 4-ton traveling crane, and the swing crane mentioned swings in the field of the traveling crane, making it possible to take a load from one crane to the other. There is a wheel and axle storage track on the side of the building adjoining the wheel press and lathe, and wheels are rolled in through a door where they may be reached by the swing crane.

The machine shop contains the following tools: Wheel press, 26-in. and 48-in. double spindle lathe, 18-in. and 10-ft. bed lathe, radial drill, 13-in. sensitive drill, grindstone, emery wheel, No. 4 power hack saw, diverter winding machine, air compressor and 4-ton traveling crane. The carpenter shop contains a saw bench, 30-in. surfacer and a 16-in. wood lathe.

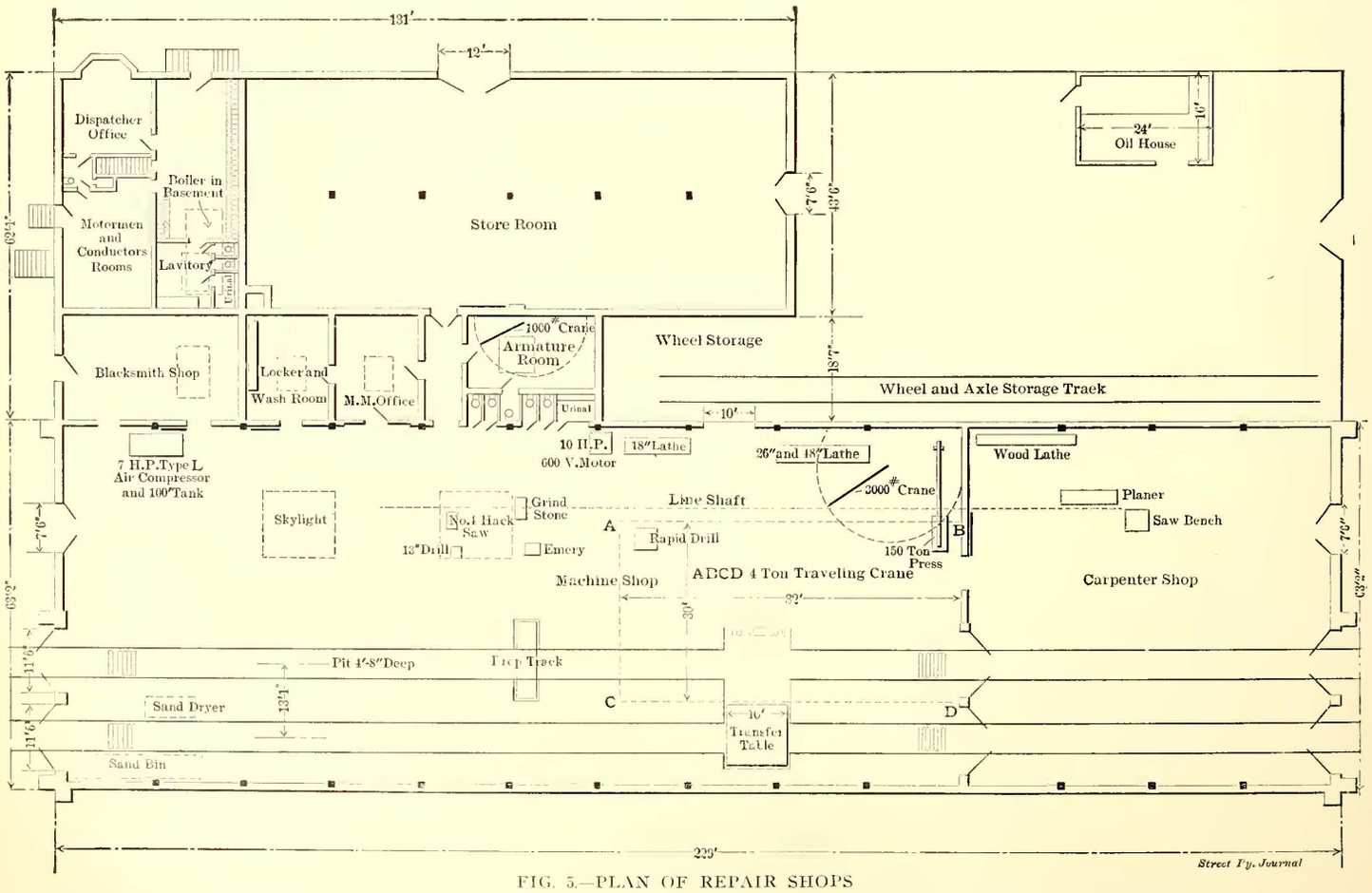


FIG. 5.—PLAN OF REPAIR SHOPS

For keeping track of cars Mr. Kelsay has designed the blackboard shown in Fig. 4. The left-hand section contains the number of the cars with a space adjoining each number for a record of trouble, which is telephoned in to the master mechanic or reported to the despatcher. The right-hand sections show

when cars on the three divisions of the road will be at points nearest the repair shop. For example, the first column shows that car No. 22 has the first run on the Lima-Piqua division, and will pass Wapakoneta going south at 4 a. m., north at 7 a. m., south at 9 a. m., and so on. The second list shows when the cars on the Wapakoneta-Celina division are due at Wapakoneta, while the third division shows the time that cars on the St. Mary's-Minister division are due at St. Mary's, the point nearest Wapakoneta. It will be noticed that there chalk lines cross, connecting the two last mentioned divisions. This indicates that Car No. 17, an express car, alternates on the two divisions. The last column shows the extra cars and those that are in the car house or repair shop.

GENERATING AND DISTRIBUTING SYSTEM OF THE BROOKLYN RAPID TRANSIT COMPANY

In a paper recently presented before the Brooklyn Engineers' Club, Charles B. Martin, first assistant electrical engineer of the Brooklyn Rapid Transit Company, presented some interesting statistics of the generating and distributing system of the company.

Both direct and alternating-current generation and distribution are used. All the latter, with the exception of that purchased from the Edison Company, is developed at the central power station of the company, located on Third Avenue and Second Street, and described in the STREET RAILWAY JOURNAL for Oct. 5, 1901, and Feb. 14, 1903. In this station there are also two direct-current 2700-kw units.

The direct-current stations and their capacities are as follows:

	KW
(1) Kent Avenue	11,900
(2) Central Station	5,400
(3) Southern Station	4,800
(4) Third Avenue	4,400
(5) Thirty-Ninth Street	3,500
(6) Brooklyn Bridge	800
Total	30,800
Alternating-Current Stations—	
Central	16,200
Sixty-Fifth Street (Edison)	2,850
Total	19,050

The overhead feeder system of the company consists of 700 miles of 500,000 circ. mils and 13 miles of 1,000,000 circ. mils weather-proof wire; 40 miles of 1,000,000 circ. mils and 3½ miles of 2,000,000 circ. mils lead-covered underground wire. For the high-tension circuits connecting from the central and Edison stations to the various sub-stations, 65 miles of cables have been installed. The company has the following sub-stations:

Halsey	6,000
Bridge	5,000
Tompkins	3,500
Essex	3,000
Coney Island	3,000

There is in process of completion a sixth sub-station at Parkville with a capacity of 2000 kw.

Owing to the large summer traffic to the shore routes in the outskirts of Brooklyn, several of the sub-stations are located at or near these points; direct-current boosters are also largely employed. A total of thirteen sub-stations are contemplated and are to be erected as the city develops. During the winter some of the apparatus in these outlying stations is moved into the congested districts and thus made to follow the load.

The tracks are bonded with two No. 0000 bonds in the outlying sections, but near the stations and sub-stations this is increased to six No. 0000 bonds. Wherever special work is encountered two 500,000-circ. mil wires per rail are placed around it. The elevated structures are also fully utilized for the return circuit. The Brooklyn "L" structure having four longitudinal girders is regarded as equal to 22,500,000-circ. mil wires; whereas, the Kings County, having but three girders, is equal to but 16,000,000-circ. mil wires. These girders are bonded with either one 1,000,000-circ. mil or two 2,000,000-circ. mil bonds, in accordance with their nearness to a station or sub-station.

In closing, the speaker presented two load diagrams showing the different characteristics of a week-day and a Sunday load. In the former, that for May 6, there are two pronounced peaks. The evening peak begins to decrease at 7:15 p. m., but does not reach its lowest point until about 4:30 a. m. It remains at low ebb until about 5:15 a. m., when the cars are started out for the morning load. The morning maximum is reached at about 8:15 a. m., but it does not follow that the greatest number of passengers are in the cars at that hour, for while the cars going to New York are well filled, there is added the load of returning empty cars, and this accounts for the lateness of the morning peak. The load then gradually falls off but turns between 1 o'clock and 2 o'clock, becoming maximum at 6:15 p. m. (about 73,000 amps.), and this maximum is greater than in the morning, due to the greater concentration of traffic.

The load diagram for a May Sunday has an entirely different characteristic. There is but one maximum peak, and that varies between 75,000 amps. and 80,000 amps. between 2:45 p. m. and 8:30 p. m. The Sunday maximum is invariably reached at 4 o'clock in the afternoon.

Reasoning from the week-day diagram it might be thought that the generating apparatus designed to stand a heavy overload for one hour would be suitable for this system, but, as has been stated, the Sunday maximum load exists at times for six hours, and, consequently, the generating apparatus must be able to stand full load for practically an indefinite period.

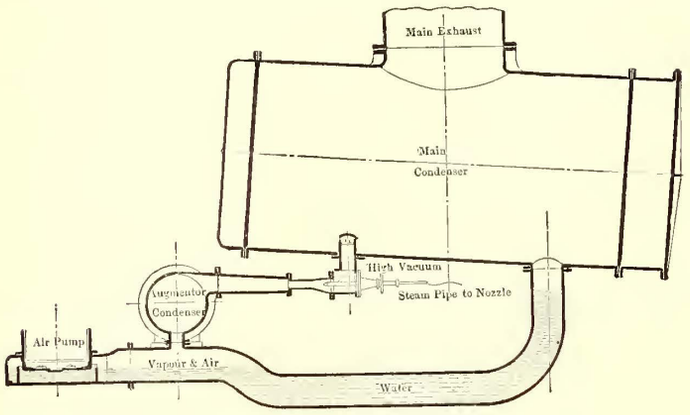
ENGLISH RECORDS OF PARSONS STEAM TURBINES

In a paper read before the May meeting of the British Institution of Electrical Engineers, the Hon. Charles A. Parsons presented some interesting figures on turbine economy. Referring to machines of his design he states that under the conditions of, say, 140 lbs. steam pressure, 100 degs. F. superheat and a vacuum of 27 ins. with the barometer at 30 ins., the steam consumption of turbo-generators are, in round numbers, as follows:

A 100-kw plant takes about 25 lbs. of steam per kilowatt-hour at full load, which figures become 22 lbs. for a 200-kw plant; 20 lbs. for one of 500 kw; 19 lbs. for one of 1000 kw; 18 lbs. for a 1500-kw plant, and 16 lbs. for a 3000-kw plant. These figures are based upon averages of a large number of tests which have been made from time to time. Without superheat the consumptions are about 10 per cent more, and each 10 degs. F. superheat up to about 150 degs. F. affects the consumption by about 1 per cent.

Every inch of vacuum between 23 ins. and 28 ins. affects the consumption on an average of about 3 per cent in a 100-kw machine, 4 per cent in a 500-kw machine, and 5 per cent in a 1500-kw machine, the effect being more at high vacua than at low. The maintenance of a good vacuum necessitates a suitable condenser, which implies sufficient tube area and also ample way for the steam between the tubes; proper velocity of water in the tubes; sufficient supply of cooling water and a sufficient means of cooling the condensed water so as to keep the air pump cool, and full provision for extracting by the air pump and other means the inevitable small quantity of air which must leak in. It is stated that by attention to these requirements it is unnecessary to increase the size of the condenser beyond

that used in ordinary practice. In the case of the most recent condensers for steam turbines, from 10 lbs. to 12 lbs. of steam is condensed per square foot per hour, at which rate of condensation a vacuum may be obtained at from 27½ ins. to 28 ins. at full load. The amount of cooling water generally allowed is about fifty times the full load steam consumption, which will increase the vacuum under normal conditions by about ¾ in. or 1 in. over that obtained by the usual circulating allowance of thirty times the steam used. With a proper arrangement of pipes and condensers in a plant taking 18 lbs. of steam per kilowatt-hour and assuming 50 per cent efficiency in the pump and motor, the power used by the circulating



VACUUM AUGMENTER

pump is only 1 per cent; by circulating water thirty times the steam consumption it would be .6 per cent, which small reduction is not to be compared with the gain of 4 per cent or 5 per cent in the turbine by the use of increased circulating water.

The paper described a vacuum augmenter which has recently been introduced and which is illustrated. A pipe is led from near the bottom of the main condenser to an auxiliary condenser, having generally about 1-20 the cooling surface of the main condenser. In a portion of this pipe a small steam jet is placed which acts in the same way as a steam exhauster and sucks nearly all the residual air and vapor from the condenser and delivers it to the air pumps. A water seal is provided, as shown, to prevent the air and vapor from returning to the condenser. With this arrangement, if there is a vacuum of 27½ ins. or 28 ins. in the condenser, there may be only about 20 ins. in the air pump, which, therefore, need only be of small size, the jet compressing the air and vapor from the condenser to about half or less of its original volume. The steam jet used only about 1½ per cent of the quantity of steam used by the turbine at full load. Condensation takes place in the condenser much more rapidly and effectually if the air is thoroughly extracted.

In low-voltage alternators rotating armatures are preferable, as the iron and copper losses are much less, especially where there are only two or four poles, but rotating armatures, although satisfactory for 500 volts to 2000 volts, have not been found suitable for the higher voltages of 6000 and 10,000 which are now common, and, therefore, rotating fields and fixed armatures have been adopted in many of the recent alternators. For direct-current dynamos the same remarks apply, only here sparkless commutation has to be provided for. Carbon brush blocks cannot be used, as at these speeds the brushes are apt to vibrate, and so diminish the intimacy of contact and cause heating and undue wear. The result is that it has been found best to form the brushes of wire, gauze or foil, preferably of brass, and these must be sufficiently flexible to maintain a good contact with the commutator over the whole section of the brush. It follows, therefore, that the properties of the carbon brush blocks in giving sparkless commutation without alteration in the lead of the brushes, cannot in turbine-driven dynamos be utilized, and other means must be adopted to secure sparkless commutation at varying loads. One way is to shift the brushes automatically according to the change of load, and this can be effected by connecting the brush gear to a steam cylinder controlled by a spring and supplied with steam from the point where the steam enters the turbine. At this point the pressure of the steam is proportional to the load of the dynamo, and therefore the piston in the steam cylinder being controlled by a spring proportional to the load, and thus shifts the brushes to the point of sparkless commutation. Another method is to provide commutating poles as proposed by Prof. Ryan and others, but the best method is to provide compensating winding as proposed by Prof. Forbes, Deri, etc. By these means, with the improvements recently adopted, absolutely sparkless commutation can be secured with fixed brushes, up to, in plants for traction purposes, 100 per cent overload.

Up to the present there are about 600,000 hp of turbines of the Parsons type at work and on order in England and on the Continent, in various sizes ranging up to 7000 kw.

The following tests of different sized turbines are quoted in the paper:

TEST OF PARSONS TURBINES

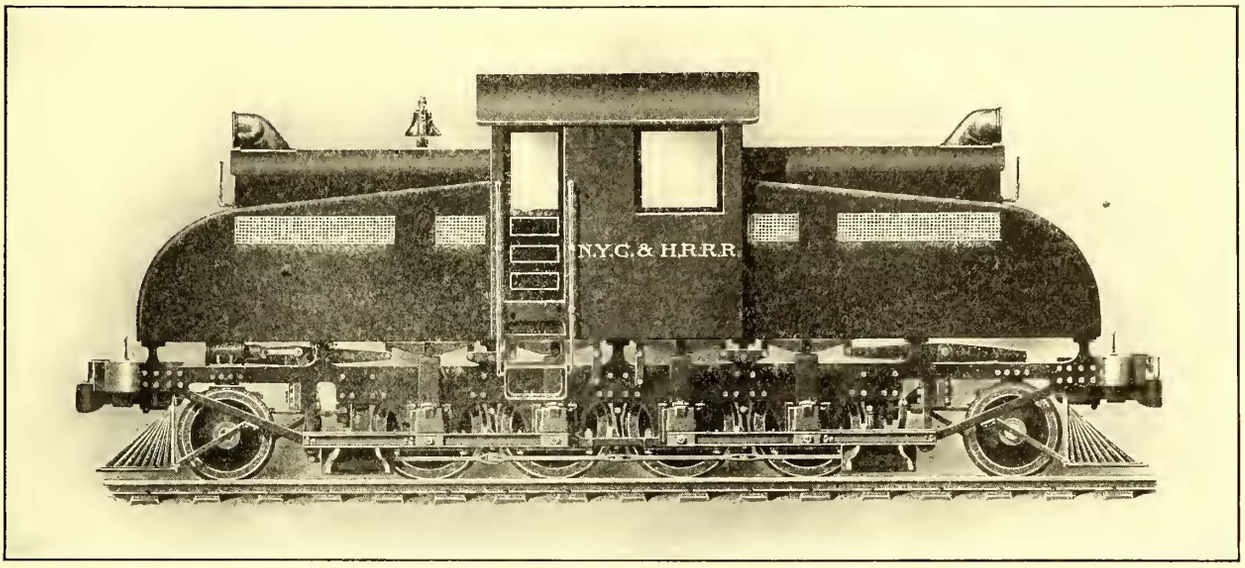
	Steam Pressure at Stop Valve	Superheat. F°	Vacuum, Inches	Speed, Revs. per Minute	Load in Kw	Pounds Steam per Kw hr.
75-kw d. c. Turbo-Generators—Banbury.	141.2	84.2	27.1	4,140	75.7	26.4
	144	0	27.0	4,140	75.2	29.2
	142	0	27.1	4,140	56.6	31.2
135-kw Turbo-Generator—Findlay, Durham & Brodie	150.8	99.0	27.15	3,600	138.3	22.8
	151.0	81.0	27.3	3,600	66.9	27.6
200-kw d. c. Turbo-Generator—Shipley	150	57	27	3,000	204.2	22.23
	151	55	27.9	3,000	101.2	26.67
	156	181	27.3	3,000	202.5	20.39
	151	166	28.0	3,000	100.27	24.41
375 kw Turbo-Generator—Dundee	152.9	----	27.4	3,000	376.9	21.6
	149.4	148.9	27.5	3,000	374.06	19.25
350-kw Turbo-Generator—Pennsylvania Salt Co	150	71.3	27.82	3,360	359.5	20.64
	152	65.7	28.27	3,151	185.5	23.44
	140.2	92.3	17.4	3,430	353.5	25.54
	143.4	82.5	17.4	3,255	177.2	32.26
300-kw Turbo-Generator—Hulton Colliery	161.0	0	0	3,000	296.6	34.2
	158.0	0	15.33	3,000	297.4	29.36
	157.0	0	19.33	3,000	305.1	27.43
	152.0	0	22.33	3,000	303.4	25.59
	154.0	0	25.33	3,000	303.15	24.19
	158.0	0	26.58	3,000	303.2	23.15
300-kw Turbo-Generator—De Beers Explosives Works	150.0	53.3	27.88	3,000	312.1	20.06
	153.0	50.0	27.78	3,000	231.8	21.45
	150.5	40.2	27.9	3,000	154.5	23.75
1500-kw Turbo-Alternator—Newcastle-on-Tyne	196	76	27.45	1,200	1,442	18.0
	197	84	27.35	1,200	1,015.5	19.8
	196	76	27.95	1,200	714.0	21.4
	199	77	28.35	1,200	360.5	25.2
	200	68	28.45	1,200	------	----
After 16 months' use the following figures were obtained	203	92	26.11	1,210	1,823	17.7
	207	66	26.46	1,208	1,513	18.23
1500-kw Turbo-Generator—Sheffield Corporation. With Vacuum Augmenter and including 450 lbs. steam per hr. used by it	113.6	108.3	26.69	1,455	1,316.5	18.75
	111.6	156.4	27.12	1,500	1,061.6	18.66
	141	113	27.72	1 500	512.7	22.3
	154	47.5	27.72	1,500	0	0
Without Vacuum Augmenter	115.6	143	25.18	1,500	1,029.3	20.7
	137	119	25.97	1,500	534.25	24.02
	150.3	72.4	26.62	1,500	0	0
250-kw d. c., Messrs. Guinness, Son & Co.		Non-C	ondens	ing T	urbines	
	144	0	0	3,047	251.55	37.80
	142.6	0	6	3,047	255.82	41.38
	138	0	11.1	3,055	253.15	44.15
	143	0	11.0	3,115	125.45	59.58
500-kw Turbo-Generator—Metropolitan E. S. Co	142	0	0	1,800	506.2	33.39
	147	0	15.67	1,800	509.06	29.07
	144	0	18.57	1,800	514.9	28.33
	145	0	20.67	1,800	512.2	27.22
	146	0	22.57	1,800	509.85	26.89
	154	0	0	1,800	0	----
	151	0	26.1	1,800	0	----

The Detroit, Monroe & Toledo Short Line Railway has begun through service between Toledo and Sibleys. At Sibleys, passengers will be transferred to the lines of the Detroit United Railway for Detroit. The running time from Toledo to Sibleys, which is 19 miles from the center of Detroit, is two hours.

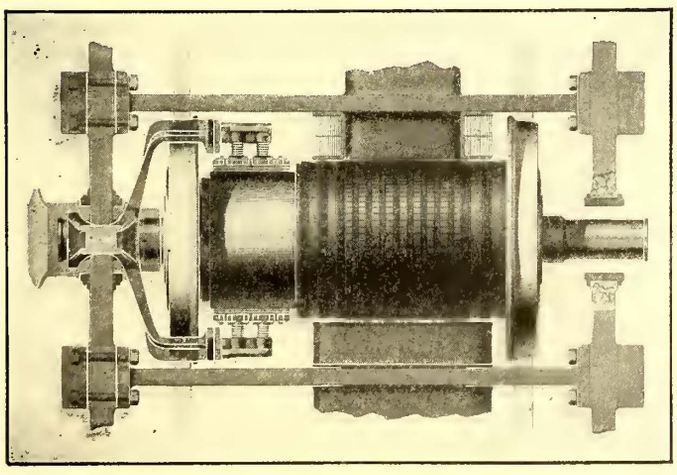
THE NEW YORK CENTRAL ELECTRIC LOCOMOTIVE

The new electric locomotives which are being built for the New York Central & Hudson River Railroad Company, at Schenectady, by the General Electric Company and the American Locomotive Company, differ radically in their electrical features from any electric locomotive hitherto constructed.

The motors are bipolar gearless, the magnetic circuit, the field windings and the motor poles being integral with the locomotive frame and spring supported. The pole faces, which are laminated, are vertically tangential to the armature, thus providing for vertical movement of the locomotive frame with attached poles without affecting the armature air gap. The armature is assembled on a quill, which is pressed solidly on the axle. The dual weight of the assembled rotating part, including the armature, axle and wheels, is less than on many steam locomotives, and there being no uncompensated reciprocating parts there is a perfect rotative balance.



SIDE VIEW OF ELECTRIC LOCOMOTIVE



PLAN VIEW OF MOTOR

This design was submitted in accordance with specifications prepared by the Electric Traction Commission appointed by the railroad company, the members of which are William J. Wilgus, fifth vice-president, New York Central & Hudson River Railroad; John F. Deems, general superintendent of motive power of the railroad company; Bion J. Arnold, Frank J. Sprague and George Gibbs. The secretary to this commission is Edwin B. Katte, electrical engineer of the railroad company.

The commission, after careful deliberation, had prescribed the conditions which must be fulfilled by electric locomotives taking the place of steam locomotives as far as Croton on the Hudson River line and as far as North White Plains on the Harlem division, a distance of 34 miles and 24 miles, respectively.

The conditions were, briefly, that the successful bidder should furnish an electric locomotive capable of making two regular successive trips of 1 hour each between Grand Central Station and Croton, with a total train weight of 550 tons, a single stop in each direction and a lay-over not to exceed 20 minutes. In addition to this it was provided that a similar schedule should be maintained with somewhat lighter trains making more frequent stops. Finally, it was provided that with a total train weight of 435 tons, the electric locomotive should be able to run from Grand Central Station to Croton without stop in 44 minutes, and, with 1 hour lay-over, be able to keep up this service continuously. This last schedule is the equivalent of the present timing of the Empire State Express, though the latter has a somewhat lighter train.

Specifications embodying these conditions were prepared by the commission and sent to all the principal electrical manufacturing companies both here and abroad. It will be observed that no restriction was placed on bidders as to whether direct or alternating current was to be used. The successful bidders were the General Electric Company in conjunction with the American Locomotive Company. The choice of a direct-current type of locomotive was dictated largely by its known reliability of service, owing to the amount of experience which had been accumulated with the direct-current motor.

The new electric locomotive will be 37 ft. in length over all. The wheel base will consist of four pairs of motor wheels and two pairs of pony truck wheels, the length of the total wheel base being 27 ft., and of the rigid wheel base, consisting of the four pairs of motor wheels, 13 ft. The diameter of the driving wheels will be 44 ins., and of the truck wheels 36 ins. The driving axles will be 8½ ins. in diameter. It will be what is known as a double ender and will weigh approximately 190,000 lbs.

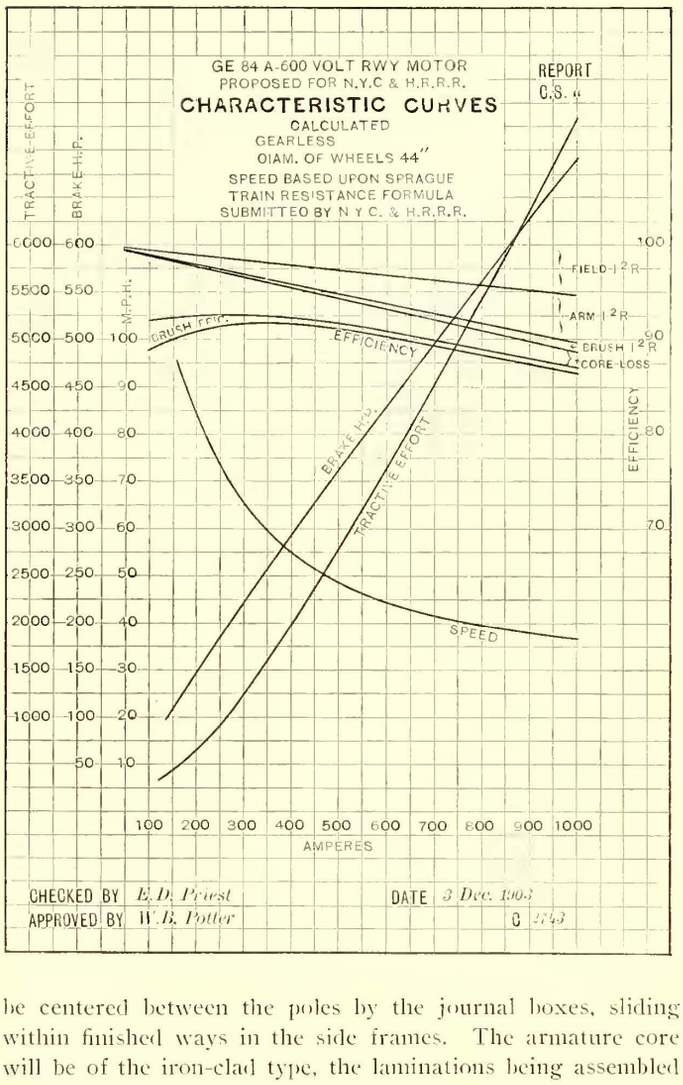
The frame will be of cast-steel, the side and end frames being bolted together at machined surfaces and stiffened by cast-steel cross transoms. The journal boxes and axles will be designed to permit sufficient lateral play to enable the locomotive to pass easily around curves of 230-ft. radius.

The superstructure of the locomotive is to be of steeple form, so designed as to offer the least practicable wind resistance

consistent with the adequate housing of the apparatus and its convenient operation. The cab is designed so as to afford a clear view of the track. The whole of the superstructure is to be of sheet steel with angle-iron framing, and the doors and windows of the cab are to be fireproof.

The driving power of the locomotive will be furnished by four 600-volt direct-current gearless motors, each of 550 hp. This will make the normal rating of the locomotive 2200 hp, with a maximum rating of about 2800 hp, or about 50 per cent greater than that of the largest steam passenger locomotives now in service.

The armatures will be mounted directly on the axles, and will



be centered between the poles by the journal boxes, sliding within finished ways in the side frames. The armature core will be of the iron-clad type, the laminations being assembled on a quill which will be pressed on the axle. The winding will be of the series drum-barrel type. The conductors will be designed so as to avoid curents, and will be soldered directly into the commutator segments.

The commutator will be supported on the quill. The commutator segments will be made of the best hard-drawn copper, and will have the ears integral with themselves. The brush holders will be made of cast-bronze and mounted on insulated supports attached to the spring saddle over the journal, maintaining a fixed position of the brush holder in relation to the commutator.

Unlike the ordinary four-pole motor, where the magnetic circuit is made through a separate box casting, the magnetic circuits in this type of electric locomotive are completed through the side and end frames. The pole pieces are cast in the end frames, and there are also double-pole pieces between the armatures carried by bars which act as part of the magnetic circuit.

The pole pieces will be shaped so that the armature is free to move between them with ample clearance on the sides. As the poles move up and down with the riding of the frame on the springs, they will always clear the armature, and provision is made so that the armature will not strike the pole pieces even if the springs are broken. The field coils will be wound on metal spools bolted to the pole pieces, and will consist of flat copper ribbon.

The Sprague-General Electric multiple-unit control will be used on this type of electric locomotive. There will be two master controllers in the cab, so placed that the operating engineer looking ahead will always have one of these under his hand. The control system will permit two or three locomotives to be coupled together in any order in which they happen to come, and to be operated as one unit by the engineer in the leading cab.

The control system will also be semi-automatic in its action, as it will provide a check on the rate of acceleration of the train, which the engineer cannot exceed, while he may accelerate at any slower rate if he so desires. Should two locomotives break apart the control current will be automatically and instantly cut off from the second locomotive without affecting the ability of the engineer in charge to control the front locomotive under his charge. The control system is designed for a minimum of 300 volts and a maximum of 750 volts.

The weight which will rest upon each of the driving wheels of the electric locomotive will be about 17,000 lbs. Proper distribution and division of the weight among axles will be accomplished by swinging the main frames from a system of elliptical springs and equalizing levers of forged steel, the whole being so arranged as to cross equalize the lead and furnish three points of support.

The locomotive will be provided with all the usual accessories of a steam locomotive, including an electric air compressor to furnish air for the brakes, it will have whistles, a bell and an electro-pneumatic sanding device and electric headlights at each end. The interior of the cab will also be heated by electric coils.

In actual performance this locomotive is expected to give better results than any engine hitherto placed upon rails. With a light train the locomotive is expected to give speeds up to 75 m. p. h., and with heavier trains similar speeds can be attained by coupling two locomotives together and working them as a single unit. Its tractive force will be greater than that of any passenger locomotive now in existence, and it is believed that in the simplicity and accessibility of its parts and in the provision made in its design to insure continuous operation with the minimum chances of failure, that it marks an entirely new and successful type of electric locomotive.

RECENT IMPROVEMENTS IN THE CURTIS STEAM TURBINE

In a paper read last week before the American Society of Mechanical Engineers, W. L. R. Emmet described certain details of and improvements in the Curtis steam turbine which had hitherto not been made public.

The step bearing consists of two cast-iron blocks, one carried by the end of the shaft and the other held firmly in a horizontal position and so arranged that it can be adjusted up and down by a powerful screw. The lower block is recessed to about half its diameter, and into this recess oil is forced with sufficient pressure to balance the weight of the whole revolving element. The amount of oil required is small. About 5 gals. per minute is used in the 5000-kw machine, but with a good alignment it could be satisfactorily operated with a much less amount. The oil, after passing between the blocks of the step-bearing, wells upward and lubricates a step-bearing supported by the same casting. This whole structure is inside of the base, and a packing is used between the oil chamber and

the base, so that oil or air cannot get into the vacuum chamber. A small steam pressure is maintained between the sections of this packing, in order that these objects may be accomplished with certainty. In many cases these same step-bearings have been operated with water instead of oil, in which case no packing is necessary, the water being allowed to pass into the base. In some of the latest designs water will be used exclusively, the lower surface of step-bearing being of wood and no packing being provided.

The extreme conditions to which these step-bearings are subjected, and a complete lack of precedent for such designs, led at first to many doubts concerning the success of this feature. Experience has, however, shown that these doubts were without foundation. Practically no troubles or interruptions have resulted from this cause, and the step-bearings have shown a ruggedness and stability far beyond the company's expectations. The step-bearing surface cuts immediately when lubrication is stopped, but the metal from it is removed very slowly, and it has the power of re-establishing itself almost immediately when oil flow is again started.

In its newer designs the company is providing a powerful brake bearing on the lower surface of a chilled iron ring carried by the lower wheel. This brake can be conveniently operated from the outside, and can be used to take the whole weight of the revolving part in case the step-bearing support should fail. In ordinary operation the shoes of this brake will be set about .01 in. below the brake ring. It is thus in a position to receive the revolving part in case the step-bearing support should fail. Another and more important function of this brake is to stop the machine when it is desired to do so. One of the 5000-kw vertical shaft machines will run for four or five hours after the steam has been shut off, unless load is put upon it or a brake is applied.

Improvements have also been made in the governor, which now opens and closes the ports connected with the first stage nozzles mechanically instead of by electrical means. The controlling valve is so designed that it always passes positively from one of its seats to the other. No matter how gradually the force is applied it opens both ways on the principle of a pop safety valve. It is thus always firmly seated and is free from the deterioration which leakage would cause. The total number of these valve required imposes a light load upon the governor, which is made strong enough to give any desired accuracy of speed regulation without the possibility of lag or sticking.

In conclusion Mr. Emmet gave some economy figures on a 2000-kw turbine as originally designed. This turbine operates a 6600-volt, 25-cycle generator at a speed of 750 r. p. m. It is temporarily installed in the General Electric Company's power station at Schenectady, with a surface condenser having 6000 sq. ft. of cooling surface. The following results were obtained under different running conditions. The tests on March 12 and on May 11 were made upon different machines of similar design. Considering the different conditions the results are consistent:

	March 12			May 11
Load in kilowatts	637	1000	2000	2270
R. p. m.	750	750	750	750
Gage pressure	150	160	155	100
Superheat F.	215	242	242	250
Corrected vacuum	28.2	28.9	28.73	28.1
Lbs. steam used per kw-hour	20.1	16.3	15.3	16.2

Such analysis of results as the company has been able to make indicates that a different proportioning of certain parts will give a substantial improvement over these figures.

The Indiana Appellate Court has decided that when an individual buys or builds a street railway, his liability to passengers injured by the negligence of his motormen and conductors is measured by the same rule that applies to street railway corporations.

THIRD MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

The attendance at the third meeting of the new Ohio Interurban Railway Association, held at Columbus, May 26, was somewhat disappointing. Managers from all over the State intimated that their spring park and excursion business had opened up in an unusually large volume, and that they could not spare the time to attend the meeting. It was decided that in view of the fact that the association had been successfully organized, and that the original object of the adoption of a form of interchangeable transportation had been accomplished, it would be advisable to dispense with the monthly meetings during the summer months. It was, therefore, resolved to hold the next meeting some time in October, probably at Toledo.

The interchangeable coupon book, which has been referred to in these columns several times of late, will become operative on a number of Ohio and several Indiana roads within the next few weeks. At the Cleveland meeting in April two forms of an agreement between the various roads for handling the interchangeable transportation were submitted, and the question of adoption was left to a mail vote. It was decided by this vote to adopt the plan proposed by the transportation committee, which plan was outlined in the report of the Cleveland meeting, published in the May 7 issue of the Street Railway Journal; with an additional clause taken from the plan proposed by H. C. Lang, of Cleveland, providing that each road party to the agreement shall give an approved bond of $10,000, to insure other roads against failure to carry out the terms of the interchange agreement. The bonds will probably be taken out through one company. Representatives of the majority of roads present agreed to sign the contract as soon as it had been made out, and the books will be issued immediately thereafter.

A number of managers reported that they had received numerous inquiries for the transportation, and there is little doubt that the book will meet with wide sale among the traveling public. The book adopted will not only unquestionably have a tendency to induce commercial travelers to patronize the interurban roads, but it will prove an excellent advertisement for the roads in the agreement, because the cover of the book contains a list of all the towns touched by the various roads.

The transportation committee made important recommendations on the plan proposed by F. J. J. Sloat, for the adoption of a fixed schedule of prices to be charged for the operation of cars of one company over the tracks of another. As outlined in the report of the Cleveland meeting, Mr. Sloat intimated that the rates should vary according to weight of cars, size of motors, gear ratio and speed. The committee advocated that it would be advisable to adopt a fixed rate based upon the average earnings per car mile of interurban roads in this district. It was pointed out that a number of roads owned several varieties of cars and equipment, and that it would frequently be impossible for them to determine in advance what cars would be available for special trips. The committee recommended that a scale of 20 cents per car mile be adopted for special cars only, and that where arrangements for the operation of regular through trains over the tracks of another company were made, the parties concerned settle the rate between themselves. On the above basis it was understood that the foreign company furnish the crew and power, and stand liable for the car while on its tracks, and the originating company take all receipts and furnish a pilot for the car.

Mr. Stebbins, of the Appleyard system, thought that the advantages of terminal facilities should enter into the price. He considered it worth more to handle a foreign car within the city than outside the city, as it interfered with city service and tended to congest the terminals. He stated that funeral cars from other roads frequently operated to the city limits on his

line, and paid $5 for a 10-mile run. He thought in such a case 20 cents would be too small. On the other hand, in cases of through shipments of freight (the Columbus roads handle freight at steam freight rates) he thought 20 cents would be too high.

Warren Bicknell, Lake Shore Electric, stated that 20 cents was about the average earnings for interurban roads, and he considered that many roads were standing in their own light by attempting to charge too much for such service. He thought that if another road originated business and brought it to him without any effort on his part, there was no reason for charging more than his own cars could earn on business that had to be created to a large extent. He stated that the Cleveland roads have been in the habit of charging $1 per mile for the distance between terminals, or at the rate of 50 cents per mile for live and dead mileage, making the charge whether the party returned or not. Much of this business has been with the Cleveland funeral car, which covers all points in Northern Ohio. In cases where parties desire to return after the usual hour of closing the power house, a charge of $5 per hour is made in addition to the regular charge, although in this case the time for dead mileage is not counted extra. He thought the 50-cent rate too high, and has suggested a lower rate to the Cleveland roads. He favored a uniform rate for all Ohio roads.

Mr. Fravel, of the Dayton & Western, said his company had spent a great deal of money securing terminal facilities, and did not think cars should be permitted to operate over these portions at as low a rate as on the interurban portions of the line. They have charged other companies 40 per cent of the gross earnings of the car where it runs into Dayton.

Mr. Carpenter, of the Western Ohio, said his company had an arrangement with the Dayton & Troy, and sent cars over its line at a flat rate of a certain amount per car. Describing the limited service between Lima and Dayton over the two lines mentioned, Mr. Carpenter said that each company furnishes one car and one crew, which run through. The earnings are divided equally, but the Dayton & Troy receives an additional amount, figured in car mileage, because of the greater length of its line.

The transportation committee will endeavor to arrange a schedule of prices, giving due consideration to the points brought out, and was given power to act.

Mr. Anderson opened the discussion on the subject, "What compensation should interurban companies give newspapers for advertising?" He said that the Dayton managers had informally discussed this subject and had suggested a uniform rule. At present his road, in dealing with the larger papers, makes a contract for advertising, and agrees to furnish one pass, good for one round trip each day in the year. The pass is made out to the editor or manager, and in case another employee of the company desires to use the book, it must be presented with a signed slip stating that the bearer is authorized and on business for the paper. Trip passes are also issued from time to time at the discretion of the company. Dealing with country papers, they agree on the rate and issue monthly trip passes to the value of the space. The proposition of hauling packages of paper, he stated, was a perplexing one. The papers with which they advertise have been permitted to ship packages without charge, and the publishers have seemed to consider that if they gave the motorman a copy it was a fair compensation for handling them. Occasionally, when papers have been lost or miscarried there have been strenuous complaints. The newspapers argue that an extensive circulation of their papers among country people aids the business of the interurbans through the advertisements of city merchants. Mr. Anderson admitted this might be true to a certain extent, but arguing conversely, the increased circulation with country people made the papers more valuable, and he thought the papers should pay something more than a few free copies for transportation of packages. With publications with which it does not advertise, the Dayton & Xenia makes a rate of ½ cent a pound, no package less than 5 cents.

A manager from the northern part of the State said his company gave no transportation to newspapers, and incidentally it cut down its free transportation to the lowest possible point. Transportation was its stock in trade, and it was just as reasonable to expect a merchant to give free dry goods to a paper with which he advertised. This company pays cash for its advertising and expects cash for its transportation, and it asks nothing but fair treatment from the newspapers.

An Indiana manager said he had started out with the same views as the speaker before, but he had decided it was poor economy. At present he gives the newspapers about what they ask for if they keep within reasonable limits. He thought it an excellent plan to have a distinct understanding with each paper, and specify what each is entitled to, charging if they exceed that limit.

Another manager said his company had been imposed upon by several papers. They had secured transportation for advertising, and in working up circulation in the neighboring towns they had gone to young men who were attending college in the large city and had given them transportation in return for subscription work, thus depriving the company of regular commuters' business. He said the majority of roads had been wide open on the subject of transportation to papers, and he would like to see the association adopt a standard form of contract.

A gentleman from Cincinnati, not a railway operator, advised the interurbans to go slow in a matter which might antagonize the newspapers. He said he was familiar with the workings of the Ohio Press Association, and had occasion to know that at present the papers were friendly to electric roads, and were endeavoring to aid their development through the news columns. The papers are constantly publishing items calling attention to attractions on electric lines, and in this way people are induced to travel when otherwise suburban trips might not occur to them. On the other hand, papers are in a position to work great injury to roads by misstatements and exaggerated accounts. He advised managers to meet the newspaper men more than half way, and favor them with a reasonable amount of free transportation.

A well-known manager said the papers in his vicinity seemed to be decidedly antagonistic to the electric roads. He said they exaggerated accidents and frequently printed deliberate misstatements. Recently a paper raised a furore by stating that the interurbans were hauling hogs and other live stock through city streets. The story arose from the delivery of a load of live stock at the city limits; it was not carried into the city, he claimed.

On vote it was decided that the executive committee should formulate a plan for a standard form of contract between interurban lines and newspapers on a basis of transportation in return for advertising.

The question, "How to provide transportation for track men who are hired for a few days only," was opened by Mr. Stebbins, of the Appleyard system. His roads issue trip passes to the heads of departments each week for the men in their charge. The foreman endorses the passes, showing the name, date and points covered. At times the passes are dated ahead, or may be used the following day.

Mr. Rounds, of the Canton-Akron Railway, supplies the foremen and regular track men with badges. Extra men travel with foremen and are vouched for by them. All track men report at car houses.

Mr. Harrigan, of the Columbus, Newark & Zanesville Electric Railway Company, issues monthly passes to foremen, and they furnish the transportation to the men. Regular men have badges, and foremen are made responsible for these.

Mr. Anderson, of the Dayton & Xenia, issues coupon books

to track men. The books are punched for certain points, so that the men can ride only between these points.

Mr. Carpenter said that his track men reported at car houses and worked their own way in hand cars. He considered this plan much better than permitting the men to crowd into cars.

The question of requiring employees and others riding on free transportation to sign a waiver of right to collect damages was discussed in connection with the above subject, and several court decisions were referred to, among them a decision by the United States Supreme Court, in which it was stated that such a waiver signed by an employee of the company was not binding. The executive committee will investigate this subject. A number of roads require all holders of free transportation to sign the "deadhead slip."

On the subject of "Benefit Associations and the Relation of Employers to Employees," Mr. Spring, of the Dayton, Covington & Piqua, said his road had an association of seventy-eight members. The association pays a sick benefit of $5 per week. Social gatherings are held once a month. They promote good fellowship and a better feeling among the men. The company contributes to the association.

Mr. Bicknell, of the Lake Shore Electric, said that he made it a point to be on friendly, although not too intimate, terms with all his employees. He makes frequent trips over the system and talks with the motormen, conductors and section men, asking about their work and seeking suggestions as to how the service can be improved. Once a month he spends half a day at some car house or power station, and talks with the heads of departments. Such meetings have a tendency to bring out defects in the equipment and service, they show each man that his fellows have their troubles and discouragements as well as himself, and they enable a manager to know the men that are worthy of promotion.

Mr. Clegg stated that the Dayton & Troy Railway had an employees' association. Formerly the company distributed turkeys to the men at Christmas time, but last year it offered to pay the expenses of organizing a benefit association, and agreed to start it with $250. The men, however, did not act upon it. Only married men are employed, and as most of them have something ahead the benefit idea did not seem to appeal to them. The company expects to follow the idea in practice at the National Cash Register Company's plant at Dayton, of a noonday "Get Together Club." The heads of departments will take lunch at a house adjoining the company's headquarters. A portion of the expense will be paid by the company. The men will be asked to discuss various phases of their work in an informal manner, and ideas will be illustrated by "chalk talks," a blackboard to be provided for the purpose. Subjects will be bulletined from time to time.

Mr. Rounds, of the Canton-Akron Company, described the plan he has adopted for getting ideas from the men. This is referred to in the article on this system in the last issue of the STREET RAILWAY JOURNAL.

A prominent manager expressed himself as strongly in favor of meeting the men regularly and discussing matters of operation, but he did not believe in a company agitating the formation of benevolent associations. He said that it was but a short step from an association to a labor organization. When men are not bound together it is much harder to bring about a strike and much easier to settle differences with employees.

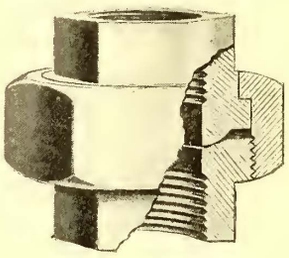
"How to Keep Cars Clean and Neat" was discussed by Mr. Rounds, Canton-Akron Company. His cars are of exceptionally handsome and elaborate design, and he finds it of great advantage to clean cars frequently. He employs women for scrubbing cars, and the cars are thoroughly swept out at the end of each run.

Mr. Harrigan, of the Columbus, Newark & Zanesville Electric Railway Company, hires several women who clean cars at night. Cars lay over at the Zanesville terminal and are swept out.

Mr. Kelsey, of the Western Ohio Railway, uses air very largely for dusting cars. This is done out of doors by means of a long hose from the air lines in the house. The method is rather expensive, but it cleans the dust and dirt from the corners, and aside from this it is of great value in blowing copper and carbon dust from the motors, circuit breakers and controllers.

BRONZE UNION

The union shown in the accompanying illustration is manufactured by Franklin Williams, Monroe-Taylor Building, New York, and is especially designed for high pressure and continuous service. It is made of "Tuxeda" bronze, an alloy said to possess unusual soundness and great tensile strength. The ends are both hexagonal, extremely heavy, insuring against spreading and for the convenience of any smooth-faced wrench, and permitting quick manipulation. The joint is made by a slightly tapered seat, to which is fitted a ball nose well ground in. The surface of contact is small and self-seating, preventing trouble caused by disalignment of pipe, due to unequal expansion. On account of the small inside area its shortness increases its strength.

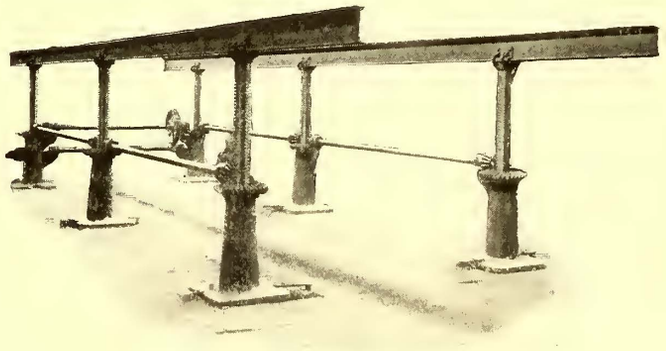


BRONZE UNION FOR HIGH-PRESSURE PIPING

This union is extensively employed in the Manhattan power station of the Interborough Rapid Transit Company, the Newark power station of the Public Service Corporation of New Jersey, and many other places where high-pressure piping is used. It answers every requirement demanded of a flange, even up to the 4-in. size, and will last a long time. In general, the coupling has been made so that it will not leak or "give" under the most severe usage.

NEW CAR HOIST

The accompanying illustration shows a new type of car body hoist manufactured by the Pittsburg Machine Tool Company, and intended for car house use. The columns are located in a pit below the level of the tracks, and the car is run in over the I-beams on the regular track. Timbers are thrown across the I-beams under the body of the car, and the power is applied to the lower shaft at the head of the machine and the car is



HOIST FOR RAISING CAR BODIES

quickly raised. This lower shaft at the head of the machine is made the right size to accommodate the regular street car motor, and any standard motor can be attached at a trifling cost. When the car body is raised the trucks can easily be run out. A similar hoist is in use in the repair shops of the St. Louis Transit Company, and was described in a recent issue of this paper.

SELECTIVE SIGNALING ON THE BOSTON & WORCESTER ELECTRIC RAILWAY

The Boston & Worcester Street Railway Company has had in use since November last a system of selective signaling in connection with its telephone system of despatching cars. By this system, which was installed by the Blake Signal & Manufacturing Company, of Boston, and which has proved very satisfactory, the despatcher can summon promptly to the telephone the crew of any car which is on the road, and give such orders as may be necessary. The advantage of this system in despatching, as well as in winter for directing the movements of the snow-fighting force, are too obvious to require elaboration.

The method of operation employed by the Boston & Worcester Street Railway is as follows: The entire line is covered by a first-class telephone system. At all important operating points or turn-outs a signal has been installed. All telephone and signal stations are furnished with an autographic register, which renders in triplicate the orders received at the station.

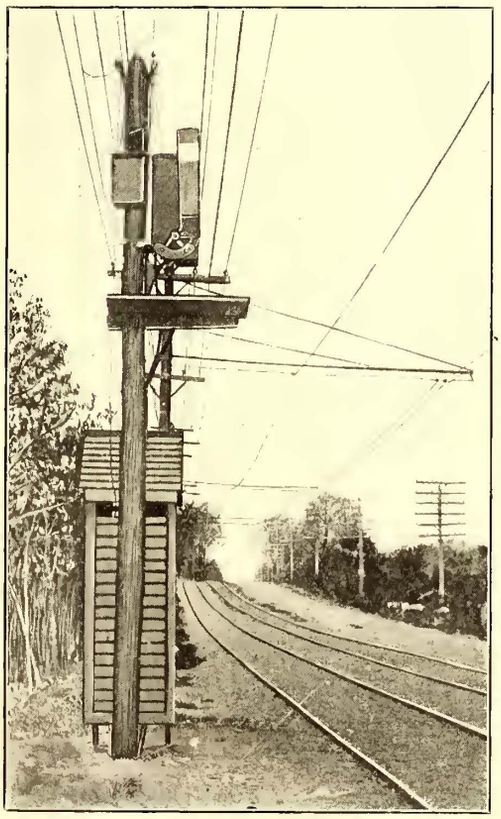


FIG. 1.—SEMAPHORE SET AT "CLEAR"

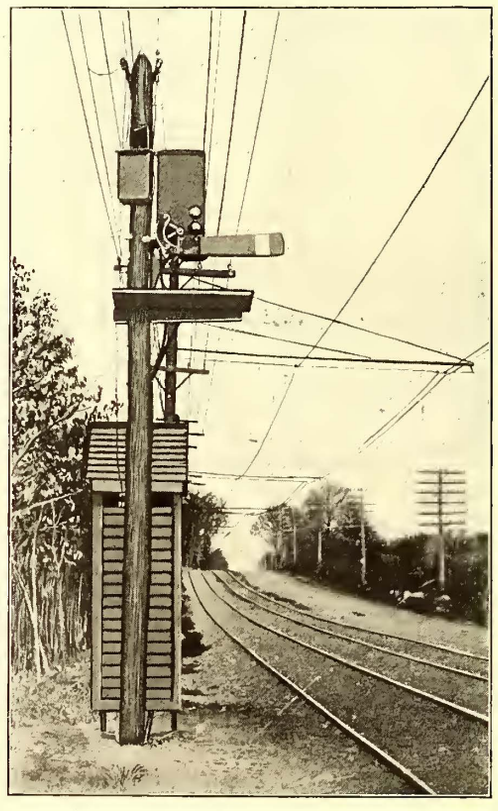


FIG. 2.—SEMAPHORE SET AT "STOP"

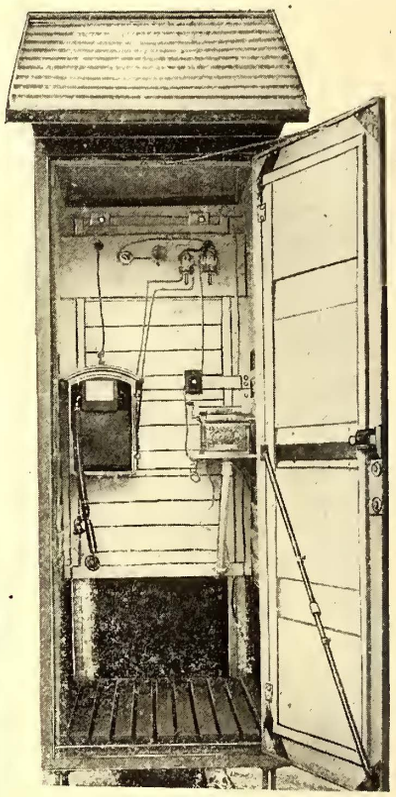


FIG. 3.—INTERIOR OF TELEPHONE BOOTH

The despatcher wishes to communicate with a car crew approaching station No. 9. He picks up a 3-in. toothed disc, numbered to correspond with the signal which he wishes to set, and slips it on a constant-speed motor-driven shaft located directly at hand. This throws a 4-ft. semaphore to a "stop" position at the station required, at the same time illuminating a red lens for a night signal.

As soon as the semaphore is properly set at "stop" the despatcher is automatically notified of this fact by the operation of a magnetic sounder in his office. The car arrives at the station, the conductor unlocks the booth and calls the despatcher by telephone, saying, "Brown and Hayes at No. 9 for orders." The despatcher then transmits his orders to the conductor, who writes them on the autographic register, repeats them back to the despatcher, takes one written copy for himself, hands one to his motorman, and the third copy is wound on a roll within the register, where it is accessible only to the management. The conductor then pulls a cord which sets the semaphore at "clear" position ready for future operation.

Fig. 1 shows the semaphore set at "clear," Fig. 2 at "stop" position, and Fig. 3 shows interior of booth with telephone on left, autographic register on right and cord suspended over telephone for resetting of signal. Fig. 4 shows interior of despatcher's office.

A detailed description with diagram of connections (Fig. 5) of signal is given herewith. The basic principle of the signal depends on the fact that the period or time of vibration of a pendulum of certain length is always the same, and varies directly as the length of the pendulum. Each signal box upon the line contains an electromagnet and a pendulum. The electromagnets are all in series on a single wire, ground return being used preferably, though, in case of need, metallic circuit could be employed. The pendulums for each signal are of different lengths, and receive impulses from the electromagnets, which may be energized at various intervals to correspond with the periodicity of their respective pendulums.

The despatcher, either by the use of a constant speed shaft on which he places toothed wheels for making and breaking contacts at various intervals corresponding with the periods of the various pendulums, or by means of setting in motion a pendulum corresponding in length and, consequently, synchronous with the pendulum of the signal which he desires to set, sets up impulses at certain intervals in all of the electromagnets. These impulses are felt by all the pendulums, but are only cumulative in increasing the arc of vibration of that pendulum whose period is synchronous with the predetermined period of electromagnetic impulses. After from ten to twenty seconds, depending on the length of pendulum, the pendulum swings through an arc of sufficient length to trip the lock holding the semaphore in a vertical or "clear" position, and the semaphore at once falls to horizontal or "stop" position. When the semaphore has reached horizontal position it automatically closes a lamp switch which gives the illuminated signal needed for use at night. Each signal is equipped with two incandescent lamps, so that, in the event of one lamp being burned out when the semaphore is set at "stop," the other lamp is automatically connected to a periodically interrupted circuit and gives a flashing danger signal. When in a horizontal position the semaphore

also automatically closes a circuit which gives a magnetic sounder signal to the despatcher, notifying him that the signal has been set as desired. Regarding the difficulty of maintaining a motor at constant speed with the widely varying voltages of electric railway circuits this difficulty has been successfully overcome by the use of a governor placed on the motor shaft.

The use of the master pendulum instead of a motor removes the necessity of using current to operate the motor, and is, besides, absolutely positive in action.

The amount of current used in energizing the electromagnets

FIG. 4.—INTERIOR OF DESPATCHER'S OFFICE

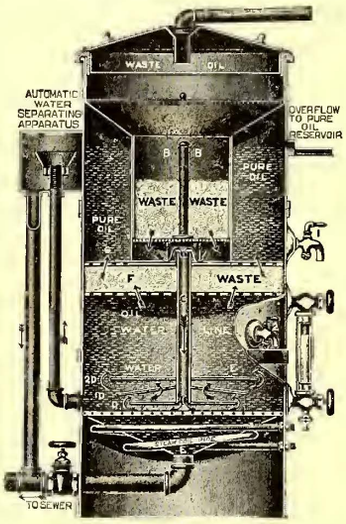
and operating the signals is .08 amps., with a voltage of 650, equivalent to 52 watts for the few seconds necessary to operate signal, or an average of about .000217 kw-hours for each time a signal is set.

A 1-6-hp-motor is sufficient for revolving the toothed discs in the despatcher's office, and is in operation only while signal is being set. The master pendulum in the despatcher's office for making and breaking the contact periodically is more reliable, and, therefore, preferable to the 1-6-hp motor. It would also have the advantage of consuming even less power than the motor. The system is, of course, extremely flexible, since the length of the line it can cover as well as the number of signals on any one circuit can be readily varied to suit any conditions that may arise. Should the despatcher find that a car has disregarded a stop signal, thereby causing two cars on a single-track division to move toward each other, he can cut off all current from the line by throwing the switches placed on the motor stand shown in Fig. 4.

The signal should be installed preferably entirely independent of the telephone, a single No. 10 galvanized iron wire with ground return being sufficient for line connections. The electromagnet coils in each signal have a resistance of 250 ohms. The drop across each electromagnet is designed to be from 15 volts to 20 volts. The amount of resistance in the despatcher's office and at the end of the line may be varied according to the initial voltage, the number of signals on any one circuit and the length of the line.

OIL FILTER

The Burt Manufacturing Company, of Akron, Ohio, has for some years been making what it calls its style "B" oil filter. This filter will take the condensation from the oil separators and exhaust heads, automatically separate the oil from the water and purify the oil at the same time.



AUTOMATIC OIL SEPARATOR AND FILTER

The oil and water is poured in the top of filter and then passes into chamber B, through a layer of waste, thence through tube C to filter plate D, where it spreads out in a very thin film, which constantly changes surface and grows thinner as it travels from the center to the circumference, thus exposing every particle of waste oil to the action of the water. It then flows upon plate D′ and D″, going through the same process in each case. It is then in a finely divided separated state and thoroughly mixed with water, which washes it out, and from which it separates by gravity all the remaining impurities. These impurities settle in chamber E, and can be removed by opening the gate valve at bottom of filter. From plate D″ the oil again filters through the stratum of filtering material F, and from there it rises to the pure oil chamber.

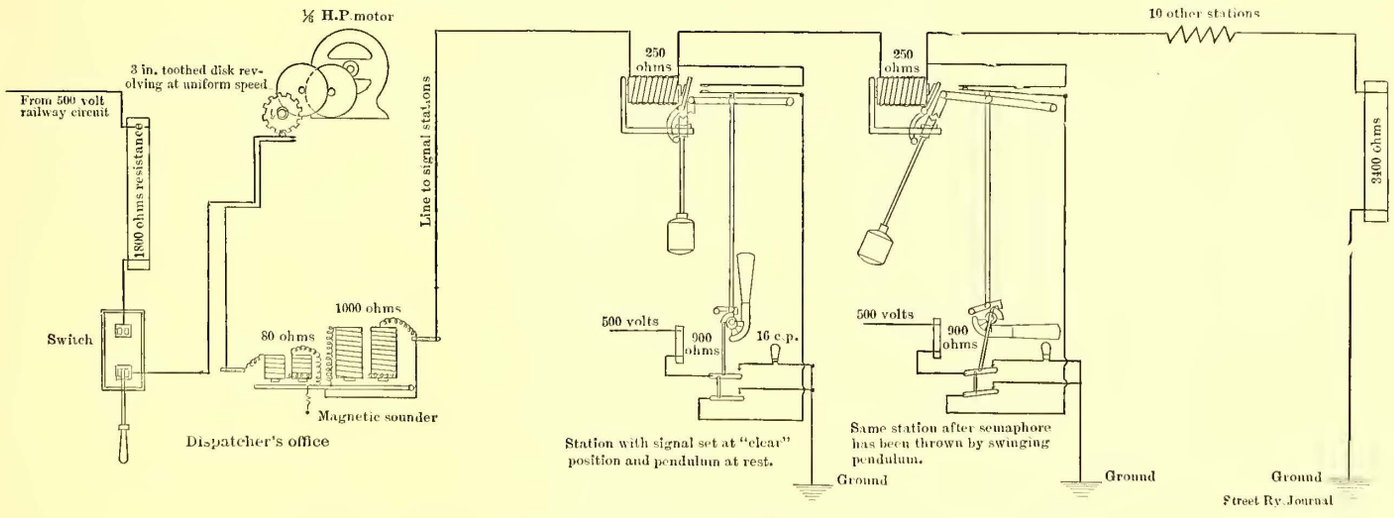
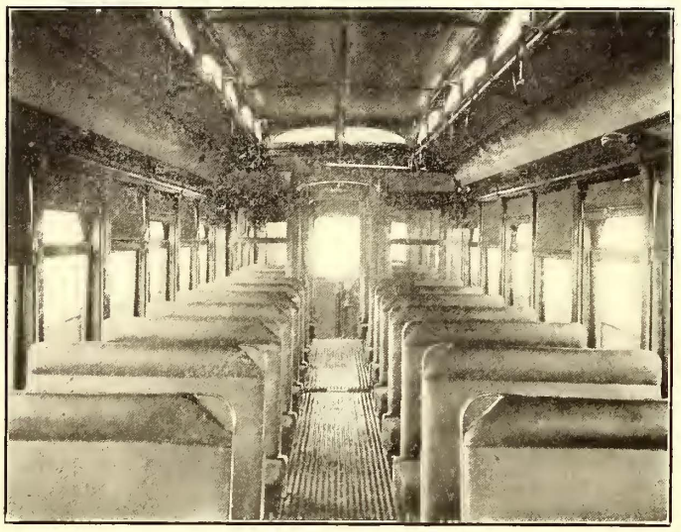


FIG. 5.—DIAGRAM OF CONNECTIONS OF SELECTIVE SIGNALING SYSTEM

SEMI-CONVERTIBLE INTERURBAN CAR EXHIBITED AT ST. LOUIS FAIR

Prominent among the cars exhibited at the Louisana Purchase Exposition is an interurban type of semi-convertible car built by the American Car Company, of St. Louis, under the Brill patents. The semi-convertible car exhibited by the latter company was described in a recent issue of the STREET RAILWAY JOURNAL. This car has curved sides, semi-accelerator doors, and single platform steps, and is intended for city and suburban service. The car shown by the American



SEATING ARRANGEMENT OF SEMI-CONVERTIBLE CAR.

Car Company has the same window system, and is very convincing evidence of the applicability of this system to interurban types. The arrangement provides a car equally suitable for summer and winter service. The windows may be raised to any desired height so that passengers may be protected from the rush of wind while running at high speed, or they may have a practically open car when moving at a moderate rate. As the illustrations show, the window pockets in the side roofs do not alter the appearance of the car appreciably, nor does this arrangement affect the construction or in any way detract from its strength.

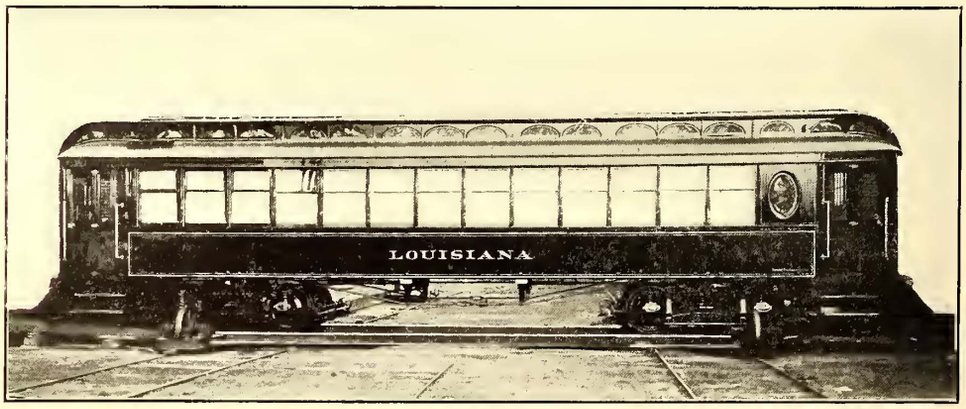
The interior is finished in solid mahogany with beautiful marquetry of light woods. The ceilings of birch are painted in a harmonious tint and tastefully decorated. The woodwork of the deck is done in semi-Empire style, with the side panels of the ceiling offset 8 ins., an arrangement which permits the lights to be placed at an angle with the moldings between these side panels and the wide center panel, giving a very attractive appearance. The deck ventilators are composed of opalescent glass with a mottled surface, and the same glass is used in the leaded oval windows of the saloon and heater compartment. The windows and doors are glazed with thick polished plate, and handsome beveled mirrors are set in the sides of the saloon and heater compartment. The corners of this compartment have large, round pillars with handsomely curved capitals, which are united with a graceful arch and transom. A single door is provided at this end of the car while the other end has twin doors. The carving of the woodwork, embellishment of the heavy bronze trimmings, and the metal work of the light is of the graceful acanthus form. The entire color scheme, including the dark green leather of the seats and aisle carpet, is refined and exceedingly pleasing. The seats have high roll-top backs, and are of the "step-over" type with levers so placed as not to come in contact with the bodies of seated passengers, and as the ends of the seats next the windows are placed within the line of the posts and against the side lining, maximum seating and aisle space are obtained. The length of the seats is 36 ins., and the width of the aisle 23½ ins. The seat and aisle, therefore, take up 7 ft. 11½ ins., and as the outside width of the car over the sheathing is but 8 ft. 4 ins., the claim of the builders that maximum seating and aisle space is obtained by not having wall pockets appears to be substantiated.

The windows in the vestibules are arranged to drop into pockets in the wainscoting. The interior woodwork of the vestibules and the platform doors are also of mahogany. The platforms are 5 ft. from end panels over vestibules. The platforms are dropped and supported by heavy angle-iron center timbers and are reinforced by outside knees. They are protected by angle-iron bumpers of Brill manufacture. Other patented specialties bearing the same name are channel-iron draw-bars, "Dedenda" gongs, "Dumpit" sand-boxes, conductors' bells and others. The trucks are also of this make and are the well-known high-speed type 27-E-2 with solid forged side frames, 6-ft. wheel base and 33-in. wheels.

The general dimensions of the car are as follows: Length over the end panels, 38 ft. 8 ins., and over crown pieces, 48 ft. 8 ins.; width over sheathing, 8 ft. 4 ins.; from center to center of posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins. and of side posts, 3¼ ins.; size of side sills, 4¾ ins. x 7¾ ins., and end sills, 5¼ ins. x 7¾ ins. The sill plates on the inside of the side sills, to which the bases of the posts are secured, are 13 ins. x ⅜ in.; height of tread of lower step from railhead, 16 ins.; from tread to tread of steps, 11¼ ins.

ENCASED SPRING POP SAFETY VALVES

The Crane Company, of Chicago, has brought out a number of improved forms of pop safety valves for stationary, marine, locomotive and portable boilers, also a variety of cylinder reliefs, water reliefs, high pressure and hydraulic relief valves for all purposes and pressures. The construction of these valves embodies a self-adjusting feature which automatically regulates the "pop" of the valve. In other words, it maintains the least waste of steam between the opening and closing points, an improvement which will be readily appreciated, as there is no necessity of readjusting to regulate the pop on changes in the set pressure.



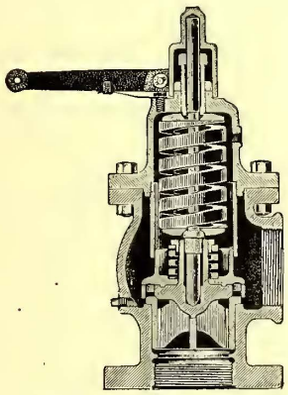
SEMI-CONVERTIBLE CAR TO BE EXHIBITED AT ST. LOUIS FAIR

In all pop safety valves it is necessary to have a "pop" or huddling chamber into which the steam expands when the main valve opens, thereby creating an additional lifting force proportionate to this increased area and greater than the force of the spring, thus holding the valve open until the pressure is

relieved. Means must also be provided to relieve this "pop" chamber of pressure, to allow the valve to close promptly and easily. This is accomplished by this company's self-adjusting auxiliary valve and spring, which are entirely independent of the main valve and spring.

The steam in the "pop" chamber finds a passage through holes or ports into an annular space provided in the auxiliary valve or disc, and by reason of the light auxiliary spring this pressure lifts the auxiliary valve and allows the steam in the "pop" chamber to gradually escape, thus permitting a greater range in setting pressures with the least waste of steam and at the same time supplying a cushion or balancing medium, thereby preventing any chattering or hammering and affording the easiest possible action in closing. The manufacturer of these valves claims that this feature is embodied in no other valves, and unlike other pop valves, in changing set pressures within reasonable limits of the spring capacity, nothing further need be done than to simply turn down or out (for a higher or lower pressure) on the screw pressure plug at the top of the valve.

This company's encased spring valves are constructed with a casing or chamber enclosing both springs, protecting them against the action of the steam, particularly high pressure, which, blowing with great force and velocity throughout all parts of valve before reaching the atmosphere, would otherwise have a tendency to disarrange the springs and other parts operating in connection therewith. This form of valve is also particularly useful, in fact necessary, where a number of valves may be connected to one main exhaust or discharge pipe. The encased spring chamber, extending over a greater portion of the top surface of main valve, prevents any retarding action of the steam due to back pressure, which might be caused by one or more valves opening slightly in advance of another, in having any material effect on the free opening of the other valves.



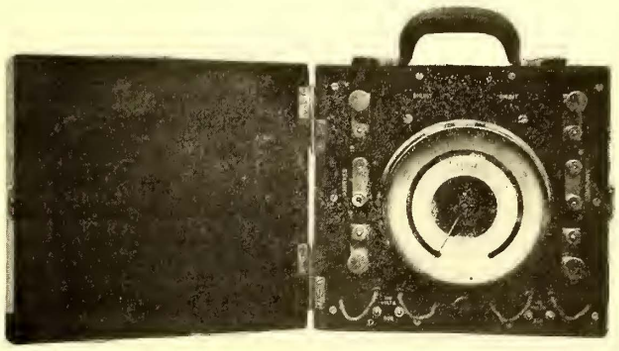
SECTION OF ENCASED SPRING POP SAFETY VALVE

The valves have bevel seats at an angle of 45 degs. from their center line of axis. The seats are made of composition or with solid nickel bushing, as may be required. The cam lever is capable of lifting the valve off its seat one-eighth the diameter of valve opening, whether or not there is pressure on the boiler. The cam lever may also be thrown over far enough to lock the valve open, should occasion require, or it is desired to blow off all or a portion of the steam from boiler through the safety valve. The cap is made with handles or cross bars and fastened to the stem by a key pin. The stem in turn is securely attached to the main or wing valve, and having a square section operating in a square socket, or recess in the main valve, affords means of turning the valve on its seat, thereby removing any incrustation or saline matter that may accumulate. The encased springs are made of best steel and with self-adjusting spring discs. The valves can be taken apart without removal from the boiler and without disturbing the outlet pipe. All parts are suitable for pressures up to 250 lbs., valves for higher pressures being made to order.

The composite marine type pop valves made by this company have been approved by the United States Board of Supervising Inspectors of Steam Vessels, and complies fully with all the rules and regulations governing the United States Steamboat Inspection Service. They will be passed by all local inspectors on the basis of 1 sq. in. of valve area to 3 sq. ft. of grate surface, and on water tube, coil or sectional boilers, carrying pressures exceeding 175 lbs., on the basis of 1 sq. in. of valve area to 6 sq. ft. of grate surface.

LONG SCALE PORTABLE INSTRUMENTS

Electrical engineers who employ the portable standard instruments in general use for the making of exact measurements of electrical quantities or in the conduct of tests, know how difficult it is to take accurate observations in those portions of the scale where the divisions are narrow, and the consequent uncertainty regarding results and difficulty in checking up a series of measurements taken with different instruments. The fact that only a portion of the scale is accurately legible,

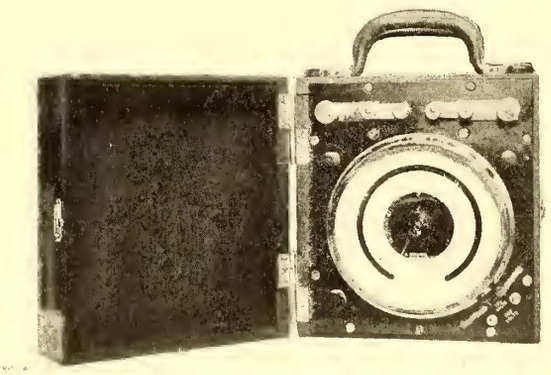


PORTABLE POLYPHASE WATTMETER

and that it is not always possible to have at hand instruments of the proper range to cover all capacities properly, make it at times impossible to avoid the use of comparatively illegible divisions; and, as result, the curve sheets of tests and tables of measurements show irregularities which rob the work of all value.

To obviate such troubles the department of standards of the Westinghouse Electric & Manufacturing Company has designed a line of portable instruments, three of which are illustrated herewith. The assortment comprises voltmeters, ammeters and single-phase and polyphase wattmeters.

The voltmeter is zero reading, this form having been found most suitable for measurements for which a voltmeter is used. In this form the readings are determined by the deflection of the milled head required to bring the index pointer to zero. Each instrument is made in two capacities, which in connection with the very long, open scale enables the readings to be taken over a wide range of voltage with great accuracy. It is astatic, and, therefore, unaffected by external fields, and may

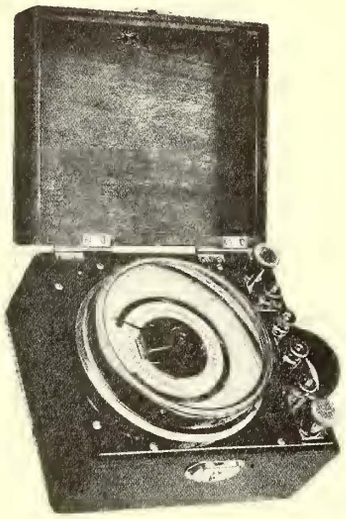


PORTABLE SINGLE-PHASE WATTMETER

be used on either alternating or direct currents without a change in calibration and without requiring "reverse" readings to be taken on the latter. It is regularly made in capacities up to 600 volts, but may be furnished for any higher range desired by the use of a multiplier. The action is entirely deadbeat.

The ammeter is similar in external appearance to the voltmeter, with the exception of the terminals, which are designed for the use of heavier connecting wires, and the absence of the knurled head with its indicating pointer, this instrument reading direct. It is furnished with coils wound in two sections,

which, by means of small connectors on the top, may be connected in series or in parallel, thus greatly increasing the range of the instruments. The scale is very long and open, being similar to the voltmeter in this respect. This instrument can be used on alternating currents only, but it is accurate over a very long range of frequencies, and may be used on circuits varying from 3000 to 8000 alternations without appreciable error. It is also unaffected by changes of wave form on the circuit. The moving element is extremely light, and being dead-beat will accurately follow any variation of current.



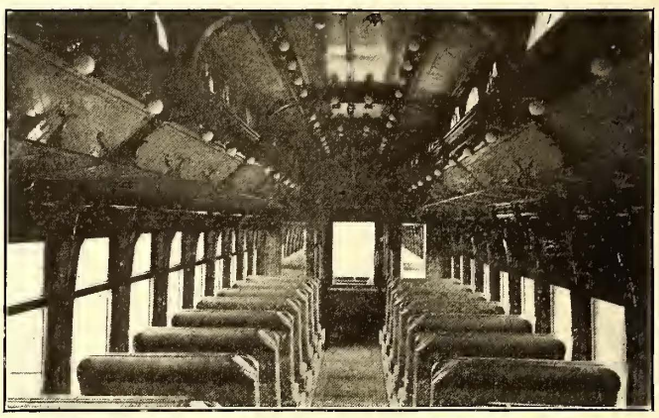
PORTABLE AMMETER

In the wattmeters the scheme of sub-dividing the coils as adopted for the ammeters is carried out for both the series and potential windings, thus giving in one instrument four ranges in capacity. In addition to this, as the scales are uniformly spaced from zero to maximum, readings may be taken at any point with equal accuracy so that one instrument will give a range several times that of any other heretofore obtainable.

The wattmeters are suitable for use with alternating currents only, but like the ammeters they may be used over a considerable range of frequency. The polyphase instrument consists of two single-phase mechanisms connected to one shaft, and indicating on a single dial the sum of the forces of the two mechanisms. It may be used for either two-phase or three-phase circuits, and will indicate correctly the total energy of a polyphase circuit irrespective of power factor or any unbalancing of the different phases. As they are not affected by external fields or proximity to large masses of iron they afford a very convenient medium for making tests of polyphase motors or other devices of this nature under actual service conditions.

NEW CARS FOR THE INTERNATIONAL RAILWAY COMPANY, BUFFALO, N. Y.

The accompanying illustration shows one of twenty cars for the International Railway Company, of Buffalo, N. Y., recently completed by the J. G. Brill Company. Some of the cars are to be used on the Niagara Falls road, and the remainder on a line running to Olcott Beach by way of Lockport. The cars are to be operated in trains on fast schedules, and are mounted on Brill high-speed trucks No. 27-E-1½, with steel-tired wheels and solid forged side frames. The construction throughout is unusually powerful. The side sills are ¾ in. x 7¾ ins., with 10-in. x ⅜-in. plates on the inside, and 6-in. x ⅜-in. plates on the outside. The center sills are composed of 9¼-lb. 5-in. I-beams, filled on each side with timber, making a total width of 4½ ins. Each end of the I-beams is fastened to end plates with two heavy bolts riveted to the I-beams and bolted through the end plates and sills. The end sills are 4¾ ins. x 8 ins., with sub-sills 2 5-16 ins. x 4¾ ins., extending the full width of the bottom frame and double mortised at the ends to receive the ends of the side sills. The end sills have a 5-in. x ½-in. steel plate on the inside, with the ends turned 8 ins. and bolted with ½-in. bolts through the longitudinal plates. The cross framing is of 5-in. x 2¼-in. white oak, double-tenoned into the sills. The needle beams are 12-lb. 5-in. I-beams, placed 5 ft. apart from center to center. The inside truss rods are 2-in. x ⅜-in. flat iron, and the under truss rods are 1⅛ ins. in diameter, and secured to the bolsters and side sills with 3-in. x ¾-in. wrought iron straps. The platform knees are of white oak, 2¾ ins. x 8 ins.; the outside knees are reinforced by 3-in. x 4-in. x ½-in. angle-iron, and the inside knees have steel plates, 5 ins. x ¾ in., securely bolted to

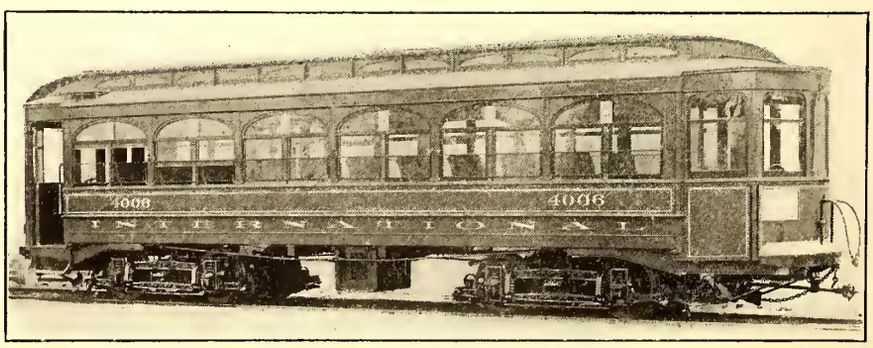


INTERIOR OF CAR FOR INTERNATIONAL RAILWAY COMPANY

the center sills of the car. The buffers are 3½-in. x 6-in. x ⅜-in. angle-iron of the builder's special type.

The general dimensions of the cars are as follows: Length over body, 34 ft., and over vestibules, 43 ft. 5 ins.; width over posts, 8 ft. 2 ins., and over sill plates, 7 ft. 11½ ins.; height from bottom of sill to top of roof, 8 ft. 10¾ ins.; height from rail to top of roof, 11 ft. 10¾ ins.; height from top of floor to underside of ceiling, 8 ft. 2¾ ins.; width over drip rails and guard rails, 8 ft. 5¼ ins.

The cars are divided into two compartments, the one for smokers being 11 ft. 6 ins. long, and the other 22 ft. 6 ins. The windows are arranged to be raised high enough to allow 4 ft. 3 ins. clear from top of floor and lower edge of bottom rail when the sash is up. The windows are of the twin-window style with the deck sashes of corresponding configuration. The sashes in the vestibule, both front and side, have pockets in the wainscoting. The platform doors at the platform entrances are hinged to the vestibule posts. The seating capacity of each car is forty-eight, the smoking compartment accommodating sixteen. The interiors are finished in natural cherry with maple



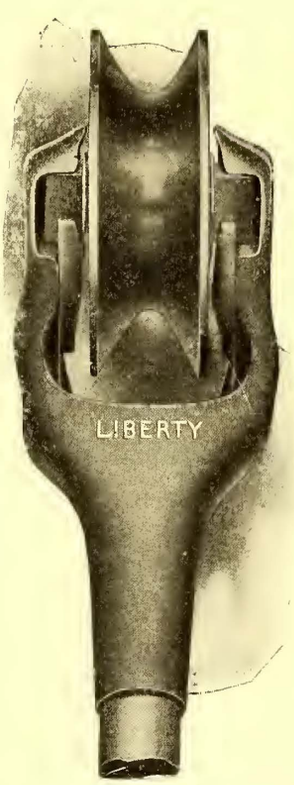
EXTERIOR OF CAR FOR THE INTERNATIONAL RAILWAY, BUFFALO, N. Y.

ceilings. The angle-iron buffers at each end have a piece of sheet-steel fastened to the buffer and set at an angle of 45 degs. against the dasher to which it is bolted. This is to prevent persons from securing a foothold on the buffers.

The Cleveland & Southwestern Traction Company is selling combination baseball and fare tickets for games in Cleveland.

TROLLEY HARP

The Liberty Bell Company, of Bristol, Conn., has brought out an improved trolley harp which permits the wheel to turn freely in making curves, thereby avoiding the grinding contact which unduly wears out both wheel and wire. Other important advantages of this harp are the arrangements for readily removing and replacing the trolley wheel, and for insuring continuous contact between the trolley wheel and the harp to prevent arcing.



TROLLEY WHEEL AND HARP

It is well understood that the movement of the car in turning curves produces considerable friction on a wheel that is not permitted to turn squarely to meet the curve. The method employed by this harp, as clearly indicated in the illustrations, seems to fully overcome this difficulty, thereby, it is claimed, increasing the life of the wheel from 50 per cent to 100 per cent over a wheel which is rigidly held. This saving in wheels certainly indicates a corresponding saving in the overhead system.

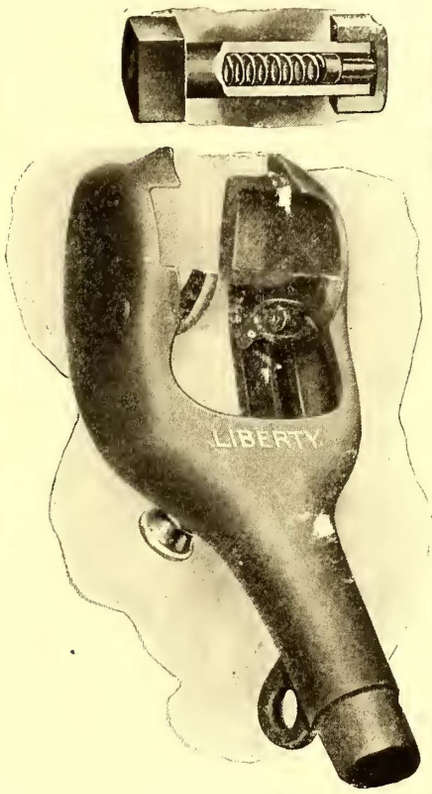
It is claimed for this harp that it practically does away with the necessity of a trolley catcher, as it is very seldom that the trolley will get off, provided the switches and curves are properly constructed. The facility with which wheels can be exchanged in the event of ice storms, or for any other reason, thereby preventing loss of time, is also a very important feature. The best possible form of non-arcing contact is provided, which admits of a perfectly free wheel.

IMPROVED HAND BLOWERS

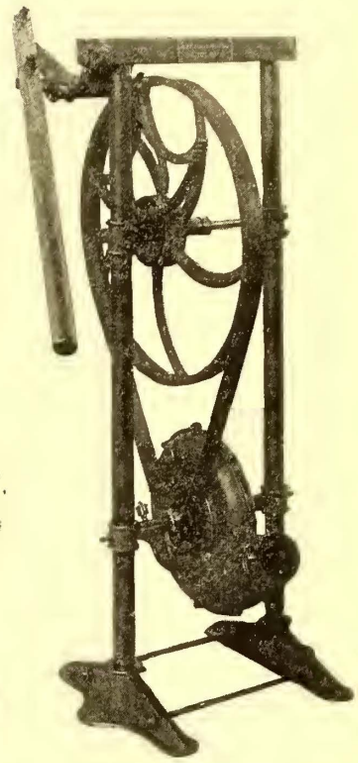
The B. F. Sturtevant Company, of Boston, Mass., recently has made a number of improvements in its style "A" hand blower, and has brought the new design on the market under the name of style "B." These hand blowers have been extensively introduced in connection with new forges of all kinds, and have likewise been applied to old style brick and iron forges as simple, efficient and economical substitutes for the bellows. Not only are they adapted to forge blowing, but can readily be applied as portable ventilating apparatus. They are simple in design, strong, rigid and compact, easy and economical in operation and readily portable. The running gear is simple, effective and strong.

The blower is adjustable on the shaft, and its outlet may thus be set to discharge in any direction and readily connected to the forge tuyere by means of galvanized iron piping. The blower is of cast-iron, strongly constructed in every particular, has a steel shaft running in babbited boxes and a fan-wheel of galvanized steel solidly riveted to a composition hub with extending arms. The frame is carefully designed, well braced, and is so arranged that the slackness of the belt driving the blower may be taken up by lowering the blower shaft, which is supported by collars sliding on the frame. The feet are provided with holes, so that the hand blower may be readily screwed to the floor.

These hand blowers are made in two sizes. The total length on the floor of style B-1 is 18 ins., while the total height of the frame, not including the handle, is 48 ins. The driving wheel is 24 ins. in diameter, the blower outlet is 3½ ins. in diameter, and the complete outfit weighs but 135 lbs. Style B-2 is of slightly larger dimensions, and has proportionately



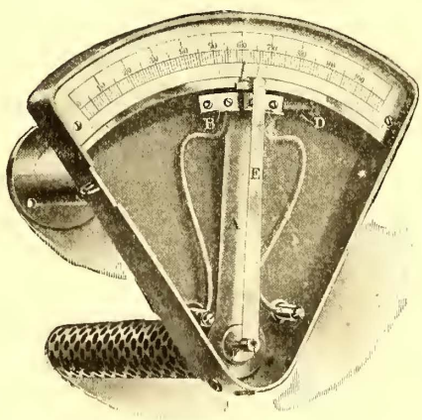
TROLLEY SHAFT AND HARP


HAND BLOWER

greater capacity for delivering air. The driving wheel is 24 ins. in diameter, the blower outlet is 4¾ ins. diameter, and the complete outfit weighs 155 lbs.

THERMOMETER-THERMOSTAT

The Bristol Company, of Waterbury, Conn., is placing a new instrument upon the market which has been given the name of thermometer-thermostat, since it is a combination of both. There is a demand for an instrument of this character which will give correct indications of the temperature of the atmosphere, gases or liquids at all times, and also serve as a thermostat to make electric connection at any predetermined limits of temperature for operating controlling apparatus, alarms, etc.


DETAILS OF THERMOMETER-THERMOSTAT

The construction and capabilities of this device will be best understood by referring to the interior view shown in the accompanying illustration, in which *A* is an arm pivoted at lower portion of the case, terminating in a point resting on the arc of the graduated scale, and is held by friction at whatever point

it may happen to be set. Two adjustable contact pieces, *B* and *C*, are carried by this arm. These are capable of adjustment by means of a screw, *D*, which is threaded so as to cause the pieces, *B* and *C*, to approach or recede at equal rates and distances from the center line of the arm upon which they are supported.

These contact pieces are also connected to binding posts, as shown, which are used for making outside connections. These binding posts are located within the case to avoid any possibility of the wires or connections being disturbed without detection. Three holes with insulating eyelets are provided in the lower portion of case, as shown, for the insertion of connecting wires. The high and low contacts can be placed on a single or on independent circuits. The arm, *E*, moving over the graduated scale, indicates the changes of temperature where the instrument is located. This arm is operated by one of Bristol's recording thermometer tubes, placed in the perforated protecting projection extending from the back of the case as shown in the illustration. On the back of the indicating pointer, *E*, there is a raised portion which makes electrical connection with the contact pieces.

A novel feature of the instrument is that the temperature indicating arm, *E*, is not restrained by the thermometer-thermostatic contacts. Thus it will be seen that the controlling effect of the treatment is perfectly adjustable as to position on the scale of the thermometer, and also as to high and low limits of operation, without in any way interfering with the correct indications of the thermometer in case the temperature does not remain, or is not controlled, within the limits for which contact pieces may be set.

For temperatures above the atmosphere a small bulb is located within the closed space or pipe. This bulb is connected with the thermometer-thermostat by a capillary tube filled with alcohol. The temperature at the bulb is communicated to the instrument which may be located at any convenient point.

GROSS RECEIPTS FOR 1903

The 1904 edition of "American Street Railway Investments," the annual "Street Railway Red Book" issued by the publishers of this paper, will be out during the present week. This year's volume contains 362 pages, 57 pages more than that of last year, and the reports of a considerable number of railway companies which have heretofore declined to present financial statements. A very large proportion of the statistics published in the book has been revised by the companies themselves. In addition, a number of other features have been added to the book, which the publishers believe will be of value to subscribers; among them are the populations for 1903 of all the larger cities, the locations of the power stations, repair shops and parks of the different properties, also very much more complete descriptions of the funded debts than have heretofore been published.

A summary of the earnings of 310 street railway companies of the United States is published in the introduction, and is reproduced in the accompanying pages. As will be seen, the number of companies in the highest class, that is, those reporting receipts of over $1,000,000, has increased from thirty-eight to forty-two, and all of these companies record an increase in gross receipts, with one exception, where the decrease is due to local causes.

The average rate of increase of the receipts in 1903 over 1902 is, in the first group, 7.1 per cent; in the second group, 10.7 per cent; in the third group, 16.5 per cent; in the fourth group, 9.5 per cent, and in the fifth group, 14.4 per cent. The general average increase for 1903 over 1902 for the 310 companies compared is 8.5 per cent.

As all of the street railway companies of the United States are not obliged to make annual reports of their earnings to the State or other authorities, it is impossible to say whether this increase would hold good for the entire country.

COMPANIES HAVING GROSS RECEIPTS FOR 1903 OF OVER $1,000,000.

NAME OF COMPANY.	1902.	1903.
Philadelphia Rapid Transit Co., Philadelphia, Pa.	$14,118,158	$15,436,574
New York City Ry. Co., New York, N. Y.	15,098,776	15,273,363
Brooklyn Rapid Transit Co., Brooklyn, N.Y.	12,788,168	13,557,814
Manhattan Ry. Co., New York, N. Y.	11,291,711	12,551,197
Boston Elevated Ry. Co., Boston, Mass.	11,321,030	12,019,371
St. Louis Transit Co., St. Louis, Mo.	6,452,218	7,295,847
Chicago City Ry. Co., Chicago, Ill.	6,413,182	6,435,565
Massachusetts Elec. Companies, Boston, Mass.	6,090,168	6,333,911
United Railroads of San Francisco, San Francisco, Cal.	5,565,216	6,243,219
United Rys. & Electric Co. of Baltimore, Baltimore, Md.	5,094,680	5,571,003
North Jersey Street Ry. Co., Jersey City, N. J.	4,437,310	4,638,891
Twin City Rapid Transit Co., Minneapolis and St. Paul, Minn.	3,612,211	4,063,938
Detroit United Ry., Detroit, Mich.	3,501,754	3,864,944
Cincinnati Traction Co., Cincinnati, O.	3,351,748	3,697,962
International Ry. Co., Buffalo, N. Y.	*4,426,675	3,663.829
Kansas City Ry. & Lt. Co., Kansas City, Mo.	2,910,500	3,187,701
Milwaukee Elec. Ry. & Lt. Co., Milwaukee, Wis.	2,776,294	3,096,324
Third Ave. R. R. Co., The, New York, N. Y.	2,951,202	2,961,659
Cleveland Electric Ry. Co., Cleveland, O.	2,524,949	2,613,049
Washington Ry. & Elec. Co., Washington, D.C.	2,325,775	2,462,294
Montreal Street Ry. Co., Montreal, Can.	2,046,209	2,222,788
Toronto Ry. Co., Toronto, Ont.	1,834,908	2,172,088
Metropolitan West Side El. Ry. Co., Chicago.	2,040,005	2,153,184
Seattle Electric Co., Seattle, Wash.	1,878,101	2,096,726
Jersey City, Hoboken & Paterson Street Ry. Co., Hoboken, N. J.	1,975,525	2,076,148
Louisville Ry. Co., Louisville, Ky.	1,771,887	1,941,599
South Side Elevated R. R. Co., Chicago, Ill.	1,483,841	1,679,310
Toledo Railways & Light Co., Toledo, O.	1,459,092	1,663,793
United Traction Co., Albany, N. Y.	1,479,608	1,624,305
Coney Island & Brooklyn R.R. Co., Brooklyn.	1,507,713	1,605,300
Northwestern Elev. R. R. Co., Chicago, Ill.	1,410,999	1,542,040
Capitol Traction Co., Washington, D. C.	1,402,040	1,435,054
Georgia Railway & Electric Co., Atlanta, Ga.	1,161,372	1,328,995
Worcester Consolidated Street Ry. Co., Worcester, Mass.	1,220,256	1,324,495
Rochester Ry. Co., Rochester, N. Y.	1,068,222	1,324,353
Birmingham Ry. Lt. & Pr. Co., Birmingham.	1,076,767	1,311,851
Connecticut Ry. & Ltg. Co., Bridgeport, Conn.	1,274,820	1,228,633
Cincinnati, Newport & Covington Ry. Co., Cincinnati, O.	1,103,995	1,224,352
Union Ry. Co. of New York City, New York	1,024,259	1,139,582
Oakland Transit Consolidated, Oakland, Cal.	945,865	1,137,041
Union Traction Co. of Indiana, Anderson, Ind.	962,266	1,118,951
Fair Haven & Westville R. R. Co., New Haven, Conn.	986,334	1,074,958
Total, 42 companies.	$158,165,809	$169,394,001

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $1,000,000 AND $500,000.

NAME OF COMPANY.	1902.	1903.
Springfield St. Ry. Co., Springfield, Mass	$844,665	$015,876
Northern Ohio Traction & Light Co., Akron, O.	745,043	882,276
Brooklyn, Queens County & Suburban R. R. Co., Brooklyn, N. Y.	826,646	867,371
Chicago & Oak Park Elec. Ry. Co., Chicago	815,284	834,059
Forty-Second Street, Manhattanville & St. Nicholas Ave. Ry. Co. New York, N. Y.	839,144	833,523
Scranton Ry. Co., Scranton, Pa.	722,228	827,778
Hartford Street Ry. Co., Hartford, Conn.	785,587	813,799
Lehigh Valley Traction Co., Allentown, Pa.	740,017	811,668
Washington Water-Power Co., Spokane, Wash.	638,967	801,253
Syracuse Rapid Transit Ry. Co., Syracuse, N.Y	693,284	753,277
United Power & Transportation Co., Phila.	720,560	747,024
Utica & Mohawk Valley Ry. Co., Utica, N.Y.	621,976	701,062
Portland R. R. Co., Portland, Me.	605,802	680,210
Wilkesbarre & Wyoming Valley Traction Co., Wilkesbarre, Pa.	634,216	678,767
Schenectady Ry. Co., Schenectady, N. Y.	350,907	648,763
Duluth Street Ry. Co., Duluth, Minn.	538,030	622,045
New York & Queens County Ry. Co., Long Island City, N. Y.	584,464	619,434
Lake Shore Electric Ry. Co., Cleveland, O.	466,051	616,484
United Traction Co., Reading, Pa.	577,680	600,368
Dry Dock, East Broadway & Battery R. R. Co., New York, N. Y.	585,975	566,992

NAME OF COMPANY.	1902.	1903.
Camden & Suburban Ry. Co., Camden, N. J.	493,305	551,109
Charleston Consolidated Ry., Gas & Electric Co., Charleston, S. C.	†608,470	538,173
Des Moines City Ry. Co., Des Moines, Iowa.	483,150	535,967
Pueblo Suburban Traction & Lighting Co., Pueblo, Col.	410,991	535,038
Savannah Electric Co., Savannah, Ga.	480,510	519,774
Harrisburg Traction Co., Harrisburg, Pa.	466,530	517,485
Total, 26 companies,	$16,279,491	$18,019,575

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $500,000 AND $100,000.

NAME OF COMPANY.	1902.	1903.
Thirty-Fourth St. Crosstown Ry. Co., N. Y.	456,841	495,100
Tacoma Ry. & Power Co., Tacoma, Wash.	442,218	493,587
Central Crosstown R. R. Co., New York, N.Y.	500,252	490,331
Fonda, Johnstown & Gloversville R. R. Co. Gloversville, N. Y.	411,944	485,343
Terre Haute Electric Co., Terre Haute, Ind.	327,957	474,250
Detroit & Port Huron Shore Line Ry. Co. Detroit, Mich.	425,920	459,615
Elgin, Aurora & Southern Traction Co., Aurora, Ill.	410,431	453,380
Milwaukee Light, Heat & Traction Co., Milwaukee, Wis.	354,802	452,931
Cleveland & Southwestern Traction Co., Cleveland, O.	300,846	445,168
American Railways Co., Philadelphia, Pa.	370,384	423,027
Trenton Street Ry. Co., Trenton, N. J.	366,459	421,640
Houston Electric Co., Houston, Tex.	360,018	416,124
Conestoga Traction Co., Lancaster, Pa.	344,227	409,182
Canton-Akron Ry. Co., Canton, O.	202,345	385,752
Holyoke Street Ry. Co., Holyoke Mass.	336,853	369,337
Union Street Ry. Co., New Bedford, Mass.	326,125	366,158
Halifax Elec. Tra'y Co., Ltd., Halifax, N. S.	314,161	365,375
Hudson Valley Ry. Co., Glens Falls, N. Y.	357,177	††349,218
Ottawa Electric Ry. Co., The, Ottawa, Ont.	310,192	348,888
Rhode Island Suburban Co., Providence, R.I.	292,649	338,049
Johnstown Passenger Ry. Co., Johnstown, Pa.	274,168	329,778
Chester Traction Co., Chester, Pa.	305,048	326,805
Lexington Ry. Co., Lexington, Ky.	266,888	315,461
Schuylkill Valley TractionCo., Norristown, Pa.	197,279	302,258
Chicago & Milwaukee Elec. R. R. Co., Chicago, Ill.	190,110	292,247
Richmond Light & R. R. Co., S. I., N. Y.	219,118	291,219
Toledo, Bowling Green & Southern Traction Co., Toledo, O.	246,933	288,301
Manchester Street Ry. Co., Manchester, N. H.	235,172	267,768
People's Ry. Co., The, Dayton, O.	218,492	265,366
Yonkers R. R. Co., The, Yonkers, N. Y.	221,781	260,723
Lincoln Traction Co., Lincoln, Neb.	213,926	251,810
Jacksonville Electric Co., Jacksonville, Fla.	173,209	248,650
Erie Electric Motor Co., Erie, Pa.	214,172	238,628
Binghamton Ry. Co., Binghamton, N. Y.	211,127	238,537
Westchester Electric R.R.Co., New York, N.Y.	222,596	238,413
Lewiston, Brunswick & Bath Street Ry. Co., The, Lewiston, Me.	230,957	231,847
Southwest Missouri Elec. Ry. Co., Webb City.	206,799	230,768
Beaver Valley Traction Co., The, Beaver Falls, Pa.	177,214	227,409
Washington, Alexandria & Mt. Vernon Ry. Co., Washington, D. C.	217,660	224,665
El Paso Electric Co., El Paso, Tex.	161,199	222,777
Sioux City Traction Co., Sioux City, Ia.	199,183	222,045
Atlantic Coast Elec. R. R. Co., Asbury Park.	209,124	221,020
Pottsville Union Traction Co., Pottsville, Pa.	161,649	219,991
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass.	201,247	218,968
Niagara, St. Catharines & Toronto Ry. Co., St. Catharines, Ont.	172,840	214,824
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.	189,187	214,631
Albany & Hudson R. R. Co., Hudson, N. Y.	187,882	213,551
Eastern Ohio Traction Co., Cleveland, O.	192,252	202,826
Rockford & Interurban Ry. Co., Rockford, Ill.	167,576	200,633
New Jersey & Hudson River Ry. & Ferry Co., Hackensack, N. J.	166,442	199,891
Middlesex & Somerset Traction Co., New Brunswick, N. J.	180,681	199,534
Altoona & Logan Valley Elec. Ry. Co., Altoona, Pa.	155,462	191,084
Houghton County Street Ry. Co., Hancock, Mich.	170,709	189,804
Twenty-Eighth & Twenty-Ninth Sts. Crosstown R. R. Co., New York	180,927	186,655
Elmira Water, Light & R. R. Co., Elmira, N.Y.	162,232	184,815
Newport & Fall River St.Ry.Co., Newport, R.I.	170,076	183,341
London Street Ry. Co., London, Ont.	154,704	172,084
Rockland, Thomaston & Camden St. Ry. Co. Rockland, Me.	145,786	170,924
Alton Light & Traction Co., Alton, Ill.	142,021	170,048
Philadelphia & Lehigh Valley Traction Co., Allentown, Pa.	74,182	169,114
Charlotte Electric Ry., Light & Power Co., Charlotte, N. C.	144,669	168,233
Lexington & Boston St.Ry. Co., Boston, Mass.	145,093	164,690
Staten Island Midland R. R. Co., S. I., N. Y.	137,914	153,456
Interstate Consolidated Street Ry. Co., North Attleborough, Mass.	148,299	152,611
Northampton St. Ry.Co., Northampton, Mass.	144,846	151,031
Meriden Electric R. R. Co., Meriden, Conn.	139,283	150,167
Holmesburg, Tacony & Frankford Electric Ry. Co., Philadelphia, Pa.	120,430	150,147
Hoosac Valley Street Ry.Co., No. Adams, Mass.	116,111	148,828
City Passg'r Ry. Co. of Altoona, Altoona, Pa.	117,550	145,834
Dartmouth & Westport St. Ry. Co., New Bedford, Mass.	132,991	145,656
Worcester & Webster St. Ry. Co., Worcester, Mass.	143,842	144,892
Lehigh Traction Co., Hazleton, Pa.	129,653	144,467
Columbus Railroad Co., Columbus, Ga.	106,183	144,103
Montreal Park & Island Ry. Co., Montreal, Can.	130,160	142,868
Consolidated Railways, Light & Power Co., Wilmington, N. C.	126,425	139,684
Jamestown St. Ry. Co., The, Jamestown, N. Y.	116,117	139,519
Phila. & West Chester Traction Co., Phila.	110,409	136,532
Newton St. Ry. Co., Newton, Mass.	134,300	135,304
Pittsfield Electric St. Ry. Co., Pittsfield, Mass.	111,697	134,952
Hartford, Manchester & Rockville Tramway Co., Hartford, Conn.	131,465	133,056
Fairmount Park Transportation Co., Phila.	116,864	128,166
Oakwood Street Ry. Co., Dayton, O.	104,527	127,149
Fries Manufacturing & Power Co., The, Winston-Salem, N. C.	103,660	123,115
Providence & Danielson Ry. Co., Providence, R. I.	97,464	122,518
Kingston Consolidated R. R. Co., Kingston, N. Y.	112,320	118,447
Woonsocket St. Ry. Co., Woonsocket, R. I.	102,962	118,423
Norwich Street Ry. Co., Norwich, Conn.	111,811	117,898
New York & Stamford Ry. Co., Port Chester, N. Y.	100,980	116,309
Williamsport Pass. Ry. Co., Williamsport, Pa.	104,656	116,206
Pittsburg, McKeesport & Greensburg Ry. Co., Greensburg, Pa.	99,308	115,841
Long Island Electric Ry. Co., Brooklyn, N.Y.	125,077	112,901
Haverhill & Amesbury St. Ry. Co., Haverhill, Mass.	113,175	109,389
Ithaca Street Ry. Co., Ithaca, N. Y.	111,090	109,090
Springfield & Eastern St. Ry. Co., Palmer, Mass.	102,788	107,509
York Street Ry. Co., York, Pa.	89,035	107,089
Bridgeton & Millville Traction Co., Bridgeton, N. J.	90,241	106,482
Schuylkill Traction Co., Girardville, Pa.	130,757	104,079
Orange County Traction Co., Newburgh, N.Y.	102,222	103,827
Allentown & Reading Tr. Co., Allentown.	56,850	101,725
Sandwich, Windsor & Amherstburg Ry. Co., Windsor, Ont.	75,601	101,278
Total, 100 companies.	$19,638,636	$22,875,139

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $100,000 AND $50,000.

NAME OF COMPANY.	1902.	1903.
Brockton & Plymouth Street Ry. Co., Brockton, Mass.	90,333	99,600
Dayton & Xenia Transit Co., Dayton, O.	80,535	98,911
Newton & Boston St. Ry. Co., Newton, Mass.	78,717	98,608
Poughkeepsie City & Wappinger's Falls Electric Ry. Co., Poughkeepsie, N. Y.	93,740	98,010
Maumee Valley Railways & Lt.Co., Toledo, O.	92,876	97,507
Montville Street Ry. Co., Montville, Conn.	90,038	95,729
Augusta, Winthrop & Gardiner Ry. Co., Augusta, Me.	60,110	91,996
Commonwealth Ave.St.Ry.Co., Newton, Mass.	81,315	91,930
New Bedford & Onset Street Ry. Co., New Bedford, Mass.	69,254	91,721
Newark & Granville St. Ry. Co., Newark, O.	63,499	91,476
Waterloo & Cedar Falls Rapid Transit Co., Waterloo, Ia.	85,636	90,852
Natick & Cochituate St. Ry.Co., Natick, Mass.	79,751	88,923
Sanford & Cape Porpoise Ry. Co., Sanford, Me.	83,847	88,385
Paducah City Ry. (Incor.), Paducah, Ky.	68,278	88,340
Syracuse, Lakeside & Baldwinsville Ry. Syracuse, N. Y.	87,855	87,976
Delaware Co. and Philadelphia Electric Ry. Co., Philadelphia, Pa.	79,136	87,788
Harrisburg & Mechanicsburg Electric Ry. Co., Harrisburg, Pa.	48,201	87,421
Exeter, Hampton & Amesbury Street Ry. Co., Exeter, N. H.	227,496	86,879
Camden & Trenton Ry. Co., Camden, N. J.	81,990	85,579
Stamford St. Ry. Co., Stamford, Conn.	64,233	83,194

NAME OF COMPANY.	1902.	1903.
Niagara Gorge R. R. Co., Niagara Falls, N.Y.	*279,436	82,711
Warren St. Ry. Co., Warren, Pa.	62,332	82,707
Lebanon Valley Street Ry. Co., Lebanon, Pa.	76,847	81,835
Portsmouth, Dover & York Street Ry. Co., Portsmouth, N. H.	80,537	81,606
Danbury & Bethel St. Ry. Co., Danbury, Conn.	78,380	81,476
Concord & Manchester Elec. Branch B. & M. R. R., Concord, N. H.	77,929	80,322
Dayton & Western Traction Co., Dayton, O.	76,871	80,251
Woronoco Street Ry. Co., Westfield, Mass.	64,489	77,220
Milford, Attleboro & Woonsocket Ry. Co., Milford, Mass.	75,461	76,849
Peekskill Lighting & R. R. Co., Peekskill, N.Y.	56,352	76,052
Fox River Elec. Ry. & Power Co. Green Bay, Wis.	58,493	75,682
Hamburg Ry. Co., Hamburg, N. Y.	29,563	75,090
Syracuse & Suburban R.R.Co., Syracuse, N.Y.	70,106	75,032
Bangor Street Ry. Co., Bangor, Me.	65,888	74,876
Olean Street Ry. Co., Olean, N. Y.	56,040	74,866
Burlington Traction Co., Burlington, Vt.	63,875	74,034
Pennsylvania & Ohio Ry. Co., Ashtabula, O.	37,464	73,063
Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Geneva, N. Y.	66,955	73,017
Tarrytown, White Plains & Mamaroneck Ry. Co., White Plains, N. Y.	65,737	72,933
New London St. Ry. Co., New London, Conn.	72,471	72,504
Hartford & Springfield Street Ry. Co., Thompsonville, Conn.	44,709	72,293
South Middlesex St. Ry. Co., Natick, Mass.	70,405	72,217
Washington & Canonsburg Ry. Co., Washington, Pa.	50,402	71,991
Portsmouth Street R. R. & Light Co., Portsmouth, O.	50,798	69,277
Worcester & Blackstone Valley Street Ry. Co., Worcester, Mass.	55,811	67,910
Warren, Brookfield & Spencer Street Ry. Co., Brookfield, Mass.	61,595	66,415
Black River Traction Co., Watertown, N. Y.	54,323	66,156
Jefferson Traction Co., Punxsutawney, Pa.	34,950	66,046
Chippewa Valley Electric R. R. Co., The, Eau Claire, Wis.	60,104	65,778
Erie Traction Co., Erie, Pa.	62,033	65,669
Portsmouth Electric Ry., Portsmouth, N. H.	59,204	65 266
Media, Middletown, Aston & Chester Elec. Ry. Co., Chester, Pa.	54.397	64,716
Olean, Rock City & Bradford R.R. Co., Bradford, Pa.	55,044	64,602
Oneonta, Cooperstown & Richfield Springs Ry. Co., Oneonta, N. Y.	41,180	64,188
Sharon & Wheatland Street Ry. Co., Sharon, Pa.	56,713	63,995
Waterville & Fairfield Ry. & Light Co., Waterville, Me.	55,783	62,911
Greenfield & Turner's Falls St. Ry. Co., Greenfield, Mass.	51,617	62,785
Shamokin & Mt. Carmel Electric Ry. Co., Shamokin, Pa.	71,478	62,726
Athens Electric Ry. Co., Athens, Ga.	48,050	62,638
Kokomo Street Ry., Light & Power Co., Kokomo, Ind.	48,700	62,238
Toledo, Fostoria & Findlay Electric Ry. Co., Findlay, O.	59,412	61,845
Citizens' Elec. St. Ry. Co., Newburyport, Mass.	54,831	61,309
Bangor, Orono & Oldtown Ry. Co., Bangor, Me.	57,680	60,850
People's Tramway Co., The, Putnam, Conn.	56,180	60,560
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.	51,208	59,706
Branford Street Ry. Co., Branford, Conn.	54,962	59,645
Gardner, Westminster & Fitchburg Street Ry. Co., Gardner, Mass.	56,106	59,237
Concord, Maynard & Hudson Street Ry. Co., Maynard, Mass.	47,008	58,877
Raritan Traction Co., Perth Amboy, N. J.	53,023	58,251
Lewistown & Reedsville Electric Ry. Co., Lewistown, Pa.	44,473	58,185
Bristol County Street Ry. Co., Boston, Mass.	53,114	57,639
Tamaqua & Lansford St. Ry. Co., Lansford, Pa.	53,153	57,090
Biddeford & Saco R. R. Co., Biddeford Me.	48,870	56,992
Middleboro Wareham & Buzzard's Bay St. Ry. Co., Middleboro, Mass.	45,170	56,881
Waverly, Sayre & Athens Traction Co., Waverly, N. Y.	49,953	56,821
Northampton & Amherst Street Ry. Co., Northampton, Mass.	51,891	56,746
Southern Boulevard R. R. Co., New York.	60,505	56,718
Rochester & Suburban Ry. Co., Rochester, N. Y.	48,521	56,316
Dunkirk & Fredonia R. R. Co., Fredonia, N.Y.	43,302	55,801
Newtown Electric St. Ry. Co., Newtown, Pa.	64,587	54,559
Wilkesbarre, Dallas & Harvey's Lake Ry. Co., Wilkesbarre Pa.	45,028	53,850
Wellesley & Boston St. Ry. Co., Newton, Mass.	62,825	53,812
Van Brunt St. & Erie Basin R.R.Co., Brooklyn.	50,055	53,609
Southwestern St. Ry. Co., Philadelphia, Pa.,	49,222	52,369
Bradford Electric St. Ry., Co., Bradford, Pa.	50,099	52,240
Citizens' R. R., Light & Power Co., Fishkill, N. Y.	37,866	51,444
Tarentum Traction Passenger Ry. Co., Tarentum, Pa.	31,525	51,411
Bristol & Plainville T'way Co., Bristol, Conn.	52,728	51,305
Torrington & Winchester Street Ry. Co., Torrington, Conn	47,251	50,967
Blue Hill Street Ry. Co., Boston, Mass.	37,232	50,388
Chillicothe Elec. R. R., Light & Power Co., Chillicothe, O.	45,900	50,347
Total 91 companies,	$5,873,042	$6,428,53

COMPANIES HAVING GROSS RECEIPTS FOR 1903 BETWEEN $50,000 AND $25,000.

NAME OF COMPANY.	1902.	1903.
Ohio River Electric Ry. & Power Co., Pomeroy, O	$42,528	$49,558
Norton & Taunton Street Ry. Co., Norton, Mass.	46,512	48,180
Templeton Street Ry. Co., Templeton, Mass.	40,578	47,532
Tiffin, Fostoria & Eastern Electric Ry. Co.	45,574	47,386
Sea View R. R. Co., Wakefield, R. I.	36,560	47,330
Middletown-Goshen Electric Ry. Co., Middletown, N. Y.	48,113	47,093
Butler Passenger Ry. Co., Butler, Pa.	19,302	47,001
Greenwich Tramway Co., Greenwich, Conn.	23,363	46,607
Monmouth County Electric Co., Red Bank, N. J.	36,334	46,352
Providence & Fall River Street Ry. Co., Swansea Centre, Mass.	36,147	44,460
Southbridge & Sturbridge Street Ry. Co., Southbridge, Mass.	33,532	43,675
Hudson River Traction Co., Rutherford, N. J.	42,406	42,907
Cortland County Traction Co., Cortland, N.Y.	37,617	42,551
Valley Street Ry. Co., Sharon, Pa.	34,230	42,431
Kittanning & Ford City Street Ry. Co., Kittanning, Pa	35,865	42,313
Middletown St. Ry. Co., Middletown, Conn.	40,112	41,905
Georgetown, Rowley & Ipswich Street Ry. Co., Georgetown, Mass.	40.514	41,221
Athol & Orange Street Ry. Co., Athol, Mass.	37,298	40,385
Phillipsburg Horse Car R. R. Co., Phillipsburg, N. J.	37,813	40,358
Oswego Traction Co., Oswego, N. Y.	41,017	38,373
Fulton St. R. R. Co., New York, N. Y.	43,694	38,289
Corning & Painted Post Street Ry. Co., Corning, N. Y	33,899	38,156
Farmington Street Ry. Co., The, Hartford, Conn.	36,301	37,922
Elmira & Seneca Lake Ry. Co., Elmira, N.Y.	29,903	36,968
Springfield Electric Ry. Co., Springfield, Vt.	37,065	36,554
Coney Island & Gravesend Ry. Co., Brooklyn, N, Y.	35,175	36,312
Marlborough & Westborough Street Ry. Co., Westborough, Mass.	31,725	36,239
Meadville Traction Co., Meadville, Pa.	29,591	35,797
West Chester Street Ry. Co., West Chester, Pa.	15,237	35,502
East Taunton Street Ry. Co., Taunton, Mass.	35,334	35,257
Penobscot Central Ry. Co., Bangor, Me.	29,743	33,808
Columbus, New Albany & Johnstown Ry. Co., Columbus, O.	26,134	32,948
Titusville Electric Traction Co., Titusville, Pa.	31,552	31,862
Haverhill, Georgetown & Danvers Street Ry. Co., Georgetown, Mass.	28,459	31,581
Millville Traction Co., Millville, N. J	30,333	30,336
Marion Ry., Light & Power Co., Marion, O.	26,948	30,310
Citizens' Electric Co., Eureka Springs, Ark.	26,938	30,301
Mauch Chunk, Lehighton & Slatington Street Ry. Co., Mauch Chunk, Pa.	23,724	29,668
Calais Street Ry. Co., Calais, Me.	26,790	29,513
Amherst & Sunderland Street Ry. Co., The, Amherst, Mass.	21,418	29,413
Ogdensburg Street Ry. Co., Ogdensburg, N.Y.	24,063	29,200
Hampshire & Worcester Street Ry. Co., Ware, Mass.	21,552	28,654
Bangor, Hampton & Winterport Ry. Co., Bangor, Me.	26,681	28,617
Somerset Traction Co., Skowhegan, Me.	24,554	28,583
Shamokin & Edgewood Electric Ry. Co., Shamokin, Pa.	32,066	28,502
Bennington & Hoosick Valley Ry. Co., Hoosick Falls, N. Y.	38,216	28,314
Vallamont Traction Co., Williamsport, Pa.	22,125	28,063
Troy & New England R. R. Co., Troy, N.Y.	26,456	27,385
Cumberland Valley Traction Co., Harrisburg, Pa.	27,114	27,251
Port Jervis Electric Light, Power, Gas & R. R. Co., Port Jervis, N. Y.	9,629	27,176
People's Street Ry. Co., Nanticoke, Pa.	28,580	25,620
Total, 51 companies,	$1,636,423	$1,871,719

*Includes earnings during Pan-American Exposition. † Exposition period. ‡ Decrease due to strike.

LONDON LETTER.

(From Our Regular Correspondent.)

It appears now as if it were certain that the tramways which have hitherto terminated at the corner of Hampstead Road and Euston Road will soon be continued to a point near Oxford Street, through the entire length of Tottenham-Court Road. The bill including this tramway improvement has been rigorously opposed by some of the largest merchants and shop-keepers in Tottenham-Court Road, but after a very full consideration of the whole case the Select Committee appointed by the House of Commons has decided to sanction the line as far as Francis Street, making it a condition, however, that no horse cars would be used, but only electric cars. This is a step further in the scheme of connecting the tramways of the north and south of London, though we are yet a very long way from seeing any definite solution of the difficulty.

The system of electric tramways in Gloucester has been inspected by Colonel Von Donop, of the Board of Trade, who has expressed his entire satisfaction with the equipment, and the whole system has now been put into service.

It appears reasonably sure now that the city of Belfast will have an electric tramway system, the Select Committee of the House of Lords who had been appointed to deal with the case having completed their consideration, and ordered the Belfast Tramway Bill to be reported for third reading. We have already published the general scheme of the electrification of the Belfast tramways, which is one of the few remaining British cities of any magnitude in which electrification of the tramways has been held back by an unfortunate disagreement between the company owning the concession and the corporation who are desirous that the system should be electrified.

There is no doubt but that the bill will be passed, and that the day of horse traction in Belfast is now doomed. When Belfast is electrically equipped it will practically conclude the list of the comparatively large cities in the United Kingdom which have been electrified within the last few years. There are certainly now no other cities of anything like the importance of Belfast which have not electric tramways, and many efforts have been made in the past few years to pave the way for the electrification which seems at last secured.

Scarborough has now formally celebrated the opening of its tramways system, the opening ceremony being performed by the Mayoress, Mrs. W. Morgan. Twelve cars of invited guests were driven over nearly the whole of the route, the cars being tastefully decorated, and the procession being cheered all along the route by crowds of spectators.

In a recent issue of the STREET RAILWAY JOURNAL an article was published on electric tramways in the East, taking them in order as they were encountered in a trip from England eastward as far as Japan. In that article it is stated that "Madras has a short electric conduit system which was installed ten years ago by the Electric Construction Company, of London. The road is only a few miles in extent." The writer of the article, it would appear, while in possession of the facts regarding the other cities which doubtless he visited, appears to have omitted to pay a visit to Madras, as the facts of the case are that Madras has now twelve miles of track, and is a system of considerable importance, and not on the conduit system. The tramways are electrically equipped on the overhead system and comprise 2¾ miles of double track and 6½ miles of single track, amounting to 9¼ miles of route, equal to 12 miles of single track, besides turn cuts, etc., which bring the total up to about 13¼ miles. The traffic receipts in 1903 amounted to £20,953 and the net receipts £6,580, so that the system is one of more importance than the writer of the article evidently considered. Arrangements are now being also made to considerably extend the mileage, and so far as appearances go the company owning the tramways is evidently in a very good condition and well satisfied with the results of its business enterprise.

The Fife Electric Power Company, which is developing an extensive scheme for the distribution of electric power, has just let one of its contracts for a generating station at Townhill, Dunfermline, to Bruce Peebles & Co. An immediate start is to be made with its erection, and it is hoped that the company will be in a position to supply both power and light by next winter. The company have also under consideration the supplying of the town of Dunfermline with electric light, as well as electric power to one or two of the large collieries in the district, and also for a scheme of electric tramways between the new naval base, Dunfermline, and Kelty, the ground of which has already been surveyed by the engineers of the company.

Recently a meeting of the Parliamentary and By-laws and the Tramways Committees of Newcastle Corporation was held, when a deputation from the Tyneside Tramways Company attended in regard to the question of their proposed running powers over the corporation lines. The deputation explained that it was the desire of the Tyneside Tramways Company to arrive, if possible, at an amicable arrangement with the corporation. They had no wish to show an antagonistic spirit toward the corporation, and the deputation had come with the object of seeing if some arrangement could be come to whereby good feeling would be maintained. The company was prepared to accept less than it originally asked for rather than go to Parliament to obtain full running powers if an agreement could be arrived at. The company would be pleased if it could be informed of all points of difference which the corporation considered to be of vital importance. After the deputation had retired it was arranged to hold a special meeting of the committee to consider the subject.

The committee of the House of Commons presided over by Henry Hobhouse has concluded the consideration of the bill promoted by the London United Tramways Company, the principal proposal of which was the construction of an electrically worked tramway from Baber Bridge to Staines. The committee sat for the adjustment of clauses embodying their decision as to drainage, pavement, the lighting of roads and other matters imposed upon the company on the opposition of the Middlesex County Council. These clauses were brought up and passed, and the committee also modified the purchase clause by reducing the period at the end of which the local authorities should be entitled to acquire so much of the undertaking as was within their area from thirty to twenty-five years. The clauses having been gone through, the bill was ordered to be reported to the House for third reading.

The tramways committee of the Exeter City Council has approved of the specifications for the tramways, and decided to invite tenders at once.

A select committee of the House of Lords—Lord Clifford, of Cudleigh, presiding—has under consideration a bill, the principal object of which is to authorize the use of the waters of Llyn Llydaw, on the eastern slopes of Snowdon, for generating electricity. The promotors proposed to supply the electrical energy so obtained for traction on light railways and as power in the quarries and mines of the district, as well as to authorize undertakers for lighting and other purposes. The area of supply is in the counties of Carnavon, Merioneth and Anglesey and parts of Flintshire and Denbighshire. Among the petitions against the bill are the Conway Corporation, Carnarvon Corporation, Flintshire County Council, Carnarvonshire County Council, the Urban District Councils of Penmaenmawr, Llandudno and Conway and the Colwyn Bay Joint Water Supply Board.

For the promotors it was explained that they proposed to construct a dam which would raise the waters of Llyn Llydaw some 20 feet, thus giving a fall of 1150 feet within a distance of a quarter of a mile of a generating station, and a line of pipes connecting it with the dam. All round the generating station were possible customers in the quarries and mines, and there was already evidence of a large demand for the power which the promoters would supply. It was proposed to transfer to the company the electricity powers of the Portmadoc Railway Company, and the two undertakers would be equal to about 12,000 horse power. About 1000 horse power of this would be utilized to "electrify" the railway authorized in the act of 1901, and 11,000 horse power would be available for quarries and other purposes. The promoters hoped to be able to supply energy at 1½ d. per unit. The estimated cost of the works at Snowdon was £86,500, and this would be provided out of the proposed capital of £170,000, the balance being available for the construction of railways. The company would own all the shares in the Portmadoc Railway and the Narrow-gage Railway, and it was proposed to extend these lines to Carnarvon on the one side and Bettws-y-Coed on the other. The promotors would supply electricity for these railways and they would be worked by the Portmadoc Company. The cost of the acquisition of the undertaking in the Conway Valley would be £40,000.

The city of Leicester has now formally opened its system of electric tramways, a full description of which will be found in another column. The invited guests assembled at the Town Hall at 2.30 p. m., and proceeded by special horse car to the power station of the Lero. At. 3 o'clock Councillor Flint, chairman of the Tramways Committee, assisted by Mrs. Flint, performed the opening ceremony, subsequent to which the car department was inspected. At about 4 o'clock the Mayor (Ald. Sawday) and Ald. Smith started the first electric car, and the guests were invited to ride to the Belgrave terminus and thence to the London road terminus, returning to Waterloo Street. Tea in the Mayor's rooms followed, after which brief speeches were given

by the Mayor, the chairman of the committee and others.

At a recent meeting of the Elland Council the clerk reported that C. T. Rhodes had seen him with respect to a proposal by a syndicate which was being formed for the purpose of running tramcars from Wyke through Halifax and Elland to Huddersfield, and thus connecting those three towns. The proposal had been favorably received by the Tramways Committees of the Huddersfield and Halifax Corporations.

In order to be able to present to the next meeting of the City Council a complete scheme for the establishment of an up-to-date system of tramways throughout the city, the Tramways Committee of the Birmingham City Counsel is now busily engaged in considering details and formulating proposals. In broad terms the scheme under consideration provides not only for the reconstruction and electrification of the existing lines upon the expiration of the present leases, but also for the provision of a series of new lines running into districts which at present are unserved by trams in any form. With regard to the projected routes, it is understood that the committee is not disposed to delay the commencement of the construction of these lines until the expiration of the present leases. To this end Parliamentary powers will require to be sought, and it is understood that the Tramway Committee intends to file a Tramway bill during the coming autumn. There is thus little time to be lost, and the Tramway Committee is desirous of completing its scheme at the earliest possible moment, so that the proposals may be considered and debated by the Council before the matter goes to London.

In an agreement between the Bristol Corporation and the British Tramways Company the latter is to make efficient provision for passengers of the working classes; the corporation may exercise the right to purchase such of the extended lines as may be within the existing boundaries of the city in May, 1915, the date at which the urban system generally may be purchased. The extensions outside the present city boundary—which will, of course, be of greater scope by that time—will be purchasable in forty-two years on payment of the fair market value as a going concern. The Westbury Road, over which a new line of tramways is to run to Henbury, is to be widened at the company's expense, and otherwise suitably prepared for the special traffic.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

The annual meeting of the Metropolitan Railway Company was held on April 16. The operation for 1903 resulted in a net profit of Frs. 4,510,056, against Frs. 2,943,870 in 1902, an increase of Frs. 1,566,185. From this amount the company deducted Frs. 500,000 for the assurance fund and Frs. 1,150,000 special, leaving available for dividends, Frs. 2,860,056. It is proposed to pay 3 per cent dividends.

It was stated at the meeting that the company had made arrangements to take a supply of current from a new power station erected by the Societé Franco-Russe, on the outskirts of Paris, as soon as the same was completed. This power station, it will be remembered, will have 35,000 kw output, of which 18,000 is being installed by the Swiss firm of Brown, Boveri & Co., as follows:

3 turbo-alternator groups, 5000 kw, 25 cycle, 5500 volts, three-phase.
1 turbo-alternator group, 3000 kw, 25 cycle, 5500 volts.
1 turbo-exciter group, 300 kw.
1 motor-generator exciter group.

It may be stated that the Franco-Russe Company, which is building the power station, really represents the same group as compose the Metropolitan Railway. The reason for the Metropolitan Railway Company contracting for power from an outside power station (although controlled by the same group of capitalists) is because the Metropolitan Railway Company only holds the concession for operation of the electric lines (built by the city) for a comparatively short period of years, when it may be bought up by the city at the then value. If, at that time, the operating company takes most of its current from independent power stations, it is evident that the city will practically be obliged to continue the supply or go to the expense of building separate and costly power stations.

In connection with the No. 3 line of the Metropolitan Company shortly to be opened for service, it is certain that double-truck cars will be used, each capable of seating eighty passengers and arranged with three doors on either side of the car, which will have a total length of 13m35. Two motors per car will be used, both motors mounted on the leading axles of the front truck. All the electrical apparatus, whether of the Thomson-Houston train control type or the Westinghouse turret control, will be mounted in an entirely fire-proof cab lined with sheet steel. The car body itself will not be fire-proof, but constructed of pitch pine, as now in use. The Metropolitan Company is in hopes that all chances of fire will be avoided in this manner, notwithstanding the fact that there is no protection against arcing from the third rail circuit. The motor-car equipments will include four shoe-fuses. The wiring in the cabs will be of bare copper or asbestos covered passed through metallic tubes.

A new feature of the No. 3 line will be the lighting circuit arrangement. In the first two lines this consisted of bare wire mounted on porcelain insulators about 3 m above the track along the sides of the tunnel. The stations were also included in the circuit, and the tunnel itself was lighted at regular intervals. The catastrophe of Aug. 10 last was directly attributable to this system, the stations being thrown into total darkness immediately the tunnel circuit was interrupted by the burning cars. In the No. 3 line the tunnel circuit will be independent of the station lighting, and instead of bare wiring, will consist of insulated cable laid under the track. Small wires will be drawn through Bergmann tubes and embedded in the walls of the tunnel.

The equipments for use on this line will be furnished by the French Thomson-Houston Company, to the number of ninety. The Sprague General Electric system will be used, and some interesting comparative tests are expected to be made between these and the new Westinghouse equipments. The latter company is transforming ninety-one cars to be used on the No. 1 line (Vincennes-Torte Maillot), and the trains will include three motor cars and four travillers. It is also furnishing nine double-motor, 200-hp equuipments for the No. 3 line.

It is well known that Paris is a most conservative city regarding the use of the trolley system within its streets. An important inroad, however, is about to be made by the conversion of the steam road from Paris to St. Germain, and running along the Route Nationale down the Avenue de la Grande Armée starting from the Arc de Triomphe. Visitors will remember the grotesque appearance of the existing steam locomotives and long train of trailers which slowly puffed up the long incline into Paris. The trailers were one by one left at certain points on the route, and the locomotives had great difficulty in mounting the grade into St. Germain with one trailer. The Compagnie des Tramways Mecaniques des Environs de Paris have obtained the concession to erect the trolley system and a high speed interurban service will replace the cumbrous steam plant.

The new 12-mile electric extension of the Paris-Orleans Railway Company is fast approaching completion, and the first locomotive and motor car will be delivered about the end of May. This is a case of a trunk railway making an extension of an existing electric plant to handle its increasing suburban traffic in preference to increasing its steam rolling stock. The line is laid out for a 11,000-volt transmission, but until further extension be made, will run at a tension of 5500 volts three-phase, 25-cycles, transformed to 600 volts direct-current; third rail distribution will be used with a few ærial contacts at stations and crossings.

M. V.

IMPORTANT CONSOLIDATION OF GERMAN STEEL COMPANIES

On March 1, almost all of the German steel companies formed a union at Düsseldorf, under the title of the Stahlwerks-Verband Aktien-Gesellschaft, with headquarters in Düsseldorf. The new company has taken over the inland and export trade of the associated works, its manufactures including the following: Heavy and light rails, sleepers, fish-plates, sole-plates, steel joists, channels, ingots, blooms, billets, sheet bars, etc.

The following are among the more important companies absorbed in founding the new corporation: Bochumer Verein für Bergbau und Gussstahlfabrikation, Bochum i. W.; Gesellschaft für Stahl-Industrie m. b. H., Bochum i. W.; Eisenhütten-Aktien-Verein, Düdelingen (Luxemburg); Georgs-Marien-Bergwerks-und Hütten-Verein, Aktien-Gesellschaft, Osnabruck; Hörder Bergwerks- und Hütten-Verein, Hörde i. W.; Fried. Krupp Aktiengesellschaft, Essen a. d. Ruhr; Luxemburger Bergwerks- und Saarbrücker Eisenhütten-Aktien-Gesellschaft, Burbacherhütte, Burbach bei Saarbrücken; Gebrüder Stumm, Ges. m. b. H., Neunkirchen, Bez. Trier; Union Aktien-Gesellschaft für Bergbau, Eisen- und Stahl-Industrie, Dortmund; Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten-Aktien-Gesellschaft, Köln-Deutz.

NOTES FROM GERMANY

The present state of the electrical manufacturing industry in Germany may be considered entirely satisfactory. It is now possible to judge the results of last year's consolidation of the leading German electrical companies into two groups, the first comprising the Allgemeine Elektricitäts Gesellschaft and the Union Elektricitäts Gesellschaft, and the second the Siemens-Halske and the Shuckert companies. Before these combinations, the capital of the Allgemeine Company was 60,000,000 marks ($15,000,000), and its annual dividend for several years 15 per cent, while the Union Company paid 10 per cent on its capital of 24,000,000 marks ($6,000,000). The Siemens-Halske Company was capitalized at 60,000,000 marks ($15,000,000) and had paid the equivalent of a dividend of 6 per cent for several years, but as the Shuckert Company had paid no dividends for a number of years on its capital of 54,000,000 marks ($13,500,000), it was obliged to consolidate on less favorable terms than the other companies. However, an actual fusion took place only in the case of the companies comprising the first group; the Siemens-Halske and the Shuckert companies, simply combining their manufacturing plants and becoming joint owners of the new stock of 90,000,000 marks ($22,500,000) issued in the name of the Siemens-Shuckert Works.

Outside of these combinations, there are two other important electrical manufacturing companies, Lahmeyer, of Frankfort, and Helios, of Cologne. These companies are not paying dividends as they are still suffering from the after-effects of the boom of 1896-1898, and although their combined capitalization is fairly large, they are almost negligible as competitors to the other companies. It must be noted, however, that the large companies have not used their power to raise the cost of electrical machinery to a very high figure; on the contrary, they have simply endeavored to avoid the ruinous prices formerly in vogue and to base their selling prices on a fair advance over the cost of manufacture. This temperate policy is in line with that followed by other German syndicates and properly enjoys the protection of the government.

As the electrification of city and suburban railways has been practically completed, the principal source of income from railways is due to renewals. This falling off, however, is compensated for by an increase in orders from mining and smelting works, which are rapidly adopting electrical machinery. Lately this business has received a temporary check on account of the Russo-Japanese war.

The consolidated companies are displaying great faith in the future of the steam turbine. The Allgemeine Company controls the Riedler-Stumpf-Curtis patents, and the Siemens-Shuckert Company the Zoelly system. Both groups have organized separate turbine companies, and the Siemens-Shuckert Company in addition has taken into partnership the North German Lloyd and Krupp. It is evident therefore what immense capital is backing turbine development in Germany.

The Studien-Gesellschaft für Elektrische Schnellbahnen (Research Association for Electric High-Speed Railways), which was organized four years ago, has ended its labors after both of its experimental cars attained speeds of over 200 km (120 miles) an hour traveling alone, and of 170 km (102 miles) per hour with one Pullman car attached. Both of the great 90-ton cars have left the field and high-speed experiments are now being conducted on the same line with steam locomotives.

At first glance, it might appear that the expensive experiments which the association conducted have proved a failure, but that is certainly a false conclusion. Those who contributed to the cost of these experiments did not expect that they would result in the immediate adoption of high-speed electric traction. They simply intended to show that with present facilities it is possible to run a train safely at speeds of 200 km (120 miles) an hour. At the same time, the trials made possible a thorough study of the air resistance at high speeds, the proper signal apparatus and other important points. The members of the association were right in judging that these tests would awaken a public desire for higher speeds and that finally a point would be reached where the demand would justify the installation of high-speed electric traction.

The government could not shut its eyes to the fact that high-speed experiments had been conducted successfully on its own lines, and it has therefore begun a series of tests with locomotives, using superheated steam. In one of these tests a locomotive hauled three Pullman cars at 130 km (78 miles) per hour. Assuming that it will be possible to adapt the present roads to carry trains running at 130 km (78 miles) per hour instead of the present 80 km to 100 km (48 miles to 60 miles) many changes will be required in signal and other auxiliary apparatus. It will also be necessary to make changes in car construction, increase the weight of the rails, etc. The greater portion of the orders resulting from these changes would go to the companies who were members of the Studien-Gesellschaft, so that their outlays would soon be recouped even if the steam locomotives were not displaced immediately. At present it is likely that the engineers of the electrical companies will endeavor to develop a single-phase system in place of the complicated three-phase system used during the Zossen trials.

The Union Elektricitäts Gesellschaft, following what has been done in the United States, has installed a single-phase system on a line near Berlin 4 km (2.4 miles) long, which will soon be placed in operation. It is evident, therefore, that a beginning in single-phase work has already been made.

Should the single-phase system prove as economical in practice as in theory, the manufacturing companies will no doubt receive many orders from street railways, and for the construction of mountain railways whose construction is not particularly profitable under present conditions. Only the existence of the old direct-current stations, from which many of the railway companies are obliged to purchase power, will prevent the latter from adopting alternating-current.

It is unfortunate that electrical science has not advanced so far as to displace the countless narrow gage steam freight lines (light railways). Usually these lines are built partly at the expense of the government or local municipality and partly by private parties. Most of them run through thinly populated districts, some of them operating as few as three trains per day in each direction. As they are built principally to open up the country districts and advance agricultural interests, little or no profit is expected from them. Thirty railways of this type are now being built in Bavaria alone. They comprise a total length of 1500 km (900 miles), and the government has granted a subsidy of 39,000,000 marks ($9,750,000) to assist in their construction. In four years twenty-four such lines have been built in Bavaria. When the new lines are completed this small kingdom will possess 173 light railways having a total of about 4000 km (2500 miles).

The following figures will give a fair idea of the small business that is done by these lines:

1885	1,537 marks per km	$640 per mile
1888	3,659 marks per km	1,525 per mile
1902	4,347 marks per km	1,811 per mile

Of course the operating expenses were very small, making it possible to pay dividends. These average 1.3 per cent in 1884, 4.6 per cent in 1888, 3.6 per cent in 1897 and 2.33 per cent in 1902. It is proposed to increase the freight rates from 20 per cent to make these lines more profitable.

It is to be hoped that the day is not far distant when the many waterfalls in Bavaria will be harnessed for electric traction. The present locomotives are very cumbersome and expensive, and the government is now considering the use of motor cars, but has not yet decided whether they should be of the electric, steam or gasoline type.

Storage-battery cars are little heard of in Germany since the Prussian authorities forbade their use for "reasons of safety." At present they are employed only in Dresden. Nevertheless, the largest storage-battery manufacturer, the Hagen Company, is enjoying excellent business as the use of stationary storage batteries is constantly increasing. The electric railways have long employed reserve storage batteries, and there are very few power stations that do not possess them; the other storage battery manufacturers have, however, done very little business.

In view of the success of gasoline automobiles a certain amount of development is taking place in the use of motor cars or dummies as steam railroad feeders. This is evident by the experiments which are being tried on several English railroads, and which are being watched with great interest in Germany, where similar experiments have repeatedly been made.

THE YOUNGSTOWN & SOUTHERN RAILWAY SOLD

The Youngstown & Southern Railway Company, incorporated some time ago under the laws of Ohio, and having under construction a 60-mile third-rail line from Youngstown to East Liverpool, Ohio, passing through Lisbon, has recently been sold to Eastern interests. The building of the line will be carried out as originally projected, and J. G. White & Company, of New York, have the contract for constructing, the work of which has already been begun. It will be fully a month before details can be secured as to the power plants to be utilized for operating the lines. Ex-Lieutenant-Governor Jones, of Ohio, is president of the company, and Ernest Gonzenbach is chief engineer.

ANNUAL MEETING OF PARIS METROPOLITAN COMPANY

The annual meeting of the Paris Metropolitan Railway Company was held May 16. The company reported receipts for 1903, Frs. 17,626,682; operating expenses, Frs. 7,577,060; other expenses, including taxes, Frs. 5,693,654; net earnings, Frs. 4,999,537. From this sum, Frs. 1,150,000 are deducted as a consequence of the accident of August, 1903, leaving a total of Frs. 3,296,368 available for dividends. A dividend of 3 per cent has been declared. It was also decided to establish a special insurance fund, and an amount was charged off to it amounting to Frs. 500,000. On Dec. 31, 1903, the company owned 132 motor cars and 462 trail cars, and had 24 km of line in operation. The capital of the company is Frs. 75,000,000.

THE NEW HAVEN RAILROAD BUYS MORE TROLLEY LINES —OTHER NEW ENGLAND ROADS PLAN TO COMPETE WITH TROLLEY

The policy of the New York, New Haven & Hartford Railroad Company regarding the purchase of competing electric railways, is certainly being carried out aggressively. Two weeks ago announcement was made in the Street Railway Journal of the plan of the company to consolidate under the title of the Consolidated Railway Company, the electric lines then controlled, and last week the appointment was noted of Mr. E. H. McHenry as fourth vice-president of the company, to devote himself exclusively to the management of the company's electric railway properties. Now the announcement is made that the company has concluded on private terms the purchase from the receivers of the Worcester & Southbridge Street Railway and its subsidiary companies, the Rochdale & Charlton depot and the Southbridge & Sturdridge Companies. These properties, it is stated, will be consolidated with the Consolidated Railway Company and brought under the management of Mr. McHenry. In mentioning these latest developments of the company, it is interesting to note the report emanating from Newport to the effect that the company has completed plans for the electrical equipment of its line between Newport and Fall River, also the statement that the company's line between Hartford and Springfield is to be equipped with the third-rail system to meet electric competition.

The Consolidated Railway Company, which is to be the operating company for electrical properties controlled by the New York, New Haven & Hartford Company, formally organized and elected officers Saturday, May 28, at New Haven. This company, it will be remembered, is the old Worcester & Connecticut Eastern, whose name was recently changed by request. The directors chosen were as follows:

Charles S. Mellen, George J. Brush, H. M. Kochersperger, J. S. Hemingway, Arthur D. Orborne, E. H. McHenry, John M. Hall, Percy R. Todd, of New Haven; Edward D. Robbins, of Hartford; Frank W. Cheney, of Manchester; Fayette S. Curtis, of Boston; Charles F. Brooker, of Ansonia; I. D. Warner, of Bridgeport; Edwin Milner, of Plainfield.

Officers were elected as follows:

C. S. Mellen, president; E. H. McHenry, first vice-president; M. H. Kochersperger, second vice-president; J. G. Parker, secretary; A. S. May, treasurer; T. F. Paradise, assistant treasurer.

Mr. McHenry, as previously stated in the Street Railway Journal, will have charge of all the electric railway properties of the company. Mr. Robbins has been connected with the Connecticut Eastern since its organization and Mr. Hemingway was president of the Fair Haven & Westville Railroad, operating the street railway system of New Haven.

But the New York, New Haven & Hartford Railroad is not the only New England Company now making announcements bearing on the question of electric competition, and the measures to be adopted to forestall it. Both the Boston & Maine Railroad and the Boston & Albany division of the New York Central have just made statements bearing on the same general subject, but showing that a very different plan has been worked out by them for special cases. The announcements of the roads mentioned refer to statements of reductions in fare. In the case of the Boston & Maine Railroad, which is paralleled by electric railways between Springfield and Greenfield, a distance of 40 miles, the schedule of fares which went into effect on the Connecticut River division of the company this week is in every instance as low as the trolley rates. The railroad has suffered especially heavy loss in local traffic between Springfield and Northampton. Under the new schedule the fare from Springfield to Holyoke, a distance of 9 miles, will be reduced from 15 cents to 10 cents. Between Northampton and Springfield, 18 miles, the fare will be cut from 33 cents to 20 cents. From Springfield to Greenfield the rate will be 50 cents instead of 83 cents. Reductions will be made in about twenty instances.

MORE EQUIPMENT FOR MANILA

J. G. White & Company, of New York, have placed a contract with the Peckham Manufacturing Company, of New York, for fifty-five single-trucks. The cars, as previously mentioned in the Street Railway Journal, will be of Belgian build, La Metallurgique, of Brussels, having taken the contract. Teak wood will be used in order to withstand the ravages of the white ant. The motors will be of Westinghouse manufacture. The Albert & J. M. Anderson Manufacturing Company, of Boston, Mass., has been allotted the contract for the line material. The J. A. McCardell Company, of Trenton, N. J., is to ship some Trenton tower wagons for construction and repair works. Milliken Brothers, of New York, are supplying the steel for the power house. Two large compound duplex feed pumps have been ordered from the Blake branch of the International Steam Pump Company, of New York.

CURTIS TURBINES FOR TOKIO STREET RAILWAY PLANT

The Tokio Shigai Railway Company, which is constructing 30 odd miles of double track in Tokio, Japan, has ordered, through the Japanese mercantile house of Mitsui & Company, of New York, four 1500-hp Curtis turbines for installation in the company's main generating station. The portion of the road now running is operated from the Tokio Electric Light Company's plant. The new station will be one of the largest in the Far East.

DECISION IN CHICAGO NINETY-NINE YEAR ACT CASE

Decision on the validity and scope of the ninety-nine year traction act, involving traction rights in Chicago, was handed down on Saturday, May 28, by Judges Grosscup and Jenkins, of the United States Circuit Court. It must be said that the decision is somewhat ambiguous; it upholds the legality of the act as affecting all ordinances, etc., prior to 1875, but does not apply to various ordinances and grants since 1875.

The Court held that when the municipality, by vote, accepted the cities and villages act, the ninety-nine year grant from the Legislature was null and void so far as Chicago was concerned. The cities and villages act was passed in 1872, but it was on May 3, 1875, that Chicago's new charter, under that act, became operative, and on that date, said the Court, the twenty-year franchise law became effective.

The gist of the decision is found in the closing paragraph, which is as follows:

"To sum up our conclusions in one paragraph, we hold that as to such ordinances as were passed by the City Council prior to the counting of the vote at the charter election in 1875, and accepted and acted upon by the railway companies, there exists, between the companies and the city, a contract relation, terminable by neither party without the consent of the other, until the period named in the legislative act expires; but that as to the streets occupied under ordinances passed after that date, the contract relation is to be looked for solely in the ordinances themselves."

Of the various expressions of opinion regarding the decision, those of Receiver John C. Fetzer, of the Union Traction Company, and of Mayor Carter H. Harrison are of especial interest, for in them one has the opinion of the accredited representatives of the company and of the people. Mr. Fetzer says that now is the time for a settlement, and that the interests involved ought to get together at once in business-like way and adjust such differences as exist. The tone of Mayor Harrison's statement, however, is very different from that of Mr. Fetzer. He seems to think that the company is left in a position where "it must do business with the city," and that the company "might as well be sensible and come in on a deal on lines the city believes right."

In order better to understand the situation it is deemed advisable to state that the decision just rendered relates to an act passed by the Legislature of Illinois in 1857, to make franchises of street car and lighting companies in that State good for ninety-nine years. In 1858 franchises were obtained from the city of Chicago covering sections of some of the lines now in the Union Traction Company. These franchises were granted for twenty-five years, and on the expiration of that period in 1883 the companies acquired a continuation for twenty years, but without in any way prejudicing their rights under the ninety-nine year act. This extension of the terms with the city expired last year, but the companies have contended that they still possess the rights under the act of the Legislature. As extensions of original lines became necessary, permits were obtained from the city for the construction of such, and these permits were granted for the same

number of years as in the original franchise. Thus while franchises of original lines under the grant of 1858 have expired, those of the extensions of the same lines have still, in several cases, many years to run.

A MOST IMPORTANT ORDER BY A RAILROAD COMMISSION

The Railroad Commissioners of Massachusetts have handed down a decision on the petition of the Newtown & Boston Street Railway Company, which allows it to discontinue the giving of free transfers on its cars. The board does this, however, for a limited period, as an experimental measure, with the understanding that no dividend shall be paid and net earnings, if there are any, shall be devoted to the reduction of the floating indebtedness of the company. The period named by the board expired on Sept. 30, 1905, when the board will review the questions now presented in the light of the experience thus gained. Such action as may be compatible with the successful operation of the company and the interests of the traveling public will then be taken.

VICTORY FOR COMPANY IN CLEVELAND LOW-FARE FIGHT

The United States Supreme Court, on Tuesday, May 31, affirmed the decision of the United States Circuit Court for the Northern District of Ohio, in the Cleveland Street Railway fare cases. The cases involved the validity of the ordinance passed by the City Council of Cleveland fixing the rate of fare on the street railways at 4 cents cash, or seven tickets for 25 cents. The ordinance was attacked on the ground that it constituted a violation of contract, and the Court, in an opinion by Justice White, held that the consolidation ordinance of 1885, fixing fares at 5 cents, constituted a contract binding on the city and the railway companies.

THE CAMDEN & TRENTON LINE OPENED—LINK IN THE NEW YORK-PHILADELPHIA LINE

The first through car over the Camden & Suburban (Public Service Corporation) and Camden & Trenton Railways, from the Philadelphia ferries at Camden, N. J., to State and Warren Streets, Trenton, made the trip on May 24, in two hours and twenty-five minutes for the 36 miles. The car left Camden at 3:45 p. m., and arrived at Trenton at 6:10, and the trip was made without a hitch of any kind. From Camden city line the new route runs through private right of way, alongside the highway and crosses the Amboy division of the Pennsylvania Railroad near Delair, on a trestle. The 10 miles to West Palmyra were covered in forty minutes, and between West Palmyra and Riverside several miles were made at rates of speed from 20 to 25 miles per hour. Through the careful planning of Superintendent James S. Gilbert, of the Camden & Trenton Railway, there was no waiting at the switches. Upon the arrival of the car in Trenton the party was escorted to the Trenton House, where an elaborate repast was served through the courtesy of the Camden & Trenton Company. Among those who made up the party were: Henry V. Massey, president of the Camden & Trenton Railway; ex-Senator M. B. Perkins, treasurer of the Camden & Trenton Railway; Dr. James S. Gilbert, superintendent of the Camden & Trenton Railway; William E. Scull, president of the Camden & Suburban Railway; W. E. Harrington, general manager of the Camden & Suburban Railway; F. A. Hewitt, chief despatcher of the Camden & Suburban; S. G. Browning, Camden & Suburban; J. B. Hutchinson, former general manager of the Pennsylvania Railroad; A. S. Chandler and A. N. Chandler, Philadelphia bankers and financiers of the Camden & Trenton and Trenton & New Brunswick Railroads; Samuel T. Corliss, secretary of the Camden & Suburban; John. J. Burleigh, fourth vice-president of the Public Service Corporation; Joseph R. Gilkyson, general agent of the Public Service Corporation; T. G. Kitchin, of the STREET RAILWAY JOURNAL, and others. Regular service was established on May 25, with cars between Trenton and Camden every forty-two minutes from 6:10 a. m. until 9:36 p m. The running time is three hours and eight minutes, and the fare is 50 cents.

With the opening of the Camden & Trenton Railway between Trenton and the Camden ferries, through service from New York to Philadelphia, with but a single change of cars, is now a reality. The time consumed is nine hours. A person leaving the Cortlandt or Desbrosses Street Ferries in New York at 8:20 in the morning, will be in Camden at 4:59 p. m., and in Philadelphia five or six minutes later, by changing cars at Liberty and Adeline Streets, Trenton. Leaving New York at 11:20 a. m., one would arrive in Camden at 7:47 p. m.; leaving New York at 2:20 p. m., arrive in Camden 11:17 p. m. The car leaving the Camden ferries (Philadelphia ten minutes earlier) at 7:53 a. m., arrives in New York at 4:45 p. m. Leaving Camden 11:24 a. m., arrive in New York at 7:45 p. m.; leave Camden 2:12 p. m., arrive in New York at 10:45 p. m. Other trips can be made by changing at Trenton, New Brunswick, Bound Brook, Dunellen and Newark, but the ones mentioned above only provide for a change at Trenton. The single fare is $1.30, and the distance 104 miles.

PERSONAL MENTION

MR. F. J. CUTTING has been appointed general manager and superintendent of the Erie Rapid Transit Street Railway Company, of Erie, Pa., to succeed Mr. Frank S. Given, who resigned recently.

MR. C. V. MILLS has resigned as superintendent of the West Chester Street Railway, of West Chester, Pa., to become superintendent of the lines of the Chester Traction Company, operating lines from Darby to Wilmington, and numerous other points in Delaware County.

MR. SAMUEL HUNT, of Cincinnati, who has had a large experience in the management of railroads, being at present president of the Detroit Southern Railway, has been elected vice-president of the New York, Westchester & Boston Railway, which plans to build an electric railway from New York to Port Chester, N. Y., a distance of 25 miles.

MR. H. A. BELDEN, general manager of theManila Electric Railway & Light Company, will arrive very shortly on a two months' visit to this country. Mr. Charles M. Swift, of Detroit, Mich., president of the company, has already returned from a trip to the Philippines. He is expected to be in New York next week, and will make his headquarters at the office of J. G. White & Company, who are installing the Manila system.

GENERAL BANCROFT and Vice-President Sargent, of the Boston Elevated Railway, recently returned from a tour of inspection of the street railway systems of Chicago, Minneapolis, St. Paul and several other Western cities. Both were particularly well impressed with the system of the Twin City Rapid Transit Company, operating in Minneapolis and St. Paul, and also said they found some interesting features in the suburban system of the Illinois Central Company.

MR. H. S. KEMP, electrical engineer of the Standard Electric Company, of Norfolk, Va., and Charlotte, N. C., has been appointed by the Tazewell Electric Light & Tazewell Street Railway Company, of Tazewell, Va., as consulting engineer to prepare plans and specifications for the extension and reconstruction of its light and railway plant. Mr. Kemp has had a long experience in the electric light and railway management and construction, and for the past five years has been with the Standard Electric Company as engineer. The company does a general engineering and contracting business for electric light, railway and water power plants.

MR. MASON D. PRATT, M. Am. Soc. C. E., and formerly of the Pennsylvania Steel Company, has opened an office as consulting engineer at 18 North Third Street, Harrisburg, Pa., and is prepared to make surveys, plans and specifications, and to supervise the construction of electric railways, power plants, waterworks or industrial plants. Mr. Pratt is a graduate of Lehigh University, class of 1887, and was for a time a draftsman with the Phœnix Bridge Company. Afterwards he became associated with the Johnson Company, at Johnstown, Pa., now the Lorain Steel Company, first as designing engineer on the new mill buildings at Moxham, later as engineer in charge of construction of electric railways at Lancaster, Pa., and Washington, D. C. In this connection he traveled extensively for this company making surveys, plans and contracts. In 1889 he was associated with M. Tschirgi, Dubuque, Ia., where, as assistant engineer, he had supervision of much municipal work, including the construction of a complete system of sewers. For the past thirteen years he has been connected with the Pennsylvania Steel Company, first as street railway engineer, and for the past two years and a half as engineer in charge of construction of new shops for the frog and switch department of this company. The buildings in this plant include a 1000-hp boiler plant, electric sub-station, iron foundry and other shops of modern steel and concrete construction, having altogether about 9 acres of floor space. For several years Mr. Pratt has been a member of the water board of Steelton, designing and carrying out many improvements to the plant, including the relining of the reservoir with asphalt. He has also been engaged to design and supervise the construction of a filtration plant for Steelton.

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., Apr. '04	63,064	37,504	25,560	22,467	3,094
	1 " " '03	61,656	35,208	26,449	23,063	3,385
	4 " " '04	241,665	145,373	96,292	90,068	6,225
	4 " " '03	236,753	137,826	98,928	87,338	11,589
ALBANY, N. Y.						
United Traction Co	3 m., Mar. '04	392,776	284,478	108,298	76,147	32,151
	3 " " '03	379,503	252,870	126,633	72,651	53,982
BINGHAMTON, N. Y.						
Binghamton Ry. Co.	1 m., Apr. '04	18,062	11,721	6,341	------	------
	1 " " '03	17,336	10,179	7,156	------	------
	10 " " '04	195,908	108,316	87,592	------	------
	10 " " '03	182,717	105,512	77,204	------	------
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Apr. '04	28,063	12,188	15,875	------	------
	1 " " '03	15,161	6,242	8,918	------	------
	4 " " '04	87,936	43,678	44,258	------	------
	4 " " '03	51,196	24,948	26,248	------	------
Metropolitan West Side Elevated R. R. Co	1 m., Apr. '04	182,886	------	------	------	------
	1 " " '03	176,395	------	------	------	------
	4 " " '04	719,668	------	------	------	------
	4 " " '03	700,932	------	------	------	------
Northwestern Elevated R. R. Co	1 m., Apr. '04	111,326	------	------	------	------
	1 " " '03	107,010	------	------	------	------
	4 " " '04	441,505	------	------	------	------
	4 " " '03	422,764	------	------	------	------
South Side Elevated R. R. Co.	1 m., Apr. '04	137,250	------	------	------	------
	1 " " '03	131,329	------	------	------	------
	4 " " '04	547,457	------	------	------	------
	4 " " '03	530,347	------	------	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., Mar. '04	100,204	*60,631	39,573	20,917	18,656
	1 " " '03	94,830	*56,296	38,534	21,433	17,101
	3 " " '04	294,002	*176,892	117,110	63,283	53,827
	3 " " '03	275,305	*165,476	109,828	63,415	46,414
CLEVELAND, O.						
Cleveland, Painesville & Eastern R. R. Co	1 m., Apr. '04	14,962	9,499	5,463	------	------
	1 " " '03	14,900	9,100	5,800	------	------
	4 " " '04	53,344	36,823	16,522	------	------
	4 " " '03	52,939	33 904	19,035	------	------
DETROIT, MICH.						
Detroit United Ry.	1 m., Apr. '04	348,502	217,813	130,689	88,303	42,386
	1 " " '03	336,047	205,018	131,029	82,009	49,020
	4 " " '04	1,282,496	874,241	408,255	355,973	52,282
	4 " " '03	1,273,544	773,388	500,156	326,748	173,408
DULUTH, MINN.						
Duluth Street Ry. Co.	1 m., Apr. '04	51,647	26,880	24,767	16,524	8,243
	1 " " '03	51,665	30,973	21,692	15,225	5,467
	4 " " '04	187,109	114,810	72 299	65,848	6,451
	4 " " '03	182,989	115,425	67,564	60,769	6,795
EAST ST. LOUIS, ILL.						
East St, Louis & Suburban	1 m., Apr. '04	98,425	50,960	47,465	------	------
	1 " " '03	83,172	40,754	42,418	------	------
	2 " " '04	195,458	97,862	97,596	------	------
	2 " " '03	161,187	81,800	79,387	------	------
FORT WORTH, TEX.						
Northern Texas Traction Co	1 m., Apr. '04	43,770	23,253	20,517	9,749	10,768
	1 " " '03	37,381	22,222	15,159	9,018	6,140
	4 " " '04	160,985	96,829	64,157	38,325	25,832
	4 " " '03	127,772	70,154	57,618	35,988	21,629
FINDLAY, O.						
Toledo, Bowling Green & Southern Traction Co	1 m., Apr. '04	19,375	12,386	6,989	------	------
	1 " " '03	22,075	13,439	8,636	------	------
	4 " " '04	77,584	58,652	19,032	------	------
	4 " " '03	83,294	53,898	29,396	------	------
HANCOCK, MICH.						
Houghton County St. Ry. Co	1 m., Mar. '04	14,022	12,394	1,627	3,403	†1,776
	1 " " '03	15,768	9,914	5,854	2,929	2,925
	12 " " '04	186,807	127,206	59,661	35,815	23,846
	12 " " '03	177,777	118,131	59,646	32,225	27,421
HARRISBURG, PA.						
Central Pennsylvania Traction Co	1 m., Apr. '04	40,139	38,985	1,154	------	------
	1 " " '03	38,089	25,531	12,558	------	------
	4 " " '04	152,425	149,369	3,056	------	------
	4 " " '03	145,991	102,951	43,040	------	------
HAZLETON, PA.						
Lehigh Traction Co	1 m., Apr. '04	10,488	7,027	3,461	------	------
	4 " " '04	40,649	30,724	9,925	------	------
HOUSTON, TEX.						
Houston Electric Co	1 m., Mar. '04	30,106	19,469	10,636	7,933	2,703
	1 " " '03	33,150	21,795	11,355	6,984	4,370
	12 " 04	407,598	272,792	134,805	88,009	46,795
	12 " 03	379,565	226,406	153,159	75,734	77,424
LONG ISLAND CITY, N. Y.—New York & Queens County Ry. Co	3 m., Mar. '04	121,382	93,156	28,226	49,099	†20,873
	3 " " '03	116,371	90,763	25,608	48,233	†22,625
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Apr. '04	254,046	127,219	126,827	73,300	53,527
	1 " " '03	239,967	121,005	118,962	70,711	48,251
	4 " " '04	1,010,774	544,619	466,155	293,804	172,351
	4 " " '03	940,706	491,373	449,334	280,611	168,723
MINNEAPOLIS, MINN						
Twin City Rapid Transit Co	1 m., Apr. '04	337,403	160,803	176,599	72,177	103,822
	1 " " '03	317,178	151,970	165,208	60,900	104,308
	4 " " '04	1,325,475	641,464	684,011	287,770	396,241
	4 " " '03	1,231,173	594,299	636,875	243,600	393,274
MONTREAL, QUE.						
Montreal St. Ry. Co	1 m., Apr. '04	186,473	125,372	61,100	20,837	40,264
	1 " " '03	172,086	107,876	64.210	19,717	44,493
	7 " " '04	1,309,152	891,706	417,446	126,435	291,012
	7 " " '03	1,189,577	759,931	429,646	119,856	309,790
OLEAN, N. Y.						
Olean St. Ry. Co	1 m., Apr. '04	7,877	4,246	3,630	2,439	1,191
	1 " " '03	6,270	3,204	3,066	1,942	1,124
	10 " " '04	83,907	41,357	42,551	24,414	18,137
	10 " " '03	59.896	31,785	28,111	16,581	11,530
PHILADELPHIA, PA.						
American Railways	1 m., Apr. '04	105,190	------	------	------	------
	1 " " '03	98,831	------	------	------	------
	10 " " '04	1,152,797	------	------	------	------
	10 " " '03	1,008,189	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry. Co	1 m., Apr. '04	116,586	64,951	51,635	26,467	25,168
	1 " " '03	97,872	49,179	48.693	25,448	23,245
	4 " " '04	457,431	271,368	186,063	105,052	81,011
	4 " " '03	397,040	207,081	189,959	101,855	88,104
SAN FRANCISCO, CAL.						
United Railroads of San Francisco	1 m., Apr. '04	569,609	------	------	------	------
	1 " " '03	518,467	------	------	------	------
ST. JOSEPH, MO.						
St. Joseph Ry., Light, Heat & Power Co	1 m., Apr. '04	45,956	28,154	17,802	------	------
	1 " " '03	38,889	22,083	16,806	------	------
ST. LOUIS, MO.						
St. Louis Transit Co	1 m., Apr. '04	710,338	------	------	------	------
	1 " " '03	607,031	------	------	------	------
	4 " " '04	2,484,176	------	------	------	------
	4 " " '03	2,180,294	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Apr. '04	119,000	38,000	81,000	------	------
	1 " " '03	109,926	34,143	75,783	------	------
	4 " " '04	487,354	160,512	326,842	------	------
	4 " " '03	422,650	129,179	293,471	------	------
SAVANNAH, GA.						
Savannah Electric Co.	1 m., Mar. '04	39,371	24,811	14,559	10,034	4,525
	1 " " '03	37,675	26,803	10,871	9,583	1,288
	12 " " '04	525,992	305,287	220,704	121,360	99,343
	12 " " '03	493,158	281,425	211,732	115,149	96,582
SEATTLE, WASH.						
Seattle Electric Co	1 m., Mar. '04	183,836	130,070	53,766	23,541	30,224
	1 " " '03	142,085	110,865	31,219	25,354	5,864
	12 " " '04	2,170,804	1,525,361	645,443	278.122	367,321
	12 " " '03	1,944,863	1,385,863	558,999	271,206	287,793
SYRACUSE, N. Y.						
Syracuse Rapid Transit Co	1 m., Apr. '04	70,539	42,428	28,111	20,376	7,734
	1 " " '03	62,612	35,646	26,966	19,238	7,729
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., Mar. '04	42,024	31,391	10,633	9,246	1,386
	1 " " '03	33,876	24,299	9,577	6,585	2,993
	12 " " '04	498,739	329,409	169,330	95,965	73,365
	12 " " '03	367,538	270,610	96,928	77,069	19,859
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Apr. '04	134,420	*77,391	57,029	41,969	15,060
	1 " " '03	127,562	*69,709	57,853	40,360	17,493
	4 " " '04	534,641	*301,158	233,483	166,843	66,640
	4 " " '03	495,217	*258,673	236,544	160,098	76,446
YOUNGSTOWN, O.						
Youngstown-Sharon Ry. & Light Co.	1 m., Apr. '04	37,602	*22,856	14,746	------	------
	4 " " '04	148,233	*92 242	55,990	------	------