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Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

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Fender Maintenance

Ever since fenders have been introduced they have been the bugbear of the master mechanic who has had them to maintain. In fact, it is rare to find a master mechanic who is in any way enthusiastic about fenders, because he is apt to look at fenders as simply devices which cause endless trouble in maintenance without considering their value in preventing accidents. Let it be granted, however, that fenders are a nuisance as far as maintenance is concerned and that no fender is infallible, and we have still left enough points in favor of the fender to make it worth while to look carefully after its condition. Even supposing that the fender is of such crude design that it will safely pick up only 25 per cent of the persons who would otherwise be run over by a car, it is manifestly short-sighted policy not to maintain all the fenders on a road at their highest state of efficiency, otherwise much of the investment that is made in fenders is simply going to waste or is serving simply the purpose of conforming with some municipal ordinance. If the company is to go to the expense of equipping cars on its system with fenders it is certainly worth while to get the most benefit out of them that is obtainable, even if the fenders leave many things to be desired. That fenders are expensive to maintain on account of collisions with wagons and the like, is granted; but it costs practically no more to maintain them so that they are in their best working condition than to give them simply the attention necessary to "keep up the bluff" of having a fender on the car. The investment in fenders is certainly too great to have its advantages virtually wiped out by careless maintenance.

The Chicago Franchise Ordinance

We feel that it would be unsafe to predict with assurance that the franchise ordinance for the Chicago City Railway Company which has been completed by the local transportation committee of the Chicago City Council is to accomplish an early settlement of the franchise question in Chicago because there have been so many "slips 'twixt the cup and the lip" in the franchise negotiations which have been going on in that city. Nevertheless, the fact that a complete ordinance has been drawn up indicates that franchise matters are at least much nearer a settlement than they have ever been before, because no previous local transportation committee has drawn up a complete ordinance with the idea of its early passage by the City Council. That some progress has been made can now also be seen from the fact that at last a tangible proposition for the settlement of the question has been drawn up which Mayor Harrison indorses. Mayor Harrison's attitude heretofore has always been that of an obstructionist, and it is encouraging to know that at last something in the way of a franchise ordinance has been framed that meets with his approval, even though that ordinance leaves several things to be desired. Although the principal features of this ordinance have already been mentioned in the news columns of this paper, a brief review of it here may be of interest in view of the fact that since the ordinance was published there are many indications that public opinion in Chicago is generally favorable to it, and for that reason its passage by the City Council seems probable. Furthermore, if this ordinance is passed by the Council and accepted by the Chicago City Railway Company, operating on the south side, it will undoubtedly mean the granting of a franchise on similar terms to the Chicago Union Traction Company, operating on the north and west sides.

The theory upon which the framers of this ordinance started out was that the company owns franchises on various streets expiring at different times, and that it is desirable for both company and city to commute these various franchises expiring at different times into one blanket franchise expiring at a certain time. On some of the streets, according to the recent decision of Judge Grosscup, the company has rights under the

ninety-nine-year act until 1958. On others the franchises have but a short time to run. By some process of averaging, the framers of the ordinance arrived at the conclusion that the average life of the company's franchises is thirteen years. The ordinance then virtually says to the company, "Since you are entitled to operate on the streets for thirteen years under your present rights, we will give you this right to operate for thirteen years more in consideration of the payment of 5 per cent of the gross receipts each year for the thirteen years." This at first seems like a rather absurd proposition, since it asks compensation for something to which the company is already entitled. However, the city, if it takes the property or has any one else take the property at the end of thirteen years, agrees to pay the appraised cash value of the physical property of the company, which, of course, would leave the company considerably better off at the end of the franchise term than if no provision of this kind were made. And it was further evidently the idea of the city authorities that "for the sake of peace in the family" and a settlement of all disputes over franchises, the company would be willing to exchange its present franchises for a thirteen-year blanket franchise, even if it did have to pay a little for rights it already had. After the expiration of thirteen years the city can, at the end of any year, purchase the company's property at an appraised valuation, but the company must pay 10 per cent of its gross receipts to the city each year after the thirteen years and up to twenty years. At the end of twenty years the franchise expires, but the city must purchase or cause to be purchased the property of the company at an appraised valuation. These are the most important features of the ordinance. To be sure, there are several thousand other provisions specifying how the road shall be constructed and operated. Much in the ordinance reads more like a set of specifications got up for a contractor than like an ordinance granting a franchise. However, most of these provisions are harmless, as they specify nothing more than any good street railway management in a city of the size of Chicago would provide in any event, whether required by ordinance or not.

Testing Car Construction in Wrecks

It is not always apparent, or to be more correct, we should say it is seldom apparent, when a car is new, what the real quality of the workmanship is. Of course, some idea can be formed of the finish, but beyond that there is no way of telling what the real strength and stiffness and ability of the car to stand long service without becoming loose jointed may be. It occasionally happens that wrecks demonstrate very forcibly the differences in car construction. Such car bodies go through collisions or other wrecks almost intact except as to the part actually in the collision. Sometimes in grade crossing accidents one end of a car will be taken away and the rest will remain so solid that scarcely a pane of glass will be broken at the rear end. Other cars going through the same ordeal, if not completely wrecked, will be so loosened in the joints that they can never be put in good shape again. Of course, much of the difference in the way cars behave in collisions is due to the difference in the weight of construction. Other things being equal, a heavy car will always go through a wreck the best. The real, fine art of car building lies in making a car body that will be strong without undue weight. It is useless to expect to be able to build interurban coaches that will not entirely go to pieces in a wreck unless they are made heavy, and it would be unwise to put light coaches on high-speed service. For low-speed service in cities, however, there is a great opportunity to save weight by good workmanship and good designs.

The Compensated Series Motor

The important announcement of the development of a successful single-phase motor by the General Electric Company is published in this issue, together with an extended description of the principles, design and construction of the motor and its performance during test runs on the Ballston division of the Schenectady Railway Company. The fact that the General Electric Company was at work upon a single-phase motor has long been known, but the type of motor has been kept a secret. There was a general impression that the company was developing the repulsion motor, but as will be seen from the article in this issue, the machine is not of the repulsion, but of the compensated series commutator type. In fact, the motor is very similar to the original single-phase Eickemeyer motor, developed and improved according to the light of modern experience in railway-motor construction. As the compensated motor promises to be largely used in railway work, a few words in regard to its general principles can well be given here, leaving a more extended discussion of the application of the motor as used on the Schenectady Railway for our next issue.

The compensated motor consists of an ordinary d. c. armature revolving under the influence of a field developed by a distributed induction-motor winding, which is really nothing more or less than a d. c. winding tapped at appropriate points, or at least gives magnetic distribution equivalent thereto. This form of winding, when used with alternating currents, reduces the reactance of the system to a reasonable amount, and correspondingly raises the power factor. Furthermore, there is no doubt that it improves commutation from a d. c. standpoint.

An approach to the same device has been employed by Thompson and Ryan in their generator with compensated compounding coils, and somewhat similar magnetic distribution has been secured by means of bushing the armature tunnel with a thin magnetic tube, or what is the same thing, throwing an isthmus across the pole pieces. Sparking in a dynamo or motor, or any device using a commutator, occurs when a circuit is opened under conditions that cause the current to change, due to such action. In other words, if there is no difference of potential between the brush and the bar which it leaves, there will be no spark. The spark is purely a matter of degree and can be controlled either by making the resistance of the bobbin and its leads so great that large short-circuit currents are avoided, or by keeping the short-circuit currents within the limits of reasonable sparklessness by controlling the flux rate of change conditions at the moment of commutation. The latter method is that employed by the compensated motor, the winding of which secures other advantages from an a. c. standpoint also. Immunity from transformer action is secured in this, as in other motors, by making the a. c. frequency so low and the speed so high that the a. c. rate of flux change is insignificant in comparison. In the case of a field with the concentrated winding, if we may adapt an old term to fit a new condition, the bobbin under commutation is moderately free from flux change, and any transformer action is more serious. With the commutated bobbin under controlled and moderately large flux change conditions, the relatively small variation of transformer action is masked, and is not so troublesome.

From a commercial viewpoint, the compensated motor is unusually attractive. The retention of so many features now familiar to the railway operator is a strong point in its favor, and the service it gives over existing d. c. lines inspires confidence to try the a. c. experiments. As a commercial problem it may be stated that any device that is handicapped by the necessity of combating invested capital is at a serious disad-

vantage. Anything that requires the creation of a large scrap heap of existing material for which money has been paid will not be received with favor. So it is that the alternating-current railway motor which can operate on both a. c. and d. c. current may be received with open arms, in many places where a. c. performance alone would debar it. This feature has been strengthened in the equipment under consideration by the application to it of the ordinary series parallel controller, which, by the new slight changes effected by the commutating switch carried on the front platform, can be used on both a. c. and d. c. circuits.

That the compensated series motor will replace the present d. c. form for city service may well be doubted. Its added weight and consequently somewhat higher cost will act as one reason, while the somewhat lower acceleration on an a. c. circuit is another. As an a. c. motor it is essentially a motor for long runs, but as such its future is most promising.

Technical Education for Railway Men

We have already referred editorially to this topic apropos of the coming discussion of it by Prof. Norris, but from the importance of the matter it is worthy of no little serious attention, and we cannot refrain from recurring to it. There is a very broad question now obtruding itself at every turn, viz: Are the technical schools doing the right thing so far as the needs of technical industries are concerned? Do they fit a young man to pursue these industries to the best advantage? As regards the value of education for its own sake and for the higher welfare of the individual, we have no doubt, but there may be, nevertheless, doubt as to the wisdom of the particular line of education followed. The fact is that success in a specialized and somewhat technical business like electric railroading requires a clever man with an alert, well-trained mind, and in so far the technical school can aid in his development, but does it give him the best training that he can get in the time available? At the very outset one must realize that while there is always room at the top in a certain sense, the top is a location not over-commodious, and for one man comfortably planted there, one must reckon on having a score in reponsible places down below. A battleship cannot be fought by the captain on the bridge; it requires the intelligent co-operation of the under officers, the engineers and the men behind the guns. And it is fundamentally important that all hands should know their respective duties.

Now, in technical education is there not a certain tendency to train men for the duties of the captain at the expense of good, hard drill in the work of the lieutenants and ensigns, not to mention the lower grades? We have a certain suspicion that there is such a tendency which is in part responsible for the doubts expressed by some captains of industry as to the practical value of technical training. We do not believe that any man in charge of a large enterprise seriously would prefer to recruit his forces from the ranks of the meagerly educated or would fail to recognize the value of specialized study in his own line. What he sometimes does intimate is that such knowledge is occasionally acquired at the cost of a thorough understanding of the every-day general principles that make a man efficient in the work, so to speak, of a line officer. The fact is that the time which the average intelligent young man can devote to higher education is limited, as is evidenced by the frequent demand for an abbreviated college course. With most students the question is not how much they would wish to learn, but how much they are able to learn in the time at their disposal. Do our technical schools make the best use of their time, taking into account the average capabilities of their students and the nature of the average work for which they are being trained? On this point we must own that we do not feel entirely at ease. One cannot take a young man at eighteen and turn him out a thoroughly trained engineer at twenty-two. In these days of extreme specialization the graduate is merely at best put in line to work out his real professional training intelligently.

Frankly, the curriculum of the ordinary technical school is rather between hay and grass. It lacks of necessity the sort of elaboration that would be possible in a post-graduate institution, and also the hard practical drill in fundamentals that would be possible were fewer advanced studies attempted. The same criticism applies in no small measure to the average American college which tends to dabble in work properly belonging to a university in the larger sense, and thereby uses up time which could well be applied to a broader collegiate training. The consciousness of knowing thoroughly what one knows, and of being ignorant of things one knows imperfectly, is very valuable. There is sometimes a certain note of pretentiousness in technical courses that is greatly to be regretted. It is a serious and important function to train young men for practical achievement in modern industries, and there is a demand for men so trained which cannot quite be met by the supply now being turned out. It is no easy matter to lay out such a course of training, for instance, as would fit a young man to enter the electric railway business, but it does seem possible to do rather better for him than is usual in technical education. We hope that the facts which are being collated by Prof. Norris will tend to throw light on the problems before us. They will at least point out some of the weak points of the training now generally available, which is the next thing to devising a remedy. The errors which seem sometimes to be made are not due to lack of thoughtfulness or to ignorance, but rather to a real enthusiasm that finds it no easy task to call a halt and face the limitations that actually exist. Education in this country has suffered not infrequently from over-enthusiasm—never from lack of it. The common school, the technical school and the college are part of our national life, and if they sometimes lack co-ordination they never lack support.

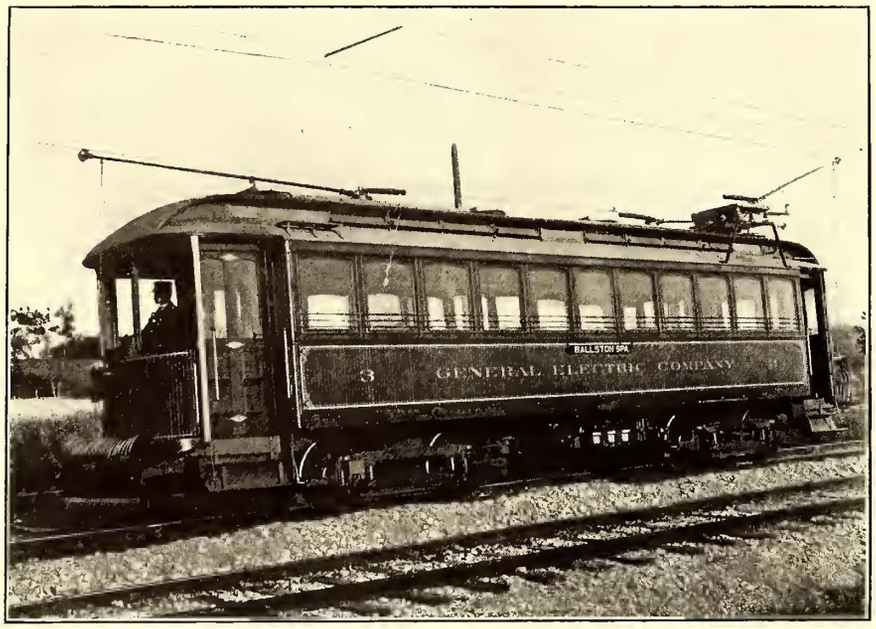
Reinforced Concrete for Car Houses

The use of reinforced concrete has of late been steadily coming into favor in construction work, but it is only recently that large car houses have been designed of this material. It has become well established by this time that fireproof qualities are of very high importance in this class of building, and perhaps no other point in car house design is better worth securing as long as the building is laid out for convenient operation.

Experience has shown that the fire risk, which is inseparable from the use of wooden and steel construction, must be reduced, and the increasing valuation of each piece of modern rolling stock adds emphasis to the conclusion that money spent in the elimination of fire hazards is extremely well invested. The concrete car house appears to offer a solution of the problem at from 25 per cent to 30 per cent less than the cost of modern steel construction, and there would seem to be no reason why such a construction should not last indefinitely with little or no sensible depreciation. The new car house which is to be built at St. Paul of reinforced concrete at a cost of from $175,000 to $200,000, with a capacity of 180 45-ft. cars, and which is described in this issue, furnishes a good illustration of the "concrete tendency" in engineering construction, and will undoubtedly constitute one of the most interesting street railway exhibits of the Twin Cities.

COMPENSATED SINGLE-PHASE MOTOR OF THE GENERAL ELECTRIC COMPANY

The fact that the engineers of the General Electric Company have been engaged for some time on the development of a single-phase railway motor has been generally known, but the details of the construction of the motor have been kept entirely from the public until the past week. A public test of a car equipped with the new single-phase motors was made, however, on Aug. 19 on the Ballston Division of the Schenectady Railway Company. A number of well-known street railway managers and several representatives of the technical press were present during the run which was made from the works of the General Electric Company, at Schenectady, to Ballston and return.



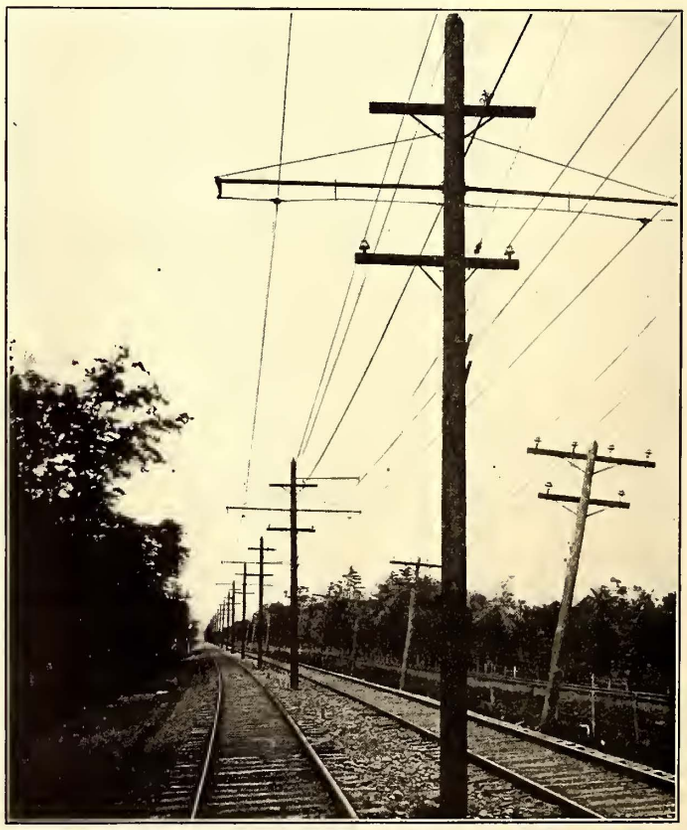
CAR EQUIPPED WITH FOUR 50-HP SINGLE-PHASE MOTORS ON BALLSTON DIVISION OF SCHENECTADY RAILWAY COMPANY

The motor is of the compensating commutator type, so called on account of the field winding, which fully neutralizes or compensates for the armature reaction, and the armature acts equally well with direct or alternating current.

Both the compensating motors and control are adapted for operation on the 2000-volt a. c. trolley between cities and the standard 600-volt d. c. trolley in Schenectady. This ability of the compensated motor equipments to run over tracks equipped with either a. c. or d. c. trolley makes their field of application very broad, as the cars can secure all the benefit of running over existing city tracks without in any way sacrificing their running qualities upon suburban sections equipped with a. c. trolley. The alternating-current motor, with its inherent advantages of high-voltage distribution, is eminently adapted to replace the steam locomotive on either high-speed passenger or heavy freight-haulage work, and as the compensated type of motor is perfectly adapted to operate on both a. c. and d. c. trolley, the alternating-current motor must be considered a large factor in future suburban railway systems. The compensated motor is essentially a variable speed motor, differing in this respect from the multi-phase induction motor, whose constant-speed characteristics proved so serious a handicap to its successful adoption in railway work. The speed-torque characteristic of the compensated motor is very similar to that of the direct-current series motor, while its commutating qualities and method of control prove equally satisfactory.

On the Ballston extension of the Schenectady Railway advantage is taken of the ability of the compensated motor to operate with either alternating or direct current. The extension is 15.5 miles in length, including 3.9 miles of city running in Schenectady over tracks equipped with d. c. trolley. The interurban section is double track on private right of way, 60 ft. wide, laid with 75-lb. T-rail, gravel ballast with maximum grade of 1.8 per cent. Special attention has been given to the high speed possibilities of the road, and no curve exceeds 4¼ degs.

Center-pole bracket construction is used, there being two brackets supporting the two 600-volt d. c. trolley wires, and a cross-arm supporting the two 2200-volt a. c. trolley wires. The Ballston extension has been operated for several months with direct-current equipments, and their operation being continued in part necessitated an additional set of trolley wires for the a. c. equipments, which would not interfere with the d. c. trolleys. The center poles are 34 ft. long, and are spaced 100 ft. apart, the a. c. and d. c. trolley wires being No. 000 grooved section with no feeders for the a. c. trolley, and with a 500,000 circ. mil feeder reinforcing the d. c. trolley. The d. c. trolley conforms to standard bracket construction and presents no unusual features, while the a. c. trolley wire is suspended from a ⅜-in. steel catenary. The a. c. trolley is clipped to the catenary midway between poles, and the catenary in turn is hung over porcelain insulators on wooden cross-arms, the whole forming a construction of great flexibility, with the further advantage of providing excellent insulation with standard porcelain insulators and eliminating the span wires adjacent to the trolley wire, thereby preventing the pole catching should the trolley-wheel leave the wire. This method of trolley construction is well adapted to high-potential high-speed work in both its electrical and mechanical features.

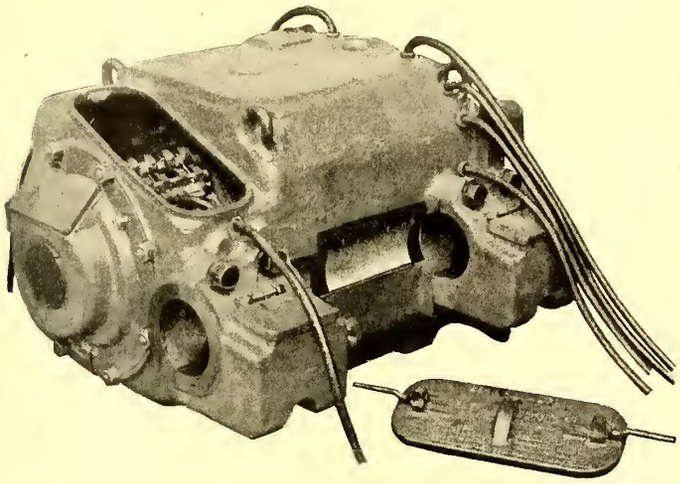


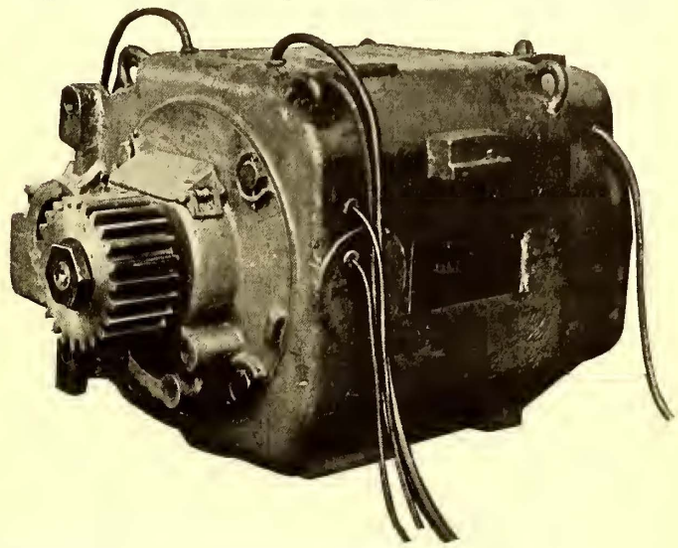
OVERHEAD CONSTRUCTION ON THE BALLSTON LINE, SHOWING DIRECT-CURRENT TROLLEY WIRES OVER CENTER OF TRACK, AND ALTERNATING-CURRENT TROLLEY WIRES ATTACHED TO CATENARY HUNG FROM PORCELAIN INSULATORS ON SHORT CROSS-ARMS ON INSIDE OF TRACK

The company believes that 2200 volts can be used as a standard for most interurban railways. Where a higher voltage is required, the motors will be built for 3300 volts or 5500 volts.

COMPARATIVE A. C. AND D. C. RESISTANCE, TROLLEY AND TRACK, PER MILE OF CIRCUIT

	D. C. Resistance	A. C. Resis. 25 Cycles	Ratio $\frac{A.C.}{D.C.}$
	ohms	ohms	
Two trolleys in series	.318	.417	1.31
One trolley and double track..	.167	.259	1.55
Two trolleys and double track.	.088	.155	1.76
Double track alone.....	.0174	.114	6.55





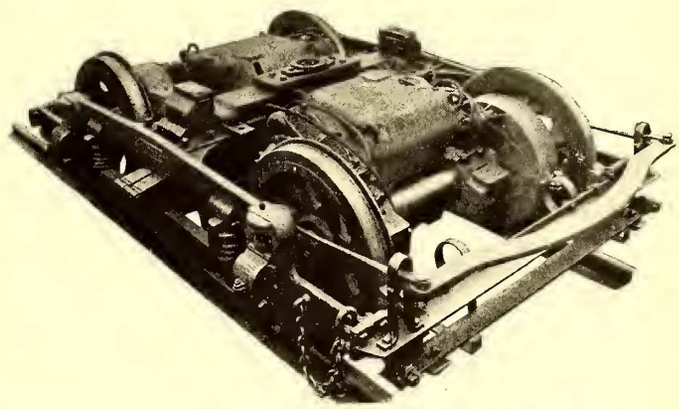
FRONT AND REAR VIEWS OF G. E. A. 604 COMPENSATED A. C. RAILWAY MOTORS

UNDER CROSSING OF BALLSTON LINE WITH BOSTON & MAINE CULVERT, SHOWING ALTERNATING AND DIRECT-CURRENT TROLLEY WIRES

With the a. c. system using a trolley and track return, there is an inductive drop in the trolley and rails, with an additional loss in the latter case due to eddy currents and hysteresis. Measurements made upon the Ballston line indicate an apparent trolley resistance of 1.3 times the ohmic resistance, and a rail resistance 6.55 times the ohmic resistance.

The resistance of the a. c. trolley wire is somewhat reduced by the steel catenary in parallel with it. The a. c. trolley wires are 5 ft. apart and 16.5 ft. above track, while the four 75-lb. track rails are tied together every 1500 ft. The increased resistance with a. c. current is a serious factor in low-voltage a. c. city systems, but since the compensated motor operates perfectly with the d. c. current of our city systems, no general necessity exists for a low-voltage a. c. trolley.

The form of a. c. trolley adopted for the Ballston line is well adapted to the requirements of steam roads where the local service is taken care of electrically, and through passenger and freight handled by steam locomotives, pending a complete change to electrical operation. The trolley wire and insulators being off-center are not exposed to the gases of the locomotive exhaust with consequent deterioration, and, furthermore, a catenary construction placed off-center can be hung much lower than a standard center wire without interfering with brakemen on freight cars. A low-running trolley at the side of the car is also preferable in main line operation, as it conforms better to the clearance diagram of such roads without calling for too great a change in height of the trolley-wheel or bow. The trolley suspension adopted on the Ballston line therefore affords valuable experience with a form of construction adapted to the requirements of electrically-converted steam-operated lines.



NO. 27 TRUCK EQUIPPED WITH TWO G. E. A. 604 MOTORS

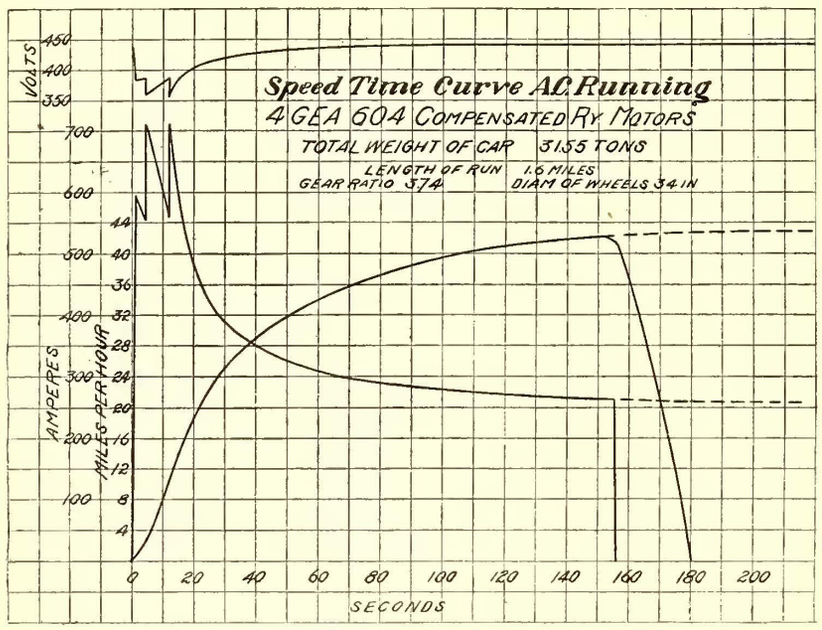
The present sub-station of the Schenectady Railway is temporarily located at Ballston Lake. This sub-station is operated from the distributing system of the Hudson River Power Company, but owing to the fact that this system operates at 40 cycles it became necessary to introduce a frequency changing device, and an inverted converter operated from the sub-station d. c. bus-bars afforded the most ready means of obtaining 25-cycle current. The permanent sub-station will be erected at Ballston and the inverted converter will be replaced by a motor-

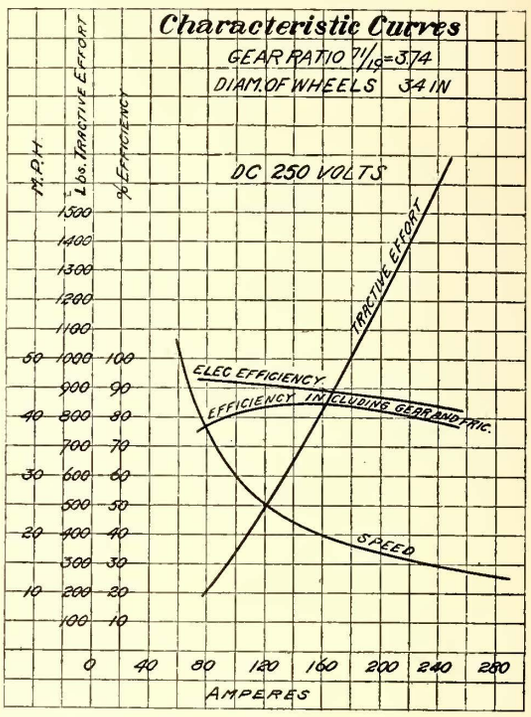
generator set, which will give better regulation than can be obtained from an inverted rotary converter. The sub-station feeds directly into the trolley circuit at 2200 volts, with no outside transformer sub-stations.

Owing to the fact that 25-cycle three-phase generators are almost universally used to supply rotary converters in existing interurban railway systems, the General Electric Company has adapted both the design of the compensated motor and the a. c. distributing system to operate from existing 25-cycle generating stations. As the alternating-current motor is single-phase, a single-phase generating and distributing system commends itself on account of its simplicity. The step-down transformers may be tied together on the low-tension side through the trolley, with consequent reduction in amount of copper required. Each sub-station acts as a reserve to the adjacent one and a transformer may be cut out without shutting down a trolley section. A standard sub-station layout is shown in the upper diagram on page 284, showing both an intermediate and terminal sub-station fed from a single-phase source of power.

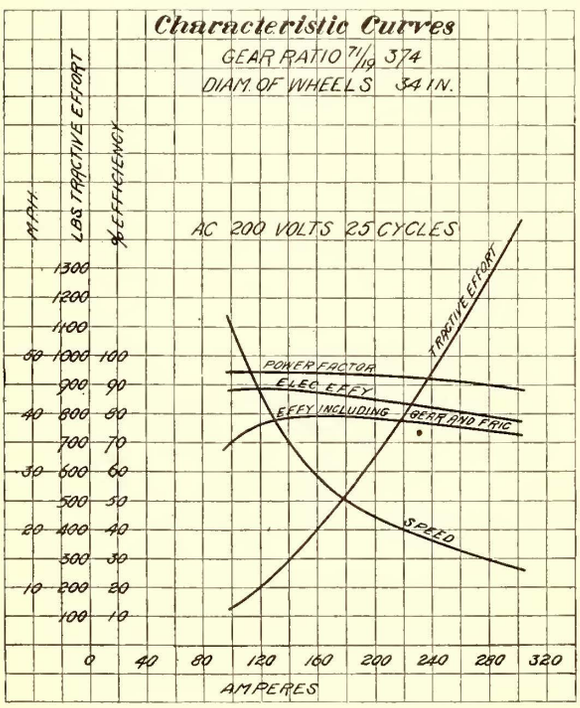
When it is desired to make use of or install a three-phase generator to take care of the operation of rotary converters, induction motors, etc., the preferred arrangement to balance the load at each sub-station is to install three-phase, two-phase transformers connected two-phase on the secondary side and feeding separate trolley sections from the two phases. Such an arrangement is also shown in the lower diagram on page 284.

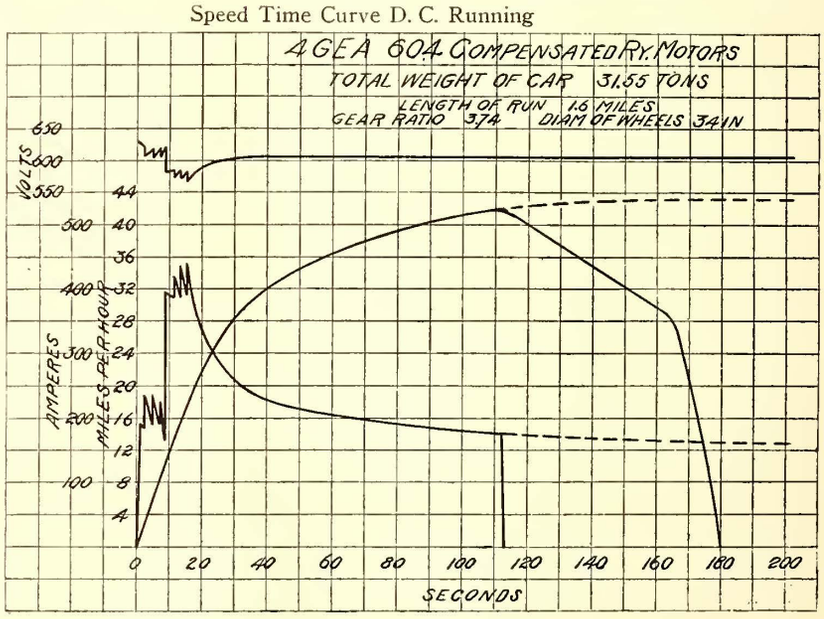
The car equipped with the compensated motors weighs 30.4 tons total without passengers, and is geared for a maximum speed of about 43 miles per hour on level. The car manufactured by the J. G. Brill Company has a 32-ft. body, is 43 ft. over all, and a seating capacity of forty-four passengers. The body is mounted upon Brill No. 27 trucks, having 6-ft. wheel base, each truck carrying two compensated motors, each motor equivalent to a 50-hp direct-current motor, standard railway rating.





Speed Time Curve D. C. Running





MOTOR AND SPEED TIME CURVES A. C. AND D. C. RUNNING

The General Electric a. c. compensated motor consists of an annular laminated iron field with a distributed winding similar to that of an induction motor, and an armature and commutator, both similar in general mechanical construction to a d. c. railway motor armature. The brushes are of standard width and size, and the holders are permanently fixed at the neutral posi-

tion. The width of air-gap adopted is about twice that employed with stationary induction motors of corresponding size. These motors are wound for 200 volts, are permanently connected two in series, and are fed from the 400-volt secondary of an 80-kw air-blast step-down transformer carried on the car. The distributed character of the field winding fully compensates for the armature reaction, so that power factors are relatively high throughout the range of operation. This type of motor is so designed that at the free running speed of the car, which is the condition most frequently met with in suburban work, the power factor and efficiency are nearly at their maximum values. A high power factor is desirable, as it reduces the capacity and cost of the generating and distributing systems, and more especially effects a material improvement in the regulation of the a. c. generators. Unlike a d. c. system which has a practically constant potential at the sub-station bus-bars, irrespective of the load, the drop in an a. c. railway system is accumulative up to and including generator and engine regulation. It is desirable, therefore, to maintain as good a power factor as is consistent with good motor design, in order to limit the total drop of the system to a reasonable amount.

A set of motor characteristics is shown in diagrams on page 282 for both a. c. and d. c. running, respectively. It will be noted that the speed-torque characteristics for a. c. running are equal to d. c. running in meeting the requirements of railway work. Unlike the multiphase induction motor, with its practically constant speed characteristic, the compensated a. c. motor varies its speed with the load, and is thus better adapted to operate trains over an irregular profile. The commutation of the compensated motor is equally satisfactory when running a. c. or d. c., and this good commutation is secured by careful electrical and mechanical design without resorting to high resistance leads.

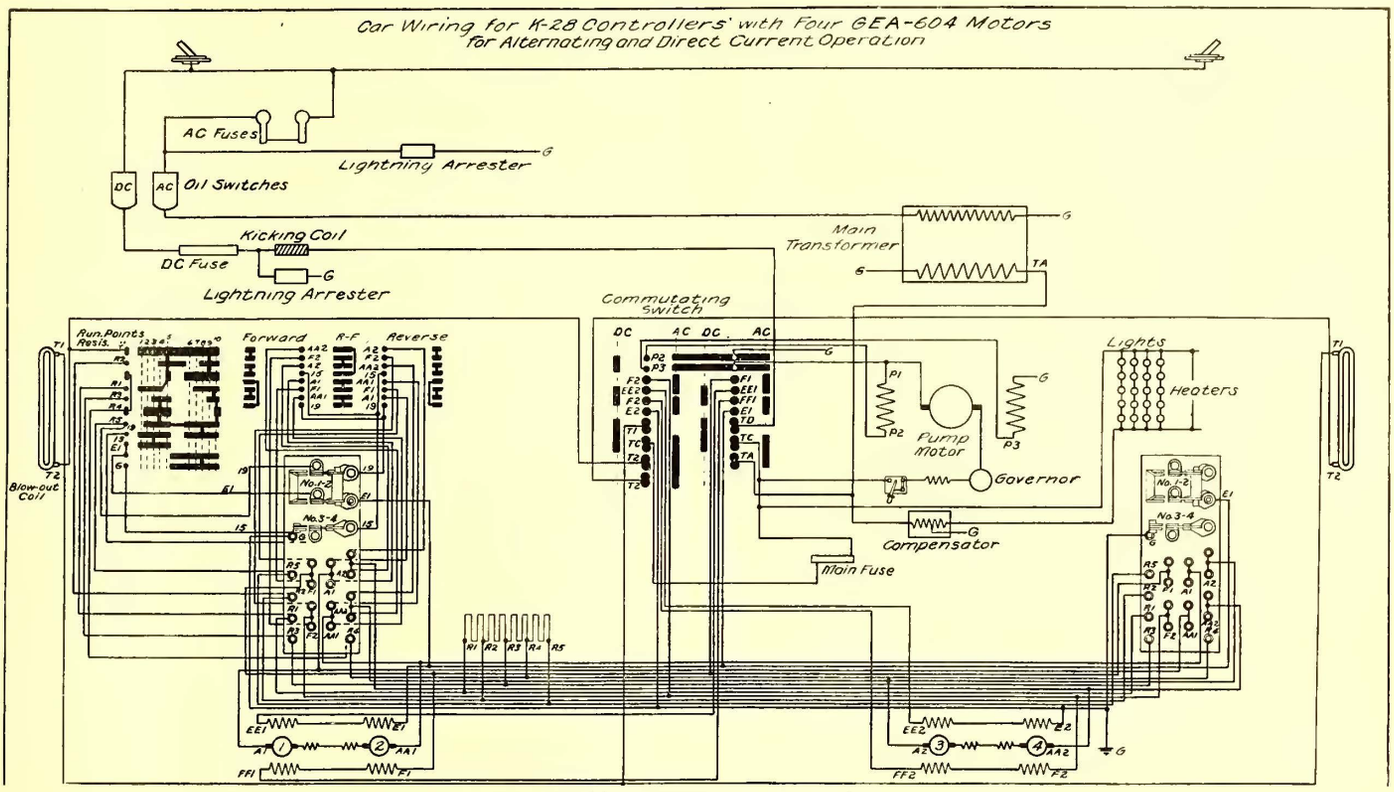
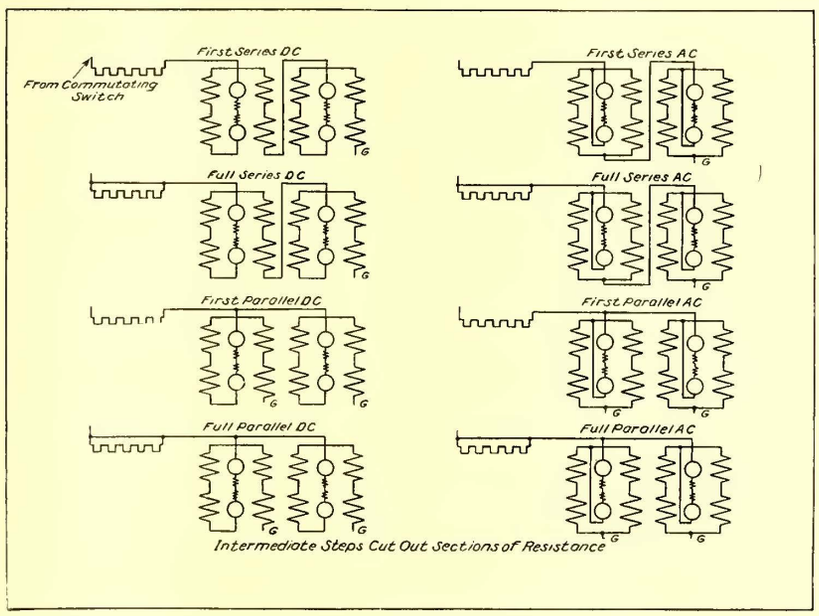


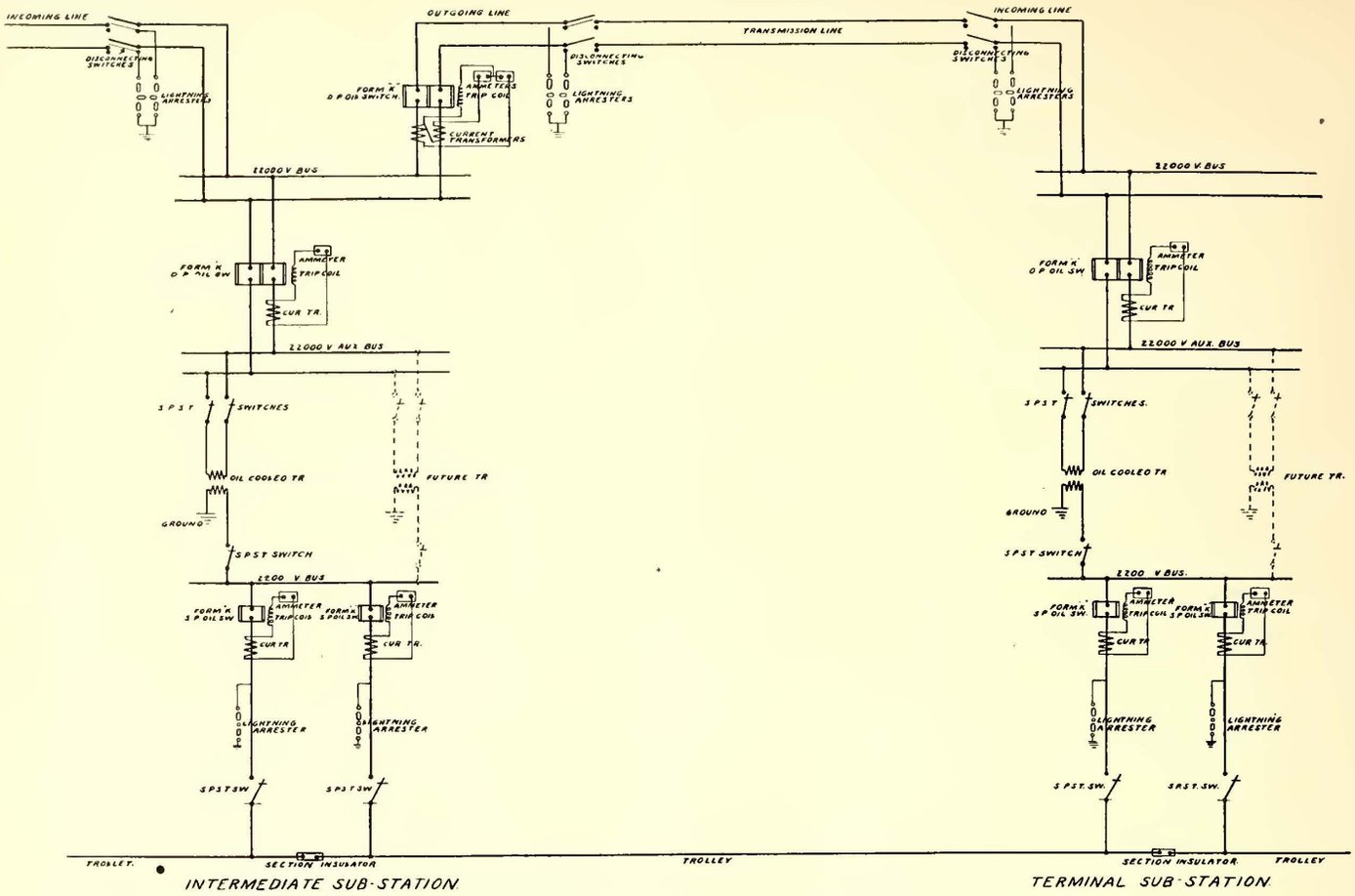
DIAGRAM OF CAR WIRING



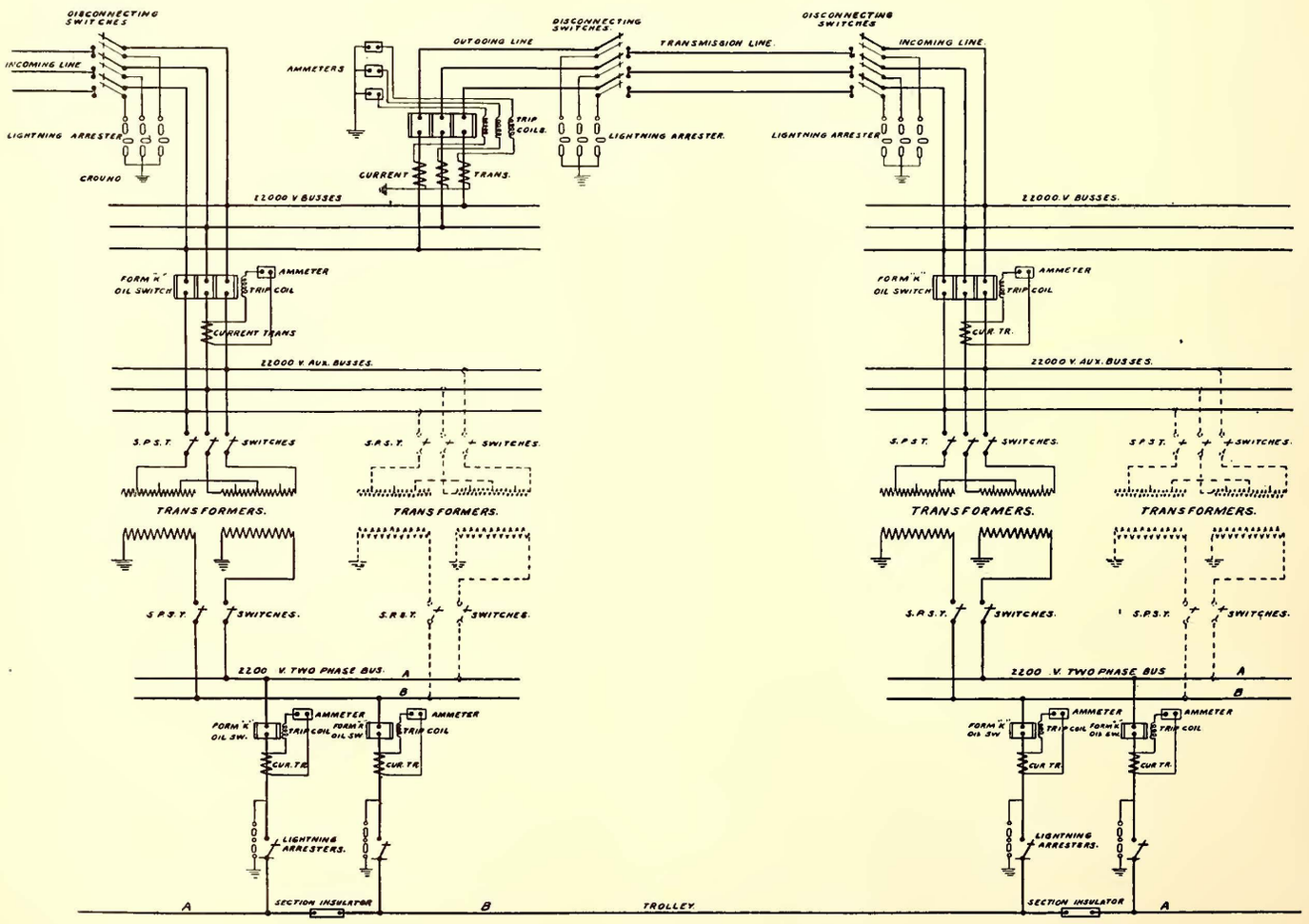
MOTOR CONNECTIONS FOR FOUR MOTORS USED IN BOTH A. C. AND D. C. SERVICE

The controller used is the standard K-28 direct-current series parallel controller employed in connection with a commutating switch to change field connections, cut-out step-down transformer, change-line fuses, etc. The time required to operate the commutating switch is but a few seconds. The scheme of connections both in diagrammatic form and for the complete car wiring is shown on this page.

The commutating switch is interlocked with two main oil switches, one being in the high-tension a. c. and the other being in the direct-current circuit; this interlocking is so arranged that only one switch can be closed at a time and the commutating switch can only be thrown when the oil switches are in the off position. Owing to the fact that the a. c. trolley construction is off-center, while the standard city and suburban trolleys are directly overhead, it has been necessary to provide double sets of trolleys, one for a. c. and the other for d. c., hence the necessity of interlocking the oil switches and commutating switch to prevent trouble should both trolley poles



POWER DISTRIBUTION SYSTEM FOR SINGLE-PHASE RAILWAY, SINGLE-PHASE TRANSMISSION, SINGLE TRACK

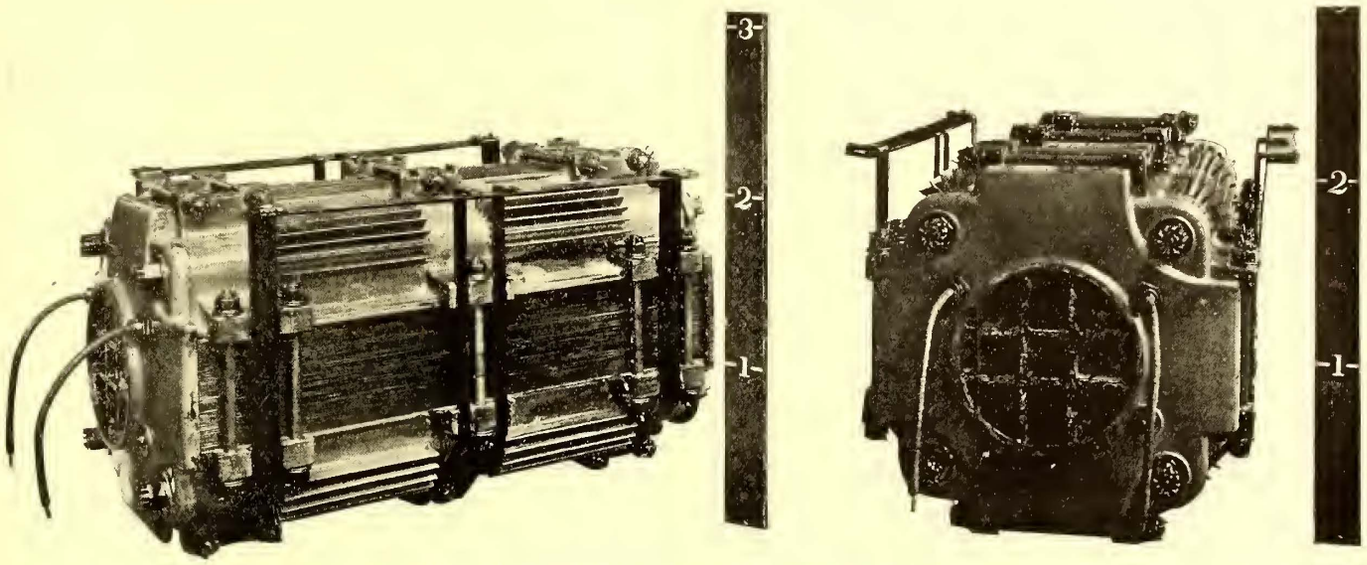


POWER DISTRIBUTION SYSTEM FOR SINGLE-PHASE RAILWAY, THREE-PHASE TRANSMISSION, SINGLE TRACK

accidentally be up at the same time. Where center-wire construction is used on both the city and suburban sections, the a. c. and d. c. trolley wires may be overlapped for a short distance to facilitate changing from one trolley to the other.

With equipments operating with both a. c. and d. c. power the engineers of the General Electric Company have considered it preferable to utilize the standard series parallel controller in order to minimize weight of controlling apparatus. Such a method of operation will not give quite so high efficiency when accelerating with alternating current as could be obtained with potential control. This difference in efficiency, however, is very small, due partly to the infrequency of stops occurring upon those sections of the road equipped with a. c. trolley, but principally due to the flexible character of the speed-torque curve of the a. c. motor, which gives a high efficiency of acceleration with series parallel control.

With modern suburban cars, especially those equipped with train control, air brakes, air compressors, etc., there is some difficulty in suitably locating the proper apparatus, even when equipped for d. c. running only. With cars equipped for both a. c. and d. c. running, using series parallel controller, there will be required but slightly more space and weight than for d. c. running only. Should, however, advantage be taken of the slightly better efficiency of a. c. potential control, such cars must be operated a. c. upon both suburban and city sections or the installation of two separate controlling systems must be considered, necessitating a considerable increase in weight and difficulty in providing room for the necessary apparatus.

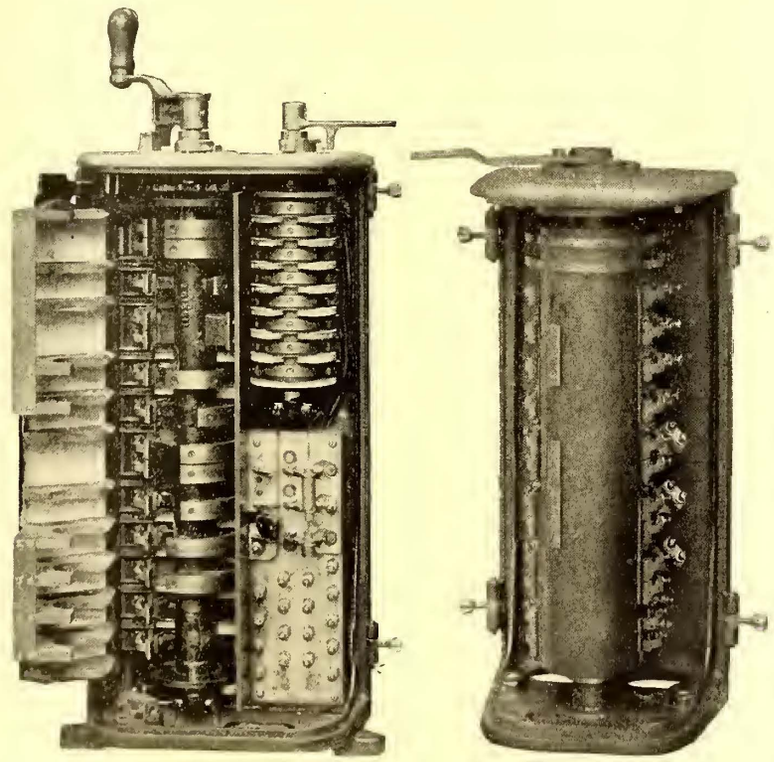


SIDE AND END VIEWS OF 80-KW TRANSFORMER

For locomotive or other service where no necessity exists for operation over d. c. systems, the manufacturers believe that the potential method of control may offer advantages sufficiently great to warrant its adoption.

The 80-kw step-down transformer is air cooled, forced draught being obtained by motion of the car itself. The transformer is suspended below the car floor and all primary leading in wires are carried in brass tubing which is grounded. Car lighting and heating is effected from the d. c. trolley in the standard manner and from the a. c. trolley from the secondary of the transformer. Trolley poles and wheels are of standard design, the a. c. trolley pole being somewhat shorter, as this wire is lower than the d. c. trolley. The base of the a. c. trolley is treated with vacuum compound and further insulated from the car body by composition insulators. The air compressor for the brakes and whistle is operated by a compensated motor which operates from both a. c. and d. c. circuits.

It is instructive to compare the performance of the compensated motor equipment when operated with a. c. and d. c. current. A set of speed-time runs is shown in the diagrams on page 283, taken over the same stretch of track with a. c. current and repeated with d. c. current. The d. c. speed-time and ampere-time curves are typical and require no particular comment. The a. c. run, taken under exactly similar conditions over the same track, illustrates what can be expected from series parallel control with compensated motors. The rate of acceleration is somewhat lower in the a. c. run, hence requiring the application of power up to and moment of braking. The shape of the speed-time curve also is characteristic of alternating-current motor work—that is, a comparatively short time on the controller with a large amount of motor-curve acceleration. The short period of fractional voltage running of alter-



K-26 SERIES PARALLEL CONTROLLER COMMUTATING SWITCH

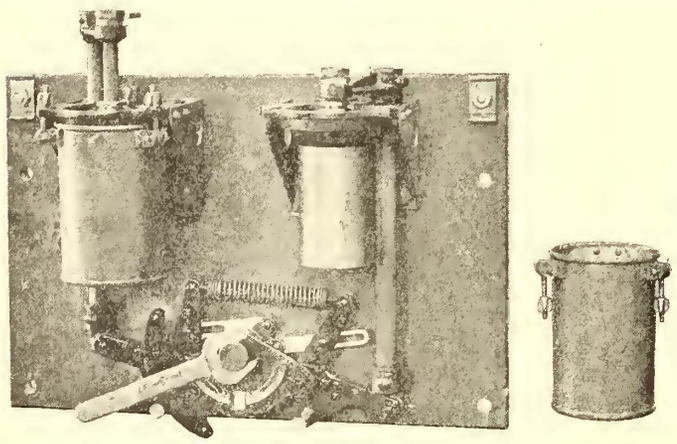
nating-current motors makes the method of their control of secondary importance and largely minimizes the economy of potential control over series parallel control.

All speed-time runs taken on the Ballston line were made over a distance of 1.6 miles on tangent level track at an average speed of 32 m. p. h., or a schedule speed of 29.5 m. p. h., including fifteen-second stops. The compensated motor equipment has thus demonstrated its ability to make as high schedule speed as any suburban road now operating direct-current equipments under like conditions. The following constants apply to both sets of runs:

COMPARATIVE A. C. AND D. C. RUNS

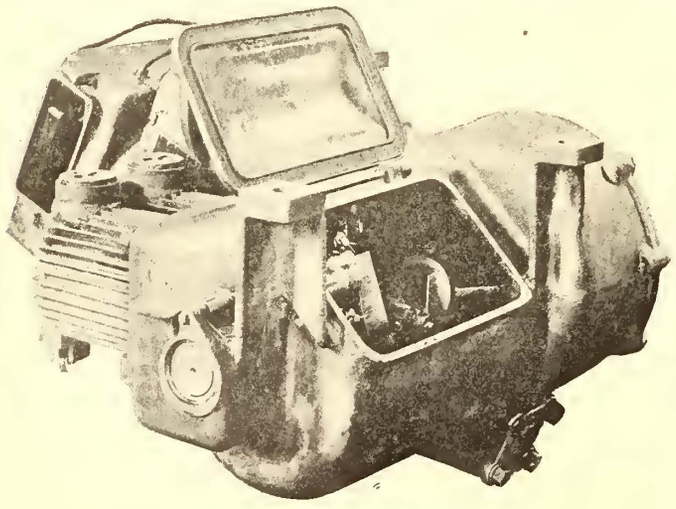
	D. C.	A. C.
Length of run	1.6 miles	1.6 miles
Weight of car	31.55 tons	31.55 tons
Time	180 seconds	180 seconds
Average current power on	229 amperes	346 amperes
Average voltage	606	425
Volt amperes full speed on level	96	110
Volt amp. hrs., per ton mile of given run	86.3	125.5
Average speed	32 m. p. h.	32 m. p. h.
Schedule speed, including 15 sec. stop	29.5	29.5

The lower volt-ampere hours per ton-mile of the d. c. run is partly due to the better efficiency and power factor of the



CONCENTRIC CYLINDER OIL SWITCH, S. P. D. T., 200 AMPERE, 2000 VOLTS

compensated motor when run d. c., and partly due to the somewhat higher rate of acceleration, permitting some coasting and resulting in a more efficient speed-time curve. The difference



A. C., D. C. AIR COMPRESSOR

in volt-amperes a. c. and d. c. depends upon the length of a given run, and the values approach each other more nearly with a run of greater length. It will be noted that the compensated motors run the car at practically the same speed with 200 volts per motor a. c. and 300 volts d. c. This uniform speed is obtained by series paralleling the fields, as shown in diagram of connections on page 283.

THROUGH ELECTRIC SERVICE BETWEEN NEW YORK AND PHILADELPHIA

The through electric service between New York and Philadelphia has proved so popular that on Aug. 4 the Public Service Corporation, the Trenton & New Brunswick Railroad Company and the Camden & Trenton Railroad Company, which together operate the service, announced the establishment of an hourly headway of cars between New York and Trenton, and a forty-two-minute headway between Trenton and Camden. A change of cars is necessary at Trenton, as the gage of the track between Jersey City and Trenton is 4 ft. 8½ ins., whereas that between Trenton and Camden is 5 ft. This change is the only one required. In addition to an hourly service between New York and Trenton, and which commences at 6 a. m. and extends to 7 p. m., intermediate through cars between New Brunswick and Trenton are run on the intervening half-hour, commencing at 8:30 a. m. and until 8 p. m., after which there is an hourly service between these two cities. The running time, including the ferry across the Hudson River, from New York to Trenton is five and one-half hours; from Trenton to Camden is three hours.

The fare from New York to Philadelphia, one way, is $1.10, as compared with $2.50 on the steam railroad. The round-trip is $2, as compared with $4 on the steam railroad.

The cars operated between New York and Trenton are the standard double-truck semi-convertible cars of the Public Service Corporation. They are equipped with four No. 56 Westinghouse motors, and eleven cars are required for the service. The traffic, as stated, has been very gratifying, and it is understood that the receipts amount to about $3.60 per car-hour, or 35 cents per car-mile. The cars between Trenton and Camden are somewhat smaller, and seat about forty passengers each. The population served on the Camden & Trenton line, exclusive of the population of the Camden & Trenton, is about 38,000, and the cars are earning about $3.20 per car-hour. The traffic is so large that the Camden & Trenton Company has recently ordered ten new cars from the Brill Company and will establish a half-hour service. These new cars will seat forty-eight passengers each, and will be equipped with four G. E.-57 motors and K-14 controllers. One of the towns on this division is Florence, where a large tract has just been secured by the John A. Roeblings Sons' Company for the establishment of its new wire works. These works will employ about 2000 men.

THERMIT RAIL-WELDING IN HOLYOKE

The Holyoke Street Railway Company has placed an order for a number of thermit joints with the Goldschmidt Thermit Company, of New York. The work is being carried out by the trackmen of the Holyoke Street Railway Company, under the supervision of the company's engineer, George Pallissier, and on the first day twenty joints were successfully laid. The Holyoke company was the first in the United States to place a provisional order for welding joints by thermit, and 160 joints will be laid with this process.

The New York City Railway Company has welded fifty joints on Lexington Avenue by this process, and is continuing the work on Madison Avenue. A number of other companies are now trying the process on a small scale. If it had been possible for the manufacturers to have completed arrangements for manufacturing thermit in this country a little earlier in the season, they state that a very large business would already have developed.

NEW CAR HOUSE AND SHOPS FOR THE TWIN CITY RAPID TRANSIT COMPANY

The Twin City Rapid Transit Company, which controls the street railway service of St. Paul and Minneapolis, is planning extensive additions to its facilities for handling rolling stock, and work will shortly commence upon a new car house in the Midway district between the two cities. During the last few years the business of the company has increased at a rate which has made necessary a notable enlargement of its physical plant, and the building of the new car house will be but a single step toward the construction of some of the most extensive car shops in the West. The company builds its own cars, having adopted a standard car 45 ft. 2 ins. in length, with four 40-hp motors per equipment, it needs all the modern facilities of a standard manufacturing plant, so that the layout of shops to be completed in the Midway district is being designed with all the care which would be given to the division mechanical headquarters of a large steam railway system.

At present the company's principal shops are located at Thirty-First Street and Nicollet Avenue, Minneapolis. While this point has the advantage of being located outside the business center of the city, it is not as convenient as the Midway location, which is not far from the geographical center of the entire transit system. Then, too, the Midway shops are to be built in a suburban section, and possess a strategic position in regard to the execution of quick repairs, as disabled cars will have a much shorter average run to the shops than the present Thirty-First Street quarters demand. Still another point of convenience comes from the location of the car house and shops directly on the line of the shortest and quickest interurban route between Minneapolis and St. Paul—the University Avenue line.

Fig. 2 shows the general layout of the new car house and shops, which will occupy a lot owned by the company on Snelling Avenue, St. Paul, between University and St. Anthony Avenues. The area of this lot is not far from 19 acres. Besides the car house, the plans of the company include the following building: A paint, varnishing and upholstering shop with an office, 300 ft. x 125 ft.; a coach shop, 300 ft. x 200 ft.; a mill, 150 ft. x 100 ft.; a dry kiln, 50 ft. x 40 ft.; a store room, 200 ft. x 100 ft.; a motor repair shop, 250 ft. x 90 ft.; a machine shop, 250 ft. x 60 ft.; a truck, frog and blacksmith shop, 150 ft. x 100 ft.; a foundry, 100 ft. x 75 ft.; an iron house, 75 ft. x 25 ft., and a coal house of the same dimensions. Power will be supplied by a plant 100 ft. x 100 ft.; oil will be stored in a fireproof building 40 ft. x 30 ft., and there will be a transfer table 605 ft. long x 90 ft. wide, extending through the center of the shop layout, so that cars may be handled with a maximum of convenience. The area occupied by the buildings will be about 4.8 acres, while the addition of the new car house, covering 3.2 acres, brings the total ground covered to 8 acres.

The design of the car house is a radical departure from existing practice through the use of reinforced concrete in practically every detail of construction. Foundations, pit floors, walls and roof will all be of this material. Fig. 3 shows the general plan of the car house, which occupies an area 550 ft. long x 266 ft. 7 ins. wide, slight modifications having been made

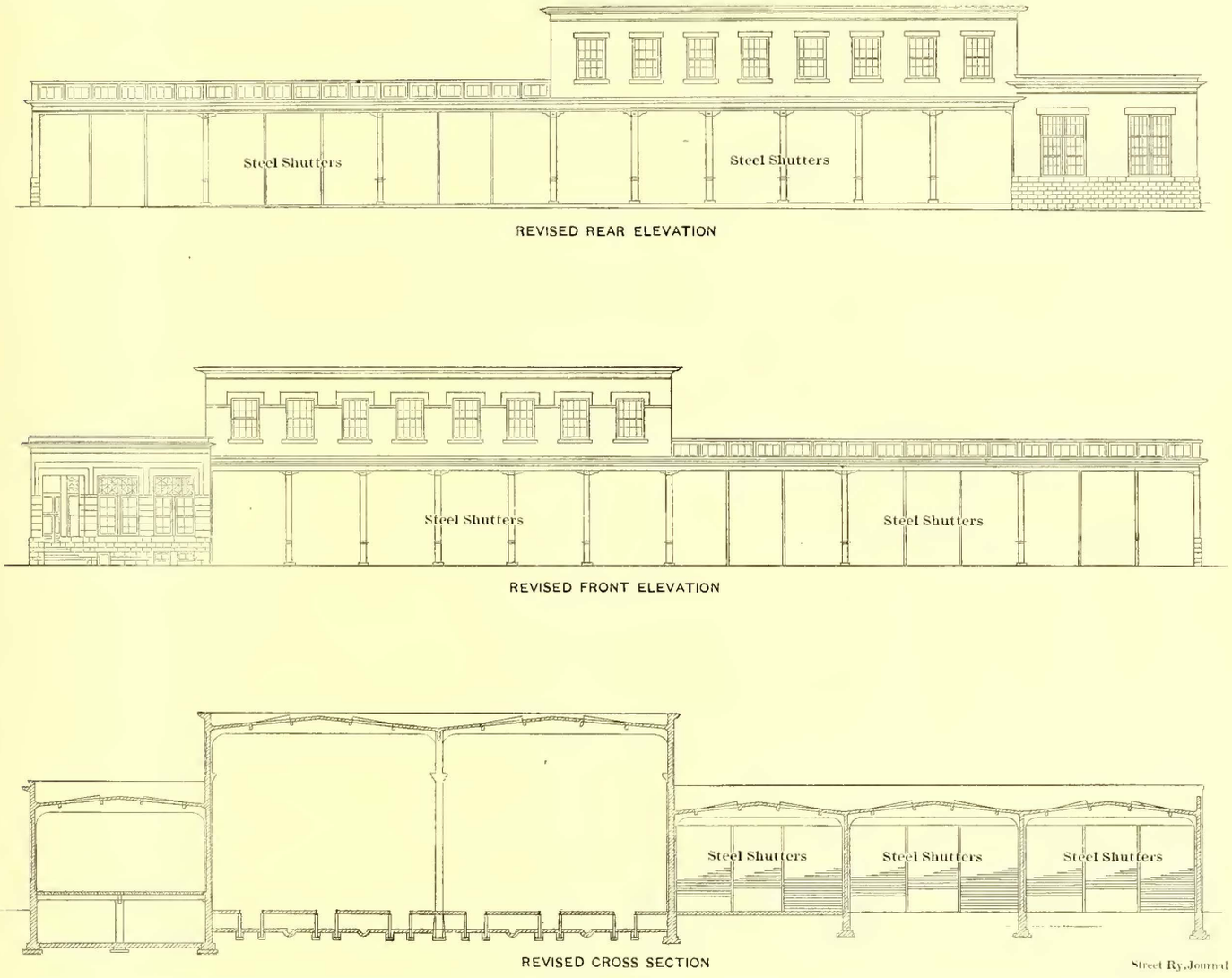


FIG. 1.—CROSS-SECTION AND ELEVATIONS—SNELLING AVENUE CAR HOUSE—TWIN CITY RAPID TRANSIT COMPANY

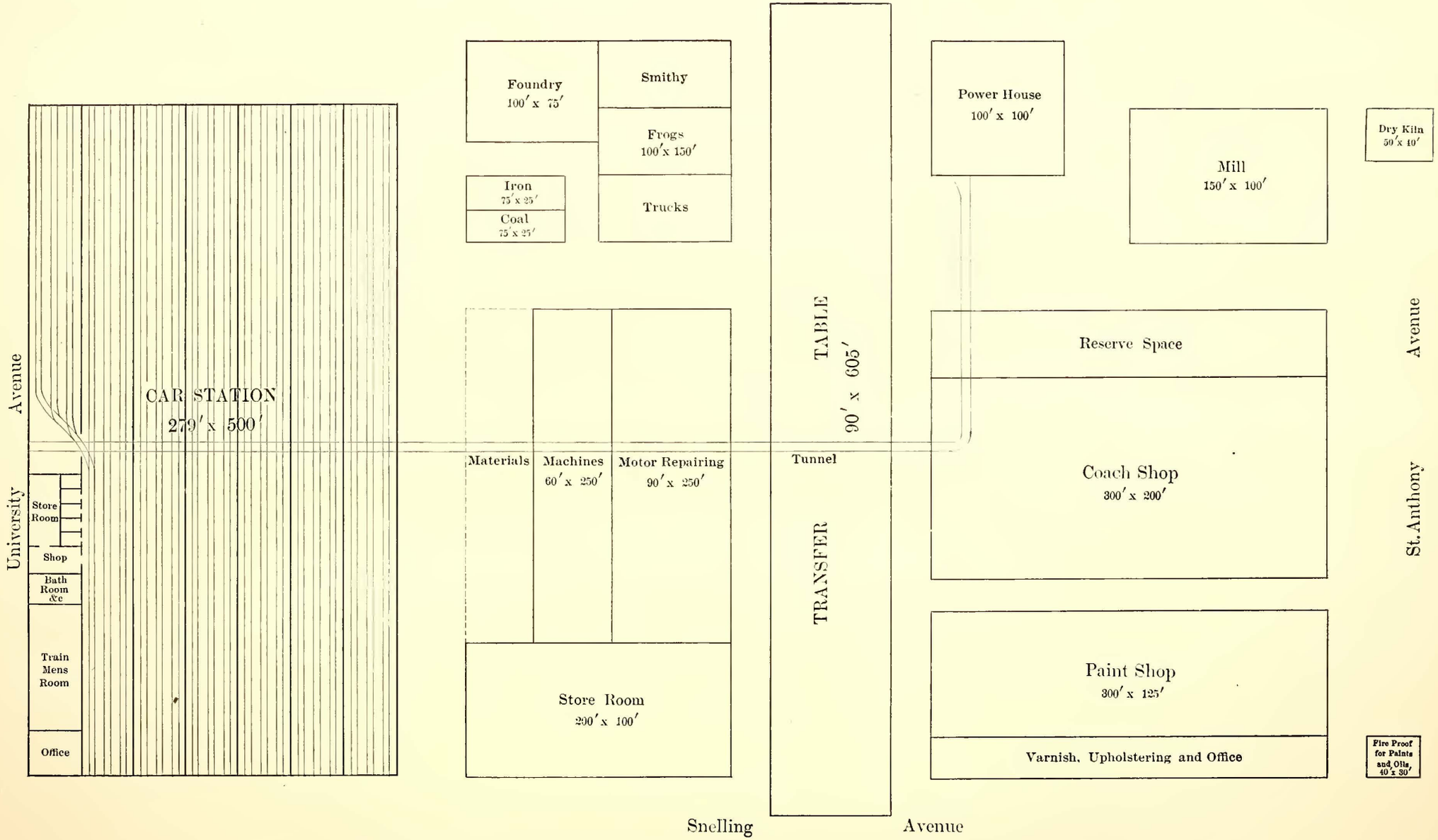


FIG. 2.—LAYOUT FOR NEW SHOPS AT SNELLING AND UNIVERSITY AVENUES—TWIN CITY RAPID TRANSIT COMPANY

in the dimensions of Fig. 2. The capacity of the car house is 180 45-ft. cars, and its cost is estimated between $175,000 and $200,000. The building is to be one story in height, and will be divided into five essentially separate divisions. There are to be three car-storage halls, each about 520 ft. long x 39 ft. 9 ins. wide. Each of these halls is to be supplied with transverse steel shutters near its middle portion, so that six compartments may be easily placed in service as a precaution against fire. Each compartment will contain three parallel tracks running its entire length. Except at the ends, there will be no communication between the different compartments and the adjoining car shops save through a door in the middle, steel shuttered, 10 ft. wide and 8 ft. high. Dirt floors will be used in these compartments, except that there will be a cement floor 100 ft. long in one, for the purpose of washing cars. This floor will be pitched to drain the water used in car washing into the sewer connections of the car house. The tracks in the three compartments will be spaced 12 ft. apart on centers, and there will be two passageways 3 ft. wide each between the fireproof concrete wall, separating each compartment from its neighbor and from the pit room.

The pit room is to be 520 ft. long by about 104 ft. 10 ins. wide. It will contain six parallel tracks spaced 17 ft. apart on centers, each. The floor throughout will be of cement, as will the sides of the pits and the steps leading into them. This floor will be 7 ins. thick, reinforced by steel rods or other approved construction, and will be supported by round columns of cast iron 5 ins. in diameter. The pits will be 4 ft. 2 ins. deep, and will be drained to 4-in. x 8-in. gutters leading to the sewer connections. The foundations of the floor supporting columns will be of concrete in two courses, each 1 ft. deep and 2 ft. wide. Fig. 4 illustrates the pit room in cross section. An electric traveling crane will serve this room. Access can be had to the pits by four sets of parallel stairways, two of which are located at the center and one at each end of every pit. Three pathways, each 6 ft. wide, are provided for transit across the pit room. It has not been settled yet whether the crane runway will be supported on steel I-beams or reinforced concrete.

The entire length of the building

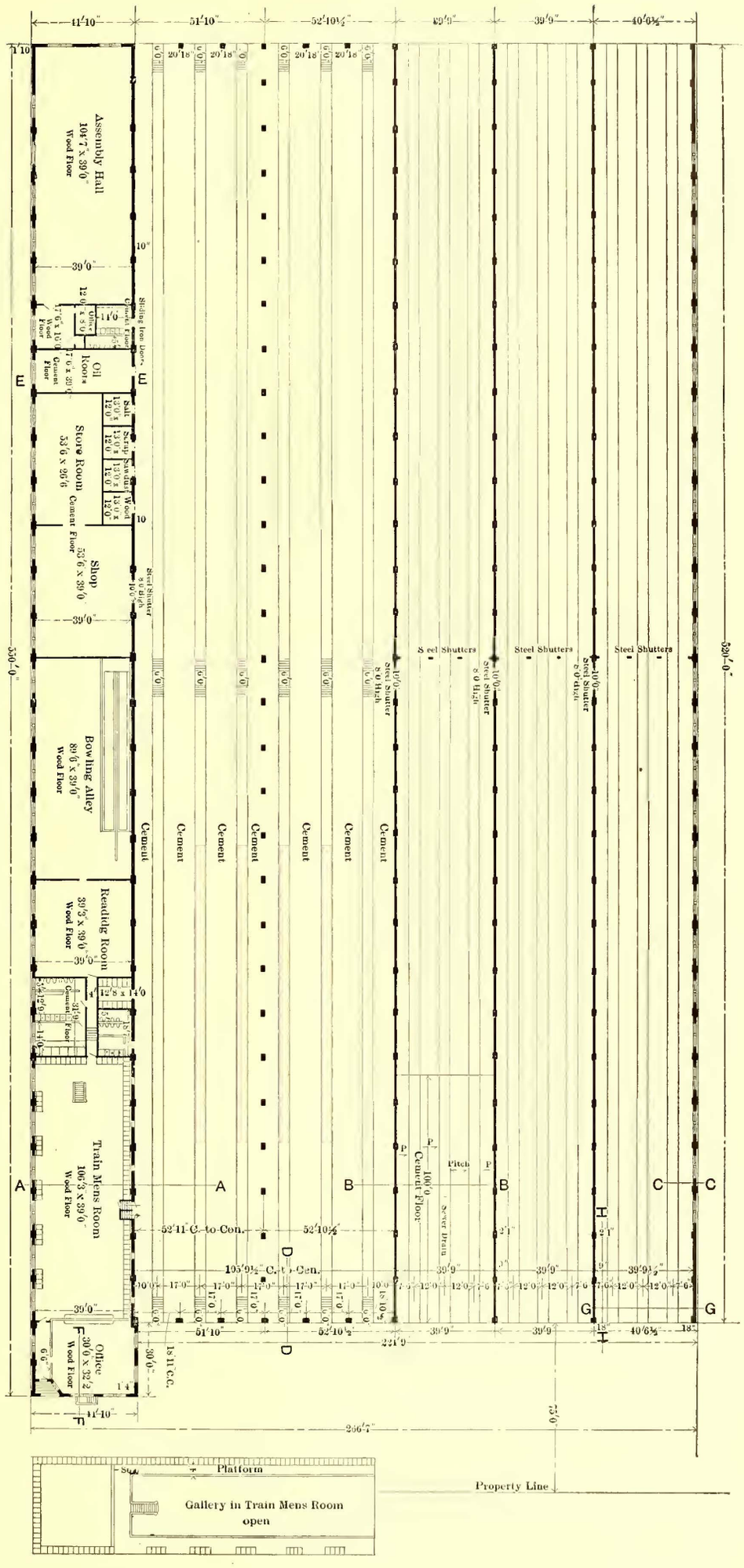


FIG. 3.—PLAN OF SNELLING AVENUE CAR HOUSE, TWIN CITY RAPID TRANSIT COMPANY.

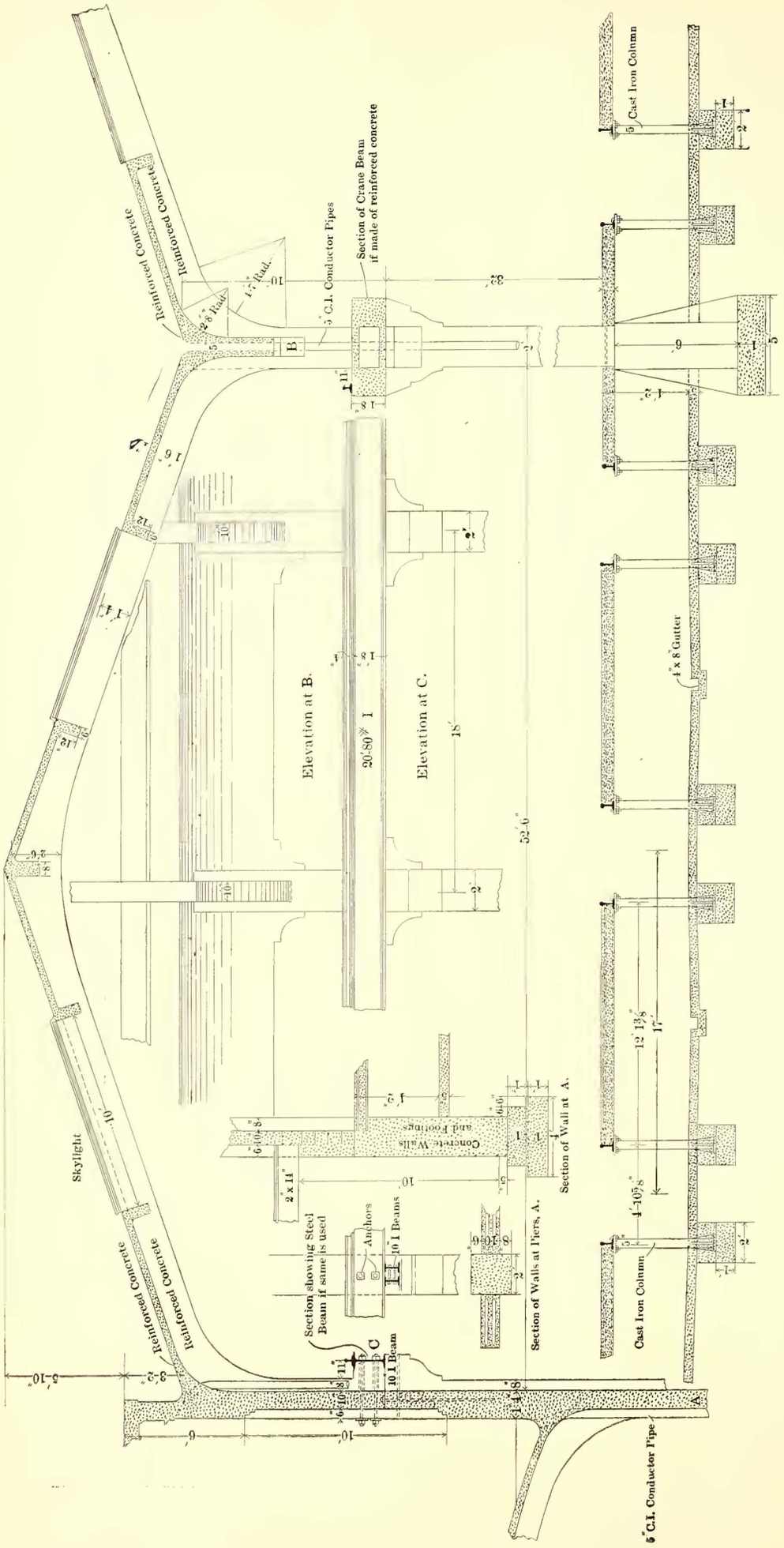


FIG. 4.—SECTIONS OF SNELLING AVENUE CAR HOUSE, TWIN CITY RAPID TRANSIT COMPANY

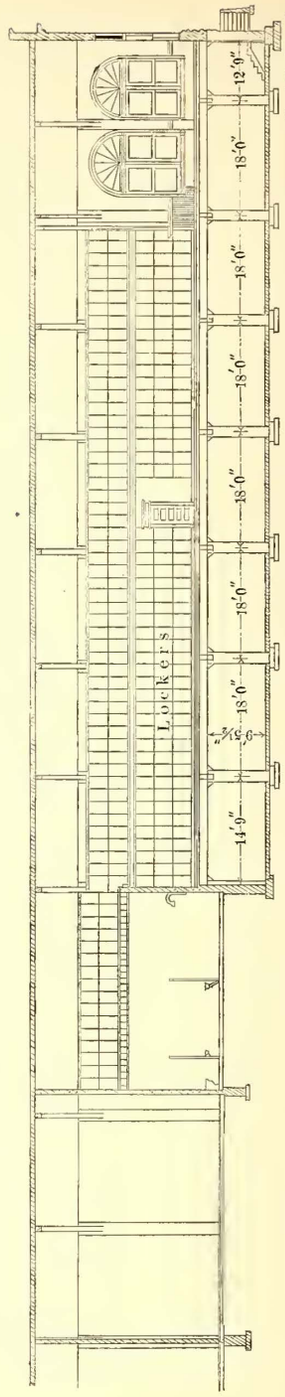


FIG. 5.—LONGITUDINAL SECTION OF FRONT END OF SNELLING AVENUE CAR HOUSE THROUGH TRAINMEN'S ROOM—TWIN CITY RAPID TRANSIT COMPANY

on the University Avenue side is to be devoted to offices, shop room, quarters for the trainmen and store rooms. Passing down University Avenue from Snelling Avenue one enters an office 30 ft. x 32 ft. 2 ins. Adjoining this is a trainmen's room containing lockers, the room being 106 ft. 3 ins. long x 39 ft. wide. A stairway at the end of this room leads to a gallery above. Adjoining the trainmen's room is a hall 4 ft. wide, connecting with a wash and toilet room 31 ft. 9 ins. x 19 ft. 6 ins. A separate toilet and wash room is located on the other side of the hall for the exclusive use of the employees working in the Snelling Avenue half of the pit room. Next comes a reading room 39 ft. square,

and after this a bowling alley 89 ft. 6 ins. long x 39 ft. wide, for the use of trainmen. Beyond the bowling alley comes a small shop 53 ft. 6 ins. x 39 ft., connecting with a store room 53 ft. 6 ins. x 26 ft. Four small rooms, each 13 ft. x 12 ft., are to be built between the store room and the pit room for the keeping of wood, sawdust, scrap and salt. The company's cars are heated by hot water, coal being used for fuel. The sawdust is used in sweeping out the cars. Next to the store room is an oil room 17 ft. 6 ins. x 39 ft. Then comes a toilet room for the employees in the east half of the pit room, this being built at this point to save the time of workmen, who would otherwise be obliged to walk more than half the length of the car house to the toilet room adjoining the trainmen's room. An office 8 ft. x 12 ft. and a waiting room 17 ft. x 16 ft. adjoin the oil room. The last part of the building is devoted to an assembly hall 104 ft. 7 ins. x 39 ft. for the use of employees. Here various meetings may be held, concerts, plays and other entertainments given, and it is expected that the room will find much use at the hands of the employees.

Power and light for the car house will be brought from the power plant through an underground passageway. The daylight illumination will be through skylights set in galvanized iron frames.

Fig. 1 shows two elevations and a longitudinal section of the car house. Below the office and the trainmen's room is to be a basement 9 ft. 5½ ins. deep, containing the coal supply for the hods carried on the cars. Temperatures of 25 degs. to 35 degs. below zero are not uncommon in the winter season of Minnesota, and the supply of coal to the company's cars presents a problem of considerable magnitude. Cars stopping on the University Avenue side can thus be readily supplied with fresh hods of fuel at the conclusion of each trip.

The roof trusses are all to be of reinforced concrete, as shown in Fig. 4. Special attention has been given to the drainage of the roof, and the problem of fire protection kept constantly in mind during the preparation of the plans by the company's architect, C. F. Ferrin. The writer's acknowledgements are due to Mr. Ferrin and to Willard J. Hield, general manager of the Twin City Rapid Transit Company, for courtesies extended in the preparation of these notes.

STEEL-WHEEL PRACTICE UPON THE NEW YORK CITY SURFACE LINES

Much interest is attached to the experimental use of steel wheels under surface cars of the New York City Railway Company in New York City, in view of the increased wheel troubles met with the larger cars, the faster schedules and heavier traffic, which are becoming the rule in electric railway operation. The use of the chilled cast-iron wheel has been attended with more than usual difficulty in New York, and has made the wheel problem one of the most difficult that is encountered in the operation of the road. Steel wheels have been used extensively, of course, in interurban service, but their employment in city service is a considerable departure from ordinary pactice. For this reason the experiment of the New York City Railway Company will be watched with interest.

This company operates over 2000 electric cars daily under the most severe conditions of operation that are to be found in any city in this country. Owing to the density of traffic in New York, the number of stops that are made on almost every line operated average nearly twenty to the mile, which is equivalent to practically a stop at every block. The result is that the wheels are subjected to almost constant braking, and also they suffer the further disadvantage of abnormal slipping resulting from the many accelerations. This produces not only abnormal wheel wear, but also excessive heating of the tread of the wheel. Moreover, owing to the large amount of special track work, the wheels are subjected to unusually rough usage at the numerous crossings, the whole combining to impose conditions which have proven very severe for the chilled cast-iron wheel.

Nearly two years ago it was decided to make a trial of the steel wheel in hopes of bettering the wheel conditions upon the system. Two maximum traction truck cars were equipped and put in operation on the Third and Sixth Avenue Divisions. The results were so satisfactory that last December the company decided to put steel wheels on fifty-six cars on the Twenty-Third Street Division. All of these cars have been running ever since. The style of steel wheel used is a special spoke wheel of cast-steel, which was gotten up especially for this service by the Taylor Iron & Steel Company. The wheels are of the same section as the chilled cast-iron wheel, but have a much thicker rim to provide for the greater wear due to the softness of the steel as compared with the chilled iron. They are cast under a new process of the manufacturer, and were turned out of the foundry practically in condition for service, requiring no machining.

These wheels are, as applied to the cars, 31 ins. in diameter, being an inch larger than the standard wheel size of this company. The extra 1 in. of diameter was added to give the wheels a greater wearing life; the rims can be worn down to 27½ ins., a reduction of 3½ ins. in diameter, before the wheel will be weakened enough to require its removal. This provides for a large amount of wear and consequent long life of the wheel. A greater depth of wear is not possible on the New York lines, as it would interfere with the position of the plow on the underground conductors. The brake shoes used with the steel wheels are the Lappin composition, which is the standard on the New York City lines. A very much stronger braking effect is produced than is possible with the chilled iron wheel, owing to the much firmer hold upon the wheel. This reduces the tendency of the wheel to heat up. A further advantage of the steel wheel is its smaller tendency to flats and the property of rolling out flats when caused.

The results of the first sixteen wheels put in service are such as to indicate the entire adaptability of the steel wheel to surface car conditions. These wheels have been in service eighteen months, and are not yet worn out. They have reached, in several cases, mileages as high as 50,000 miles without showing extreme wear, and it is confidently expected that they will run up to 75,000 miles before removal. A notable feature of the wear upon these wheels is the even contour of the tread, there being no grooving or double-flanging effect, as found on locomotive steel tires.

Owing to the above-mentioned conditions, the wear to which the wheels are subjected is more severe than the mileage can possibly indicate. In reality, the mileage does not indicate the service to which they have been subjected—the large number of accelerations, with consequent slippages, cause the actual mileage of each wheel, it is thought, to run from 10 per cent to 25 per cent higher than the car mileage. The extreme braking conditions also tend to increase the wear very severely, and the results of the steel wheel in the service have been so gratifying that a large number of new cars, which have recently been ordered, are being equipped with steel-tired wheels. This new order involves 100 new Brill cars, upon which the shrunk steel-tired wheel will be used, so that a practical trial of all three kinds of steel wheels will be made. The steel-tired wheels will be furnished by the National Car Wheel Company, of Pittsburg, Pa.

A new wrinkle in three cars just delivered to the Lake Shore Electric Railway, of Cleveland, by the Stephenson Company is a speaking tube extending from the motorman's cab to the rear platform so that the motorman and conductor can be in constant communication. The idea was originated by Warren Bicknell, president of the Lake Shore Company.

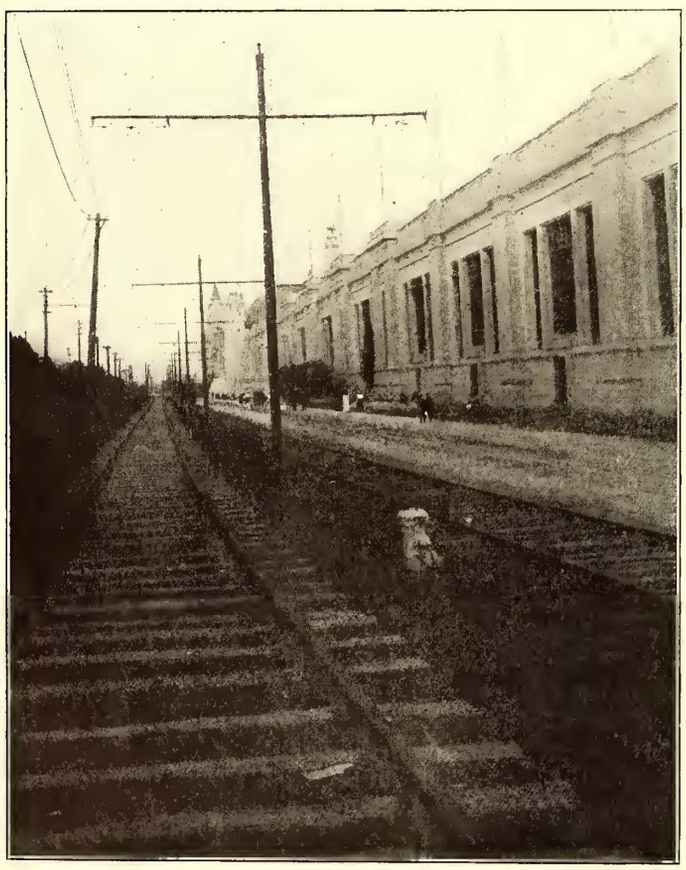
TESTS BY THE ELECTRIC RAILWAY TEST COMMISSION

The Electric Railway Test Commission, working in conjunction with the Department of Electricity at the World's Fair, after several weeks spent in the organization of the tests, the construction of special instruments required in the work, and

THE EXECUTIVE COMMITTEE AND TESTING CORPS OF THE ELECTRIC RAILWAY TEST COMMISSION

in preparation in general, has begun the actual work of testing the several pieces of apparatus submitted.

The corps of assistants, headed by Prof. H. H. Norris, of



THE TEST TRACK ALONG THE NORTH SIDE OF THE TRANSPORTATION BUILDING ON WHICH MANY OF THE CAR TESTS WILL BE PERFORMED

Cornell; Prof. B. V. Swenson, of the University of Wisconsin, and Prof. H. T. Plumb, of Purdue University, includes several graduate students from each of the three institutions.

The first of the series of tests to be made was the determination of the resistance to alternating current of rails of standard section. Tests were made through wide ranges of both currents and frequencies. The frequencies varied far beyond the limits of present railway alternating-current practice, the variation being from 10 cycles to 60 cycles. The maximum current used was from 600 amps. down.

These tests were made in the exhibit space of the Bullock Electric & Manufacturing Company, in the Palace of Electricity.

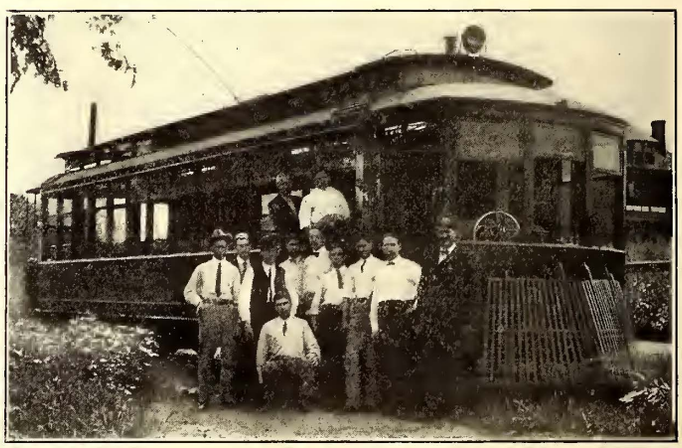
The accompanying reproductions of photographs give a general idea of the apparatus used. The non-inductive carbon resistance, one terminal of which is seen connected to the rail to be tested, was placed in series with the rail. The heavy bar connections were necessitated by the large currents used.

For measuring the power consumption the three-voltmeter method was employed. The voltages were measured across the terminals of the non-inductive resistance, across the portions of the rail to be tested, and the total across both the non-inductive resistance and the rail. From the three readings so obtained the phase position of the current with respect to the e. m. fs. were readily deduced, and, together with the ammeter readings, the power consumed in the rail was easily computed.

In connection with general tests on air-brake apparatus, very complete data were obtained from the compressor station of the St. Louis Transit Company, located at the extremity of the Park Avenue line.

It will probably be remembered that the cars of the St. Louis Transit Company are equipped with the Westinghouse storage

INTERIOR VIEW OF CAR 2600, SHOWING POSITION OF INSTRUMENTS AND OBSERVERS



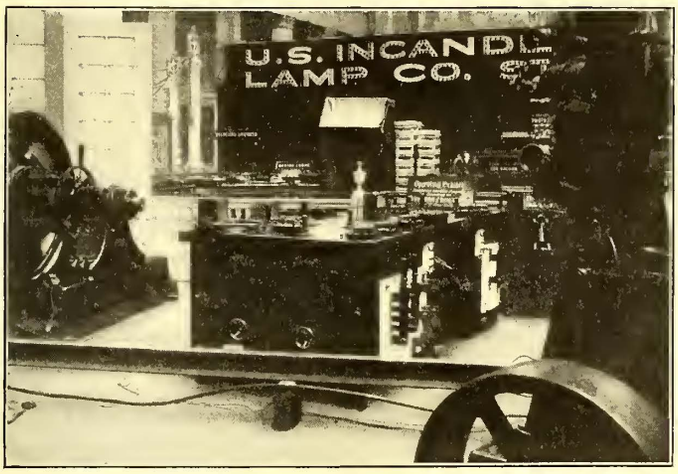
ST LOUIS TRANSIT COMPANY'S CAR, WITH TESTING CORPS

air-brake system, the storage tanks on the cars being charged from compressor stations located at convenient points on the line.

The station tested was equipped with two Ingersoll-Sergeant

compressors driven by Westinghouse motors. The test continued over a period of thirty-six hours. Readings were made to determine the total input in watts, as well as the output measured in cubic feet of free air compressed to 300 lbs. per square inch.

Another test on air-brake apparatus was made on car No. 2600 of the St. Louis Transit Company. This is one of the 450 new cars purchased for World's Fair traffic, having a seating capacity for forty-eight persons, the car-body measuring 33 ft. 4¾ ins. over corner posts.

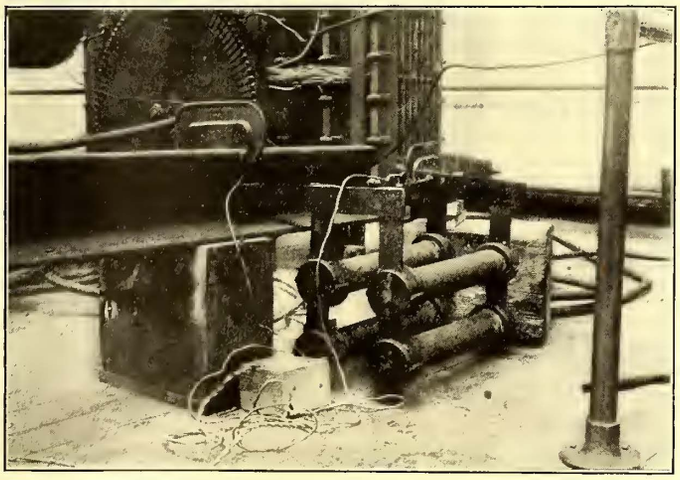


TESTING TABLES AND INSTRUMENTS USED IN THE RAIL TESTS

For the test, the car was specially equipped with National Electric Company air-brake apparatus complete. The compressor used was the A. A. I. type, being controlled by an automatic governor.

The instruments were so arranged that the observers would occupy the four forward seats on one side of the car. The car was operated over the regular Park Avenue run.

In general, the readings obtained were those required to compute the total watt consumption in the compressor motor and the output of the compressor. Record was also kept of the number of applications of the brakes, the pressure used at each application, the number of revolutions of the crank-shaft of the compressor, and the length of time the compressor was operating. Personal error was largely eliminated by the use of automatic recording instruments. A recording gage connected to the train line registered the maximum pressure at each application. An electrically connected counter recorded the number of revolutions of the crank-shaft of the compressor. Reading signals were given by means of a clock, which at intervals of five seconds operated electric bells.



THE NON-INDUCTIVE CARBON RESISTANCE USED IN THE RAIL TESTS

To eliminate errors in the measurement of the air compressed, through the possibility of the pump operating while an application of the brakes was being made, the governor connections were somewhat modified. With this modification the pump could not be started as long as there was any pressure in the train line, and if the pump were in operation when the application was made it was immediately cut out.

During the test the National Electric Company was represented by Messrs. Tolman and Metzler. During the tests on the brake apparatus very complete data were obtained on the motor consumption. For this purpose an Armstrong recording ammeter, with time marker registering every five seconds, was used. Temperature readings of the motors were also obtained at the end of each run.

Several tests will be made on an Indiana Union Traction Company car. This is one of the twenty cars recently constructed by the Cincinnati Car Company.

In the group showing the members of the Electric Railway Test Commission, Prof. Goldsborough, Chief of the Department of Electricity, is in the second row from the front, at the right of the center. Prof. Norris, of the test commission, is at his side. Prof. Swenson, of the University of Wisconsin, is seated at the left of Prof. Norris, and Mr. Thurston, of the Westinghouse Company, stands at the left of the picture.

THE APPLICATION OF ELECTRIC TRACTION TO LIGHT RAILWAYS*

BY H. LUITHLEN
Chief Inspector of the Austrian State Railways.

The advantages of electric traction over steam for light railway service can be classified under three headings, viz: (1) those which appeal to the traveling public and which lead to an increase in traffic, and consequently to an increase in receipts; (2) those resulting from a centralization of the motive power; (3) economies in first cost, maintenance and operating expenses. It is proposed to examine each of these classifications separately and point out as well the disadvantages of electric traction. It might be mentioned in this connection, however, that one of the principal advantages of electric traction will not be discussed, viz., that of possessing possibilities for very high speeds. This forms really a separate subject, so that the present paper will be confined to a consideration of the motive power as it can be applied to light steam railways as they are operated to-day.

ADVANTAGES TO THE PASSENGER

Two important advantages are (a) the easy division of trains into a large number of units so that trains can be run at frequent headway, and (b) the maximum speed being fixed, the duration of the trip is reduced by electric power on account of rapid starting and stopping.

A short headway and a reduction in the length of trip are often two conditions which are essential to successful commercial results, especially on short suburban lines. There is no doubt that electricity answers this demand much better than steam, thus, for example, the application of electricity to the Provincial Tramways of Naples was followed by an increase in the train kilometers of 140 per cent, although the increase in expenses was only 20 per cent. Having a better coefficient of traction they can also be stopped more quickly than steam trains. This is true even when an electric locomotive is used, because the coefficient of adhesion on the rails is greater than with a steam locomotive, owing to the rotary movement of the motors. Cserháti has estimated that from 25 per cent to 30 per cent of the weight of an electric locomotive can be utilized as draw-bar pull, whereas the coefficient for a steam locomotive is only about 16 per cent. Articles in the technical press show

*Abstract of report to be presented at the September (1904) meeting at Vienna of the International Tramways and Light Railways Association.

that on the three high-speed lines, Milan-Varese, the Berlin Elevated Railway and the Liverpool & Southport Railway, the braking deceleration was respectively 0.35, 0.7 and 0.9 m per second^2, while on the Vienna Metropolitan line it reached a maximum of only 0.25 m per second^2, with an average of 0.17. It should be stated here that the Vienna Metropolitan Railway operates, as a rule, trains of considerable weight. In addition to the gain in running time from this cause, electric trains have also the advantage over steam on lines of considerable length that no stops are necessary to take in a water supply.

Another advantage is that the number of cars per train can very easily be arranged by the multiple-unit system to suit the traffic without changing the number of trains. This advantage under certain conditions is of very great importance. Absence of smoke and cinders is another important feature, as is the possibility of easily and economically lighting the cars and stations, conditions which undoubtedly affect the volume of traffic, especially in case of two parallel lines, one operated by electricity and the other by steam. Incidentally, the absence of smoke also undoubtedly increases the life of parts of the permanent equipment, such as rails, bridges, etc., and improves the chances of getting running powers, especially in the suburbs of large cities.

ADVANTAGES OF A CENTRALIZATION OF MOTIVE POWER

These are especially important when water power is available. The economy of a steam-power station over individual units increases, of course, with the cost of coal. On the Valtellina Railway the cost of coal with steam power amounted to 235.6 centimes per 1000 tonne kilometers, while with the water-power station the cost is only 65 centimes. There is considerable economy, however, even where steam power is used, owing to the use of refinements in steam generation and consumption as well as to a high-load factor, as compared with the consumption of coal in the ordinary locomotive boiler; also in the possibility of using an inferior quality of coal. The latter point is particularly advantageous where coal can be secured near the station. For instance, in Bohemia lignite of a sufficiently good quality to burn under stationary boilers can be secured for 1.60 kr. per tonne, whereas the poorest quality of lignite suitable for use in locomotive boilers cannot be obtained for less than 4 kr. per tonne. Another advantage of the centralization of motive power is that the capacity of the steam locomotive has to be that of the maximum power demand which is required for a very short time only, whereas the load on the power station is only the sum of the average loads on the different motors. This reduces the first cost. The improvements during recent years in steam turbines, as well as in gas engines, afford the hope of a still greater economy in central power generation. The ability to utilize current for lighting as well as for miscellaneous power purposes, should not be overlooked. Lechner cites a practical instance of this in the case of the Meckenbeurn-Tettnang interurban railway, where the profit on the sale of current from the railway power station for miscellaneous purposes paid from 1.1 per cent to 3.2 per cent on the entire capital investment.

Another advantage of the centralization of power is the possibility of recovering the energy lost in braking. This plan is followed on several rack railways, such as in Barmen, Trieste and the Jungfrau, where from 55 per cent to 60 per cent of power is recovered. It is probable that on ordinary railways there will be greater progress in this direction in the more or less distant future.

Having mentioned the advantages of central power distribution, it is only right to refer to the disadvantages. The total power available is limited by the capacity of the station and by the size of the conductors, so that there is a lack of elasticity depending upon the layout of the line and the copper investment. For instance, in the Munich-Grünwald line electricity is depended upon for ordinary service, but on Sundays and holidays steam trains are also run. This practice saves the necessity of installing a power station of large enough capacity for all conditions. For this reason electric traction does not seem to be especially adapted for heavy irregular traffic, because the power station and distribution system would have to be of such a large size that it would not be working at a high rate of efficiency at all times. It seems, therefore, desirable in many cases to continue the hauling of freight by means of steam locomotives even if electricity should be utilized for passenger service.

Again, in case of interruption to the service, there might be a bunch of trains on one section, which would be of greater capacity than that for which the local distributing system was designed, resulting in great inconvenience. Thus, the annual report of the Bergdorf-Thun Electric Railway for 1902 shows a number of interruptions to train traffic, one of them of six and one-half hours duration. These interruptions were caused by falls of the poles carrying the transmission line, breakages of the trolley wire and defects in the motor cars. On the Milan-Varese line a storm recently interrupted the service for over an hour. There are also other possibilities of delay due to a central power station and to the distributing system, and the sleet problem has not yet been satisfactorily worked out on the third-rail roads.

REDUCTION IN FIRST COST AND OPERATING EXPENSES

The cost of construction is in favor of electricity in several items, particularly because the limiting grade is higher on an electric railroad. This not only often permits a shorter route, but reduces the necessary excavations and fills. For example, the Tabor-Bechnyn Railway in Bohemia was originally designed for steam traction with a maximum grade of 2½ per cent. When electricity was decided upon the maximum grade was increased to 3½ per cent. This made it possible to lower the grade of a large bridge across the Luznitz Valley and reduced its length 174 m. As the electric trains are shorter, the station platforms may also be shorter, and as the trains can be operated from either end, the switch yard may be made smaller and many sidings can be omitted. Stated conversely, the electrification of a steam road permits a larger traffic with the same sidings. For instance, the St. George & Commiers-Lamure line was a single-track line, with a number of grades reaching as high as 2.7 per cent, and with steam power had reached the limit of its capacity. As it was a narrow gage line, heavier locomotives could not be used, but the substitution of electricity permitted the employment of electric locomotives which could haul much longer trains. Another economy lies in the possibility of the use of a lighter sub-structure on account of the smaller weight per axle and the absence of reciprocating machinery; thus, on the Tabor-Bechnyn line, mentioned above, 21.75-kg rail was used instead of the 26-kg rail, estimated upon with steam traction. Finally, electric traction does not require water towers or coaling depots. On the other hand, an electric system requires a considerable investment for the power station and distributing system.

The cost of track and car maintenance is considerably less for an electric line than for a steam line; for instance, on the Meckenbeurn-Tettnang line the cost of track maintenance is 280 marks per kilometer as compared with an average of from 300 to 400 marks for steam. The other maintenance expenses, such as that of electric equipment, are not of great importance. Hecker figures that in the case of city tramways, 0.1 pf. per car-kilometer is sufficient for the maintenance of the overhead wire. As far as concerns rolling stock, there is no doubt that the cost of maintenance for an electric car or an electric locomotive is less than that of a steam locomotive. Armstrong (Street Railway Journal, Jan. 16, 1904) estimates that in trains weighing 250 tons, the cost of repairs for the locomotive per 1000 ton-mile is 25 cents for steam locomotives and 8 cents for the electric locomotive, about one-third. Cserháti arrives

at the same result. He figures steam locomotive maintenance at 9 heller and electric at 3 heller. He also claims, with reason, that the maintenance of the trail cars ought to be less on an electric road, owing to the absence of gases of combustion.

As for the operating expenses, they ought to be less with electricity, as the dead weight is less and the operating crew required is smaller. On the other hand, the operating force is increased by those required in the power station and sub-stations. The operating ratio ought, theoretically, to be considerable lower for electricity, and has been shown to be so on the Manhattan Elevated, the South Side Elevated, the Milan-Varese, the Liverpool & Birkenhead and on other converted steam lines.

Estimates of the reduction of cost on single-phase over three-phase construction range from 32 per cent (Blank's figure) to 22 per cent (Lincoln's estimate). As no single-phase line of considerable importance has been put in operation, it is impossible as yet to determine whether the reduction in first cost may not be counterbalanced by an increase in operating expenses.

STORING COAL IN WORCESTER

The Worcester Consolidated Street Railway Company has evolved a method of storing coal which is very ingenious, inexpensive and effective.

The storing of coal is a problem in street railway power house work which is by no means of small importance. A small quantity of coal can, of course, be stored in the housed bunker, and gives no trouble, but such an arrangement requires to be continuously replenished and affords no protection in time of railroad or mine labor troubles. The problem of storing a very much larger quantity requires different treatment, and is usually solved by the simple expedient of dumping it in a large heap on the ground and running an industrial railroad near the heap and loading with shovels. This method

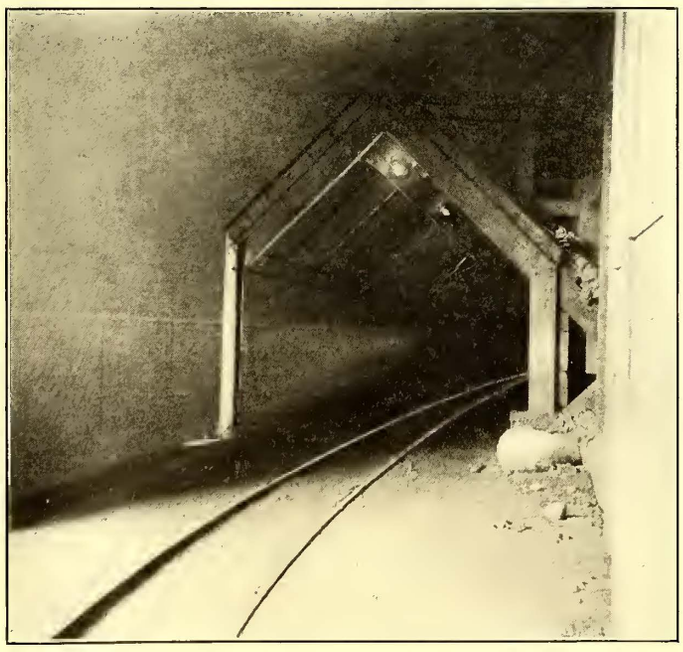


FIG. 1.—ENTRANCE TO TUNNEL

further takes a chance, and a serious chance, of spontaneous combustion.

The Worcester Consolidated Street Railway Company has constructed an enormous bin, which is little more than a fenced yard, except that the fence is made unusually substantial and well bolted, and of 2-in. planking, with stays of appropriate strength. The bin is about 300 ft. long and 100 ft. wide and is capable of containing roughly about 15,000 tons.

The bottom of the bin is traversed by a tunnel running the full length of the bin and about 9 ft. wide and 8 ft. high at its apex, the tunnel being pitch roofed. The tunnel is made of 2-in. planking, mounted on 8-in. x 6-in. timbers, reinforced by ¼-in. iron plates, securely bolted together. It contains fifty-seven steel chutes of ⅛-in. iron, 2 ft. wide and 15 ins. deep.

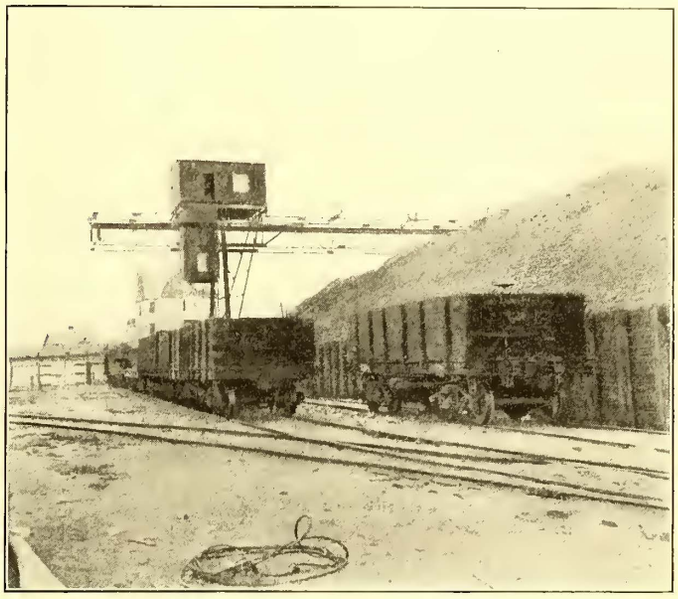


FIG. 2.—CRANE FOR HANDLING COAL

The coal is unloaded from the freight cars and piled on top of this tunnel by an electrically-driven crane. This crane is mounted on two vertical end supports running on rails, the wheels being driven by a system of shafting and double gearing, thereby enabling the crane to traverse the bin longitudinally. The transverse motion of the coal bucket is obtained by a traversing carriage on the horizontal members of the frame.

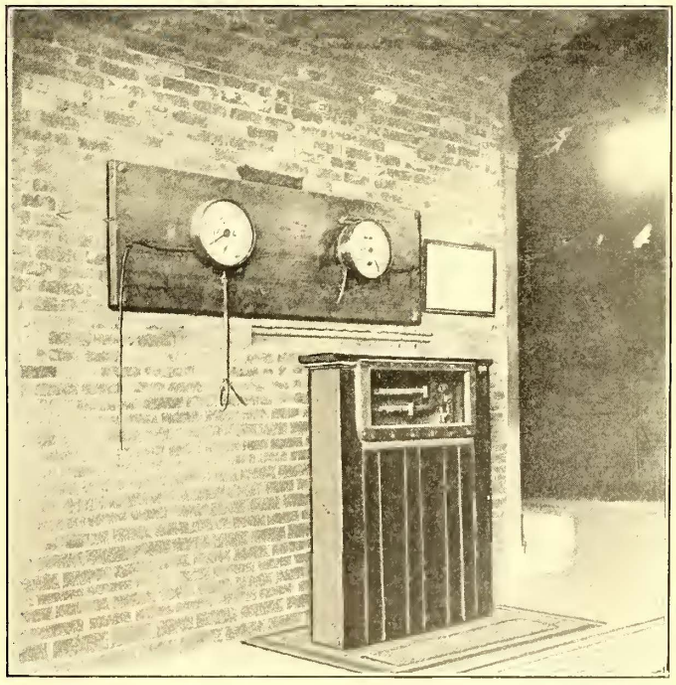


FIG. 3.—COAL WEIGHING AND RECORDING APPARATUS

The whole operation of the crane is managed from a house located on the top of one of the vertical stanchions from which any part of the coal bin or the cars adjacent thereto can be observed. The capacity of the crane is such that it is able to turn over the entire bin in five or six days.

Spontaneous combustion is guarded against by means of taking the temperature of the pile every day. Long iron tubes are located at intervals throughout the yard, and every day the

temperature at the base of these tubes is taken by letting down a recording thermometer. This temperature is not allowed to exceed a given temperature, and when this point is exceeded the crane is called into play and the coal in that particular part of the yard is turned over and given access to the air.

The tunnel with its chutes is, of course, the means for withdrawing the coal from the yard, and the crane piles the coal up on the tunnel as the occasion demands. Soft coal covers one portion of the tunnel and anthracite screenings at the other, and a mixture of the two is used in the boiler room. An industrial railroad runs the entire length of the tunnel and the coal passers push steel cars into the tunnel to the appropriate chute, fill the car and push it back into the boiler room, being always under cover the entire length of the trip. As they enter the boiler room the car is put on a platform scale, where it is weighed and a record made of its contents. The cars are also counted by the ingenious device of putting in service an old car register for the purpose. Two of these are used, one for anthracite screenings and one for soft coal, although it might be suggested that a double register giving cash fares on one side and transfers on the other might perhaps serve the same purpose.

The entrance to the tunnel is shown in Fig. 1. The tunnel is lighted by lamps every 15 ft., and the first two of these can be seen in the picture. The tracks of the industrial railroad, 19½-in. gage, can also be seen.

The yard and crane are the subject of Fig. 2, and give an idea of the immense quantity of coal that can be stored, the convenience of adjacent cars, and the flexibility of the crane in handling this large pile of fuel.

The last picture, Fig. 3, is devoted to illustrating the platform scale and the car registers, and show how easy it is to keep track of the amount of coal burned and also how the useful car register can protect the street railway expenditures as well as receipts.

THE VALUE OF SPECIAL REPORTS

BY H. S. KNOWLTON

The preparation and submission of special reports constitutes a large portion of the modern consulting engineer's work, and as the complexity of industrial life increases there is no reason to believe that the demand for recorded expert opinion will in any measure abate. There is little need at this time of proving the value of special reports to those engaged in the financing and commercial management of engineering enterprises, although much might be said about the importance of making sure of an adviser's qualifications before basing costly decisions upon his unchecked recommendations. An instance in point occurred a year or so ago in New England, when the entire design and construction of an electric railway connecting a prominent manufacturing city with several outlying farming towns was placed in the hands of a well-known promoter whose technical ability had never been demonstrated. Thanks to an able civil engineer who carried out the actual work upon the roadbed, the line and track turned out to be examples of first-class practice, and as the cars and motor equipments were manufactured by established companies of long experience, no fault of consequence could be found with the rolling stock. The power station, however, was left to the personal supervision of the promoter, and the result was an abortion in design and economy of equipment. The boilers were installed beneath a roadway so that extension in a symmetrical direction is not feasible; the boiler room floor was divided into two sections 18 ins. different in height, so that the fireman is constantly obliged to climb up and down in handling coal and ashes; the generators and engines were of the old belted single-cylinder type, and had become nearly used up by ten years' service on one of the first electric roads built in Massachusetts; while the switchboard was a second-hand wooden framed affair, which offered little safety from the standpoint of fire risk. If memory serves correctly, the switches were installed to fall closed instead of open, and there were other defects galore.

Although it is true that the cost of power is far from the most important item in the operating expenses of a moderate speed electric railway, it is also true that the entire business is carried on in small units of money. The aggregate of these units decides the question of dividends at the end of the year, and it is now well established that every possible reduction in waste is worth while. Had the company retained the services of a competent engineer it would have been spared the inefficient design which turned its power station into an operating bungle that has been a continual thorn in the flesh since the road started. Schedules have been slow, and at times the cars have been unable to ascend 4 per cent or 5 per cent grades because the antiquated machinery refused to hold up the voltage, while the direct cost of operation in the power house is not made public as yet by the management. The cost of obtaining the proper advice at the outset would have been a small part of the total construction cost of the power house, and it would have amply repaid the company by the increased economy of operation with improved equipment. A single expert report would have placed the company in possession of information enough to enable it to go ahead with confidence that economical and reliable operation would be insured as long as the proper attendance could be had.

Along with the error of dispensing with expert advice goes the all too common practice of making little or no use of reports after they are submitted. Either a report is valuable or it is not, and if the chief end of the consulting engineer's recommendations is the filling of a dusty pigeon hole or drawer in a filing cabinet, there is little reason for spending money in this way. Of course, circumstances often arise where the management of a company, a firm of bankers or some manufacturing partnership desire to preserve for reference the recorded opinion of a disinterested expert, but in almost every case such a report is filed with the express purpose of consulting it in the near future. An instance of this failure to make the most of reports may be drawn from the practice of a large telephone company on the strength of its being typical of many other corporate interests in the engineering world.

The company under consideration retained an engineer for the purpose of making a series of reports upon the condition of its overhead lines at points where those lines crossed or paralleled the high-tension circuits of various power companies. The voltages on the power lines ran all the way from 6600 to 20,000, and the investigation covered several weeks, involving considerable railroad traveling, hotel and livery bills of consequence, stenographic work, etc. Altogether, it is safe to say that the carefully prepared reports cost the company four or five hundred dollars, and placed it in possession of exact information as to the present condition of each crossing, the previous conditions and the responsibility of the power or the telephone company for the situation. In many cases a recommendation was added in regard to methods of making the crossing safe, and the reports were complete with sketches of the construction in force. The same engineer was also instructed to make a careful examination of the fire risk in all the larger central offices of the company, and to report upon each office separately, giving an account of the existing hazards, precautions in force and suggested improvements on the score of safety. This was done with the same thoroughness as in the case of the crossings. Some four months later the engineer who had performed these two tasks visited one of the cities which had occupied a large share of attention in the preparation of the reports, and as far as could be ascertained, not a single recommended improvement had been carried out

on either report! It is difficult to explain the company's inaction on any other grounds than the gambling instinct which leads so many officials to take risks rather than spend even the moderate sums of money necessary to insure safety. The particular improvements at the city in mind were inexpensive, as far as the fire risk of the company's buildings was concerned. Many of the high-tension crossings could also have been made safe by moderate expenditures. The engineer had personal knowledge that his reports had been well received by the executive and technical officials of the telephone company; his fee was cheerfully paid, and the connection terminated in mutual good feeling. It is not necessary at this time to point out the danger of ignoring the fire and life risks involved, but it does seem worth while to repeat that if the reports were worth what they cost the company they deserved a better use than pigeon-holing, particularly as there was no ground for disagreement upon the advisability of protecting the company's lines, buildings, employees and patrons. Certainly there is no sense in spending money for expert advice if that advice is to be permanently side-tracked as far as making use of it goes when perfect agreement exists between the engineer and his client. It is a matter for congratulation that the modern engineer's report finds much appreciation in many quarters of the industrial field, and as time goes on there is every reason to expect a wider recognition of the value of expert advice.

CORRESPONDENCE

FREQUENT STOPS VS. FAST SCHEDULE

Chicago, Aug. 20, 1904.

Editors Street Railway Journal:

In view of the vast amount of attention which is paid to the subject of high acceleration, would it not be advisable to make a great effort to reduce the number of stops in electric railway operation? Perhaps it is too much to expect at present that stops can be omitted at any intersecting street in the business centers of cities, particularly as the tracks in such portions of the community are nearly always crossed and blockaded by every species of team, from an Italian push-cart to a four-horse coal wagon, so that the increase in speed resulting from fewer stops has a smaller influence upon the schedule as a whole than as though such a gain were secured in the more sparsely traveled sections of the town. It has taken considerable time and patience to secure the public's acceptance of the practice of making stops only at street corners; but now that this is done in practically every city, the resulting improvement in schedule speed and in the quality of service rendered has amply demonstrated the far-sightedness of cutting out the old horse-car practice of making stops anywhere along the route. People have grown to realize that much faster time can be made by stopping only at designated points, and are for the most part willing to walk the maximum distance of half a block in order to save a few minutes in the total time of their journey.

The same line of reasoning applies with more than redoubled force to residential and suburban lines, and it is gratifying to note that the "white-post" idea is carried out to its logical conclusion in many systems of the country. Some kind of marking is, of course, an absolute necessity at designated stopping points, otherwise a great deal of inconvenience and trouble is sure to result. It is a waste of good money, however, to equip cars with four 38-hp or 50-hp motors, capable of propelling them at speeds of from 35 miles to 50 miles per hour, and then to operate them over a route which is mostly made up of purely acceleration and braking runs between stops close together.

This phase of operation is well illustrated by a road located in a large city of the Middle West, which operates a line extending 5 miles from the city proper to a residential suburban section. The track is double throughout nearly the entire distance; the greater part of the route is unhampered by grades of any consequence; there are few sharp curves, and there is so little travel over perhaps a third of the route that it practically amounts to a private boulevard right of way. The cars are equipped with four motors each, and air brakes are used throughout. In spite of these favorable conditions, the running time is nearly half an hour over the line from end to end, and as far as can be seen, it is largely due to the practice of stopping at every street corner, coupled with the fact that the cars cannot be boarded or left until an absolute stop has been attained—thanks to a pair of gates at the rear end, which is controlled by a handle in the motorman's vestibule. These gates are never opened until the car has ceased to move, and are never closed until every passenger is aboard and the car ready to start—a proceeding which is most commendable on the score of safety, but which necessitates a nine-second stop about every time a passenger boards the car, whether that person be an active man of thirty-five or forty, or an elderly lady of ninety summers. An additional delay is caused by the fact that the gates swing outward in opening, which results in a certain hesitation and standing back on the part of groups of people who do not wish to collide with the gates, and who therefore wait until both the car and gates have reached a peaceful dead level of inaction before they start to walk toward the haven where they would be. This point is brought out in no spirit of criticism of the company's policy toward securing the greatest possible safety, although it is hard to see how any very congested traffic can be handled expeditiously with the gate system mentioned. Rather is it intended to emphasize the importance of speeding up the schedule in other possible directions, and this can be most readily effected by cutting out some of the stops at street corners in the residence districts of the route. This need cause no special inconvenience to citizens, for some of the blocks are scarcely 150 ft. long. Probably a good deal of opposition would be encountered at first if the plan of stopping at points from 300 ft. to 500 ft. apart were carried into effect, but there is little room to doubt that a saving of 20 per cent or 25 per cent in the running time would be accomplished by this means, and it ought not to be long before the entire community realized the improvement in service gained. It is impossible to escape the conviction, in a trip over the line, that the equipment is not being worked to either its best efficiency or to its capacity, in terms of speed attainable and investment, and a still further gain would be that of decreased power consumption in acceleration and lessened wear and tear of equipment due to frequent stops—this being chiefly to the railway company's advantage. Both the company and the public would be the gainers if a reasonable scheme of car stops was inaugurated, and the expense would be trifling in comparison with the mutual economies in time and operating expenses which would be derived from a properly designated series of stopping points.

R. P. Gorham.

IMPROVED NEW CAR TERMINAL AT WILLOW GROVE, PHILADELPHIA RAPID TRANSIT COMPANY

The Philadelphia Rapid Transit Company is making extensive changes in its terminal facilities at its Willow Grove Park, by which the congestion of traffic at this important point will be greatly relieved. The increase of traffic which the beauties and attractions of the park have developed, had caused the former terminal facilities to become outgrown and entirely inadequate for the large and growing service. It was formerly the custom to operate the cars on the two lines leading from the city to the park, over a loop which extended around a portion of the park ground, and over a circuitous route through Willow Grove village. This former system gave access to many parts of the park, but proved an inconvenient method of

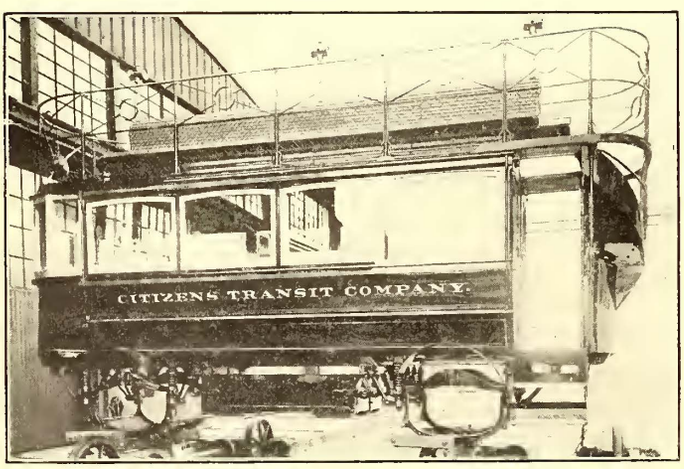
handling the traffic, and also did not permit of rapid handling of cars, as is so desirable for park service.

The new terminal system provides for an interesting terminal station arrangement, in which the arrival and departure platforms are entirely separated, and both of which are approached by an underground tunnelway leading under the Germantown and Willow Grove pike to the park grounds, so that there will be no crossing of tracks, with its attendant dangers. The ground to be occupied by the new terminal tracks, as well as also the Germantown roadway, has been raised about 4 ft., which is found a material advantage in arranging for the tunnel entrance. The departure platform is conveniently arranged between tracks, while the terminal platform is on the side next to the music pavilion in the park. The departure track is of the island type, with the cars for the two different lines leading out from opposite sides. A large number of storage tracks are provided in a space 400 ft. long and averaging 75 ft. wide, so that a large number of cars may be stored there in anticipation of the large crowds leaving at night. The storage tracks at one end of the terminal are covered.

The improvements include further, a crossing of the North East Penn Steam Railroad by a new steel bridge, which will eliminate a grade crossing and do away with delays resulting at that point. Also several changes have been made in the turnpike leading to the park, to permit of the tunnel construction, as well as to facilitate access to the park for carriages. The tunnel leading to the arrival and island departure platforms is 36 ft. wide, and is divided in two halves, with four approaches on the east end; no steps are used, the approaches consisting of easy inclines leading down to the tunnel level. The tunnel will be well lighted and ventilated, and will, by greatly facilitating access to the park from the cars, cause this resort to grow even greater in popularity.

A NEW STYLE OF AUTO-COACH

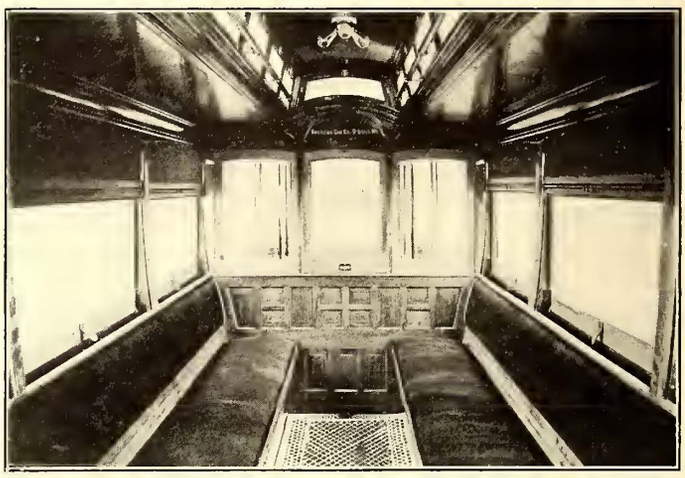
The Citizens Transit Company, of Detroit, Mich., is about to put in operation an auto-coach of a new design, built by the American Car Company, of St. Louis. The coach has a seating capacity of forty, and is the largest of its kind ever built.



AUTO COACH FOR THE CITIZENS TRANSIT COMPANY

The Citizens Transit Company intends to operate twenty-five or thirty of these coaches from Campus Martius, in the heart of the city, over the bridge to Belle Isle. This is one of the few sections of the city not served by trolley lines, and doubtless the new coaches will do a large business from the start. As the illustrations show, the coach is excellently planned for convenience, compactness and strength. The stairway to the roof is neatly arranged and occupies little space, and the motorman's cab is also compact. All the windows, including those in the motorman's cab, are arranged to drop into pockets. The motors are supplied by a storage battery placed in a box suspended under the coach.

The length of the coach body is 14 ft. 6 ins., and the total length over the crown pieces, 20 ft. 6 ins.; from the end panels over crown pieces at either end, 3 ft. The width over the sills, including the panels, is 4 ft. 3¾ ins., and over the posts at the



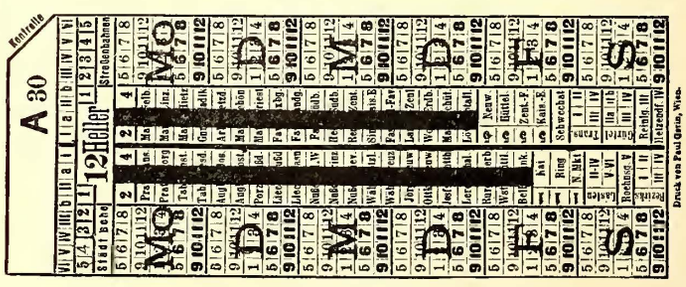
INTERIOR OF AUTO COACH

belt, 6 ft. The sweep of the posts is 9¾ ins.; distance from center to center of posts, 3 ft. 6¼ ins. The side sills are 3¾ x 7 ins., and the end sills, 3 ins. x 3¾ ins. The corner posts are 3⅜ ins. thick, and the side posts, 2 ins. The steps are 12 ins. from tread to tread, and the lower step, 15 ins. from the pavement. The wheel base is 11 ft. 8 ins., and the wheels, 36 ins. in diameter.

A NEW FARE RECEIPT FOR THE VIENNA TRAMWAYS

The fare ticket shown in the accompanying illustration is an improved form which has just been adopted on several of the street railway lines operated by the Vienna municipality.

When this ticket is used for a straight trip the conductor punches a hole above the line "Städtische Strassenbahnen" ("Municipal Street Railways"), but when transfers are desired the ticket is punched below this line. The Roman numerals at the top of the slip denote the zones traversed by the lines, whose names are printed in the middle of the ticket. It will be



NEW TRAMWAY RECEIPT USED IN VIENNA

noted that the right and left sides of the ticket are similar, each including the week days and the hours of the day. This arrangement permits the conductor to indicate the direction the car is going, and thus prevents the passenger from returning on the same ticket. When a transfer is given, one perforation marks the line and entering zone, and the second the day and hour of beginning the trip. To assist the conductor the abbreviations of the week days are printed in different colors, according to the various classes of the fares paid.

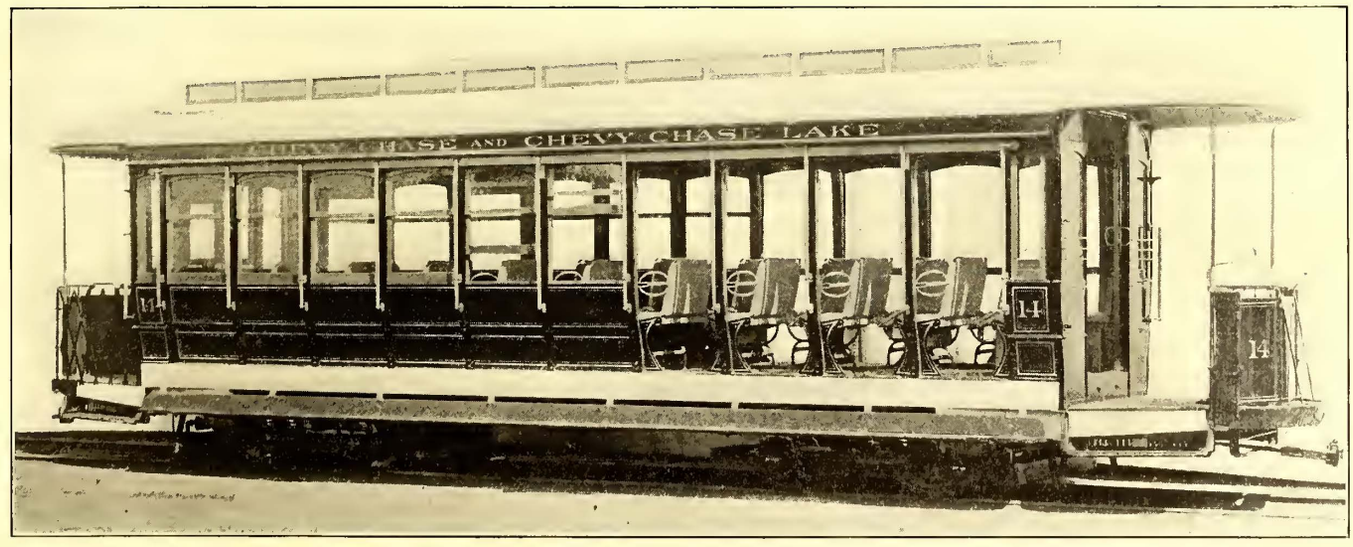
SEPT. 15 CHOSEN AS ELECTRICITY DAY AT THE ST. LOUIS WORLD'S FAIR

Electricity Day will be celebrated at the Louisiana Purchase Exposition Sept. 15. This date occurs during the session of the International Electrical Congress. Prof. W. E. Goldsborough, chief of the Department of Electricity, as chairman of the electricity day committee, in a letter to all the exhibitors in the Palace of Electricity, has requested that on this day they present some especially novel and attractive feature in connection with their exhibit.

CONVERTIBLE CARS FOR THE CAPITAL TRACTION COMPANY, OF WASHINGTON, D. C.

The Capital Traction Company, of Washington, D. C., has lately placed on the line running to Chevy Chase two handsome convertible cars, built by the J. G. Brill Company. This railway company controls a large amusement park at Chevy Chase, which has been a popular resort of Washington people for a number of years, and is considered one of the finest parks of its kind in the country. There is a large population north of the city through which the lines extend, and the cars are kept busy both summer and winter. These are the first convertible cars used in Washington, and it is believed that they will prove popular because of their easy conversion and the protection that they afford in rainy and unseasonable weather.

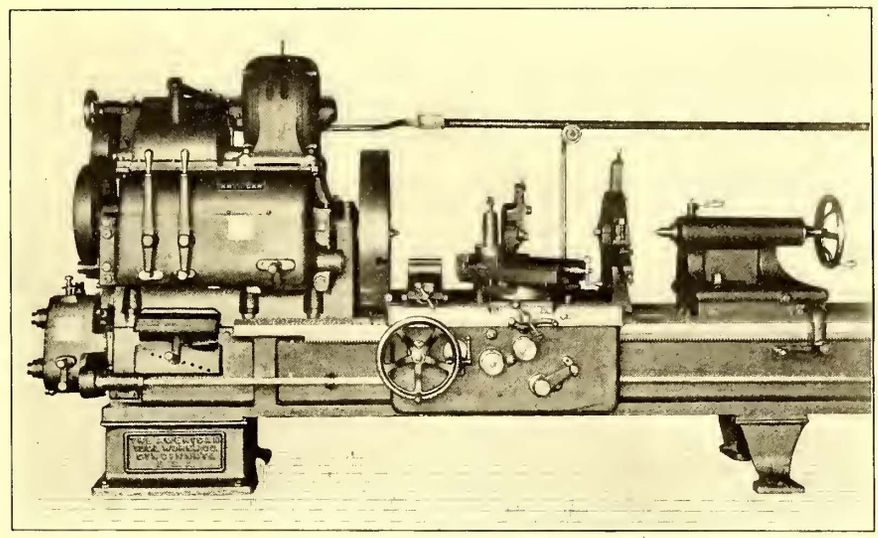
The cars are finished in cherry, with birch ceilings neatly decorated. The seats are of the step-over style, and are 35 ins. long, leaving the aisles 20 ins. wide; the seating capacity of the car is forty-four. Besides the usual grab-handles on the outside of the posts, handles are formed by the brackets connecting the backs of the seats with the posts, which, by offering a convenient handle, encourage passengers to face in the right direction when leaving the car. The length of the cars over end panels is 28 ft. 4 ins., and over crown pieces, 27 ft. 4 ins.; from end panels over crown pieces, 4 ft. 6 ins. The width over the sills and the panels is 6 ft. 11¼ ins., and over the posts at the belt, 7 ft. 9 ins. The sweep of the posts is 5 ins. The side and end sills are 4¾ ins. x 7 ins. The sill plates are 7 ins. x ⅝ ins.; thickness of corner posts, 3¾ ins., and side posts, 3⅜ ins. The equipment includes a number of the manufacturer's specialties, such as folding gates, "Dumpit" sand boxes, "Dedenda" gongs, ratchet brake handles, round-corner seat-end panels and angle-iron bumpers. The cars are mounted on "Eureka" maximum-traction trucks having 4-ft. wheel base, 30-in. and 20-in. wheels, and equipped with motors of 50-hp capacity. The weight of a single car, including trucks, is 21,500 lbs.



CONVERTIBLE CAR USED ON CHEVY CHASE LINE OF THE CAPITAL TRACTION COMPANY

AN INTERESTING ENGINE LATHE FOR MOTOR-DRIVING

The accompanying illustration shows a 30-in. "American" engine lathe, built by the American Tool Works Company, Cincinnati, Ohio, which is equipped with an unusually interesting new design of headstock, to accommodate the constant-speed method of motor-driving. The interesting feature of this new style of headstock drive is that it provides for the use of a constant-speed motor—the great majority of motor-driven lathes are equipped with variable-speed motors, for obtaining quick speed changes and consequent rapid production, even though at much greater first cost. In this instance, a constant-speed motor, either direct or alternating current, may be used, and the various speeds to the spindle are obtained mechanically through the all-geared headstock.



ENGINE LATHE, WITH HEADSTOCK FOR CONSTANT SPEED MOTOR

The new headstock consists essentially of the patented gear

and clutch mechanism, which employs a minimum amount of gears and shafts to avoid complication, and is probably one of the simplest and most efficient of any such drive yet devised. Through manipulation of levers 1 and 2, shown at the front of head, and 3, shown at the lower right hand corner of the head, sixteen distinct and positive speeds may be delivered to the spindle of the lathe, all in geometrical progression, ranging from 3.8 r. p. m. to 246 r. p. m. Thus a wide range is obtained entirely through mechanical means, sufficient to cover all ordinary work of this size of lathe. By reason of the simplicity of construction, all gears and shafts can be made of large diameters, and the whole is neatly encased by an oil-tight boxing, which still permits all parts to be accessible for lubrication.

A non-reversible constant-speed motor may be used for driving through one of these headstocks, if desired, because the reverse is obtained mechanically, by means of the rod shown above the lathe, out of the way, and yet very convenient to the operator; this makes this lathe especially adaptable to street railway repair shops, where 500-volt power circuits and constant-speed motors are always available. The superiority of this construction is that the motor is at no time reversed, but runs at continuous constant speed, all starting, stopping and reversing of the machine being readily accomplished without interference with the motor. The motor is in this arrangement of driving substantially mounted above the all-gear headstock, where it is convenient of access, yet out of the way of oil and chips.

ST. LOUIS CAR COMPANY IN TRANSPORTATION PARADE

The first of a series of special days, devoted to the different exhibit departments at the Louisiana Purchase Exposition, was celebrated July 30. This was "Transportation Day," when the exhibitors in the Transportation Building combined to make the day memorable in the history of the Exposition. Although all details were arranged within a period of two weeks, the advertising of the special events was so systematically carried out that more than 150,000 people were in attendance.

The big feature of the day, however, was the land transportation parade held in the afternoon. The historical exhibits in the Transportation Building were utilized, and almost every

THE ST. LOUIS CAR COMPANY IN THE TRANSPORTATION PARADE, WITH THE LARGE GLOBE IN THE FOREGROUND

form of conveyance was to be seen in the parade. The St. Louis Car Company, which is one of the large exhibitors in the Transportation Building, had more than 3000 of its employees in the line of march. The accompanying reproduction from a photograph made during the parade shows their formation. The men were divided into sections corresponding to the department of the shop in which they were employed. The officers of the company in carriages headed that portion of the parade devoted to the St. Louis Car Company. The office force followed in automobiles, and behind these was drawn an immense globe, representing the World, and showing the foreign cities and countries where the products of the St. Louis Car Company are in use. Next were the different workmen's divisions, including a military company and fire department.

FINANCIAL INTELLIGENCE

WALL STREET, August 24, 1904.

The Money Market

The money market has had another very dull week, especially in the time loan branch. Lenders are inclined to think, now that the autumn is so near, that they ought to be asking better terms, but they are discouraged from attempting an advance, by the indifference of borrowers, even at the recently prevailing quotations. Sixty-day loans remain at 2 per cent, ninety days at 2½, and six months at 3½ per cent. Call funds are offered abundantly at 1 per cent. These conditions have very naturally made for an active demand for commercial paper, which is being taken freely as offered. The first transfer of currency reported this season was announced yesterday; it was $200,000 consigned to New Orleans. This, together with the fall in interior exchange at the Western cities, indicates that the time is at hand when local cash holdings may be expected to decrease rather than increase. With a $57,000,000 surplus reserve, however, it will obviously be a good while before the crop-moving withdrawals make enough of an impression upon the money market to justify an advance in rates. The gold movements to Cuba appears to be over, and the decline in sterling exchange has removed any immediate possibility of gold exports to Europe. Meanwhile, new gold continues to arrive from the Alaskan fields, and is transferred to this city from the Pacific coast. These receipts have averaged lately between $1,500,000 and $2,000,000. As an offset to the first currency demands from the interior, these new gold accessions are an important factor to consider.

The Stock Market

For a market in which outside interests stand at a minimum, stocks have been remarkably well sustained during the past week. Business has fallen off considerably and the professional operators have supplied most of the activity. On one or two occasions there have been reactions sharp enough to show that the movement is by no means all one way. But in the main the tendency of prices has been pretty steadily upward, and a number of prominent stocks have reached new high levels for the year. The attempt to create a wheat scare, although it has been accompanied by violent rises in the wheat options, has failed to make much impression upon the stock list. It was found that whenever stocks were offered at concessions there were more buyers than sellers, and each time prices have rallied more easily than they declined. The market has been sustained, in face of the undoubted damage to the wheat crop, by the excellent accounts which continue to come in regarding the conditions of cotton and corn. Anybody that takes the trouble to figure out crop values will easily discover that the increases in cotton and corn, assuming no serious damage occurs between now and harvest time, mean much more to the country than the losses in wheat. The two great facts upon which the current market solidly rests are, first, that another four years' political security are reasonably well assured, and, second, that good harvest sold at high prices will bring increased prosperity, and in due time provide a fresh impulse for general activity.

The market for the traction shares reflects the opinion that negotiations for some important purpose are still on between the rival faction interests, but that announcement of what has been accomplished will not be made yet awhile. Acting on this assumption there has been some heavy profit-taking in Metropolitan and Metropolitan Securities during the week, causing a sharp set-back in prices. At the low figures of last Saturday, the Securities shares had lost over two-thirds of their previous rise. A report that the Ryan holdings had been turned over to the Interborough Company, had something to do with the weakness in Metropolitan Securities, it being supposed that this would remove the chief incentive to operations for a rise in these shares. This story is not credited, however, in well-informed circles.

Philadelphia

Advances have been the rule among the Philadelphia specialties during the week. Consolidated Traction of New Jersey was the feature, rising from 67¾ to 70, the highest price of the year. About 100 shares changed hands at the high figure. Philadelphia Traction also equalled its highest of the season, selling at 99. Philadelphia Company common on active trading rose from 39½ to 40, the preferred going at 44½. Philadelphia Electric was also active between 6¼ and 6½. No particular interest was shown in Union Traction, which merely held its recent gain, selling at 54⅛ and 54¼. One hundred shares of Rapid Transit were taken at 13. An odd lot of Fairmount Park Transportation sold at 16, four points down from the last previous sale. American Railways held steady, although inactive, at 49.

Chicago

About the only thing of interest in local traction circles during the past week was the action of Mayor Harrison in requesting Judge Grosscup to use his influence in getting the Union Traction Company to accept the ordinance adopted by the Chicago City Railway for the renewal of franchises. It is thought in City Hall circles that Judge Grosscup will do all in his power to bring about a settlement at the earliest moment. It is understood that the South Side Elevated will soon begin active preparations for the building of its new extensions. The funds are in hand, but the preliminaries will take up a large amount of time before any tangible results will appear. Traffic on all lines is good, and the current month bids fair to make a good showing as compared with the same period last year on both the overhead, as well as the surface properties.

There were next to no dealing in the various traction issues during the week. A few odd lots of South Side Elevated sold at 90, fifty shares of Metropolitan common at 20, and and one hundred Metropolitan preferred at 53. Chicago & Oak Park Elevated stocks were traded in for the first time. The common opened with a sale of fifty shares at 7, and declined to 6½ on a sale of one hundred shares. Fifty shares of the preferred were reported at 27, after which eighty shares sold at 25, and fifty shares at 25½.

Other Traction Securities

The feature of the Boston dealings was the violent break in Massachusetts Electric issues, reflecting the uncertainty as to the company's ability to maintain dividends on the preferred stock. The preferred shares only a few weeks ago were selling around 75. A week ago they were quoted at 67½. On Friday last they sold as low as 59¾, under rather heavy liquidation, recovering on Monday, however, to 62½. The common stock on larger dealings went down from 18 to 14¾, rallying subsequently to 15. For some time past the earnings of the company have not been satisfactory from the shareholders' standpoint. Boston Elevated sold between 150 and 150½, West End common at 91½, the preferred at 112, and Georgia Electric preferred (50 shares) at 83. In Baltimore the week's business in the traction group was rather light. One hundred shares of United Railways sold at 8¼, and another one hundred at 8⅛. The income bonds went at 47⅛ and 47½, and the 4 per cents at 93¼ and 93⅛. Lexington Street Railway 5s sold at 100. Norfolk Street Railway 5s at 106¼, City & Suburban (Baltimore) 5s at 113⅞, and North Baltimore Traction 5s at 120. In the week ending Saturday there were 27,000 shares of Interborough Rapid Transit dealt in on the New York curb. The price was run up from 136¾ to 150, which established the record on the movement. On Monday the stock reacted to 147½, but recovered yesterday to 148¾. Nothing of a confirmatory nature has yet been published regarding the traction "deal" which is supposed to be involved in this rise. Washington Traction common (140 shares) changed hands at 15 and 15⅛. The preferred sold up to 70, but reacted to 69½, 200 shares being traded in. The bonds of the company made a new high figure of 83⅝. This was the extent of the week's transactions in the curb market.

Detroit United showed a gain on the Cincinnati market last week and ranged from 66½ to 67½, sales about 200 shares. Cincinnati Street Railway was stationary at 141½, on sales of about 200 shares. About 500 shares of Cincinnati, Newport & Covington preferred sold at 89, an advance over previous figures. Fifteen thousand dollars worth of the first 5 per cent bonds of this company sold at 109¾. A block of Indianapolis Street Railway 4s sold at 85¾.

Northern Texas Traction made a new high mark of 36¾ at Cleveland last week. This stock is the strongest on the Cleveland traction list and buyers seemed to have cleaned up the market under 40. There were several small dealings in Cleveland Electric at 71¾, and several sales of Northern Ohio Traction & Light were made at 13⅞ and 14. A small lot of Northern Ohio 4s sold at 58⅛. It is reported that the Everett-Moore syndicate has refused an offer of 60 for its entire holdings in this issue.

Security Quotations

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

	Closing Bid	
	Aug. 16	Aug. 23
American Railways	49	49
Aurora, Elgin & Chicago	a12	a12
Boston Elevated	150	150
Brooklyn Rapid Transit	53⅜	53⅜
Chicago City	170	170
Chicago Union Traction (common)	5⅜	4¾
Chicago Union Traction (preferred)	30½	30
Cleveland Electric	70	70
Consolidated Traction of New Jersey	66½	69½
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	66	66⅝
Interborough Rapid Transit	142½	147
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	3¼	3½
Manhattan Railway	151¼	155
Massachusetts Electric Cos. (common)	17½	15
Massachusetts Electric Cos. (preferred)	65½	63
Metropolitan Elevated, Chicago (common)	18½	19
Metropolitan Elevated, Chicago (preferred)	52½	52½
Metropolitan Street	123⅞	121⅞
Metropolitan Securities	93¼	90⅜
New Orleans Railways (common)	9½	9½
New Orleans Railways (preferred)	29	29
New Orleans Railways, 4½s	74⅜	73
North American	88	89
Northern Ohio Traction & Light	12⅞	13
Philadelphia Company (common)	39¼	39⅞
Philadelphia Rapid Transit	12⅞	13
Philadelphia Traction	98¾	99
St. Louis (common)	9⅞	11
South Side Elevated (Chicago)	89	89½
Third Avenue	124	122
Twin City, Minneapolis (common)	99	98½
Union Traction (Philadelphia)	53⅞	54⅛
United Railways, St. Louis (preferred)	52	54
West End (common)	91	91½
West End (preferred)	111½	111

a Asked.

Iron and Steel

In its weekly report of iron trade conditions, the "Iron Age" describes the feeling among buyers as very cautious, owing to the cuts which have already been made on wire products and steel billets, and the extravagant stories in circulation about coming reductions in other directions. These stories have some basis in the fact that indirect concessions in lines like structural material, shapes and plates, have been the rule for some time past. The whole situation is extremely unsettled, a great deal depending upon whether the producing interests can see a larger consumption ahead if they lower prices. Quotations are as follows: Bessemer pig iron $12.85, Bessemer steel $23, Steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 12⅝ cents, lead 4⅛ cents, tin 27⅛ cents, and spelter 4 15-16 cents.

LEHIGH VALLEY TRACTION REORGANIZATION

The plan of reorganization of the Lehigh Valley Traction Company, which has just been issued, calls for the formation of a new company to take over the properties and interests heretofore owned, managed or controlled by the Lehigh Valley Traction Company, which new company is to issue bonds and stocks as follows: $5,000,000 first mortgage thirty-year gold bonds, part of which are to bear 4 per cent interest and part 5 per cent; $7,500,000 consolidated thirty-year gold bonds, bearing 4 per cent, or not more than 5 per cent; $5,000,000 preferred stock and $3,000,000 common stock. Dividends on the former are limited to 5 per cent. No distribution is to be made on the common stock when there is any arrearage on the preferred. It is figured that earnings of the new company will reach $884,000 gross and $440,600 net, leaving a balance of $124,100, or equal to about 2½ per cent on the preferred stock. The preferred and common stock of the Lehigh Valley Traction Company and the common stock of the Allentown & Slatington Street Railway Company, deposited under the plans, are subject to an assessment of 2 per cent of their face value.

PENNSYLVANIA AFTER ELECTRIC PROPERTY?

The report is current in railroad circles that the Pennsylvania Railroad Company has made a proposition for the purchase of the property of the Scioto Valley Traction Company, which has recently completed lines from Columbus to Lancaster and Circleville, Ohio. The Lancaster division parallels the Hocking Valley, while the Circleville division parallels the Norfolk & Western, both Pennsylvania properties. Although the new traction line has been in operation but a short time, it is apparent that it has seriously affected the traffic on both roads. Some time ago it was announced that the Pennsylvania proposed to electrify the Cincinnati & Mahoning Valley division from Trinway to Lancaster, and establish a through electric system between Trinway, Zanesville, Lancaster and Columbus.

MORE EQUIPMENT FOR MANILA SYSTEM

Further orders were placed last week for various equipment by the Manila Electric Railway & Light Company, Ltd., for its electric traction system now being hastened to completion by the contractors, J. G. White & Company, Inc., of New York. The orders to which reference is made in this instance call for power house equipment principally. The Goubert Manufacturing Company, of New York, has been allotted the order for two 1500-hp feed-water heaters. The Rand Drill Company will ship two large air compressors. The Atha Tool Company, of Newark, N. J., has secured a fair sized order for different kinds of tools.

FOREIGN ELECTRICAL ENGINEERS IN NEW YORK

The programme for the reception and entertainment in New York City of the electrical engineers from abroad attending the International Electrical Congress at St. Louis, has been issued by the reception committee of the American Institute of Electrical Engineers. The guests of the Institute will be comprised chiefly in two main bodies, one consisting of members of the Institution of Electrical Engineers of England, the other of members of the Associazione Ellettrotecnica Italiana. The members of the British Society will land in Boston about Sept. 2, those of the Italian Society in New York about Aug. 25. The latter will be entertained on a special programme until Sept. 1, when they will join the English contingent in Boston. The entire party will then rendezvous in New York Sept. 4. On that day they are invited by J. G. White on a special trip to view the scenery of the Hudson River. On Sept. 5 a trip will be made through the subway on a special train. Visits will then be made by boat to the different power stations on the Hudson and East Rivers. In the evening a banquet will be given at the Waldorf-Astoria. The visitors will start on the morning of Sept. 6 on the special circular tour, already mentioned in these pages, visiting first Schenectady and then Montreal.

SLEEPING CARS ON COLUMBUS, NEWARK & ZANESVILLE RAILROAD

J. R. Harrigan, general manager of the Columbus, Newark & Zanesville Electric Railway Company, has made a contract with the Holland Palace Car Company, of Indianapolis, for the use of its famous palace sleeping cars to be run as limited cars over this road between Zanesville and Columbus, a distance of 65 miles. The cars will be operated and maintained by the railway company, but a charge of 25 cents between Newark and Columbus and 35 cents between Zanesville and Columbus will be made, in addition to the regular fare. The additional fare will be collected by the porter of the car and will go to the Holland Company for the use of the car. The service will start this week, and at first only one of the Holland cars will be used, as the other was damaged in a fire some time ago and will not be out of the shops for about two weeks. The running time will be two and a half hours, as compared with three hours for the regular cars, stops being made only at Newark and the terminal cities. Each car will make two round trips a day, giving four limiteds each way in addition to regular hourly headway. Of course, the sleeping car feature of these cars will not be available until arrangements can be completed for operating the cars through over other roads. Mr. Harrison believes the present arrangement will be profitable for both his company and the Holland Company, and he believes that the other Columbus roads will soon be anxious to follow his example.

EXTENSIONS TO BUENOS AIRES SYSTEM

La Capital Tramways Company, Ltd., which operates about 20 miles of electric traction system in Buenos Aires, Argentine Republic, is about to make considerable extensions. Some 30 more miles will be built. The president of the company is Theo. N. Vail, of the Bell Telephone interests. The New York offices are in the Havemeyer Building. H. R. Parrish is the purchasing agent.

REPORT OF BROOKLYN COMPANY FOR YEAR ENDING JUNE 30, 1904.

The report of the directors of the Brooklyn Rapid Transit Company to the stockholders for the year ending June 30, 1904, has just been made public. It is probably the most complete report ever issued by the company. Besides the usual statement of earnings, traffic figures, etc., detail reference is made to the many improvements made to the system during the year. Among these improvements were increases in power plant capacity; the reconstruction and improvement of elevated stations, structures, etc.; additions to the surface tracks; terminal improvements and car storage facilities at Coney Island and other seaside resorts; the thorough overhauling of interlocking installations at eight different places; the development of plans for a new general office building, and the making of the contract with the city for the operation of trolley cars across the new Williamsburg Bridge.

The surface car equipment was increased by 200 new surface cars, 26 gondolas, 13 box cars, 7 express cars, 8 ice cars and 1 derrick car. The work of rebuilding and fitting elevated steam cars for electric operation was carried forward to the full capacity of shop accommodations, and the early part of the year 1905 should see this work on the equipment completed. The company will then have 270 closed electric standard trail cars and 357 standard motor cars fully equipped with the multiple-unit control system. There are now being received 100 new elevated cars, making a total of 457 motor and 270 closed trail cars. The 120 open elevated cars purchased last year were equipped with side sections and ventilating apparatus and otherwise fitted for winter service. The new central power station is practically completed, and eight 4000-hp units in that plant are now in operation. A portion of the block adjoining this station has been equipped with machinery for handling coal from barges and transferring the same to the receiving bins in the plant. The construction of the new power house adjoining the Kent Avenue station has been commenced. It is proposed to install here two turbine units of 5500-kw capacity, and to make provision for the installation of additional machinery from time to time, according to requirements. The capacity of the sub-stations was also increased and a new station was erected at Parkville. Track improvements made during the year extended to practically all the lines and included 3460 electrically welded joints. The important improvements made for handling the crowds at Coney Island have already been referred to in detail in the STREET RAILWAY JOURNAL.

The results of the operations of the Brooklyn Rapid Transit system for the year ending June 30, 1904, were as follows:

Gross earnings from operation		$14,738,709
Operating expenses		8,760,438
Net earnings from operation		$5,978,270
Income from other sources		211,852
Total income		$6,190,122
Less taxes and fixed charges		4,801,214
Net income		$1,388,907
Out of which was taken for betterments and additions to property		383,706
Surplus for the year		$1,005,201
Surplus June 30, 1903		1,747,839
Surplus June 30, 1904		$2,753,041
Of this amount there has been appropriated:		
For discount on bonds sold	$1,153,200.00	
For old accounts adjusted	5,651.75	1,158,851
Balance surplus June 30, 1904		$1,594,189

Following is a comparative statement of the gross earnings:

			Per cent 1904 over 1903		Per cent 1904 over 1902
Passenger:	1904	1903		1902	
Surface	$9,757,629	$9,284,157	+ 5.10	$9,049,229	+ 7.83
Elevated and bridge	4,671,917	3,802,683	+ 22.86	3,272,036	+ 42.79
Freight, mail and express	176,508	75,658	+133.29	64,902	+171.96
Advertising	132,655	117,823	+ 12.59	124,455	+ 6.59
Total	$14,738,709	$13,280,321	+ 10.98	$12,510,622	+ 17.81

COMPARATIVE SUMMARY OF OPERATIONS FOR YEAR ENDING JUNE 30, 1904

GROSS EARNINGS

	1904	1903	Inc. or Dec.	Per cent
Passenger	$14,429,546	$13,086,840	+ $1,342,706	10.26
Freight, mail and express	176,508	75,657	+ 100,850	133.29
Advertising	132,655	117,823	+ 14,832	12.59
Total earnings from operation	$14,738,709	$13,280,321	+ $1,458,388	10.98

OPERATING EXPENSES

	1904	1903	Inc. or Dec.	Per cent
Maintenance of way and structure	$619,848	$495,188	+ $124,659	25.17
Maintenance of equipment	1,217,924	812,600	+ 405,323	49.88
Operation of power plant	1,535,930	1,680,751	— 144,820	8.62
Operation of cars—trainmen's wages	2,677,443	2,542,214	+ 135,229	5.31
Operation of cars—other expenses	1,181,789	908,310	+ 273,478	30.11
Damages and legal expenses	987,759	956,730	+ 31,029	3.24
General expenses	539,745	535,286	+ 4,459	0.83
Total operating expenses	$8,760,438	$7,931,080	+ $829,359	10.46
Net earnings from operation	$5,978,270	$5,349,241	+ $629,028	11.76

INCOME FROM OTHER SOURCES

	1904	1903	Inc. or Dec.	Per cent
Rent of land and buildings	$56,711	$81,877	— $25,158	30.74
Rent of tracks and structure	103,071	99,053	+ 4,017	4.05
Miscellaneous	52,069	96,562	— 44,499	46.08
Total income	$6,190,122	$5,626,734	+ $563,388	10.01

DEDUCTIONS

	1904	1903	Inc. or Dec.	Per cent
Taxes	$748,258	$757,788	— $9,530	1.26
Interest and rentals	4,052,956	3,904,068	+ 148,888	3.81
Total deductions	$4,801,214	$4,661,856	+ $139,358	2.99
Net income	$1,388,907	$964,878	+ $424,029	43.95
Special appropriations	383,706	168,095	+ 215,610	128.27
Surplus for year	$1,005,201	$796,782	+ $208,419	26.16
Sundry accounts from previous years charged off		40,386		
Balance to credit of surplus	$1,005,201	$756,396		

CONSOLIDATED GENERAL BALANCE SHEET, JUNE 30, 1904

ASSETS

Cost of road and equipment		$99,114,624
Properties owned in whole or in part by B. R. T. Co.		
Advances account of construction for leased companies		6,306,901
Brooklyn City Railroad Co.	$6,003,941	
Prospect Park & C. I. R. R. Co.	302,960	
Construction expenditures, constituent companies		1,816,617
To be reimbursed by issuance of B. R. T. 1st refunding gold mortgage 4 per cent bonds, upon deposit with Central Trust Company, trustee, of certificates of indebtedness to cover		
Guaranty fund (securities and cash)		4,005,755
Treasury bonds		5,724,000
B. R. T. 1st ref. gold mortgage 4 per cent	$5,614,000	
Other issues	110,000	
Treasury stock		146,228
Current assets		3,970,864
Cash on hand	$2,500,893	
Due from companies and individuals	294,441	
Construction material and general supplies on hand	837,802	
Prepaid accounts	337,728	
		$121,084,989

Note.—The certificates of indebtedness issued by constituent companies, aggregating $8,136,025.21, against which B. R. T. bonds have been issued, do not appear separately on this consolidated balance sheet, as the property purchased appears as an asset under the head of "cost of road and equipment," and "advances account construction for leased companies," and the liability is represented by the bonds of the Brooklyn Rapid Transit Company, issued from time to time as such certificates of indebtedness are acquired and deposited with the Central Trust Company, trustee.

LIABILITIES		
Capital stock		$45,990,255
Brooklyn Rapid Transit Company	$45,000,000	
Outstanding capital stock of constituent companies.	990,255	
Bonded debt and real estate mortgages		67,324,180
Brooklyn Rapid Transit Co.	$21,458,000	
Bonded debt of constituent companies:		
Brooklyn Heights R. R. Co.	250,000	
Brooklyn, Q. Co. & S. R. R. Co.	6,624,000	
The Nassau Electric R. R. Co.	15,000,040	
Sea Beach Railway Co.	650,000	
Brooklyn Union Elevated R. R. Co.	23,000,000	
Real estate mortgages	342,140	
Current liabilities		6,144,486
Loans and bills payable	$3,250,000	
Audited vouchers	791,187	
Due companies and individuals	75,418	
Taxes accrued and not due	1,327,880	
Interest and rentals accrued and not due	644,459	
Interest accrued on real estate mortgages and not due	3,755	
Insurance reserve fund	51,785	
Long Island Traction trust fund		9,439
Accounts to be adjusted		22,439
Surplus		1,594,190
		$121,084,989

AN AGREEMENT AS REGARDS NEW YORK SUBWAY POSITIONS

The question of the interpretation of the rule of seniority in appointing employees of the elevated lines of the Interborough Rapid Transit Company to positions on the underground railroad has been settled by an agreement satisfactory to both the management and the men. The men at present in the employ of the company will have preference over new applicants in every case. It appeared at one time as if a settlement would not be effected, and the statement was made that if an agreement was not reached a strike would be declared.

LINK IN LINE FROM WORCESTER, MASS., TO NORWICH, CONN.

It is now said that the much-talked-of electric railway between Central Village and Norwich, Conn., will be constructed shortly, supplying the missing link in an unbroken electric connection between Worcester, Mass., and New London, Conn., a distance of 60 miles. The line will be built by the Consolidated Railway Company, controlled by the New York, New Haven & Hartford Railroad. Work will probably be begun next spring. An unusual feature of the new road will be its use of the steam road's tracks from Plainfield to Lisbon station. The former point will be reached from Central Village by a new track parallel to the steam tracks on the west side. Leaving the steam tracks at Lisbon the electric line will pass through Jewett City and Versailles, where it will connect with the Norwich road. Steam traffic from Plainfield to Lisbon will be confined to freight service and steam trains will run into Jewett City on new tracks to be laid.

TITUSVILLE ELECTRIC TRACTION COMPANY'S EXTENSION

The Titusville Electric Traction Company, of Titusville, Pa., is building an extension from Mystic Park to Trionville, a distance of 2½ miles. The grading has been completed between the two points mentioned, and about a mile of track has already been laid. The work is being done by P. Hart & Sons, of Staten Island, N. Y. About three years ago this firm built the extension of the original system from Hydetown to Mystic Park, a distance of 3½ miles. The construction work is under the immediate supervision of Chas. F. Hart, who has had extensive experience in both steam and electric railway work. The grading is exceptionally well done and the foundation to the roadbed is excellent; curves have been eliminated as far as possible, and private right of way has been secured all the way from Mystic Park to Trionville. Roebling trolley wire is used, and the overhead material and rail bonds were supplied by the Ohio Brass Company. The new extension of the Titusville system makes a total of 20 miles of track, connecting Titusville with Hydetown and Trionville on the north and East Titusville and Pleasantville on the south. W. J. Smith is general manager of the company.

PENNSYLVANIA STREET RAILWAY ASSOCIATION'S NEXT CONVENTION TO BE HELD IN SEPTEMBER, 1905

It is announced that the meeting of the Pennsylvania Street Railway Association for 1904 will be postponed until the regular meeting time in September, 1905. This action seems to meet with the approval of the railway as well as the supply men, inasmuch as the major portion of them expect to attend the National Convention at St. Louis.

ELECTRIC HEATERS FOR THE NEW YORK SUBWAY

The Interborough Rapid Transit Company has just closed a contract with the Consolidated Car Heating Company for heaters for the 200 new steel cars for use in the New York subway. There will be twenty-four heaters of the panel type in each car and two special heaters for motormen's cabs. One mile of wire will be used in the coils for each equipment. The maker of these heaters has also received an order for electric heaters for 100 cars for the Manhattan Elevated division.

The Consolidated Car Heating Company has sold to date 75,000 electric heaters for use in the city of New York, more than 54,000 of which have been sold during the last three years. It is now supplying to the Chicago Union Traction Company 12-heater equipments for 100 cars. These are of the company's new cross-seat type. It has also received an order from Ford, Bacon & Davis, of New York, for thirty-four car equipments for roads at Birmingham, Ala., Knoxville and Nashville, Tenn.

HOTEL ACCOMMODATIONS AT UTICA DURING SEPTEMBER CONVENTION OF THE NEW YORK STREET RAILWAY ASSOCIATION

W. W. Cole, secretary of the Street Railway Association of the State of New York, has prepared the following list of hotels and apartment houses in Utica which are prepared to furnish accommodations to the delegates to the twenty-second annual meeting to be held at Utica, N. Y., Sept. 13 and 14. In view of the large attendance expected, reservations should be made at an early date.

At the Hotel Butterfield, American plan only, the rates are: Two double rooms with bath, $5 per day; five double rooms with bath, $4 per day; three single rooms with bath, $4 per day; fifty rooms without bath, $3 per day; by doubling up, some of these fifty rooms will accommodate two people.

At the Baggs Hotel, American plan only: Thirty rooms $3.50 per day with bath, and $3 per day without bath. At the St. James Hotel, American plan only: Thirty rooms, accommodating fifty persons, rates $2 and $2.50 per day.

The rates at the Olbiston and Kanatenah Apartments are ten single rooms at $2 per day, and fifteen single rooms at $1.50 per day.

All of these rooms do not have private baths, but are convenient to baths.

THE MIAMI & ERIE CANAL REORGANIZATION

The work of reorganizing the Miami & Erie Canal Transportation Company is progressing slowly. According to the agreement arrived at between the Cleveland and Cincinnati bondholders, the money was to be raised for paying off the indebtedness if the claims outstanding could be bought for the figures agreed upon in an option agreement last fall. It was thought that this could be done, but it is now found that some of the smaller creditors are inclined to hold out for 100 cents on the dollar. This the representatives of the bondholders are not prepared to pay. If the plan falls through, the investigation before the referee to assess the debts against the stockholders will be carried out. The hearing will be reopened for the report of the committee on Sept. 6.

It is reported that the reorganization plan calls for an assessment of about $3 per share of stock, with an income bond issue to ensure the company against another receivership. The ability of the canal boat scheme to show earnings over actual operating expense has yet to be demonstrated. An income bond would call for interest only if earned through a stated period of years, after which it would call for the usual rate of interest. This would place the company where all it would have to do would be to pay expenses until such time as additional concessions could be obtained from the State enabling the company to use the canal tracks for ordinary passenger and freight service.

ELECTRIC RAILWAYS AND STEAMBOAT TRAFFIC

The consequences of building suburban or interurban electric railways substantially parallel to steam railway lines are now a common story, so that the veriest novice in transportation matters feels confident that he can, from the date of promotion of the electric railway, predict at least the immediate results of its construction. In the vicinity of Providence, however, the somewhat unusual case of electric railways coming into at least indirect competition with steamboat lines has occurred. On both shores of Providence River, the tidal stream forming the upper end of Narragansett Bay, there are many summer resorts frequented by people from the city and many summer residences of persons doing business in Providence.

Years ago the only public means of transportation to the majority of these places were the steamboat lines, although some few places could be reached by the steam railroad lines. During recent years, however, lines of electric railway have been built on both sides of the river, some of the routes affording attractive rides, with beautiful views of the bay and its shores, and one of the old steam roads, following the edge of the water pretty closely for some distance, was equipped for electric traction, and has now been operated with this motive power for several years. Riding in an open trolley is hardly less comfortable than boat travel, and, in case of crowds, either means of transportation causes a high tensile test of patience. The greater accessibility and convenience of the electric railways, with their more frequent trips, have been a telling argument in their favor, and so in these latter days it has come to pass that many a Rhode Islander, who does not own a "buzz-wagon," rides on the sparking rail to get his clambake dinner instead of in the formerly popular steamboats. The steamboat companies, nevertheless, are still in business and get a good share, although it is reported that their schedules have been noticeably reduced.

TESTS ON PUMPING ENGINE ECONOMY

In view of the intense interest at present manifested in the steam economy of prime movers, both of the reciprocating and turbine types, it is impossible to pass without remarking some results lately obtained in an official pumping engine test at the Park Avenue Pumping Station, Chicago. The engine is of the Worthington, duplex, reciprocating, triple-expansion type, having semi-rotary steam valves, but no fly-wheel. The latter is replaced by compensating cylinders so arranged that their pistons retard the motion of the main piston during the first part of the stroke, but assist it towards the close, giving a uniform resultant thrust. The pistons of these auxiliary cylinders work against air under pressure from a tank. The engines are vertical and the weight of the pistons, plungers and rods is counter-balanced by another auxiliary balancing plunger, also working through the medium of water against air under pressure.

The capacity of the engine is about 22,000,000 gallons per day, against a total head of slightly over 121 ft., and 660.9 hp were indicated in the test. The duty obtained was 174,735,801 ft. lbs. per 1000 lbs. of steam used, corresponding to an economy of 11.32 lbs. of steam per net hp delivered in water lifted, or 10.01 lbs. of steam per i. h. p. The steam pressure was 144.45 lbs. per sq. in., with 154 degs. F. superheat at the throttle, the steam cylinders being provided with jackets and reheaters. Two other engines of the same design in the Central Park Avenue Station, and three more in the Springfield Avenue Pumping Station have all shown under test an economy of steam less than 11 lbs., although the economy per delivered hp was not as high in the test quoted. These tests were carried out under the supervision of the Bureau of Engineering of the City of Chicago, and, together with the engines and the power station, are fully described in a pamphlet distributed by Henry R. Worthington, of New York City.

INTERURBAN FREIGHT RAILWAY FOR ZANZIBAR

An interurban railway is to be constructed in Zanzibar, East Coast of Africa. The line will be about 20 miles in length. Surveys are about to begin. The Zanzibar Railroad Company has been incorporated under the laws of the State of New Jersey for the purpose of building and operating the system, over which freight—principally spices—will be carried. The capital of the company is $100,000. The East African house of Arnold, Cheney & Company, whose New York offices are at 158 Water Street, is primarily interested in the project.

NEW PUBLICATIONS

Friction and Lubrication. By William M. Davis. Second Edition; 257 pages. Price, $2. Published by The Lubrication Publishing Company, Pittsburg, Pa.

The necessity for issuing a second edition of this book so soon after its original publication must be gratifying evidence to the author that his work filled a long empty niche in the power station engineer's library of useful information. This edition contains about thirty-five pages of new matter which, together with a stronger cover and better paper, gives it considerably more value than the first impression.

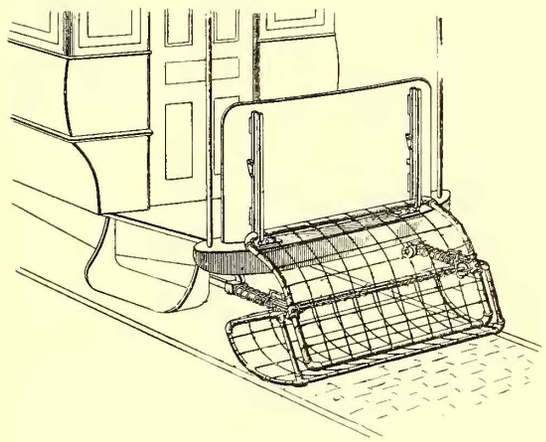
STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED AUGUST 16, 1904

767,436. Switch-Throwing Device; William B. Perry, Wright City, Mo. App. filed Nov. 28, 1903. The invention consists of a longitudinally movable shoe pivoted between its ends, means for normally holding the shoe out of the path of the track switch-throwing device, means for locking the shoe in the path of said device, and means for automatically unlocking the shoe to restore it to its normal position.

767,534. Conductor for Electric Railways; Arthur Whittier, Wollaston, Mass. App. filed Sept. 8, 1903. The track rail has a flexible circuit-closing magnetizable conductor, and the car has an element connected thereto for sliding movement transversely with reference to the car and provided with a spring, an element pivotally connected to the transversely sliding element for horizontal angular movement, and magnets and track-engaging devices carried by the angularly movable element and operating on the track rail, the spring exerting a downward pressure on the track-engaging devices.



PATENT NO. 767,538

767,538. Car Fender; William E. Zachry, Brooklyn, N. Y. App. filed Dec. 15, 1903. The fender comprises a folding frame removably supported on one end of the car and a second frame pivoted to turn with relation thereto, whereby when the fender comes into contact with an object in front of the car the pivoted frame will be thereby released and spring up and support such object free of the ground and out of danger.

767,577. Tram or Railway Point or Switch and Means for Working Same; John Leighton and Robert Hacking, Nottingham, England. App. filed Nov. 20, 1903. Instead of moving the switch rails sidewise together, one of them is dropped out of the way of one wheel while the other remains stationary and acts on the other wheel.

767,599. Electrically Operated Apparatus; Charles E. Sedgwick and Walter H. Abbott, Cleveland, Ohio. App. filed Sept. 17, 1903. In this patent is disclosed an automatic signalling system for electric railways comprising the power supply line for the car, having insulated sections at intervals provided with feed-connecting wires tapping the main supply line, an electrical apparatus consisting of a shell and a coil thereon connected in circuit with the feed wire whereby current is supplied to energize the coil whenever current is supplied to the car when it passes said section, a ball within said shell adapted to shift alternately to opposite ends therein as the coil is successively energized by the movement of the car from sec-

tion to section, and signalling means controlled by said ball whereby the location of the car is determined.

767,740. Three-Way Split Switch; Thomas Dean, Toledo, Ohio. App. filed June 6, 1904. The invention consists of a switch-stand, a frame, a shaft mounted in said frame, a pair of cam members keyed to said shaft, a pair of levers mounted in said frame in an intersecting plane with said shaft and each having a forked end within which one of the cam members is adapted to rotate, connections between said levers and the switch points to be turned and means for turning the shaft.

767,858. Automatic Track Lubricator; Reuben G. York, Lynn, Mass. App. filed May 26, 1904. A lubricant is automatically applied to the flanges of the wheels of a car which is to travel upon the track to be lubricated, the lubricator being operated at the proper times and places by means which co-operate with the guard flange of the rail which is always to be raised at those portions of the track which by conditions of curve or bend are subject to special wear.

767,889. Electric Switch; Charles F. Hopewell and Charles H. Morse, Cambridge, Mass. App. filed Dec. 31, 1903. The switch is designed to operate a circuit leading from the trolley wire to a ground or other return, which includes the operating electromagnet of the trolley signal mechanism, and the switch which is designed to be operated by a trolley passing along the wire.

767,939. Trolley Pole Head; John E. Greenwood, Utica, N. Y. App. filed Aug. 29, 1903. The trolley pole has a flexible terminal on which is movably mounted a cap-piece carrying oppositely disposed members provided with collectors, said members being independently movable to cause them to readily adapt themselves to the line wire, and means are provided for limiting the movements of said members and for maintaining them in longitudinal alignment.

PERSONAL MENTION

MR. CHARLES C. BENSON, formerly general manager of the San Juan Light & Transit Company, which Porto Rico system is controlled by J. G. White & Company, of New York, is now here.

MR. E. B. GUNN, who recently resigned as general superintendent of the Dayton, Springfield & Urbana Railway, of Dayton, Ohio, was tendered a reception at Tecumseh Park by the operating force of the road one evening last week.

MR. WILLIAM BARCLAY PARSONS, the consulting engineer of the Rapid Transit Commission, of New York, has just arrived from Liverpool. Mr. Parsons went to England several months ago to give his services to the London company which is building the underground railroad.

MR. N. F. LANGDON, who was lately connected with the construction of the Wellington, New Zealand, tramway system, has accepted a position with the United Railroads of San Francisco. Prior to going to Wellington, Mr. Langdon served four years in the repair shops of the Brisbane Tramways Company.

MR. WILLIAM E. CONKLIN, who acted for some time past as assistant engineer of the Schenectady Street Railway, has been appointed assistant engineer to Mr. H. A. Belden, general manager of the Manila electric traction system and general representative for J. G. White & Company in the Philippines. Mr. Belden is now in New York.

MR. S. S. NEFF, formerly superintendent of the Boston Elevated Railway Company, Boston, Mass., and previously superintendent of the Union Elevated Railway, of Chicago, Ill., has just been appointed general superintendent of the Mexican Tramways Company, Ltd., of the City of Mexico. Mr. Neff left to assume charge of his new position last week.

MR. R. W. BAILEY, formerly superintendent of line construction of the East St. Louis & Suburban Railway, has been appointed receiver of the St. Louis, St. Charles & Western Railroad Company. It is not often that a small electric railway property is fortunate in having as practical a railway man for receiver as Mr. Bailey, who has for some time had entire charge of the overhead construction of the extensive city and interurban system centering at East St. Louis.

MR. GEORGE BOWRON, president of the New Zealand Electric Construction Company, which has recently been awarded the contract for the construction and equipment of a somewhat extensive electric traction system to be operated in and around Christchurch by the municipal authorities of that Antipodean city, is now on his way to the States. The Christchurch system will be built almost entirely of American material and equipment. The expected trip of Managing Director Taylor has been indefinitely postponed. The New Zealand company contemplates undertaking further construction work which will, it is expected, mean the placing of further interesting contracts on this side.

MR. CHARLES F. GOODRICH, general superintendent of the Fox River Electric Railway & Power Company, of Green Bay, Wis., since January, 1898, and secretary and treasurer of the Knox Construction Company since the organization of that company, is to end his connection with both companies on Sept. 1. Upon the retirement of Superintendent Goodrich, Mr. George W. Knox, president of the Knox Construction Company, will assume the general supervision of both systems. According to present arrangements, there will be, within a short time, a formal consolidation of the interests of the Fox River Electric Railway & Power Company and the Knox Construction Company under the title of the Green Bay Traction Company. President Knox will be named as general manager for the entire system.

MR. JOHN BLAIR MAC AFEE, of Philadelphia, has been elected president of the Augusta-Aiken Railway & Electric Company, of Augusta, Ga., controlling the Augusta Railway & Electric Company, the Augusta & Aiken Railway Company, the North Augusta Electric & Improvement Company, the North Augusta Land Company and the North Augusta Hotel Company. Mr. MacAfee is well known to the industry as a contractor and street railway manager. He is a Canadian by birth, but he has lived since childhood in Philadelphia. After graduating from the University of Pennsylvania, he became a member of the Philadelphia Bar and began the practice of law. He acted as attorney for several railways, and soon became interested in construction work. He was one of the organizers and for some time vice-president of the Railways Company General and of the American Engineering Company.

MR. JOHN LOWBER WELSH, for many years closely identified with banking, railroad and street railway interests in Philadelphia, and especially prominent in Reading Railroad and Union Traction Company affairs, died at his home in that city Monday, Aug. 22. Mr. Welsh was born to wealth created by two generations of conservative financiers, and made his own way very rapidly in the financial world. At thirty years of age there stood to his credit the financing in Europe of the Reading Railway loan. This was in 1870. Thereafter his connections with the company were intimate and, at times, vital. No less important an undertaking, however, was the laying by him of the foundation of the traction system that afterwards became the Philadelphia Rapid Transit Company, controlling all the lines in the city. In 1893, when electric traction was coming into general use, he organized the People's Traction Company. His ambition to merge the two big rival systems, the Electric Traction and the Philadelphia Traction, was gratified in 1895 by the organization of the Union Traction Company, of which he was made the first president. He remained president until September, 1898, when he declined to stand for re-election. Soon after he devoted himself to the affairs of his own firm and that of Drexel & Company, with which he had been connected for many years in an advisory capacity.

A MEETING OF THE EMPLOYEES of the mechanical department of the Brooklyn Rapid Transit Company was held Saturday evening, Aug. 6, in Trommer's large hall in Brooklyn, N. Y., to do honor to their retiring master mechanic, A. J. Wilson, who recently resigned on acccount of ill-health. The meeting was an entire surprise to Mr. Wilson and was one of the largest gatherings that was ever held in that city to do honor to a single individual, nearly 2500 of his former employees and friends being present. The occasion was the presentation to Mr. Wilson of a set of resolutions and a cut-glass punch-bowl service, as a testimonial of their regard for him. The resolutions, which had been very carefully prepared to express the sentiment of esteem, were beautifully engrossed and bore the emblems of the Brotherhood of Locomotive Engineers, the Brotherhood of Firemen and other fraternities in which Mr. Wilson had long been interested; in the center appeared a photograph of Mr. Wilson, which was flanked on either side by a pen sketch of one of the former steam locomotives and a rear view of a motor car. The presentation speech was made by Mr. Barnaby, of the auditor's office of the company, who had been selected as chairman of the meeting. Speeches were also made by many of the officials of the mechanical department of the company, including R. C. Taylor, mechanical engineer, and several others. Mr. Buehler, president of the Columbia Machine Works & Malleable Iron Company, of Brooklyn, also added interest to the occasion by referring pleasantly to his long and intimate acquaintance with Mr. Wilson. J. Grimm, who presented the resolutions, recounted the life of the master mechanic in the shop and office, and explained how he had made his way into the hearts and affections of those who had been under his charge.