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Of this issue of the Street Railway Journal 8200 copies are printed. Total circulation for 1905 to date, 392,350 copies, an average of 8174 copies per week.

Wiring-Diagrams in Power Houses

While it is not essential that a switchboard operator or electrician in a power house or sub-station should know all the connections of the apparatus, yet if he does know them he may some time be able to meet an emergency which he otherwise would not be able to care for. We know of no better way of encouraging those about the power house to acquaint themselves with the wiring than by placing a well gotten up blue print of all the connections in an accessible position in each station or sub-station. The prints should be pasted to a strong backing and then varnished to protect them against the rough usage that they will doubtless receive. This practice is followed by some of the large companies, and it assuredly has a beneficial effect on the men. They feel that the company is encouraging them to study the plant more closely than is absolutely necessary to carry out their duties, and they are therefore more prone to gather general information about the machinery. While such information may never be used in the operation of the machinery, yet good cannot help resulting from it. When a visitor enters a plant and finds the attendants able to talk intelligently, he always carries away with him the idea that the company is enterprising enough to secure good men, and this consideration alone should compensate for the trouble of providing the blue prints.

The Gasoline-Electric Car

To many the use of a dynamo and motors to transmit power between the engine and wheels of a gasoline vehicle seems an unnecessary complication. Nevertheless, this combination seems to be growing in favor where powers of any magnitude are concerned, as is strikingly illustrated in the new Fifth Avenue 'bus, whose equipment is described in detail elsewhere in this issue, and in the case of the larger motor cars for steam railroads, which have been built and are building. It is, in truth, a striking tribute to the wonderful operative qualities of the electric motor that, in spite of the high first cost, rather modest efficiency and considerable maintenance of the duplex equipment, its operative properties are so admirable as to give it a strong hold on popular favor. Considered merely as a clutch and change gear, a combination of dynamo and motor is held by many engineers as far simpler and, in the long run, cheaper than any mechanical substitute. The tests given elsewhere in this issue on the new Fifth Avenue stage show the mean generator output for an average speed of 9 m.p.h. to be about 8 kw, with a maximum output of about 17.5 kw on the Thirty-Sixth Street grade with the speed cut to 4 m.p.h. This is a good showing in point of efficiency. We very much doubt whether any so-called 12-hp gasoline engine could have done better with the customary form of transmission. The consumption of gasoline in this run is stated to have been, however, 0.6 gal. per car-mile, which would seem high for this duty under favorable conditions.

But the long and short of the matter is that both with gasoline and gasoline-electric cars very much depends on the conditions of the test. The mechanical transmission of a motor car is a fearsome thing of very dubious economy. At certain speeds it can be arranged to be relatively simple and efficient, but at others, and generally at all others, it is at a great disadvantage. Bitter experience has shown that it is liable to great wear, and the way it is thrown in is mechanical assault and battery. Hence, it may well be that with high powers the electric "clutch" of dynamo and motors, despite its moderate efficiency considered as a clutch, may yet do far better, considering the varied speed required in such work as that of the Fifth Avenue 'bus or in independent large motor car work for commercial transportation. As to weight, the electric equipment is at a great disadvantage, although, fortunately, weight is a secondary consideration in the work we are considering.

One issue frequently raised in favor of electric automobiles is that they are substantially foolproof and do not require the services of a chauffeur. Within limits this advantage is a telling one. Whether it extends to a gasoline-electric combination is quite another matter, for a gasoline engine has deviltries all its own and cannot be altogether sanctified even by association with an electric motor. This much is sure, however, that the gasoline-electric combination is going to be tried out on a considerable scale, both for 'bus service and on tracks, and that it has mechanical advantages of no mean order in spite of its apparent complication. Even though it should prove to have small advantage for anything but the heavier kind of service, it would be a useful adjunct. Meanwhile, if the advocates of a straight gasoline system are determined to win out, they must get to work and improve the transmission, which needs improvement badly, as every owner of a touring car fully realizes to his cost.

Proper Hanging of Brake-Shoes

It is apparently not a generally recognized fact that the method of hanging brake-beams and of applying force to the brake-shoes has as much influence upon economy of shoe wear as does the quality or structure of the shoe itself. It is possible by improperly hanging a brake-beam to cause an ensuing unevenness of wear upon all shoes applied to it, which will necessitate their being scrapped before they are even half worn out. This is a difficulty that has been experienced to a large extent both in light street railway service and with the heavier interurban equipments. It has even been found that shoes upon some trucks will wear entirely through to the back at one end before the initial face is worn through at the other end of the shoe, with resultant very low mileage per unit of weight of the shoe.

The cause of this class of uneven wear of the shoes is improper hanging of the shoes relative to the attachment of the brake-gear, which results in an eccentric action upon the shoes in braking, as one end of the shoe is forced against the wheel more heavily than the other. In such a case an analysis of the connections of the brake-gear will without a doubt reveal a condition of faulty alignment of the point of application of the braking force and the hanger support relative to the desired resultant of force against the wheel. In other words, the point of hanger support becomes an offset center around which the braking force tends to revolve the brake-beam and shoes, and the greater the offset, the greater obviously is the eccentric action. Certain forms of hanger, in fact, make this result inevitable, yet with the forms of construction most generally in use it may easily be avoided, and wherever such uneven wear is encountered this cause should be looked to.

The remedy for the trouble is simple and may be applied with certainty of relief. It may be entirely avoided by rearranging the brake-gear and hanger connections so that the direction of application of the resultant of the braking force shall pass through the center of the wheel, which is the condition of freedom from eccentric action upon the shoe. In other words, it is necessary that the line of pull of the brake-gear shall intersect the center line of the supporting hanger for each shoe upon a radius of the wheel to be braked. With this accomplished, an even pressure will be distributed over the entire surface of the shoe, with consequent uniform wear throughout its life. This is not a difficult problem, as it may easily be worked out, even for inside-hung brake systems, by laying out to scale upon the drawing board and analyzing the forces set up during braking. It may also be added in this connection that such an analysis is liable to indicate methods whereby the disagreeable "chattering" of gear and hangers, so often complained of, may be overcome by reconstruction of the hangers.

With the brake-gear thus properly disposed, the question of maximum life of shoes lies in the structure of the shoe. As has previously been stated in these columns, the tendency of practice upon representative electric railway systems points toward the use of the harder shoes or the well-known shoes of soft iron body with hard metal inserts. With the excessive dirt, sand and grit picked up in street railway service, such shoes designed to withstand abnormal wearing conditions are unquestionably the more advisable.

Improving the Waiting Room

A point which progressive interurban railways have been appreciating of late is the influence of attractive waiting rooms upon their passenger business. It is now considered almost a matter of course that clean and comfortable places shall be provided for the use of the traveling public between cars on cross-country lines, and this idea is by no means confined to interurban roads, as may be observed in recent terminal practice in various cities. At the same time, many companies still fail to realize the importance of the subject, judging by the character of waiting rooms maintained.

Waiting rooms are often poorly lighted, destitute of public convenience stations, indifferently heated, illy-ventilated, malodorous and dirty. Even in localities where electric lights are available it is not uncommon to find waiting rooms illuminated by the ghastly glare of half a dozen decrepit Welsbach mantels: little or no provision for the reception of the omnipresent cigar stub; cheap lithographs of doubtful attractiveness on the walls, and a cooking stove running full blast in the rear, separated from the waiting room by a partition impervious to the eye, but not to the nose. Naturally it is a well-nigh perpetual task to keep public places of this character clean, and it cannot be done without an expense of perhaps $1.50 to $2 per week per waiting room; but the steam road long ago realized the necessity of keeping its stations in good condition, and it would seem to be equally important to prevent the making of disparaging comparisons by close attention to details on the part of those street railway companies which have thus far permitted the lessees of their waiting room privileges to take but slack care of the surroundings.

Reasonably good illumination can be obtained by providing one 16-cp lamp for each 30 sq. ft. of floor space, and in some cases this average can be run up to 40 sq. ft. or 45 sq. ft. without much trouble if the lights are skilfully placed. What is wanted is an illumination which will permit the reading of newspaper print with ease in practically any part of the room. Metal waste cans are useful, and a fire extinguisher should not be omitted from the equipment. In the matter of toilet facilities our American cities are none too well supplied with public convenience stations. By maintaining these at its waiting rooms the street railway company does its part in a really philanthropic work, and at very little expense. Perhaps the one point above all others in importance in the conduct of waiting rooms is cleanliness. Public telephone stations, newspaper and magazine stands, lunch counters and first-class illumination count for much as conveniences, but if a waiting room is to attract any other class of passengers in addition to the "great unwashed," it must not of itself fail in the matter of soap and water. In such situations these two commodities may be quite as useful in drawing passengers at city waiting stations as other forms of advertisement. Waiting room privileges should not be sub-let or leased without the retention of supervisory powers on the part of the street railway company concerned.

Some Lessons of the Zossen Tests

We close this week our report of the details of the earlier work done in the Zossen experiments. Although the later tests led to the more sensational results, it must not be forgotten that it took this long period of preliminary tests to bring them to full fruition. The important facts regarding power, air resistance, braking and proper balancing of the trucks were invaluable in determining the success of the final experiments. The work on air resistance may be fairly said to have cleared up that difficulty long before the record-breaking runs were finally made, and the early experiments settled once for all the feasibility of the speeds which were to be attempted. Thereafter the experimenters could settle down to business, safe in the certainty that while accidents might happen, yet so far as power available and power necessary were concerned the issue was certain. It was no small thing thus early in the game to have the major difficulties well in hand. But in addition to these auguries of final success, facts less cheering, but of great practical importance, were developed. At ordinary railway speeds braking is relatively easy. At those attempted in the Zozzen work new conditions arose, for while in point of fact locomotives had repeatedly made the speeds reached in the work of 1902, they had never been under the necessity of braking from such speeds. And right at this point developed what perhaps must be regarded as the gravest difficulty in high-speed railroading of any kind—the lowering of the coefficient of friction between brake-shoe and wheel as the speed rose. This situation was not in itself new in the Zossen tests, but it for the first time there came seriously under observation as a practical matter.

As appeared from the work of 1902, this coefficient of friction fell at, say 70 m.p.h. to about half of its initial value at a few miles per hour. This looked somewhat ominous, and the work of 1903 was doubtless begun with some misgivings upon this score. It is the unexpected which happens, however, and the unexpected is not necessarily evil, for the braking tests of 1903 showed not only that the friction diminished greatly in passing from 5 m.p.h. or 6 m.p.h. to 80 m.p.h., but that beyond that point it held fairly steady up to the highest speeds attained. This is one of the most curious facts brought out in the experiments, but it seems to be pretty well established, and remains for future consideration, as a point which deserves to be explained. Another very singular feature in the work of 1902, as our readers have doubtless noticed, was the very curious distribution of air pressures near the front of the car, showing that there is plenty of field for investigation even after the absolute value of the pressure as a retarding factor has apparently been well determined. It is a pity that the air currents about the head of a car and along the sides of the train cannot be rendered visible, so that their eccentricities can be definitely investigated. One would almost as soon expect a manhole cover on a high-pressure boiler to fall in as a shutter on the front wedge of the Zossen car to fall out, and yet this is precisely what did happen. A close knowledge of the air currents about the train would tell pretty definitely what might be expected from wings used for retardation. Possibly they might prove rather disappointing.

The braking problem certainly seems, both from these early tests and from those of 1903, as decidedly the gravest with which the worker at high speeds has to struggle. After all, even granting that very high retardations could be secured, it is very doubtful how far it would practically be safe to employ them on account of the passengers. All the tests point to the conclusion that it will be a very troublesome matter to stop from a speed near the maximum attained in less than about a mile. This is a longish distance when one considers the problem of running night trains with any system of signaling yet tried in railroading. Possibly the application of wireless may facilitate signaling in such cases, but certainly when one depends in any way upon the visibility of signals, a stopping distance of a mile is longer than discretion would dictate. The obvious moral is that in work at Zossen speeds, the high-speed track should be absolutely independent and the trains run on such headway as to insure clear track for a very long distance. After all, it is merely a matter of headway, for with a clear track assured for a distance beyond that needed for stopping, the way is safe. It is merely the old question of the length of the dangerous space, which on an ordinary electric interurban car may be 200 ft. or 300 ft. instead of 4000 ft. or 5000 ft. as in this high-speed work. In either case the safety precautions must be adjusted to the length of the dangerous space and kept in working order. If high-speed work becomes common it would not appear to be a difficult matter to arrange a set of wireless signals to show in the motorman's cab the conditions in the blocks a few miles ahead, to take the place of our somewhat imperfect track signals.

It must not be forgotten that while all this Zossen work was aimed directly at a three-phase traction system, it hits in actual fact any system of high-speed traction that is likely to be evolved. If our friends of the New York, New Haven & Hartford Railroad carry to success their plan for single-phase traction they will have to meet the same conditions of track and general equipment as would be required for three-phase work, but with the material gain of having to provide for but one overhead working conductor. The great mass of all this Zossen work will be available for the solution of the mechanical difficulties of the situation, which are really the only serious ones. Or if some wizard evolves a scheme for 10,000-volt direct-current motors, the great mass of data are as applicable to such as to any others. The 100-m.p.h.-train, which was vociferously announced so long ago, has not yet arrived, but when it comes its success will turn upon the roadbed and the mechanical equipment of the system rather than upon the details of the motive power. It is for this very reason that we have given so considerable space in our columns to these detailed reports of the earlier work—that they might be permanently in record in English for the instruction of whoever should need them. Of course, the greater interest centers around the later triumph of 1903, but when one wishes to study the causes of that success he must turn to the preliminary experiments that cautiously felt out the way of advance. The data on power and on acceleration and retardation in the tests of 1902 will particularly repay close examination. The time is soon coming we hope in which this country will do its share in high-speed traction. Up to the present it has followed somewhat conservative lines, at least since the earlier days of electric traction. With the beginning of trunk line work, which now seems to be in sight, there will be a new era of pioneering, to which the great Zossen experiments form in their entirety a splendid prelude.

BERLIN-ZOSSEN TESTS OF 1902—II.

An abstract of the first half of the report of the Berlin-Zossen tests of 1902 was published in the STREET RAILWAY JOURNAL for Oct. 28, and was devoted to the air-resistance experiments conducted during that year. The second half of the report for 1902 describes the methods followed in measuring the total energy consumption of the two test cars, the losses in the power transmission lines, the results of the tests on braking, the alterations made in the equipment of the car between the 1901 and 1902 tests and those recommended before the commencement of the 1903 tests, and the effect upon the track. As the car and track in 1903 are described in the 1903 tests, which are in book form, the portion of the 1902 report relating to these features will be omitted from this abstract, which completes the abstracts to be published in this paper.

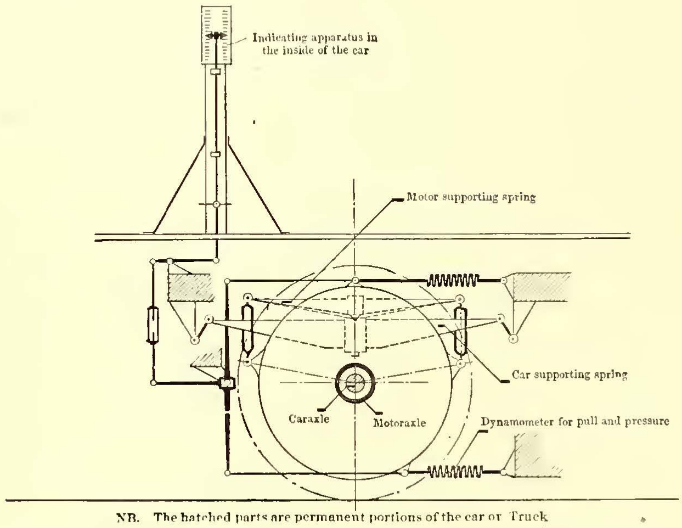


FIG. 1.—APPARATUS USED TO DETERMINE THE POWER CONSUMPTION BY MEASURING THE TORQUE OF THE MOTORS ON THE DRIVING WHEELS

MEASUREMENT OF THE ENERGY CONSUMPTION

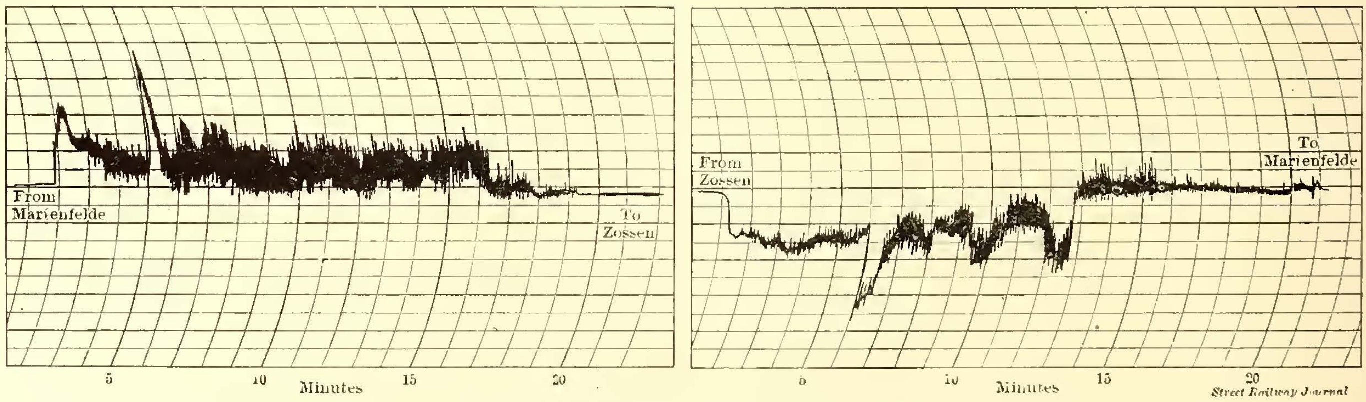
In the earlier tests, the measurements of the energy consumption, the current and the potential were all made in the power house at Oberspree, and were therefore subject to the possible errors of including in the calculations the resistance of the light transmission line from the power house to the feeding point along the trolley line. In order to eliminate these errors as far as possible in the present tests, a special observation station was constructed at the feeding point along the test section near Marienfelde, and was equipped with precision instruments, which were practically not affected by the frequency and the phase angle of the current. This was accomplished chiefly by being able to connect the ammeter and wattmeter directly in the high-potential circuit and thereby avoiding the use of transformers. The instruments in the car were connected in the same phase as those at the feeding point. The readings at the feeding point were taken at intervals of 10 seconds, and in the car, generally after each 20 seconds. For this purpose a clock was used which closed an electric circuit at intervals of 10 seconds each, thus operating one or more signal bells. The time noted by the clock at the feeding point was made to correspond exactly with that recorded in the car by checking them up before and after the tests through telephone.

It was found that the readings taken at 20-second intervals were not close enough to determine accurately the form of the curves, on account of the variation in the loads on the motors, and thereafter the readings were taken at least every 10 seconds. The strain on the observers under these latter conditions was somewhat severe on account of the length of the runs, and a further decrease in the time between the several observations was found not to be possible without an intermission, although a separate observer was assigned to each instrument.

The greatest value was laid upon the results obtained at the feeding point, which, on account of the substantial mounting of the instruments, were intended to form a basis for all further calculations. Unfortunately, this observation station was thrown out of service during a portion of the test, as the insulation would not stand the damp autumn weather and frequent short-circuits affected the readings of the instruments. Although the insulation was strengthened as much as possible, all further experiences indicated that it was not possible to take reliable readings during foggy and rainy weather. Under these conditions, the readings taken at the feeding point and in the car had so slight an agreement throughout that they could not be used in the calculations. However, a series of reliable measurements were made, independent of these disturbances, the results of which are plotted in Figs. 10, 11 and 12 in the article in the STREET RAILWAY JOURNAL for Oct. 28.

The curves of speed, current, potential and load were integrated with a planimeter, and the resulting average values are given separately for accelerating and running in the table of runs presented on the opposite page. The omission of certian values in these tables is due to the unreliability of the readings from which they must be derived. The following remarks apply to these tabulated results:

The car was started with very low accelerations on account of the small load capacity of the steam engine driving the generator, thus giving a low frequency, which resulted in a comparatively small energy consumption and a considerable accelerating distance. By comparing the consumption of electrical energy during the starting period with the theoretical energy consumption at the wheels, calculated from the accelerating power, and the average load due to air and friction resistance, an average efficiency of 45 per cent was obtained, as



FIGS. 2 AND 3.—RECORDS OBTAINED WITH TORQUE-MEASURING DEVICE, FROM TRIPS IN WHICH THE MOTORS WERE SHORT-CIRCUITED WITHOUT THE USE OF A RESISTANCE

in the earlier tests. This low figure is due chiefly to the energy losses in the starting resistances of the cars, but is of little consequence for a high-speed road, as the length of the accelerating periods in comparison with the entire running time will always be very short. The energy consumption and the torque at the wheels, derived from the recorded values measured at the trolleys, were calculated for the running periods by using the efficiencies of the transformers and motors as derived by the electrical companies, and results were obtained which are slightly in excess of those taken from the curves under similar conditions. No apparent reason for this difference was found. Probably a small amount of additional power was necessary in driving the cars by the motors which was not required during coasting. Also, the efficiencies of the electrical equipments of the cars, which were determined by calculation at low frequencies and loads, might not have agreed absolutely with the real values. After a great many more runs have been made it may be possible more accurately to locate this disagreement and find a reason for it.

Attempts were also made to determine the energy consumption during the trip by direct measurement of the torque transmitted by the motors to the driving wheels. For this purpose an ingenious device, illustrated in Fig. 1, built by the Allgemeine Elektricitäts-Gesellschaft, was attached to one of the motors of car A. The motor was supported, not by rigid links, but by spiral springs, which were so arranged as to indicate the turning moment exerted by the motor on its suspension point. This moment has the same value, but oppositely exerted, as the turning moment transmitted by the driving axle. The variation in the length of the spiral spring is transmitted through a lever arm to an indicating and recording apparatus with clock located in the car. The turning of the motor as recorded by this apparatus gave a measure of the torque, the value of which was determined by calibration with weights.

It was necessary to alter the suspension of the motor somewhat so that it would turn only on its middle point and not on the original bearing point of the motor-supportings springs, as otherwise an unequal transmission of the load on the spiral springs indicated at the pointer would occur.

In using this recording apparatus it was found that sufficiently smooth curves were obtained only when a resistance was connected in the secondary circuit of the motors, as without such a resistance the pointer and recording pencil vibrated widely and a reliable mean curve could not be approximated. The cutting in of a resistance has no effect upon measuring the power absorbed, although, in this case, it is not possible to make a direct comparison of the torque with the electrical energy recorded at the same instant. In Figs. 2-6 several of these records are reproduced. Those represented in Figs. 2 and 3 are taken from trips in which the motors were short-circuited without the use of a resistance, while those shown in Figs. 4, 5 and 6 were taken with a resistance connected in the secondary circuit of the motors during the trips. The torque calculated from the last three diagrams is plotted in Figs. 7A and 7B. It gives somewhat higher values for the train resistance than those found by the coasting tests. The reason for this disagreement lies possibly in slight discrepancies made by the recording apparatus. In the tests to be made in the future this can easily be remedied, and the apparatus will then be adequate for measuring the torque directly at the driving axle.

TABLE MEAN VALUES OF THE ELECTRICAL AND MECHANICAL TERMS FOR THE RUNNING PERIODS OF THE HIGH-SPEED CAR IN THE AUTUMN OF 1902

No. of Run	No. of Motors Working	Total Train Weight. Metric Tons	Average Speed. Km. per Hour	Frequency	Measurements at Feeding Point			At the Trolley of the Car			Hp. at the Trolley	Efficiency of the Electrical Equipment of the Car. %	Hp. at the Driving Wheels	Draw-Bar Pull at the Driving Wheels. Kg.	Remarks
					Amp.	Volts	Kw.	Amp.	Volts	Kw.					
Car A															
4	2	89.5	95	20.6	43.4	5,835	....	42.1	5,543	246	335	82.7	277	788	Car alone.
2	4	89.5	96	20.8	....	5,450	....	64.0	5,190	247	336	69.7	234	660	Car alone.
5	2	89.5	107	24.	45.6	6,460	....	43.8	6,089	302	410	86.4	354	892	Car alone.
2	4	89.5	113	25.	....	6,830	....	71.5	6,390	365	496	79.1	392	938	Car alone.
2	4	188.4	117	25.	84.7	6,647	694	....	.....	644	875	87.1	762	1,760	3 four-axle passenger cars attached.
Car S.															
8	2	77.9	92	20.8	36.7	5,781	....	34.5	5,619	197	268	84.	225	660	Car alone.
8	2	77.9	106	24.	39.2	6,447	....	36.8	6,162	283	385	86.5	333	850	Car alone.
4	4	159.6	117	25.	69.2	6,937	566	65.0	6,685	499	679	85.5	580	1,330	2 four-axle passenger cars attached.
1	4	193.4	118	25.	81.5	6,700	713	75.	6,425	680	925	87.7	810	1,840	3 four-axle passenger cars attached.

TABLE MEAN VALUES OF THE ELECTRICAL AND MECHANICAL TERMS FOR THE ACCELERATING PERIODS OF THE HIGH-SPEED CARS IN THE AUTUMN OF 1902

No. of Run	No. of Motors Working	Total Train Weight. Metric Tons	Distance Meters	Average Grade in Per Cent.	Average Acceleration Meters Per Sec.	Maximum Speed Km. per Hr.	Frequency	Measurements at Feeding-Point			Measurements at the Trolley of the Car			Hp. at the Trolley	Remarks
								Amp.	Volts	Kw.	Amp.	Volts	Kw.		
Car A															
5	2	89.5	4,430	.030	0.08	88.6	20.6	51.2	5,662	....	50.0	5,376	358	487	Car alone.
2	4	89.5	3,950	.084	0.12	97.5	20.8	....	5,165	....	74.2	4,835	446	606	Car alone.
6	2	89.5	7,930	.054	0.07	106.	24.	51.1	6,383	....	50.1	6,024	407	553	Car alone.
2	4	89.5	4,550	.057	0.11	102.5	25.	....	6,740	....	76.	6,360	535	727	Car alone.
3	4	188.4	8,700	.061	0.07	113.3	25.	101.	6,253	880	....	.....	813	1,105	3 four-axle passenger cars attached.
Car S.															
9	2	77.9	2,744	.111	0.13	91.2	20.8	52.6	5,472	....	51.8	5,257	394	535	Car alone.
9	2	77.9	4,294	.068	0.12	105.6	24.	51.1	6,290	....	50.5	5,950	434	590	Car alone.
6	4	159.6	5,583	.060	0.11	116.7	25.	108.2	6,237	1,010	105.6	5,938	928	1,261	2 four-axle passenger cars attached.
1	4	193.4	8,300	....	0.07	115.	25.	110.	6,140	988	107.	5,450	855	1,160	3 four-axle passenger cars attached.

DETERMINING THE LOSSES IN THE POWER TRANSMISSION LINES

At the conclusion of the speed tests, measurements of the ohmic and apparent resistances of the transmission lines were made in order to determine the energy and voltage losses in the transmission and trolley lines. These measurements were made separately for the exposed parts of the transmission as well as the trolley lines. The observation station at cable house I., in Johannisthal, served for measuring the former, and cable house II., at the feeding point along the track, served for measuring the latter. The location of these observation stations may be seen from Fig. 8, while the arrangement of the wires on the poles is shown in Figs. 9 and 10.

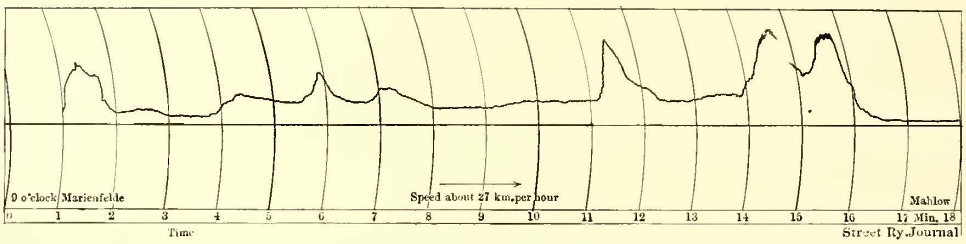


FIG. 4.—DIAGRAM OF MOTOR TORQUE TAKEN ON CAR A DURING RUN ON NOV. 7, 1902 (RUNNING WITH ONE MOTOR)

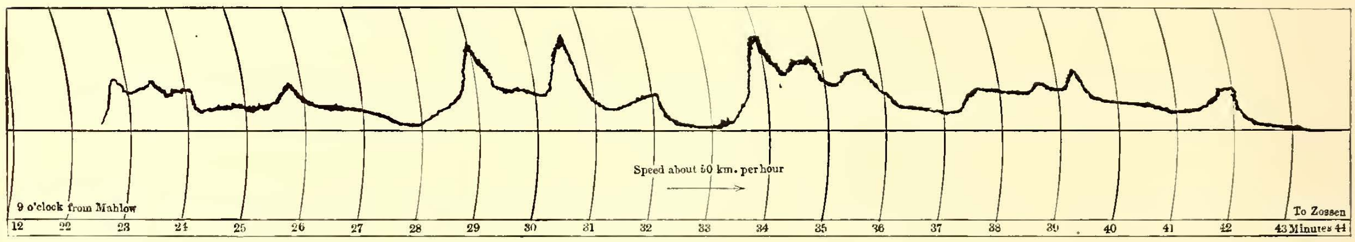


FIG. 5.—DIAGRAM OF MOTOR TORQUE TAKEN ON CAR A DURING RUN 1, ON NOV. 7, 1902 (RUNNING WITH ONE MOTOR)

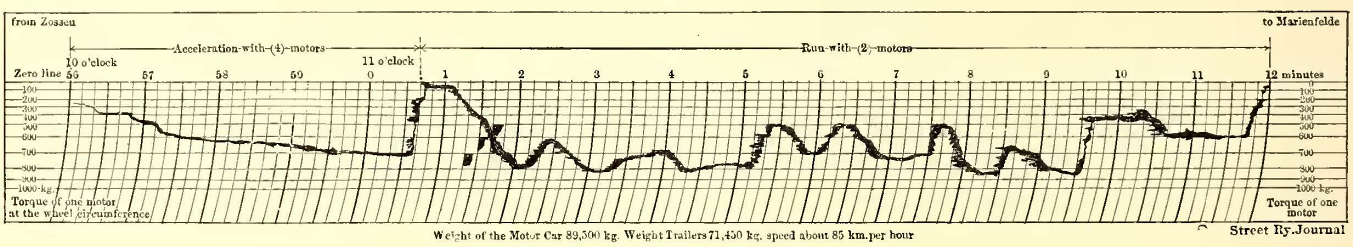


FIG. 6.—DIAGRAM OF MOTOR TORQUE TAKEN ON CAR A DURING RUN, ON NOV. 8, 1902, WITH FOUR THREE-AXLE TRAIL CARS

The transmission line consisted of stranded copper wire 50 sq. mm in area, the trolley lines of drawn figure 8 profile wire of approximately 100 sq. mm area. The measurements of the lines were made as follows:

(1) *Resistance measurements with direct current.*

The lines *a*, *b* and *c* and the earth line *E* were short-circuited at one end and a small battery was connected alternately in each circuit at the observation station. The measurements of current and potential gave the resistance of each loop.

(2) *Determination of the coefficient of induction for alternating current.*

For this purpose the free and the earth lines were short-circuited as before at one end and energized with alternating current from the power house. Then measurements of the load, current and potential in each phase were made at the observation station according to the scheme shown in Fig. 11. The frequency was noted at the same time in the power house from the revolutions of the steam engine. The apparent resistance, R', of one line for the frequency used during the observations follows from the relation

$$R' = \frac{E}{J} = \frac{\text{Phase voltage}}{\text{Current}} \text{ in ohms.}$$

In order to determine the apparent resistance at any other frequency (n), it is necessary to know the coefficient of self-induction (L) and the capacity (C) of the line;

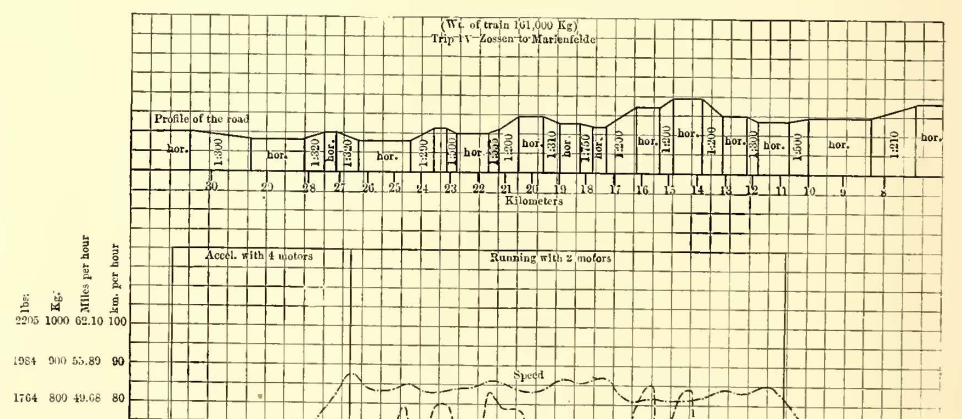


FIG. 7B.—TEST RUNS WITH CAR A AND FOUR THREE-AXLE TRAIL CARS, ON NOV. 8, 1902, SHOWING TORQUE, SPEED AND PROFILE OF LINE for which purpose we may use the approximate relation:

$$R' = \sqrt{\frac{R^2 + \omega^2 L^2}{\omega^2 C^2 \left[R^2 + (\omega L - \frac{1}{\omega C})^2\right]}}$$

R represents the ohmic resistance determined from the measured watts, which varies very slightly from the value W derived from the direct-current measurements. $\omega = 2\ \pi\ n$.

When the capacity C is small, as in this case, the apparent resistance approaches the expression

$$R' = \sqrt{R^2 + \omega^2 L^2},$$

in which it is only necessary to determine the value of L from the measurements. For this purpose we may use the equation

$$E = J \sqrt{R^2 + \omega^2 L^2},$$

and we obtain from the potential diagram, Fig. 12,

$$\cos \Phi = \frac{K}{J \cdot E} = \frac{\text{measured load per phase}}{\text{measured voltamperes per phase}}$$

$$\sin \Phi = \sqrt{1 - \cos^2 \Phi}$$

$$R = \frac{E}{J} \cos \Phi = \frac{K}{J^2}$$

$$L = \frac{E}{Ja} \sin \Phi \quad \text{in henrys.}$$

(3) *Determination of the coefficient of induction for single-phase current.*

For this purpose the lines a, b and c were short-circuited at one end, but disconnected from the earth line E. Two lines were simultaneously connected at the observation station with the power house, and the load, current and potential of this loop were measured. The third line and the earth line remained without current. The connections were made as illustrated in Fig. 13. The calculation of the coefficient of induction follows in the same way as described under division 2, except that in this case it refers to the entire loop, while in the former instance it related only to the single wire, the earth wire acting only as a voltmeter connection, and is considered as carrying no current.

For comparison, the coefficient of induction was also cal-

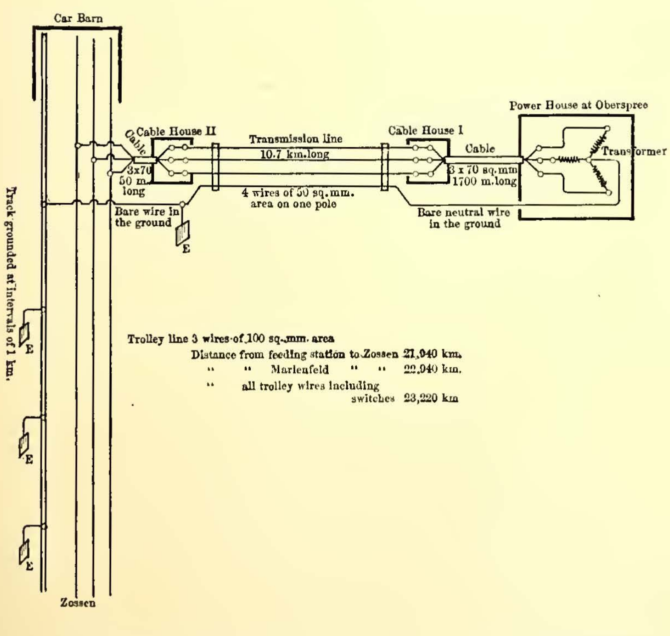


FIG. 8.—SHOWING LOCATION OF STATION FOR OBSERVING THE ENERGY AND VOLTAGE LOSSES IN THE TROLLEY AND TRANSMISSION LINES

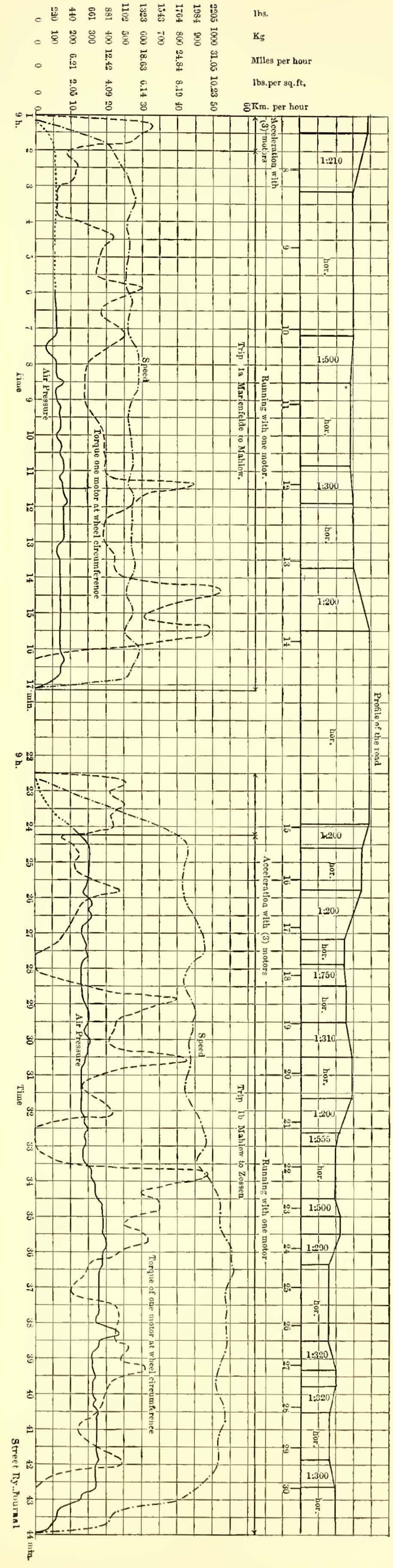


FIG. 7A.—TEST RUN WITH CAR A ON NOV. 7, 1902, SHOWING TORQUE, SPEED, AIR PRESSURE AND PROFILE OF LINE

Weather, dry; direction of wind, northeast; velocity of wind, 5 meters per second; weight of car, 89,500 kg.

culated from the readings taken from the lines according to the formula

$$L' \div \text{km} = 0.4605 \log \frac{d}{r} + 0.05 \text{ Millihenry}$$

correct for two parallel wires of radius r and separated by a distance d for 1 km length of single wire.

Conclusions may be drawn from the more or less perfect agreement of the recorded results with the values obtained from this formula, whether it is possible to neglect the capacity of the lines in the calculations.

The results of the measurements are tabulated in the following:

1. Ohmic resistance for direct current:

(a) Transmission line (10.7 km long)

Resistance of a single line a, b or c (average)

at — 4° C. $W = 3.462$ Ohm

at + 15° C. $W = 3.75$ Ohm

Resistance for the running kilometer

$W \div \text{km} = 0.35$ Ohm

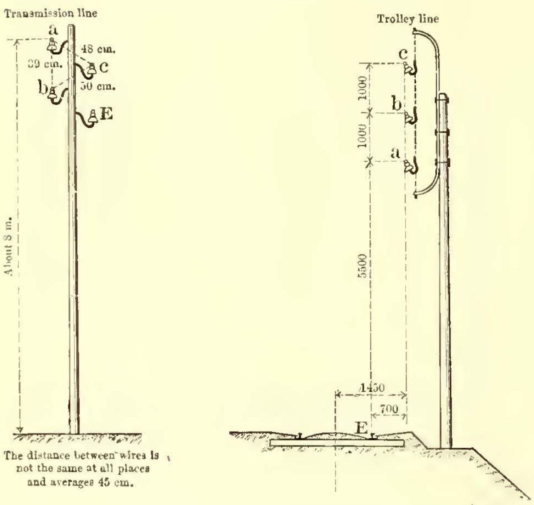
Resistance of the earth line E

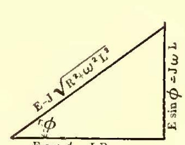
at — 4° C. $W = 0.775$ Ohm

By calculation we obtain

$$W' \div \text{km} = \frac{17.5}{50} = 0.35 \text{ Ohm}$$

(b) Trolley line (approximately 22 km, including the cable at the feeding point).





FIGS. 9 AND 10.—ARRANGEMENT OF WIRES ON TRANSMISSION AND TROLLEY POLES

FIG. 12.—POTENTIAL DIAGRAM

Resistance of a single line a, b or c (average)

at + 4.5° C. $W = 3.85$ Ohm

at + 15° C. $W = 4.02$ Ohm

Resistance for the running kilometer

$W \div \text{km} = 0.183$ Ohm

Resistance of the rail return

at + 4.5° C. $W = 0.42$ Ohm

By calculation we obtain for the trolley line

$$W \div \text{km} = \frac{17.5}{97.3} = 0.180 \text{ Ohm}$$

(By accurate measurement the area was found to be 97.3 sq. mm).

2. Coefficient of induction for alternating current:

(a) Tranmission line (10.7 km long) at — 3° C.

Line a . . . . $L = .01078$ $L \div \text{km} = .001008$
Line b . . . . $L = .01043$ $L \div \text{km} = .000974$
Line c . . . . $L = .01030$ $L \div \text{km} = .000966$

Average . . . . $L = .01051$ $L \div \text{km} = .000983$ Henry

The calculation gives . . . . $L' \div \text{km} = .000995$ Henry

(b) Trolley line (22 km) at + 5° C.

Bottom line a . . . . $L = .0255$ $L \div \text{km} = .001159$
Middle line b . . . . $L = .0234$ $L \div \text{km} = .001064$
Top line c . . . . $L = .0260$ $L \div \text{km} = .001183$

Average . . . . $L = .0250$ $L \div \text{km} = .001135$ Henry

The calculation gives as average . . . $L' \div \text{km} = .001131$ Henry

3. Coefficient of induction for single-phase current:

(a) Transmission line (21.4 wire length) at — 3° C.

Loop a-b . . . . $L = .0208$ $L \div \text{km} = .000974$

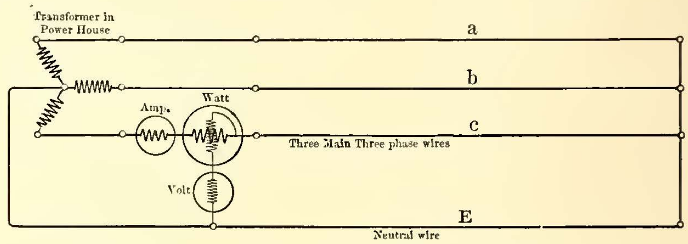


FIG. 11.—SCHEME ADOPTED FOR FINDING THE POWER, VOLTAGE AND AMPERAGE OF EACH PHASE

Loop a-c . . . . $L = .0219$ $L \div \text{km} = .001023$
Loop b-c . . . . $L = .0222$ $L \div \text{km} = .001037$

Average . . . . $L = .0216$ $L \div \text{km} = .001012$ Henry per kilometer and line

The calculation gives . . . . $L' \div \text{km} = .000995$ Henry

(b) Trolley line (44 km wire length) at + 5° C.

Loop a-b (1 m apart) . $L = .0469$ $L \div \text{km} = .001064$
Loop a-c (2 m apart) . $L = .0566$ $L \div \text{km} = .001285$
Loop b-c (1 m apart) . $L = .0483$ $L \div \text{km} = .001096$

Average . . . . $L = .0506$ $L \div \text{km} = .001148$ Henry per kilometer and line

The calculation for the loops gives:

a-b, $L' \div \text{km} = .001085$

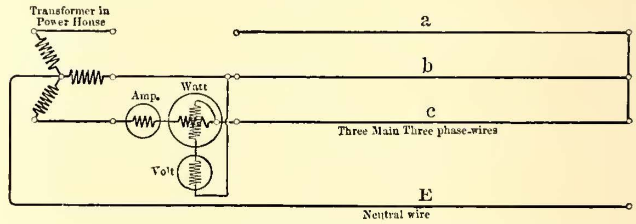


FIG. 13.—WIRING SCHEME ADOPTED TO DETERMINE THE COEFFICIENT OF INDUCTION FOR SINGLE-PHASE CURRENT

a-c, $L' \div \text{km} = .001223$

b-c, $L' \div \text{km} = .001085$

Average, $L' \div \text{km} = .001131$ Henry

After knowing these values, which refer to the line installation, the energy and potential losses in the transmission and trolley lines for the several groups of runs in the accompanying tables are calculated as follows:

The energy loss, according to Joule's Law, is

$$R = 3J^2W,$$

in which J represents the current strength and W the ohmic resistance of one line. Since the length of the line through which the current flows changes continually during the run, the average distance from the feeding point to the middle point of each division of the run must be estimated in order to determine the proper resistance to be employed for the accelerating and running periods.

As the average load will always be referred to time, so also this middle point must be referred to the time interval of the division of the run. That is, it is necessary to determine in the time-distance diagram (Fig. 14) that distance which answers to the mean between the time at the beginning and the time at the end of the division under consideration.

The drop in voltage is found from Fig. 15, in which

Ew = Voltage in car,
Esp = Voltage at the feeding point,
Ej = Voltage at Johannisthal,
JR = Ohmic voltage drop,
$J \omega L$ = Inductive voltage drop,
$\triangle Ef$ = Voltage drop in the trolley line,
$\triangle Ez$ = Voltage drop in the transmission line.

After plotting the triangle MNO in the vector diagram on the basis of the measurements taken in the car, in which $\cos \Phi$ is calculated from the equation

$$\cos \Phi = \frac{\text{Watt}}{\text{Amp. Volt.} \sqrt{3}}$$

we obtain the voltage and also the load factor at the feeding point and in Johannisthal by combining the diagrams of losses NPQ and QRS for the trolley and transmission lines. Through subtraction, we acquire the voltage drops $\triangle Ef$ and $\triangle Ez$.

The losses thus obtained do not always agree with those obtained by subtracting the measurements taken in the car from those noted at the feeding point. This is due to small errors of observation. A relatively small difference in the measurements of the power and voltage taken in the car and those noted at the feeding point produces a considerable error in only a small fraction of this large total difference. In this case the calculations of the losses based upon the line measurements are authoritative and should be considered as correct.

In the accompanying table the losses in power and voltage for the separate groups of the running periods are collected together in order to give a general idea of their magnitude. It will be seen that they stand in small relative proportion to the energy consumption, and this fact was also apparent during the progress of the calculations. The energy loss is proportional to the square of the current strength; but for a given load may vary considerably, depending upon the height of the voltage and the value of the load factor $\cos \Phi$. The energy loss varies also with the average length of the trolley line. The voltage drop is found from the formula

$$e = J \sqrt{R + \omega L},$$

or graphically from the loss diagram illustrated in Fig. 15. This loss is dependent upon the current strength, the resistance referred to the length of the line and its induction coefficient, also eventually upon the frequency. The induction coefficient and the frequency, or the value of ωL, exert also an influence on the direction of the losses in the potential diagram, from which the value of the resulting voltage at the feeding point (Esp) as well as that at Johannisthal (Ej) is greatly dependent.

TABLE OF THE ENERGY AND VOLTAGE LOSSES

Average Length of the Trolley Line	Average Current in the		Energy Losses in the		Voltage Losses in the		Comparison of the Measured		Remarks
	Trolley Line	Transmission Line	Trolley Line	Transmission Line	Trolley Line. ($\triangle$ Ef)	Transmission Line. ($\triangle$ Ez)	Load in the Car. Kw.	Voltage in the Car. Volts.	
Km.	Amp.	Amp.	Kw.	Kw.					
12.2	42.7	44	12.4	21.7	205	260	246	5,543	These refer to the test runs of Car A.
11.5	65.0	66	27.0	49.0	277	343	247	5,190	
13.1	44.7	46	14.5	23.7	252	292	302	6,089	
11.0	72.0	73	31.6	60.0	329	418	365	6,390	
14.1	84.0	85	55.2	81.2	527	565	644	6,120	
12.0	35.6	37	8.4	15.4	165	216	197	5,619	These refer to the test runs of Car S.
10.8	38.0	40	8.6	18.0	179	263	283	6,162	
10.8	67.0	70	27.0	55.0	330	463	499	6,685	

BRAKE TESTS

The braking apparatus installed in the cars was described in detail in the preceding year's report. It was also stated that an accurate adjustment of the brake-shoes was attended with great difficulty on account of the numerous brake-rods, and that the desired results were not secured by connecting the Westinghouse pressure-reducing valve in circuit, since the pressure resulting from the operation of this valve was not

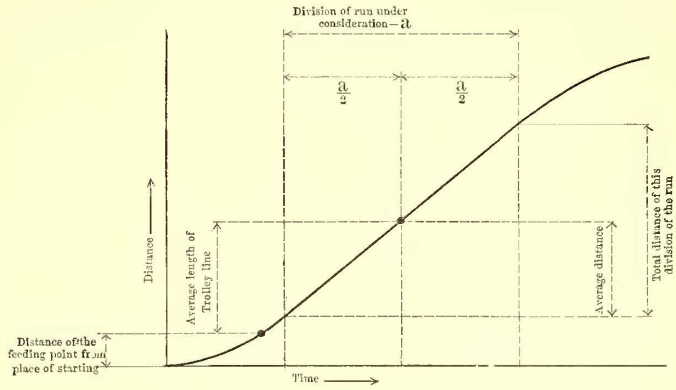


FIG. 14.—TIME DISTANCE CURVE

dependent upon the decrease in speed, but followed after a definite time interval.

As the proposed changes in the brake rigging could not be made on account of the limited space in the trucks, the greatest care was taken in the adjustment of the brake-rods so that the best possible braking effects would be obtained. The pressure-reducing valve was placed experimentally in the motorman's cab of car S and connected through pipes and cut-off cock with the brake cylinder. This made it possible to cut in the valve at any time, to retain the air pressure in the cylinder for a long time and to regulate it in proportion to the speed. The results obtained in the brake tests made with this arrangement may be seen in the table on the next page.

The decrease in speed in proportion to the time is shown by the curves in Fig. 16, which have a similar form to those obtained in the preceding year. As reliable speed recorders were used in this year's tests, the decrease in speed and the corresponding retardation could be accurately determined during the entire braking period, from which the coefficient of friction was calculated.

If we call, as in the preceding year, the

Coefficient of friction . . . . f.
Total pressure on the brake-shoes . . . . D.
Mass of the car . . . . M.
Rotating mass referred to wheel circumference . . . . R.
Resistance of the car . . . . W.
Retardation . . . . p.

then we have:

$$f = \frac{p(M + R) - W}{D}$$

Grades are not taken into consideration in this equation,

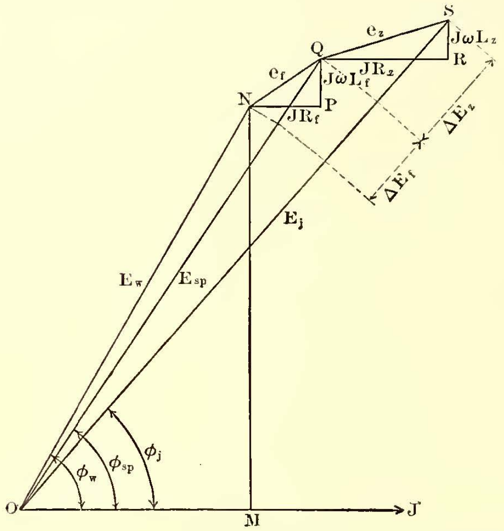


FIG. 15.—VECTOR DIAGRAM LAID OUT FOR DETERMINING THE VOLTAGE DROP

since the braking was done in most cases on level sections of the test track. All terms on the right-hand side of the equation are known. M, as in the preceding year, $= 9300$, and R

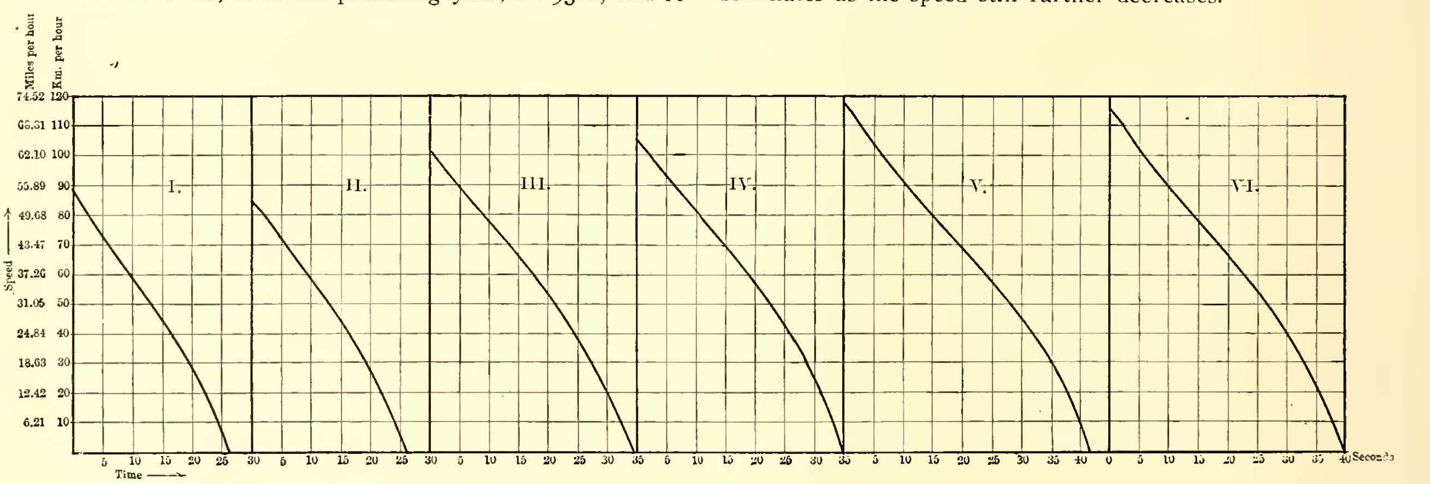


FIG. 16.—BRAKE TESTS ON OCT. 30, 1902, WITH CAR S

$= 790$. The resistance W is taken from the resistance curve, published in the issue of Oct. 28 as Fig. 6, and D is calculated

TABLE OF BRAKING DATA

No. of Test	Braking Distance Between Km. Posts	Speed at Beginning of Braking Km. Per Hour	Braking Distance M.	Braking Time Sec.	Air Pressure in the Pipes Atmos.	Air Pressure in the Cylinders Atmos.	Average Retardation v $p=\frac{v}{t}$ M. per Sec.	Retarding Force in % of Car Weight $\frac{100\,p}{g}$	Application of the Pressure Reducing Valve	Remarks
I	9.708 to 10.07	89.2	362	26.5	7.8	5.5 to 4.5	0.936	9.5	Ready before braking.	Emergency braking.
II	12.886 to 13.238	85.5	352	26.2	7.5	5.5 to 4.5	0.908	9.3		
III	17.005 to 17.554	102.4	549	34.5	8.5	6.2 to 5.5	0.823	8.4	After 15 seconds.	Emergency braking.
IV	22.494 to 23.081	105.8	587	35.	8.5	6.2 to 5.5	0.840	8.6	After 18 seconds.	Emergency braking.
V	26.23 to 25.469	118.4	761	41.8	8.3	5.9 to 4.8	0.708	8.0	After 25 seconds.	Emergency braking.
VI	16.952 to 16.232	116.2	720	40.	8.5	6.2 to 5.0	0.808	8.2	After 25 seconds.	Full service braking.

from the air pressure in the brake cylinder and the lever ratio of the brake-rods.

The results, presented in the table on the opposite page, give several calculated values of the coefficient of friction for the same speeds, and also the average of these values.

From these values it is seen that the friction coefficient during the first part of the braking period decreases; but with further reduction in speed, rapidly increases. This agrees throughout with the observations which Capt. Douglas Galton published in the year 1878, according to which the friction coefficient at a constant speed decreased with the continuation of the braking. But in the above brake tests the simultaneous decrease in speed must be taken into consideration, as it results in an increase in the friction coefficient. On this account it is to be assumed that at the beginning of the braking period the decrease in the friction coefficient with the time is greater than

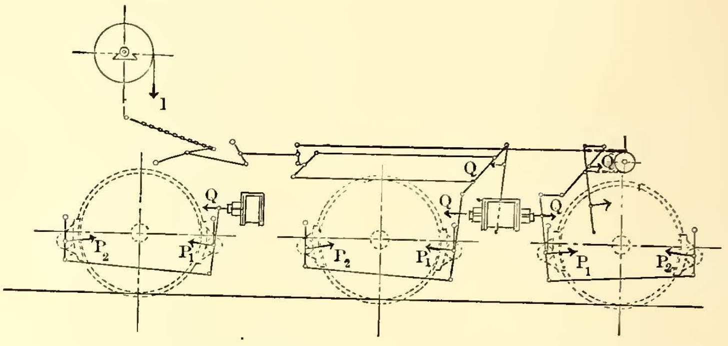


FIG. 17.—SIMPLIFIED BRAKE RIGGING FOR THREE-AXLE TRUCK

its increase resulting from the reduction of the speed, while after a few seconds an increase in the friction coefficient predominates as the speed still further decreases.

In general, the tests gave no better results than braking under the most favorable conditions during the preceding year. It was also impossible to obtain a shorter braking distance by operating the pressure-reducing valve by hand, through which the highest air pressure could be retained in the brake cylinder for a long time.

With due consideration of the high brake pressure used, the conclusion must be reached that the complicated brake rigging, although the greatest care was observed, could not be adjusted accurately enough. A simplification of the brake rigging is therefore to be desired. For the proposed new three-axle truck with a 5-m wheel base, a brake rigging is already designed, and its principal features are illustrated in Fig. 17. The most important simplification to be gained by this brake rigging will be through placing the brake cylinders in the plane of the wheels and providing so that one piston operates on the

TABLE OF BRAKING DATA

Average Speed. Km. per Hour	Brake Test. No.	Time after Application of the Brakes. Sec.	Retardation. p Meters per Second.	Brake Pressure D. Kg.	Coefficient of Friction. f.	Average Coefficient of Friction
113	V	2–3	0.94	119,000	0.072	0.066
	VI	2	0.83	126,000	0.060	
100	III	1–2	0.78	126,000	0.057	0.055
	IV	3	0.78	126,000	0.057	
	V	7	0.78	119,000	0.060	
	VI	6	0.67	126,000	0.048	
75	I	5	0.83	103,000	0.076	0.062
	II	5	0.89	103,000	0.082	
	III	11–12	0.72	126,000	0.054	
	IV	13–14	0.72	126,000	0.054	
	V	18	0.67	119,000	0.053	
	VI	17	0.67	126,000	0.050	
50	I	14	0.94	91,000	0.100	0.075
	II	13	0.86	91,000	0.092	
	III	21–22	0.83	107,000	0.069	
	IV	23	0.83	119,000	0.068	
	V	28–29	0.67	114,000	0.057	
	VI	27	0.83	123,000	0.066	
25	I	21–22	1.11	80,000	0.128	0.108
	II	21–22	1.11	80,000	0.128	
	III	29–30	1.00	109,000	0.091	
	IV	30–31	1.00	109,000	0.091	
	V	37	1.03	93,000	0.110	
	VI	35	1.06	107,000	0.098	
8	I	25–26	1.39	80,000	0.162	0.149
	II	25	1.44	80,000	0.167	
	III	33	1.33	109,000	0.122	
	IV	34	1.47	109,000	0.135	
	V	41	1.56	93,000	0.168	
	VI	39	1.39	98,000	0.142	

brake shoes of a single wheel. Two double cylinders are carried on each truck, one each between each pair of wheels lying nearest the middle of the car, and single cylinders between each of the outside wheels. The hand brake is commonly connected only with those brake-shoes that are operated by the double cylinders. This seems advisable since the highest admissible brake pressure through the large lever ratio used can be by no means reached even though only two axles of the truck are braked. Through this great simplicity of the brake rigging a good adjustment of the brake-shoes is assured, and it is therefore hoped that the best braking results will be obtained that are possible with wheel brakes.

DAILY REPORTS TO THE GENERAL MANAGER IN ROCHESTER

In the final results the value of any system of departmental records and reports in electric railway administration must depend upon the promptness and accuracy with which the system renders available the salient information required by the manager or head of department. In other words, there is certain information the general manager wants each morning concerning the previous day's happenings and results. There is another class of information, particularly with reference to details, which, although significant and of prime importance, does not necessarily demand the personal attention of the manager each day. If the attempt is made to include too much of the latter class of details in the daily reports to the manager, the main object aimed at may be defeated in that the salient information is buried in the mass. In short, any successful system of reports must be so devised as to render available each morning an epitomized summary of the previous day's operations. And it should be emphasized that the workings of the system of reports should be such as to provide that these daily reports be delivered at the manager's desk automatically, in so far as any specific attention on the manager's part is required.

As a "pointer" on the preparation of daily summarized reports, the system instituted by R. E. Danforth, general manager of the Rochester Railway Company, is suggestive. No attempt is made to use an elaborate printed form. The digest reports are typewritten on sheets the size of an ordinary letter head. The form of report reproduced herewith covers the mechanical, line, track and claim departments, and it will be seen, lays bare at a glance a summary of the previous day's work and happenings. The principle is carried even further, and the report includes not only a record of the previous day's results, but also covers the work and conditions for the day on which the report is made, so that report received "this morning" shows track work, line work and cars in shops and on road "to-day," and accidents, emergency calls and cars disabled "yesterday." The same idea is carried out with reference to the operating departments, and thus, by glancing over two small and conveniently handled sheets, the manager is able to keep close watch from day to day as to the general conditions on his property.

FORM OF DAILY EPITOMIZED REPORT MADE TO GENERAL MANAGER, ROCHESTER RAILWAY COMPANY

Rochester Railway Company, Oct. 7, 1905.

To-day in shops, Car Numbers
500 Paint.
501 "
502 "
511 "
452 "
457 "
458 "
459 "
73 Sodus—Overhauling.
328 Paint.
341 School.
315 Damaged.
430 Damaged.
126 Wheels.
226 Wheels.
200 Wheels.
303 Wheels.
441 General overhaul 17

STATE STREET DIVISION
80 Cars running on road.
25 Cars available in shed.
10 Swing cars to go out.
14 Disabled cars in shed...... 129

EASTERN DIVISION
51 Cars running on road.
43 Available cars in shed.
9 Swing cars to go out.
17 Disabled cars in shed...... 120
37 Cars stored.................. 37

SODUS DIVISION
9 Cars running on road.
4 Available cars in shed.
1 Disabled car in shed....... 15

SUBURBAN DIVISION
10 Available cars in shed.
2 Disabled cars in shed...... 12

330

LINE WORK
1 Wagon to Platt Street bridge.
1 Wagon to West Main Street.
1 Wagon to Hudson Avenue.

TRACK WORK
1 Team to South Avenue, a/c 1.
2 Teams to Franklin construction.
4 Teams to Genesee St., job No. 431
1 Team to Portland Ave., job No. 399.
7 Men to South Ave., a/c 1.
30 Men to Franklin construction.
40 Men to Genesee St., job No. 431.
12 Men to Hudson Ave., job No. 323.
4 Men to Park Ave., job No. 38.
6 Men to Park Ave., job No. 454.
20 Men to Portland Ave., job No. 399.
1 Man to Saratoga Ave., job No. 430.
3 Men to Curve cleaning.
2 Men to blacksmith and helper.
1 Man and cart.

EMERGENCY CALLS (Yesterday)
Main and Caledonia Ave. bridge, trolley wire broke.
Hudson and Ave. E, ear off.
Charlotte line, cemetery, ear off.

SODUS WORK
2 Putting up crane, job No. 36-A.
8 Surfacing tracks, job No. 36-A.
2 Flagging Hudson Ave., job No. 323.
1 Flagging Park Ave., job No. 369.
18 Sand account.
4 Line work, job No. 37-E.
4 Track repairs, section 2.
4 Track repairs, section 3.

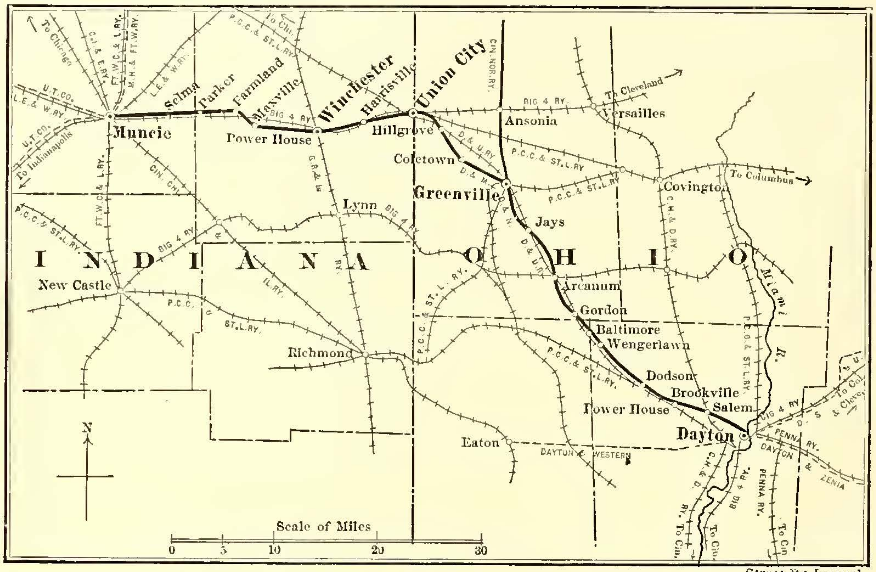
ACCIDENTS (Yesterday)
Man stepped off moving car and fell; injured his hand.
Car struck horse; was knocked down; leg scratched and thill broken.
Car struck wagon.
Man caught car and fell.

DISABLED CARS (Yesterday)
8 Motor trouble.
4 Brakes.
1 Miscellaneous.

Of course, reports as to minute details follow with all possible promptness.

THE DAYTON & MUNCIE ELECTRIC RAILWAY

The Dayton & Muncie Traction Company has recently completed its line into Muncie, Ind., forming a most important link in the great chain of lines in Ohio and Indiana. It affords through service from Dayton to Muncie, and it also furnishes the most direct route for travel on electric lines from numerous points in Southern and Central Ohio to points in Central and Northern Indiana. The Dayton & Muncie proper extends from Greenville, Ohio, to Muncie, Ind., but at Greenville it connects with the tracks of the Dayton & Northern, which joins Greenville and Dayton. The two properties are under the same general ownership and management, and although at present through passengers are transferred at Greenville, it is probable that this will soon be done away with, since, from the general operating standpoint, the two roads are a unit and will doubtless be consolidated in the not very distant future. Through limited service has been provided for and will be instituted as soon as the track on the new line is in better shape.

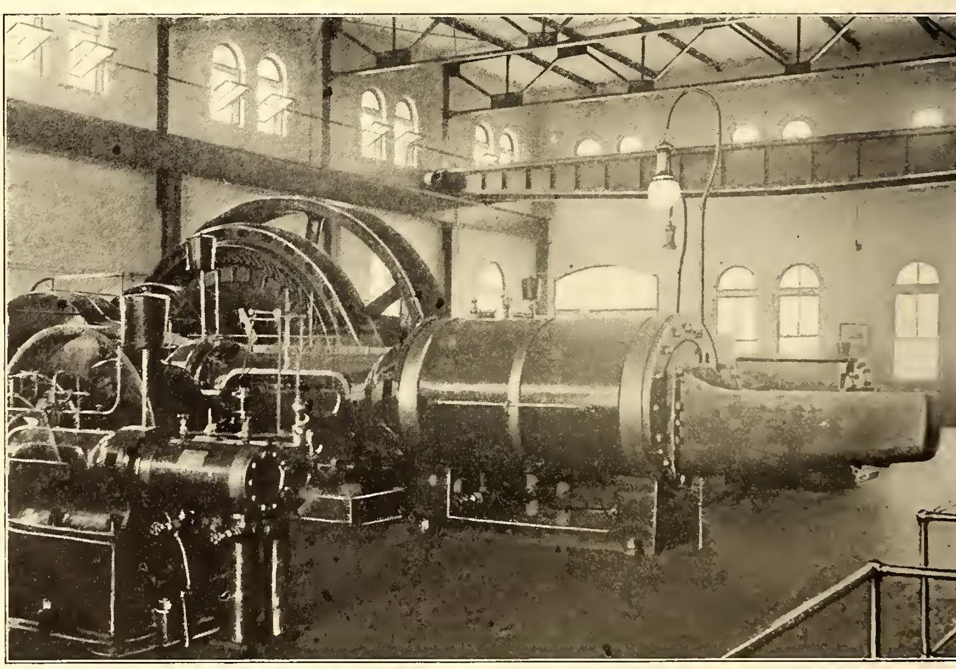


MAP SHOWING ROUTE OF DAYTON & MUNCIE TRACTION COMPANY

The distance from Dayton to Muncie, including city entrances, is 86.5 miles, the Dayton & Northern having 41.6 miles of track and the Dayton & Muncie 44.9 miles. It is interesting to note that the population tributary to the system is much greater in Indiana than in Ohio, as the Dayton & Muncie has 1054 people per mile of road as compared with 471 for the Dayton & Northern, which lies wholly in Ohio. It is the numerous towns and the densely settled rural districts that have made Indiana the premier traction State in the Union.

The towns on the Dayton & Muncie may be described briefly as follows: Greenville is the seat of Darke County, Ohio, which ranks first as an agricultural county in Ohio. The population is about 8000, having experienced a splendid growth since the building of the Dayton & Northern three years ago. It has four banks, a large stove factory, a screen door factory, wire fence factory, lumber yards, planing mills, several machine shops, etc. Union City, on the State line, has about 7500 population. It is an important railroad center, and it has a large automobile factory, lumber yards, planing mills, six grain elevators, city waterworks, natural gas, sewer and electric light systems. Winchester, seat of Randolph County, Ind., has a population of 6000; fine county and city buildings, excellent public utilities, three banks, several hotels and manufacturing establishments. Farmland has a population of about 2000. It has two banks, several manufacturing concerns, and within the past two years it has grown rapidly owing to the discovery of oil; at present the town is surrounded by hundreds of wells. Parker City has a population of about 1500, and is said to be the center of the richest oil district in Indiana. It has a large furniture factory and several oil supply houses. Selma has about 900 population, and large oil interests are represented there. Muncie in 1900 had 21,000 population. At present, owing to the growth of the oil industry, it is claimed the population is 32,000. It has numerous manufacturing plants, including glass works, iron mill, barb wire factory, nail mills, harvesting machinery factory, numerous fine office buildings, city and county buildings, and a number of hotels, which are always crowded. The Muncie, Hartford & Fort Wayne Traction Company connects for Bluffton and Fort Wayne, while the Indiana Union Traction Company operates to Anderson and Indianapolis, and connects for numerous other cities. The traction interests centering there have completed arrangements for the erection of a fine freight and passenger station. Other lines are projected from Muncie, and it promises to be the second most important traction center in the State.

When the Greenville-Muncie extension was decided upon, several preliminary designs were worked out relative to the location of the power station, and the general plans were as follows:



INTERIOR OF DAYTON & MUNCIE STATION AT WINCHESTER

(1) Increasing the Dayton & Northern power house.

(2) Building a power house solely for the new section.

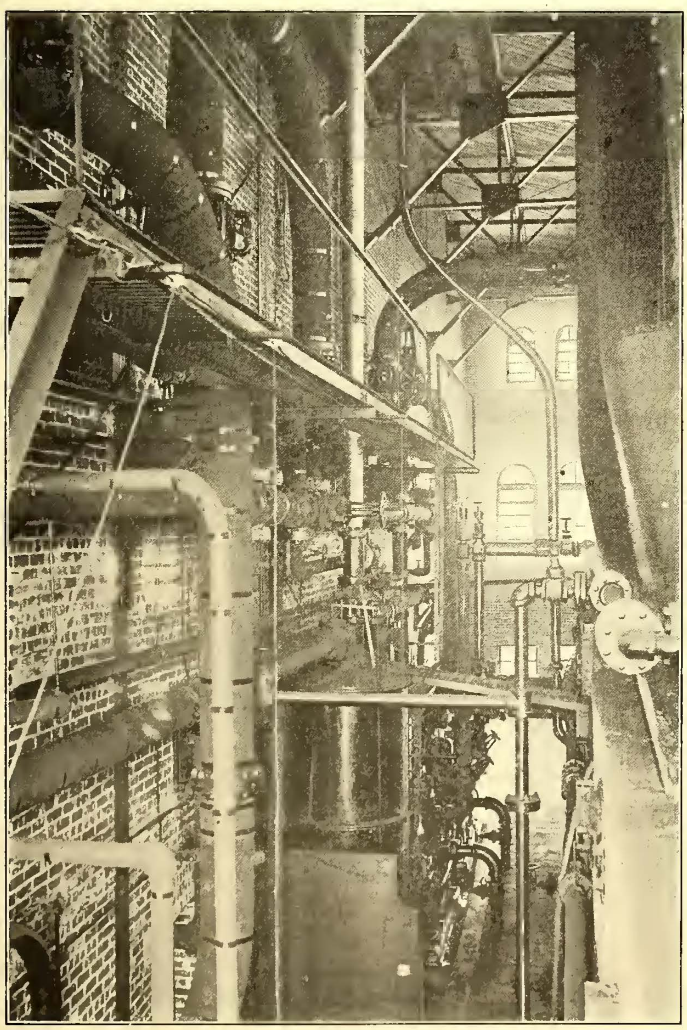
(3) Building a new power station for both sections and transferring all of the power generation for both roads to it.

Preliminary estimates of the first cost and operating expenses were made for each of the general plans and for several subdivisions, and the decision was to locate a new station at Winchester, Ind., to be used chiefly for the new section, and to locate a large sub-station at Greenville and have this sub-station feed a portion of the Dayton & Northern, thereby relieving its station.

One difficulty encountered was obtaining ample water for condensing purposes, especially at a point on the line of the road where it was possible to obtain coal direct from a steam road. The Dayton & Northern station was furnished with water from a very small stream and from wells, and had cooling trays, and there was not sufficient water to more than double the output, which would be necessary to provide power for the entire system.

POWER STATION

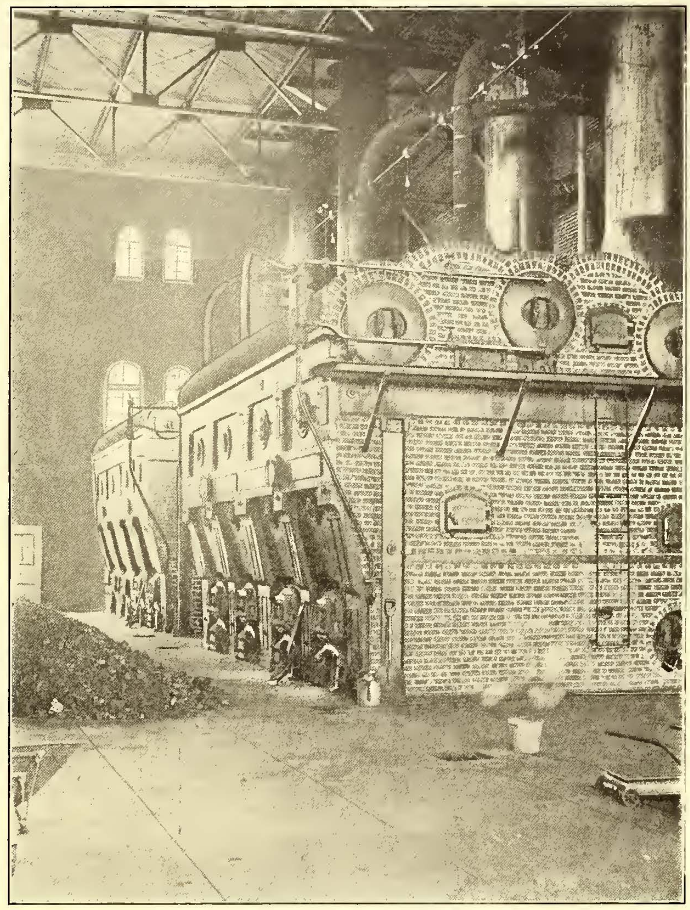
As stated above, the new station was located at Winchester, where there is a small stream, which was dammed to create a pond, and cooling trays were installed. A connection was also made with the city waterworks system. This enables the station to pump into the city mains in case of fire. The power house also has a fire pump for its own protection and that of the adjacent car house, while the connection above mentioned



STEAM PIPING AND PUMPS BACK OF BOILER

enables the city and railway to be mutually helpful in case of emergency.

The station building is of plain but neat design, and is of machine brick with red mortar and stone copings. It has a wing on one side for fuel storage bins, and on the other for a static room. In the engine room are two Westinghouse 500-kw 400-volt a. c. generators of the revolving-field type, driven by 21-in. and 42-in. x 48-in. horizontal cross-compound Buckeye engines operating at 95 r. p. m. Provision has been made in the station layout for the installation of a third unit of the same or larger capacity. There are two exciter sets, composed of 37½-kw Westinghouse generators, each driven by a Buckeye simple engine running at 300 r. p. m. The condensers for the main engines are of the surface type, Stilwell-Bierce-Smith-Vaile manufacture. Each engine has a separate condenser, but the exaust piping is cross-connected so that either will handle either engine. A Bundy vacuum oil separator is provided in the exhaust of each engine operated in connection with a 6-in.



BOILER ROOM AT WINCHESTER

x 8-in. x 10-in. vacuum pump. The live steam separators for the exciter engines are Cochrane.

There are two 10-in. x 6-in. x 12-in. boiler feed-pumps of the outside-end packed plunger type and having pot valves. There is a 6-in. x 8-in. x 10-in. duplex piston pattern pump for pumping water to a 1600-hp Stilwell-Bierce open heater. A 5¼-in. x 4¾-in. x 5-in. duplex piston pattern pump provides water to a supply tank for house purposes. A 16-in. x 9-in. x 12-in. Underwriters' fire pump takes care of the fire service. The pumps, the heater and steam piping are arranged back of the boilers, there being a space of about 9 ft. between the wall and the back of the boilers. All of these pumps are Stilwell-Bierce-Smith-Vaile manufacture. Each is provided with a Fisher governor, and they have cast-iron drip pans to catch all drip, pans being piped to drain. All governors are by-pass. All high-pressure receivers, heaters, steam headers, etc., are drained by the Holly system, and an auxiliary feed-water line connecting with each boiler is provided in addition to the main feed line. A Worthington hot-water meter is placed in a by-pass of the feed-water lines. The condensed steam in the engines is discharged into a cast-iron hot well adjoining the feed-water heater. A float valve is placed in the line from the condensing water discharged from the condensers, and an additional connection to the hot well is also made from the city water service. All boiler feed lines, fire lines, city water lines, tank lines and water line to header are cross-connected. There is a cold well outside the building, with lines from this to the condensers and to the various pumps. The suction piping is so connected that the heater pump can take water from either

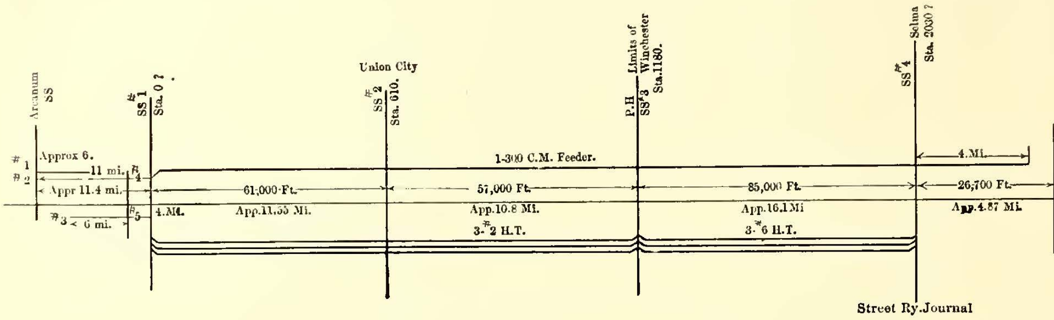
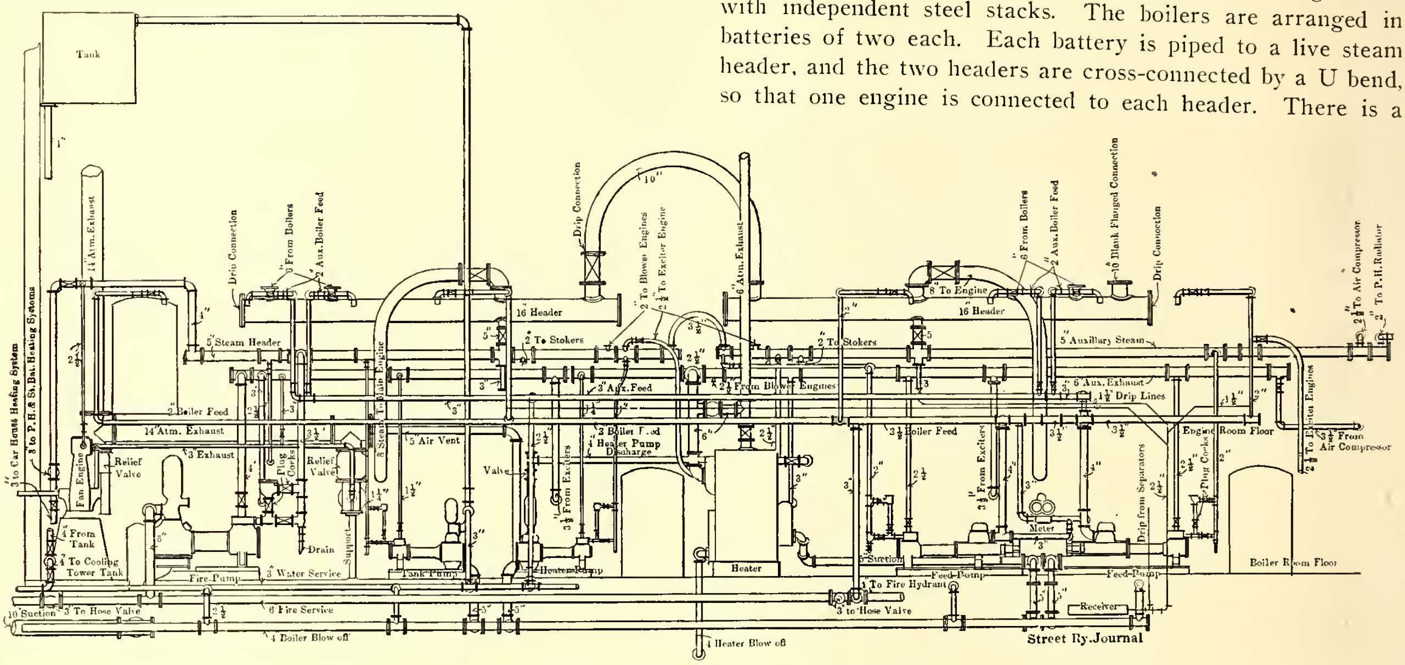
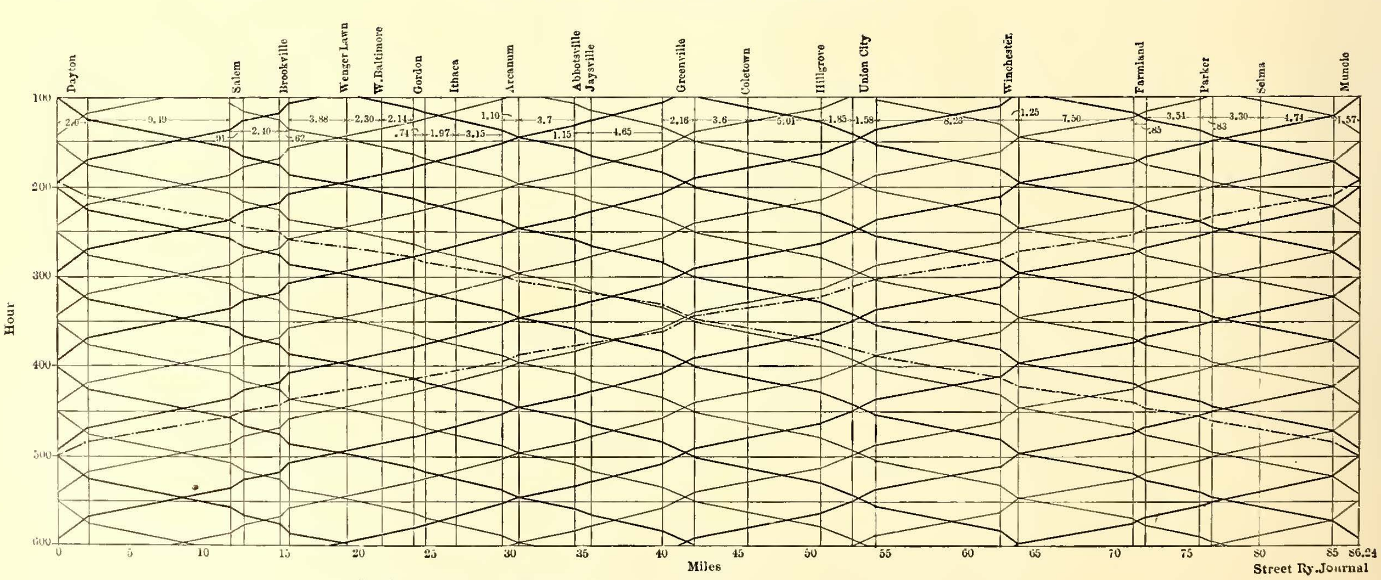


DIAGRAM OF FEEDER SYSTEM

the hot well or the cold well, and the feed-pumps can obtain water from the heater, hot well or cold well and discharge through either feed line to the boilers; also either boiler feed-



ELEVATION OF BOILER HOUSE PIPING



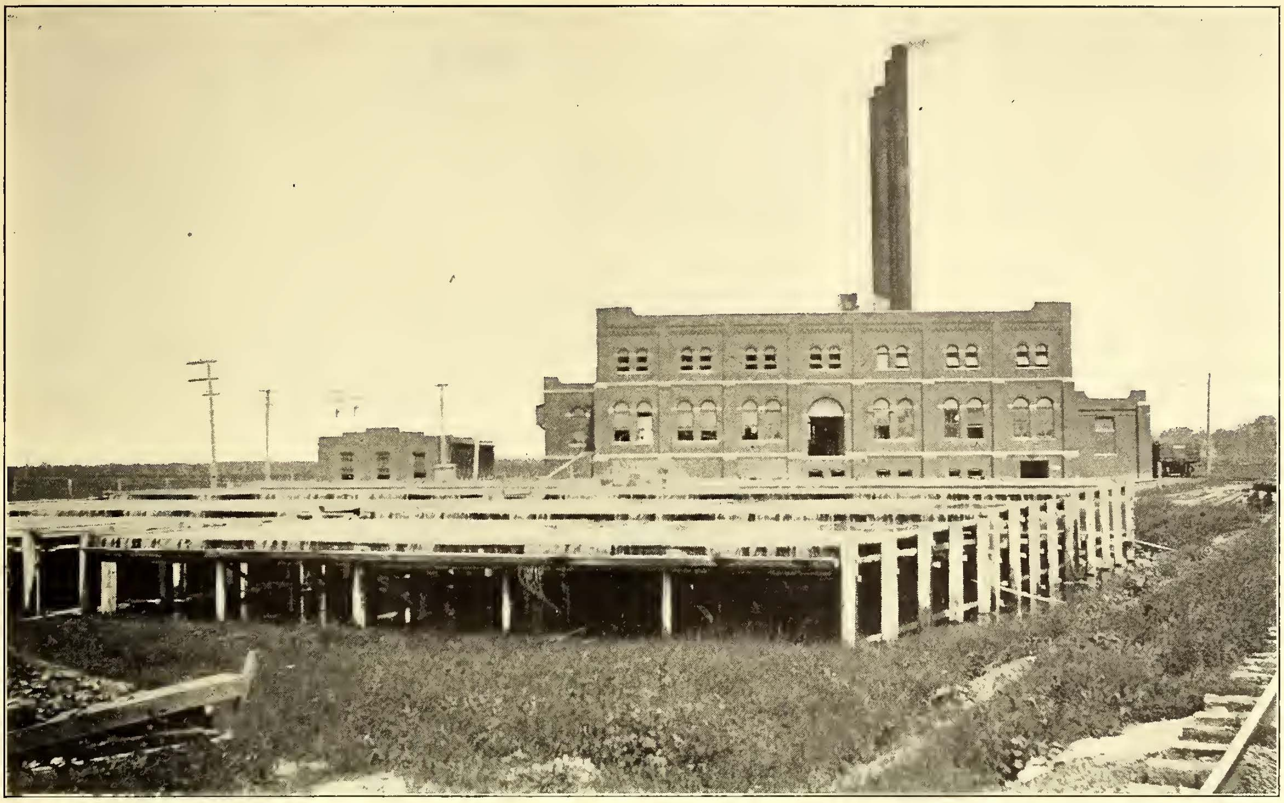
AFTERNOON TIME TABLE BETWEEN DAYTON AND MUNCIE

pump can obtain water from the heater, the second pump obtaining water from the hot well or the cold well.

The condenser discharge is cooled for re-use by means of the cooling trays illustrated in the view of the power station. The trays were designed to handle double the present capacity of the house, and are provided with sectionalizing walls so that any portion can be cut out for repairs, and they can be leveled up in sections. The water after leaving the trays passes to a point not far from the pond overflow and at some distance from the cold-well intake, so that the coolest water is used first, and if there is any overflow, it is the water from the trays.

A gravity oil system is provided for the engine oil supply. The oil is returned to a 150-gal. Cross filter and storage tank, and is pumped from the tank and filter to a supply tank near the boiler room roof by a small Marsh pump.

The boiler equipment consists of four 250-hp Stirling boilers with independent steel stacks. The boilers are arranged in batteries of two each. Each battery is piped to a live steam header, and the two headers are cross-connected by a U bend, so that one engine is connected to each header. There is a small header for the auxiliaries below the main headers, and the necessary valves are provided so that the headers can be subdivided into groups for repairs. The connection is such that each main engine is complete with its complement of two

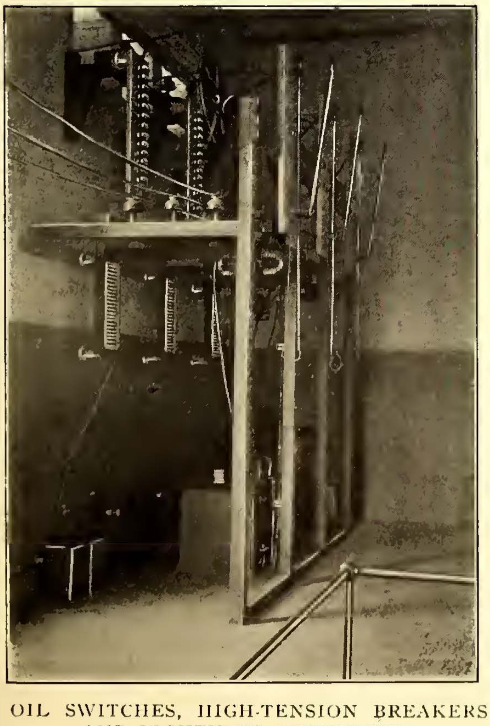


POWER STATION AND COOLING TRAYS AT WINCHESTER

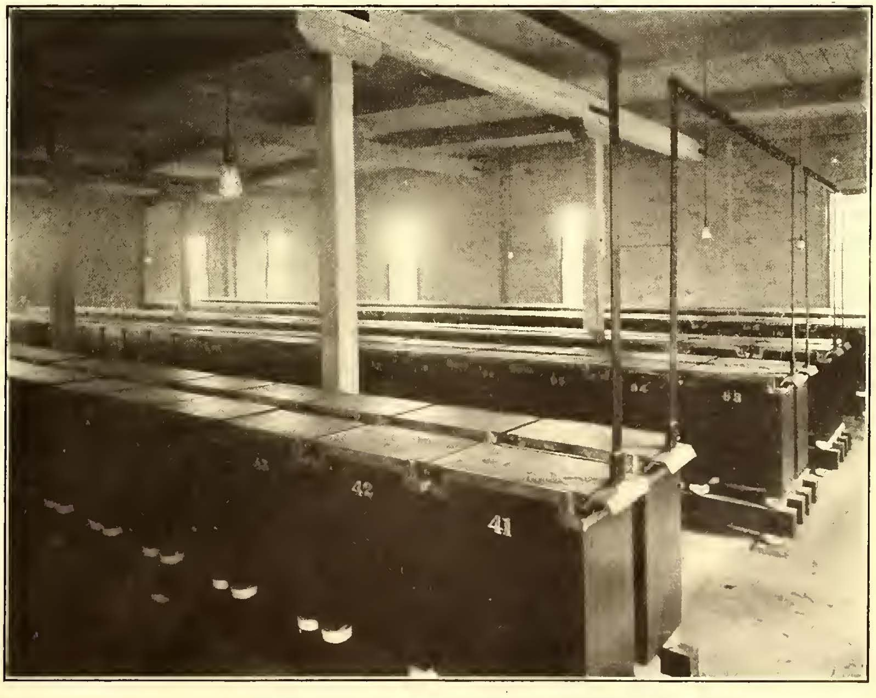
boilers, one feed-pump and one exciter engine. At the same time the auxiliary header connections are such that either exciter engine or feed-pump can be operated off from either battery or boilers.

All piping and steam auxiliaries were furnished by the Shaw-Kendall Engineering Company, of Toledo. The piping is all covered with Keasbey & Mattison pipe covering painted terra cotta, and it presents a very neat appearance. All high-pressure piping has 85 per cent magnesia covering.

In the basement below the static room of the power station there is one bank of 200-kw transformers and one of 100-kw transformers, with extra transformers in each group. The transformers are oil-cooled and raise the voltage from 400 volts to 16,500 volts. Directly above the transformers in the static room are oil switches on the high-tension side, which are operated by hand from the switchboard placed in the engine room. They are provided with automatic trips, operating in case of overloads. The transformers are also connected to the low-tension bus-bars by knife switches and circuit breakers placed on two transformer panels. A high-tension cross-connecting oil switch is also provided. Normally, the bank of 100-kw transformers takes care of the Selma sub-station located at the west end of the line, and the bank of 200-kw transformers provides current for the Union City and Greenville sub-stations to the east of the power station, but the connections are such that either or both banks can be used for either section. Thus, in case of light loads, the bank of 200-kw transformers will take care of the load on both lines.

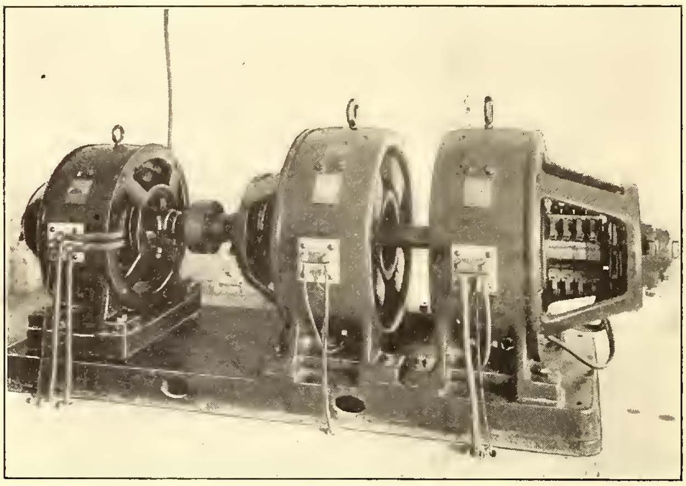


OIL SWITCHES, HIGH-TENSION BREAKERS AND LIGHTNING ARRESTERS



SELMA STORAGE BATTERY PLANT

There is also provided in the power station one 200-kw rotary supplying 650 volts direct current. In both the Selma and Union City sub-stations there is a 200-kw rotary with its

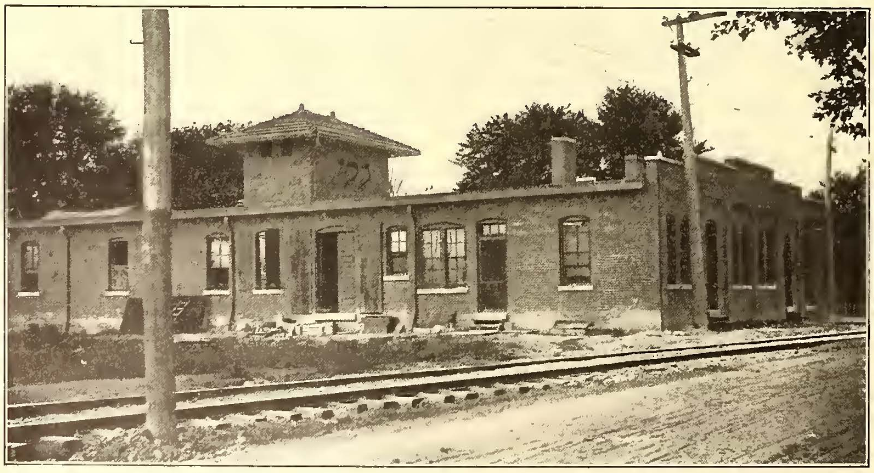


BOOSTER SET FOR BATTERIES

complement of 75-kw statics, switchboard, etc. The Greenville sub-station is provided with one 300-kw rotary and a bank of 100-kw statics, switchboard, etc. In addition there is a portable sub-station with a 200-kw rotary with 75-kw oil-cooled statics, switchboard, etc. All the above electrical apparatus as well as car equipments were furnished by the Westinghouse Electric & Manufacturing Company.

STORAGE BATTERY

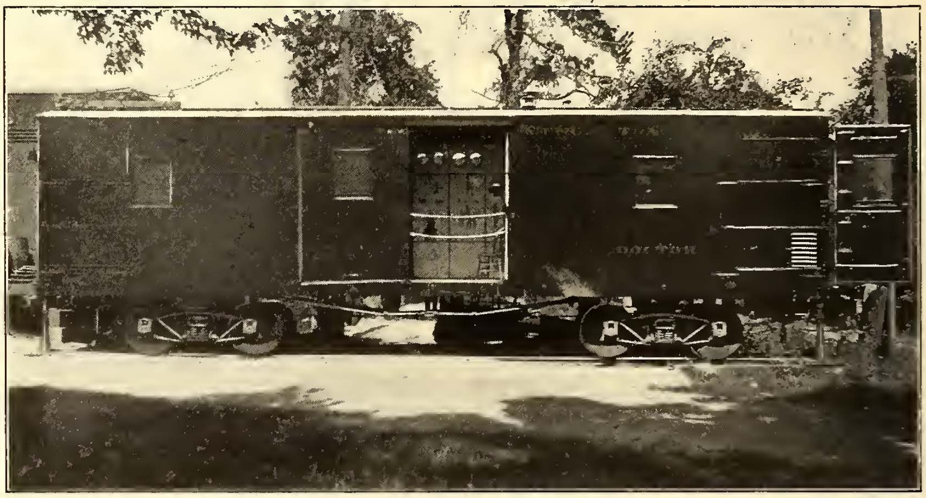
At the power house and at each sub-station there is a Gould storage battery having a normal discharge rate of 320 amps. for one hour, provision being made for an increase in the capacity to 400 amps. Each battery is provided with a booster set, consisting of a booster generator and a c. e. m. f. generator, driven by a 650-volt shunt-wound motor. The booster automatically prevents the fluctuation of load falling upon the rotary or rotaries, from exceeding 5 per cent above or below the average when the average is not less than 60 per cent of the capacity of the rotary or rotaries in operation and the battery is approximately 75 per cent full. The same regulation is also obtained under the same conditions with the average load less than 60 per cent capacity of the rotary or rotaries in operation. It will be seen that the use of these batteries at each station permits of the use of smaller rotaries than would otherwise be necessary, and the regulation at the power station is much better. The batteries were furnished complete with the booster sets and necessary switchboard panels by the Gould Storage Battery Company. The installation is first-class, particular attention being paid to insulation. The battery cells rest on wood blocks resting on porcelain insulators. These rest on heavy stringers, which in turn rest on other insulators, and finally these insulators are imbedded in sulphur blocks on the tile floor. The battery house roofs are of slow-burning mill construction, and the rooms are all steam heated by Peter Smith heaters. At the power station there is a distillery for providing distilled water for the batteries.



SELMA SUB-STATION, DAYTON & MUNCIE

SUB-STATIONS

The sub-station buildings are of three distinct types. At Greenville the building is located on the Public Square, and it consists of passenger waiting room, ticket office, freight office, large receiving platform with track at the side, room for sub-station machinery and battery room. At Union City a three-story brick building, formerly used as a wholesale warehouse, was purchased and remodeled. It is located on the main street, within 100 ft. of the main business corner. The front portion of the first floor was fitted up for ticket office, waiting room and



PORTABLE SUB-STATION

freight room, while the machinery room is in the rear. One section of this was partitioned off with heavy brick wall for the transformers and high-tension apparatus, the high-tension lines running up to the top of the building through a fireproof flue, which also serves to ventilate the transformers. The basement is ceiled off with concrete and tile roof for the storage battery room. The two upper floors have been rented at good profit.

The sub-station at Selma has a residence for attendant, in addition to freight and passenger rooms, machinery room and storage battery room, and it is interesting to note that it is but one-story high. The living rooms are arranged so that the attendant from his chamber can see the switchboard and machinery. The static room is ceiled off with fireproof walls and window covers, and the high-tension lines enter through a fireproof tower, which has tile roof. An exterior view and details of this station are presented.

CAR HOUSE AND REPAIR SHOP

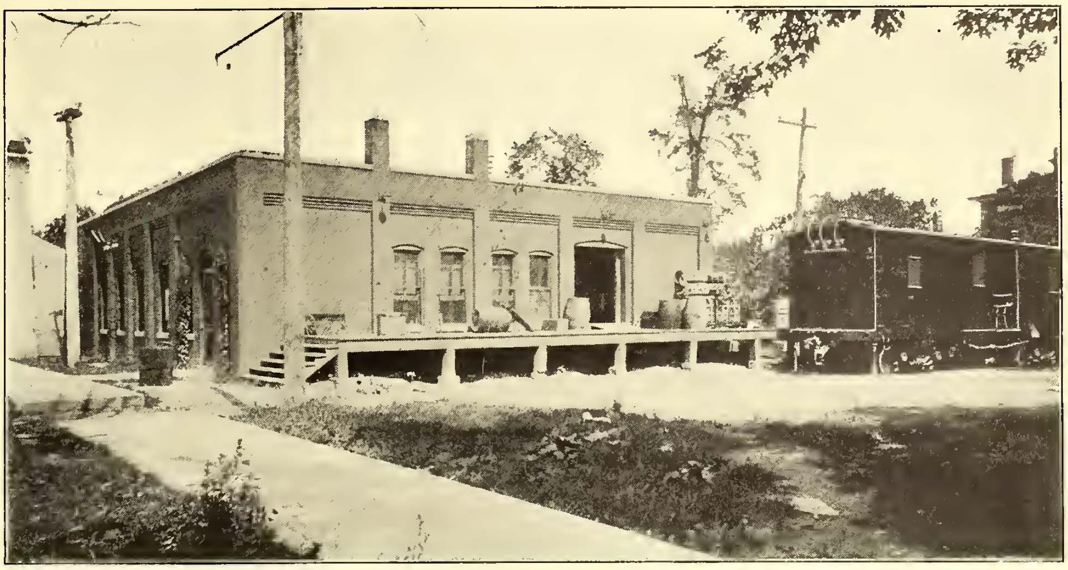
The car house and repair shop building is in front of the power station at Winchester. It is 83 ft. x 170 ft., of mill construction. There are four tracks for storage, each long enough for three cars, with pit under each track at the front of the building. The repair shop portion is separated from the storage room by fireproof wall. There is a 90-ft. pit in the shop, and the balance of the space is partitioned off for armature room and stock room. Air is used for cleaning and for certain tools, but not much machinery has been installed, as the heavy work is taken care of at the Dayton & Northern shop at Brooksville.

ROLLING STOCK

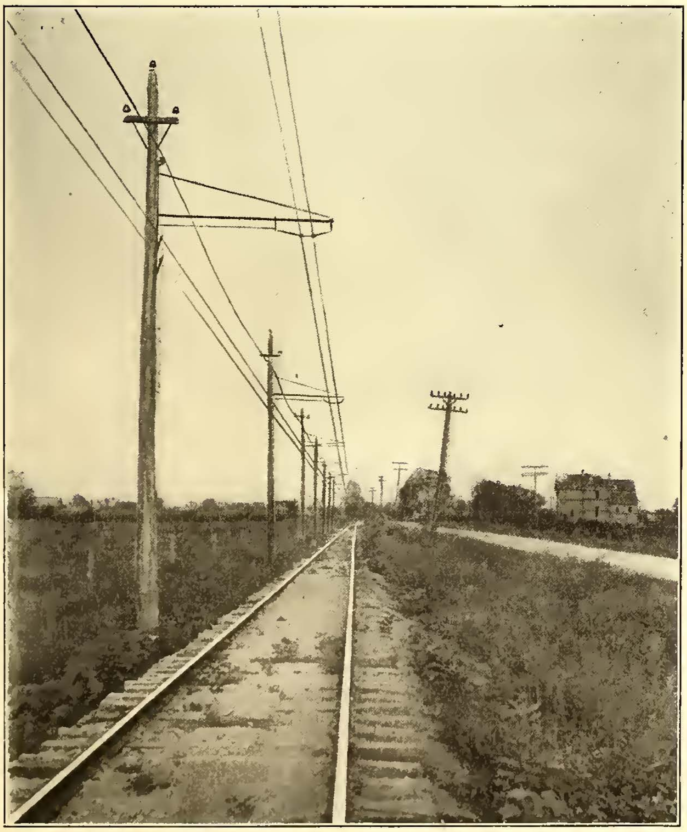
The rolling stock consists of eight passenger coaches, two combination passenger and baggage cars, one express car and one work car. The passenger cars are double-end steam coach type with drop platforms and with round three-front window vestibules, step openings being enclosed by double folding doors. They were built by the Stephenson Company, and have Peckham No. 36 M. C. B. trucks and four Westinghouse No. 56 motors. The Christensen storage air system is used for brakes, the air reservoirs being filled at Winchester each half trip. Air is supplied by an Ingersoll-Sergeant compressor located in the power station, which also supplies the repair shop. The storage air system is also used on the Dayton & Northern, and the desirability of having the cars of the two lines uniform and interchangeable caused its adoption by the Dayton & Muncie Traction Company.

TIME-TABLES

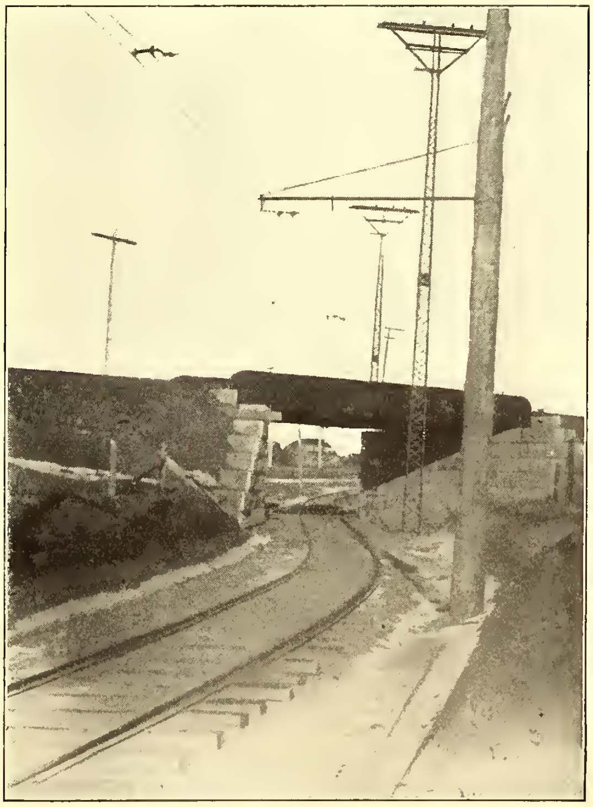
The diagram on page 980 gives a graphical time-table of the company. According to the usual method, distances are shown on the lower horizontal line, and the names of the towns are given upon the upper horizontal line. Time is shown on the vertical line at the left. The diagonal lines represent the movement of passenger cars. The heavy full lines represent cars operated on hourly headway, and the light full lines intermediate cars giving half-hourly service. For example: Starting at the upper left-hand corner of the diagram and following the diagonal, the car leaving Dayton at 1 will be found to reach the terminus at Muncie a few minutes before 5. The dot and dash lines show the time of the run of a "limited" train making no stops in the country and only one stop in each of the principal towns along the route.



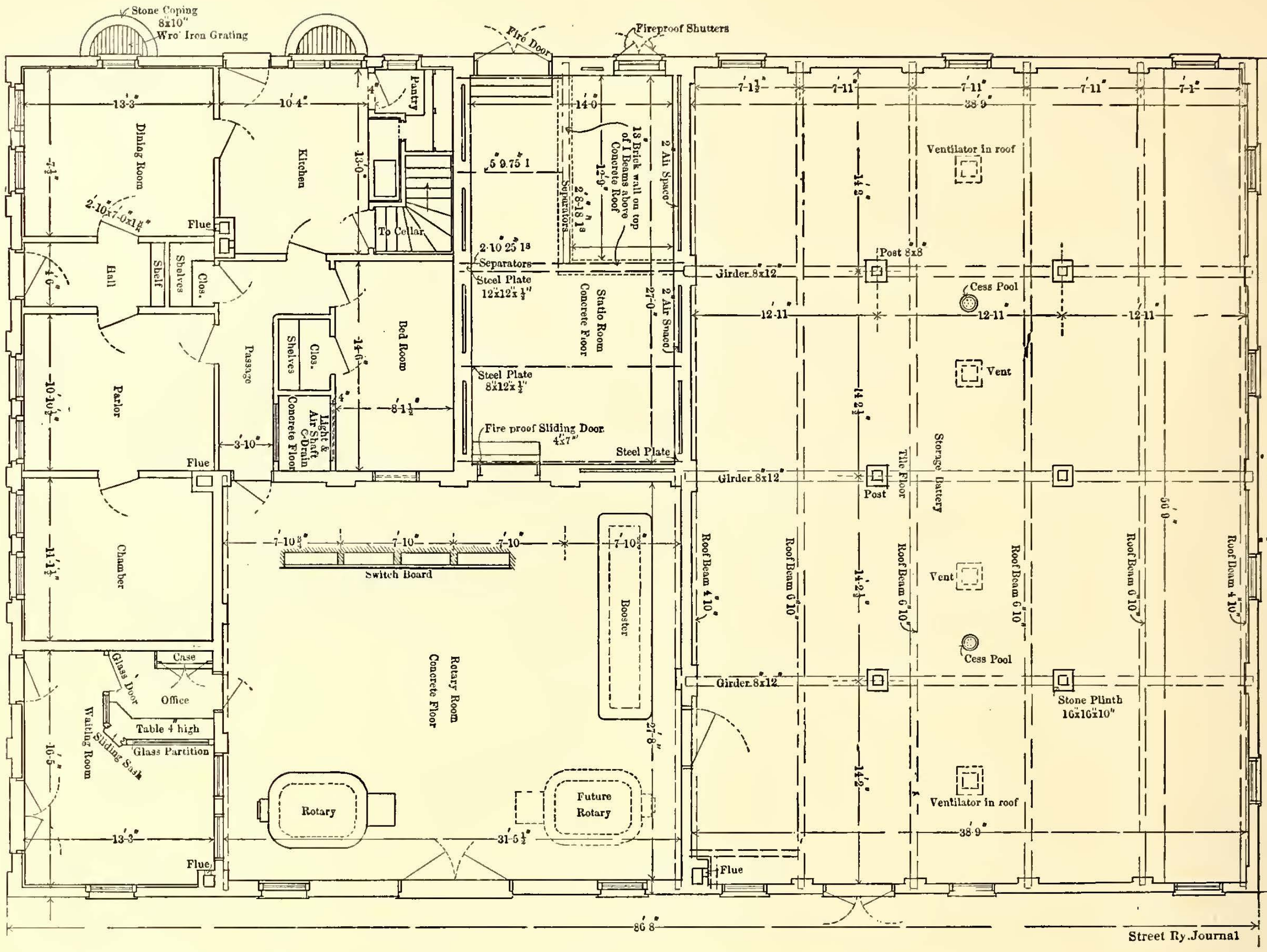
GREENVILLE SUB-STATION, WITH SUB-STATION CAR HELPING OUT



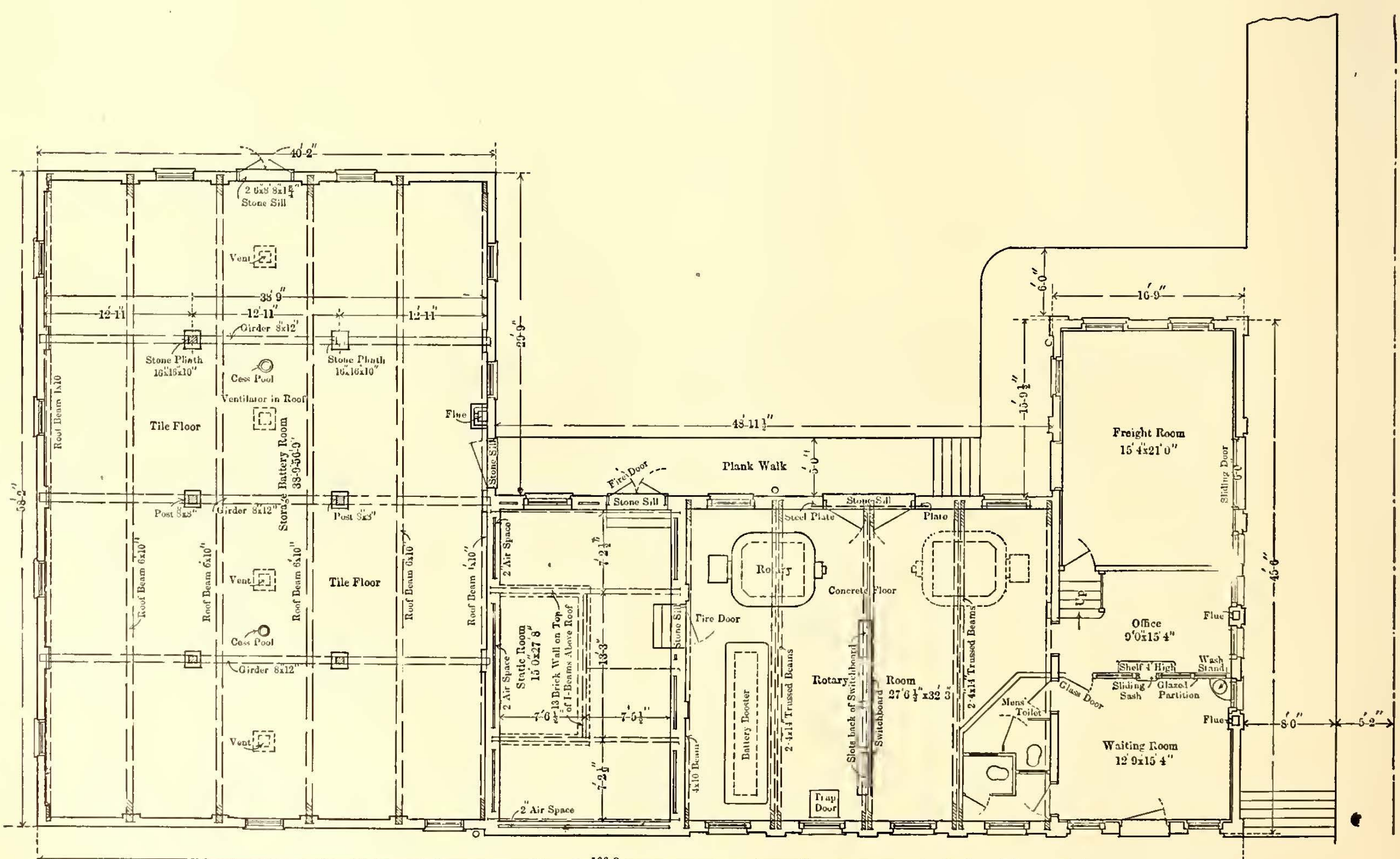
TYPICAL VIEW ON LINE, DAYTON & MUNCIE



UDERGRADE CROSSING, SHOWING STEEL POLES FOR H.-T. WIRES



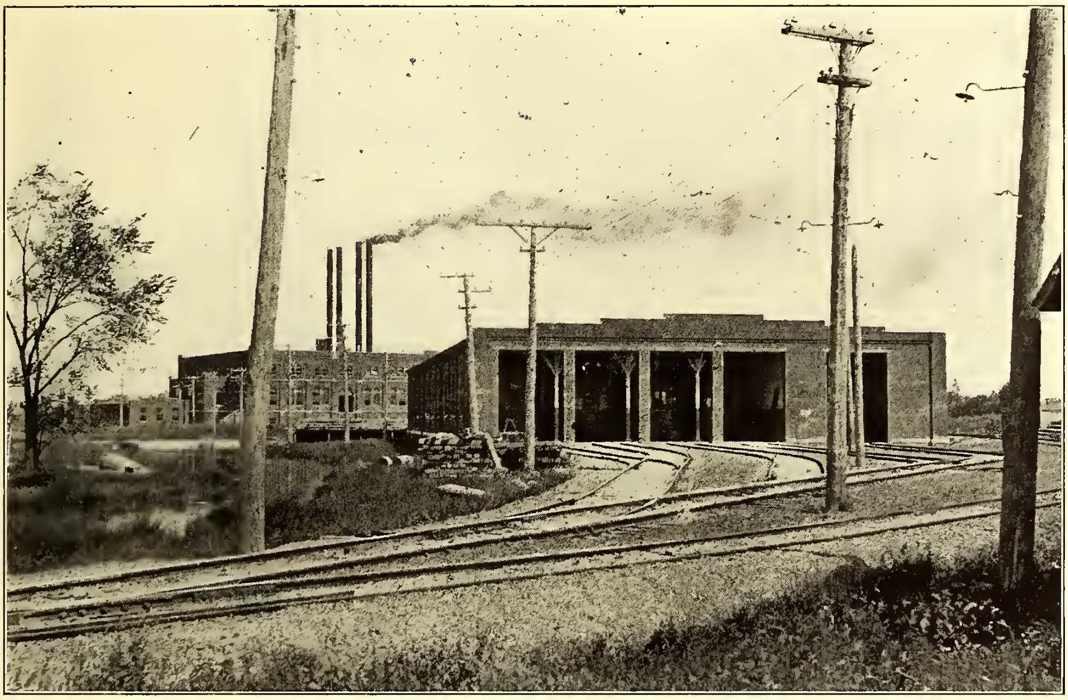
FLOOR PLAN OF SUB-STATION AT SELMA



FLOOR PLAN OF SUB-STATION AT GREENVILLE

LINE CONSTRUCTION

The line work is first-class bracket construction, all Ohio Brass Company's material. Two high-tension lines are placed on a cross-arm and one on the ridge iron at the top of the pole. Double three-pin arms are used on all curves greater than 5 degs. Insulators are 6-in. porcelain. The high-tension line is carried over two railroad crossings on structural iron poles and cross-arms, a grounded copper wire net or guard being suspended below the high-tension wires at these crossings. A 300,000-circ.-mil feeder, extending practically the full length of the line, is carried on malleable-iron brackets. The trolley consists of two No. 000 figure 8 wire. Stromberg-Carlson telephones have been provided at all passenger stations, sub-stations, despatcher's office, car house, power house, sidings and for each car. The telephone wire consists of No. 10 B. B. wire.



CAR HOUSE AND REPAIR STATION, DAYTON & MUNCIE

The line work was furnished and installed by G. E. Fisher, of Detroit.

The right of way averages 50 ft., all of it private, in the country portions. A greater portion of the distance it is adjacent to the highway. Special attention was given to passing through towns without right angle turns, there being but one of this kind on the line. The curves in the country are 3 degs. or less, with the exception of one 7-deg. curve, which is 200 ft. long. There are two overgrade crossings, three undergrade crossings and three crossings at grade, located in towns. The maximum grade is under 2 per cent. The track is laid with 70-lb. rails in 60-ft. lengths, and it is bonded with Ohio Brass Company's 10-in. twisted copper bonds. It is ballasted with good gravel, 150 yds. to the mile. There are eight small bridges, two of them, about 40 ft. long, are through plate girders; the others are I-beam girders on concrete abutments.

OFFICERS

The officers of the Dayton & Muncie Traction Company are F. J. Ach, president; T. J. Weakley, vice-president, and W. B. Gebhart, treasurer. The road was practically completed under the presidency of the late Dr. J. E. Lowes, who also financed and built the Dayton & Northern line. J. E. Feight, secretary, has charge of the operation of the property, and Frank Newsbaum is chief engineer.

The plans and specifications were furnished by the Roberts & Abbott Company, of Cleveland, who also supervised the construction, the company being represented in the field by M. A. Munn, C. E., and Bret Harter, E. E.

INVESTIGATION OF MUNICIPAL OWNERSHIP.

A few days ago a call was issued by Melville E. Ingalls, chairman of the committee of twenty-one appointed to investigate municipal ownership under the auspices of the Civic Federation, for a meeting of the committee in New York on Nov. 27. This committee, as announced in the Street Railway Journal for Oct. 14, was appointed by the Public Ownership Commission, organized to investigate actual conditions of municipal ownership in this country and Europe. Mr. Ingalls is chairman of the board of directors of the Big Four Railroad, of Cincinnati, and the members of the committee are heads of corporations, prominent college professors, journalists, publicists and heads of unions in trades.

A sub-committee, which consists of Frank J. Goodnow, of Columbia University; E. W. Bemis, superintendent of the Cleveland waterworks; Walton Clark, third vice-president of the United Gas Improvement Company; M. R. Maltbie, of New York, and J. W. Sullivan, editor of the "Cloth-Trades Bulletin," and which has for some time been engaged in preparing a report on the scope and methods of the investigation, has made the following recommendations:

That as many members of the committee of twenty-one as can find it convenient, visit, in a body, such of the muncipal plants of this country as may be selected as fairly presenting the measure of financial and operative success or failure attained by municipally owned and operated plants in America, and study the conditions and the results to the municipality, the consumer and the citizen generally.

That the sub-committee be authorized to arrange for the employment of engineers and accountants to aid the committee in its work.

That the sub-committee be authorized to select one or more members of the committee of twenty-one to direct and devise such experts in their work.

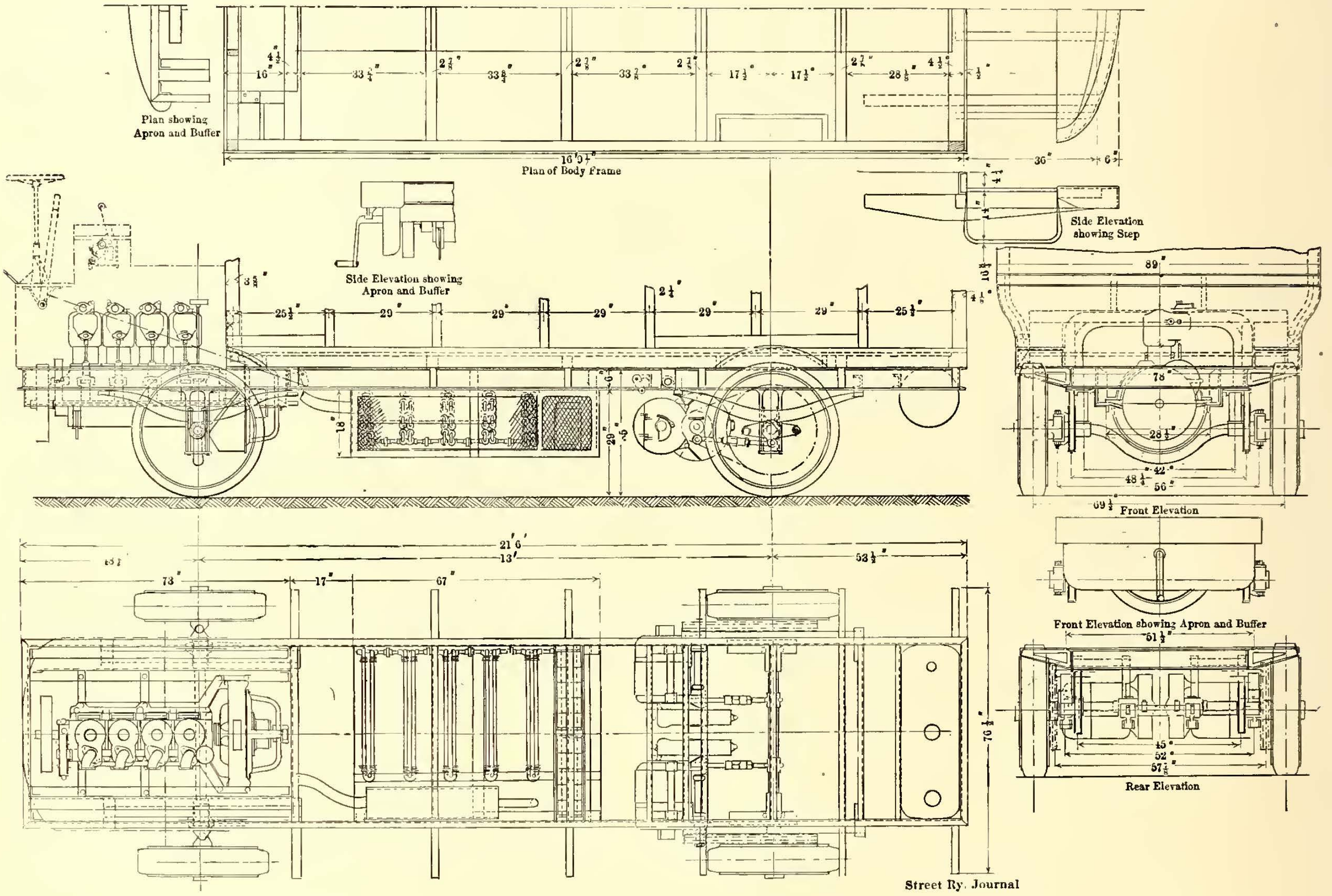
That, when the committee of twenty-one has made a study of conditions in this country, said committee, or as many of them as may find it convenient, shall visit Europe in a body and examine there, as in this country, into the operation and effect of the various forms of management of public utilities, as indicated by the reports of the experts and otherwise.

That, to collect the facts relating to private and municipal ownership and operation, information be secured upon points falling under the following general heads: (1) Franchise of private corporations. (2) Public supervision of municipalities. (3) History of municipal ownership. (4) Effect of public and private management upon: (a) Political conditions; (b) conditions of labor; (c) character of service; (d) price of service; (e) cost of service; (f) economy of management; (g) improvement in service and methods; (h) financial results.

Each of these subjects is to be carefuly investigated and a list of questions, about 1000 in number, relating to the franchise, political and operating conditions in the different cities.

GASO-ELECTRIC EQUIPMENT FOR FIFTH AVENUE 'BUS

In the description of the thirty-passenger gaso-electric omnibus in use on Fifth Avenue, published in the STREET RAILWAY JOURNAL for Oct. 28, a short account only was given of the motive power equipment. As stated, it consists of a gasoline-electric set which furnishes power to two series electric motors driving the rear wheels of the car. The generating set, controller and operating mechanism, which were developed and supplied by the General Electric Company, are contained in a compartment forward of the body, and are easily accessible for adjustment and inspection. The engine is supported lengthwise on an underframe, and may be started either in the usual manner, by means of a hand crank at the front of the car, or by the following very simple method:



ASSEMBLY OF CHASSIS FOR GASO-ELECTRIC OMNIBUS, FIFTH AVENUE

A small storage battery of ten cells is carried to supply current for the numerous electric lamps used. This battery is not normally in the generator circuit and is removable for charging. By throwing in a knife switch, which connects the storage battery to the generator as a motor, the driver may start the engine without leaving his seat. The importance of this feature cannot be emphasized too highly, as there are times, when handling a 'bus in congested city traffic, that it is of the utmost importance that the driver be able to start his engine immediately, if it should have been stopped.

Another feature worthy of notice is the location of the driver's seat, which is placed transversely on top of the engine compartment. This is an original detail in omnibus design, and represents a saving in total length of the 'bus of about 4 ft. Further shortening of the car is effected by facing the forward inside seat to the rear, which leaves a box-like compartment for the generator.

Suspended from the steel frame, between the front and rear wheels, are the cooling coils, water pump, muffler and lighting battery, all of which are protected at the sides by woven wire screens.

CONTROL

The speed control of the car is extremely simple, and is effected principally by varying the gasoline motor speed by means of a spring-returned foot pedal, which, when depressed, advances the point of ignition and opens the throttle. The levers which perform these functions are so arranged that the spark and throttle are moved in proper relation throughout the whole range of speed of the engine. If for any reason the driver, either voluntarily or involuntarily, removes his foot from the pedal, it automatically reduces the motor speed to its minimum running point, at which the generator is not sufficiently excited to move the car, even though the controller is on the high-speed notch. It is clear that this device also insures automatic retardation of the spark so that the operation of starting the car is perfectly safe.

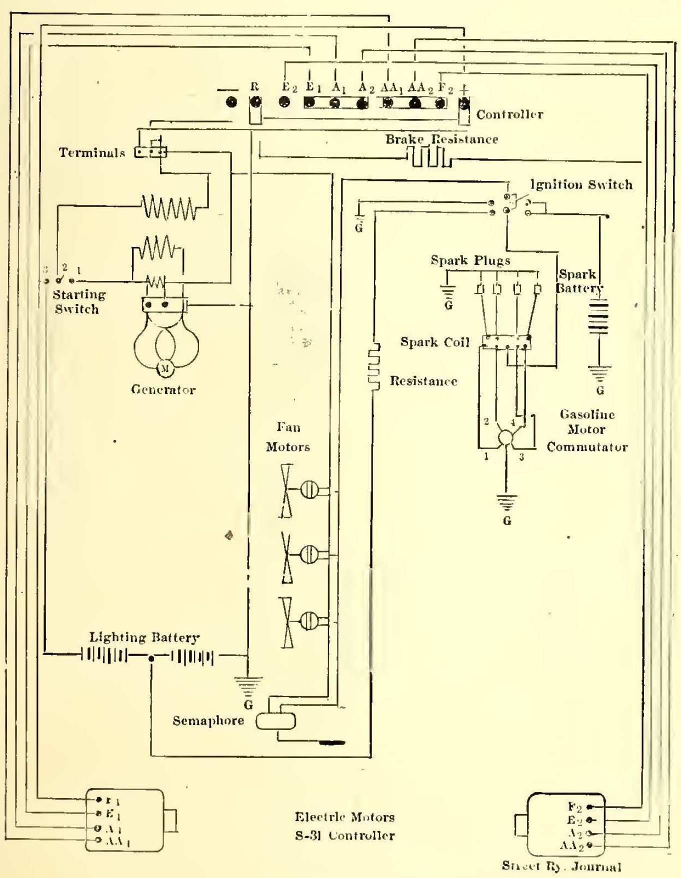
Further control in the speed of the car is secured by an electric controller which is used for reversing the motion of the car, and provides what may be called a low-gear notch, by placing the two motors in series, for very heavy grades or roads. On the high-speed notch, which is used about 90 per cent of the time on average roads, both electric motors are in multiple; on the high-torque notch they are in series. The first notch back of the rest position gives an effective electric brake for forward motion of the machine, and the first notch forward brakes the car when it is running backward. The operation of electric braking is effected by closing the circuit of the motors when the car is running, with a resistance inserted. A diagram of the motor connections is presented herewith. A full stop may be made by the use of the powerful mechanical brake which will be mentioned later.

Under actual running conditions on Fifth Avenue, the driver starts from a standstill, accelerates quickly to the desired car speed, slows down and stops again, using only the single foot pedal, above referred to, over the entire route. In the simplicity of its method of control, this machine is probably unique. Both the driver's hands are always free to steer the car and operate the hand brake for the final complete stop. This permits him to keep his mind on the road, as the movement of the foot pedal is analogous to the functions of the human mechanism which are performed almost automatically as in walking.

By arranging the two motor armatures in multiple, and in series with the two fields, the braking action is positive and independent for each wheel, with a tendency to correct skidding. This feature has been actually demonstrated on several occasions by applying the electric brake suddenly while the car was turning a sharp curve at full speed on greasy pavements, when the rear part of the body slewed only about 3 ft. or 4 ft. An electric brougham under similar conditions would have completely turned around.

EQUIPMENT

The gaso-generator set consists of a 40-hp, maximum-rating, 4-cylinder, 4-cycle engine, built by the Gas Engine & Power Company, directly coupled to a General Electric compound generator, which will give a continuous output of 12 kw and a maximum output for short periods of 24 kw. Both generator and engine are attached to a common base, thereby forming a unit. Careful provision is made for lubricating all bearing



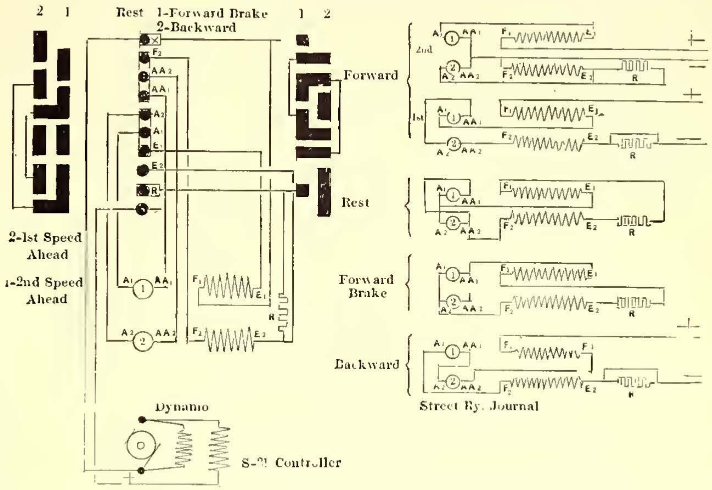
GENERAL WIRING DIAGRAM, FIFTH AVENUE 'BUS

surfaces of the engine, and a mechanical lubricator gives a consistent supply of oil under pressure at necessary points. In addition to this, the cranks are splash oiled. The generator has an oil cellar of large capacity and is ring oiled. The engine is of the usual type and needs no detailed description.

There are two General Electric 1012, 40-amp., 1200 r. p. m. automobile motors of the double-reduction type, suspended side by side from the running frame, forward of the rear axle. Two distance rods, one at the end of each motor, hold them and serve to adjust the chains. These are of the 2-in. standard roller type, and the sprockets have a low ratio of about 3.2 to 1, which gives a quiet and long-wearing condition. The first reduction is by spur gears, which run in oil, and have a ratio of about 5 to 1, giving a total of approximately 16 to 1.

The controller is of the well-known General Electric type for use on automobiles. For this particular work, extra wide fingers and contacts are provided.

A description of the chassis was published in the article on the 'bus in the issue of Oct. 28, so that it will not be repeated



CONTROLLER DIAGRAM, FIFTH AVENUE 'BUS

here. It might be stated, however, that the body is mounted on a running frame composed of light section structural steel channels, to which are fastened short steel axle guides which take all thrust and hold the axles in adjustment as in locomotive construction. The necessary cross members are securely riveted to corner angles and special forgings are used where stresses are concentrated. All four wheels are of artillery type, 36 ins. in diameter, and are made of wood. Seven-inch standard automobile rubber tires are employed for passenger service on account of their resiliency. The car is hung on four long half springs to give easy riding qualities.

The braking arrangement is very complete. Large double-acting internal brakes are fitted securely to the rear axle so that they may be expanded with great pressure against drums attached to the driving wheels of the car. A novel arrangement is introduced in the method of applying them. In addition to the usual foot lever, and on the same shaft, is a long hand lever which may move the brake rocker shaft by means of a dog. The long lever is like the emergency handle of a touring car and has a ratchet segment so that it may be locked in any desired position. Normally it is held by a catch against the seat, and the foot lever may be operated without regard to it. As the hand lever is several times as long as the foot pedal, it is obvious that the brakes may be set to the same degree, by its use, with less pressure but more movement of the body, and to a greater degree by additional pressure.

The total weight of the omnibus, including all supplies and the body, is about 15,500 lbs. The chassis complete with supplies weighs about 10,000 lbs.

PERFORMANCE

In a test run on Fifth Avenue a short time ago, the following readings were taken, showing the average generator output:

Output	KW	Volts	Amperes	Car Speed
Down	7.10	86.9	81.7	9 m.p.h.
Up	8.59	90.0	95.5	9 m.p.h.
Maximum at 36th St., Up	17.47	112.0	156.0	4 m.p.h.

The maximum speed of the car which can be maintained is 15 m.p.h., although it has run on tests slightly higher than this.

The average gasoline consumption is about six-tenths (0.6) gallon per car-mile. Forty gallons of gasoline are carried in a drawn steel tank, which is thoroughly tinned to prevent corrosion. This amount gives a mileage radius of about 60.

RESULTS AT MOUNTAIN PARK, HOLYOKE, MASS.

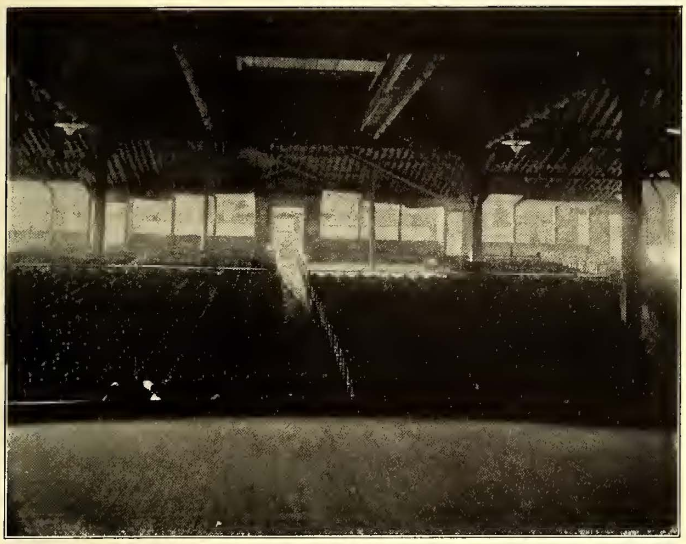
The Holyoke Street Railway Company, operating in and around Holyoke, Mass., maintains a pleasure park known as Mountain Park, located at the base of Mt. Tom. The place is one of the few self-supporting street railway pleasure resorts in the East. In handling the enterprise, the company has followed a few well-defined policies based on experience accumulated during past seasons. Although, as has been frequently emphasized, governing conditions are so different as to forbid the adoption, in toto, in any locality, of methods and policies found successful elsewhere, nevertheless policies that have made for success in one locality are worthy of careful study and attention, for they will always be found to contain suggestions that lend themselves to general application. When an enterprise like Mountain Park, which draws the greater part of its patronage from a tributary population of less than 100,000, can be made not only to pay its own way, but to return good interest on its own investment, leaving the increased railway earnings as profit, the means by which these results have been accomplished must certainly contain lessons applicable to other situations. And in this same connection, speaking of financial results secured at pleasure parks, emphasis must again be placed on the necessity for proper and conservative accounting methods. More than one manager responsible for the maintenance of a park has realized, to his grief, how easy it is to fool oneself in this matter of park accounting. If proper charges for depreciation, insurance, lighting and all the other incidentals that enter as factors are not included in the park balance sheet, the statement will not only be misleading, but in the day of reckoning ahead is more than likely to cause the manager to condemn street railway parks and pleasure resorts in terms that will leave no question of doubt about his feelings.

The management of the Holyoke Street Railway Company some time ago formulated the policy of requiring the park to stand on its own merits, and bear all the charges of depreciation, insurance and miscellaneous expenses properly chargeable to the park account. The park comprises a tract of land about 4 miles from the City Hall in Holyoke, and admirably situated with regard to scenic and picturesque surroundings. No attempt has been made to provide the place with a miscellaneous lot of attractions, but a few well-selected attraction features have been added from time to time, the policy in this regard having been to give enough that was new each year to keep the place fresh and popular. The park is directly under the management of L. D. Pellissier, the treasurer of the Holyoke Street Railway Company. The attractions at the present time include a well-conducted theater, a merry-go-round, a photographic gallery, a small zoo and dancing pavilion. The results from the dancing pavilion during the past season bear out the experience reported from other cities to the effect that public dancing at summer resorts, like roller skating and bowling, can now be revived with success, providing, always, that they are offered with proper surroundings and with strict attention to the moral tone maintained about the place.

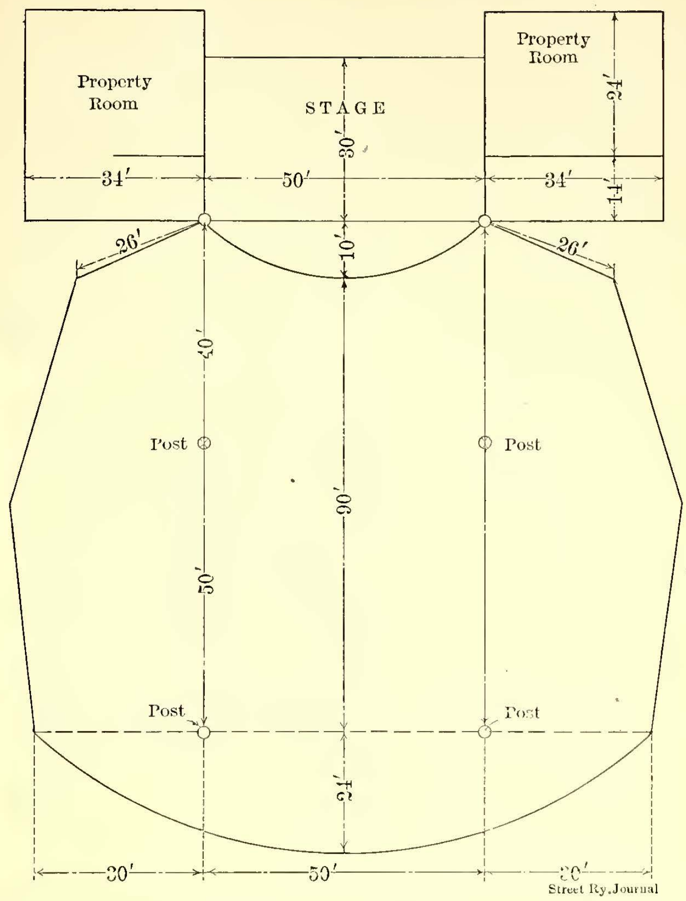
A VIEW OF MOUNTAIN PARK AND SURROUNDING SCENERY AT THE BASE OF MT. TOM, NEAR HOLYOKE, MASS. THE BUILDING IN THE FOREGROUND IS THE CASINO, AS SEEN FROM THE REAR

With regard to the dancing hall, as well as in connection with the theater and other attractions, the management of the Holyoke Street Railway Company emphasizes the necessity for maintaining at a street railway park not only an outward semblance of respectability, but the highest degree of good order, refinement and chasteness. The point is made that park managements often make a pretense of supervising the character of the attractions at their pleasure resorts, but do not always use the same care in supervising the general character of the people admitted. It is recognized that a summer park is not a Sunday school room, and that the whole spirit of the enterprise includes a certain degree of freedom and fun, but the temptation is often strong to lower the standard just a little in order to make room at the park for all classes of the public who care to use the street cars. The experience at Holyoke, and observations made at other places, tends to the conclusion that if it is necessary to cater to two classes, it is better to establish one park or resort on some other line where, if necessary a certain degree of coarseness can be winked at; but it is impossible to mix the two elements at one place. As W. S. Loomis, president and general manager of the Holyoke Street Railway Company, expresses it: "A bench will hold only about so many people, and if you attempt to crowd on to the lower end of the bench the rougher element, the effect will be simply to crowd off of the other end a much larger element which does not care for license in its fun making, and will not countenance any suggestion of rowdyism or coarseness."

At Mountain Park the theater has a seating capacity of 2800 and is devoted entirely to musical comedies. A plan outline is



INTERIOR VIEW FROM STAGE OF THE CASINO AT MOUNTAIN PARK, HOLYOKE, MASS., SHOWING ARRANGEMENT OF SEATS



GENERAL PLAN OF THE CASINO THEATER, SHOWING LOCATION OF THE STAGE, PROPERTY ROOMS AND AUDITORIUM

presented herewith. The admission charge is 20 cents for reserved seats and 10 cents for general admission. The sides of the theater are open so that others can stand outside and witness the performance in this way without paying. High-class vaudeville and other entertainments have been tried, but in every case have been found wanting in this particular locality, and the company has always returned to musical comedy for its theater attraction. Last summer vaudeville was put on for three weeks early in the season, but the summer attraction was light opera, in which twelve performances were given a week for twelve weeks. The railway company organizes its own troupe every season and signs individual contracts with the players. Last year the theater troupe included about twenty-five members, from ten to twelve of which were classed as stars and were paid from $30 to $50 per week. The balance of the troupe consisted of the chorus, the members of which were paid from $12 to $18 per week. The total expenses of conducting an opera of this kind are about $1,000 a week. In organizing the theatrical company and the plays, the railway company avails itself of the services of a man who in the winter time manages city theaters and is well versed in theatrical matters. This man is placed on the payroll of the railway company during the park season, and works under the general jurisdiction of the railway management. He goes to New York early every year and through the theatrical agencies engages the members of the troupe. At the same time he makes arrangements with costumers and producers of stage scenery for all of the costumes and paraphernalia required during the season. Good musical comedies, most of which are copyrighted pieces, and have demonstrated their popularity, are given, and a change of bill is made each week. Appropriate costumes for each production are rented from New York costumers for the week the particular play is given. The change of bill is always made on the Monday matinee, and as a little sidelight on the business, attention is called to the fact that the success of the piece produced during any week will depend

A REHEARSAL OF "FRA DIAVALO" IN THE MOUNTAIN PARK CASINO very largely upon the measure of success achieved at the two opening performances. If the piece and manner of production meets with the approval of these two first audiences, the chances are all in favor of a good attendance during the rest

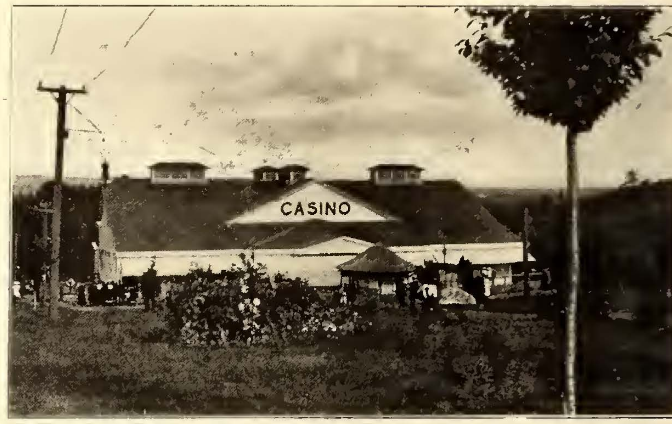
THE OBSERVATORY ON THE TOP OF MT. TOM

of the week, as the news is quickly spread through the press and by word of mouth that the show is worth seeing.

For advertising the theater, the Holyoke Company confines its efforts almost entirely to small cards in the local papers and pasteboard announcement cards in the cars. The announcement cards used in the cars bear a permanent notice concerning the theater and the name of the piece to be given during each particular week is inserted in the permanent card by means of a small detachable slide. More elaborate methods of advertising, such as billposting, have been tried, but are not believed to be warranted as a general thing in a locality where the tributary population is less than 100,000. Additional publicity is sometimes secured by placing a few photographs of the prominent players or special productions in the shop windows on the main street of the city.

With regard to dancing, the Holyoke management has hitherto been somewhat skeptical in consequence of the apprehension that the moral tone set as the standard for Mountain Park could not be maintained. Some time ago, however, it was determined to try the experiment of offering facilities for dancing, and at the outset every precaution was taken to regulate the tone and conduct in the dancing pavilion. A few special officers were stationed at the place with explicit instructions to discourage promptly anything not in keeping with the high standard set. During the first few days and evenings one or two attempts were made to introduce the very things that the management had determined to avoid, but a few cautionary words from the special officers, and in one or two instances quiet ejectment from the park were all that were necessary before the public realized just what the management had in mind by the term "good order." From the first the dancing pavilion has been patronized freely by the best people in the community, and no difficulty was experienced in maintaining the same spirit of etiquette and refinement that would be found in a private dancing academy. The results secured are all the more striking when it is understood that a considerable portion of the park patrons are engaged in paper mills and other factories.

For the dancing pavilion a merry-go-round building was utilized, all that was required to fit it for dancing purposes being the addition of a good floor and the installation of artistic lighting effects. During the season just passed, it was the practice to charge 5 cents per couple for each dance. The collection of the fee was easily regulated by building a light railing around the dancing floor and requesting the dancers to purchase a ticket for each dance at the ticket office. These



A FRONT VIEW OF THE MOUNTAIN PARK CASINO

tickets were then collected as the couples went on to the floor. This practice of charging 5 cents for each dance is believed to include advantages over the system of charging 15 cents or 20 cents or some other stated amount for the entire afternoon or evening. Many of the patrons do not care to dance for a long time, but do enjoy two or three dances during the afternoon or evening. This class of patrons is thus easily accommodated.

The performances in the theater never last over an hour or an hour and a half, so that there is always time for the patrons

ENTRANCE TO MOUNTAIN PARK AND CASINO FROM THE RAILWAY TRACKS

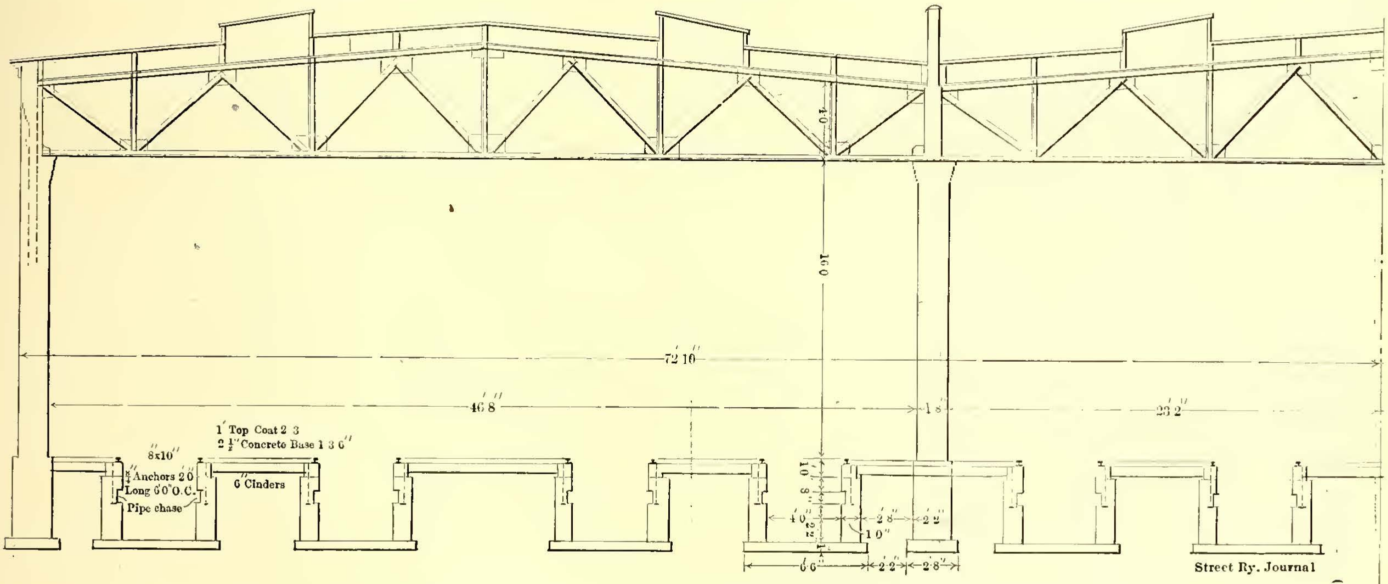
to enjoy several dances after each performance. While a play is being given in the theater, music in the dancing pavilion is given on a piano, but after each theatrical performance the regular theater orchestra moves to the dance hall and furnishes the music for the balance of the afternoon or evening. In organizing the orchestra each year the company takes advantage of the services of local musicians who for the most part are engaged in the local theater during the winter. The dancing pavilion is large enough to accommodate about 125 couples, and if the accommodations were a little larger a separate orchestra would be provided for the dancing.

THE FEDERAL STREET CAR HOUSE OF THE ROCHESTER RAILWAY COMPANY

BY I. E. MATTHEWS, CHIEF ENGINEER

During 1904 the Rochester Railway Company added to its rolling stock to such an extent that all of its car houses were filled to overflowing and many cars had to be stored on tracks outside of the car houses. To relieve this condition it was decided to build a new car house large enough to hold about 100 double-truck cars.

The first step was to purchase about 4 acres of vacant land adjacent to the eastern division car house of the company, which is also the terminal of the Rochester & Sodus Bay Railway, an interurban road operated by the Rochester Railway Company. Upon this land the proposed car house was so located that future extensions can take place, as shown on the map herewith. Plans and specifications were prepared and contracts let for the building during the winter of 1904-5. The work was commenced early in the spring, and was practically completed and buildings occupied in September, 1905.



CROSS-SECTION OF FEDERAL STREET CAR HOUSE, SHOWING THE ROOF GIRDERS, PIT LAY-OUT, ETC.

The car house is 144 ft. x 326 ft., and contains twelve tracks. It is divided by two fire walls into three four-track sections. This was done to keep the floor area within the limits prescribed by the Board of Underwriters, and also to reduce the span and cost of the roof trusses. The foundation walls are built of gravel concrete composed of 1 volume of Portland cement, 2½ volumes of sand and 5 volumes of gravel. They average 2 ft. in width and 5 ft. in depth, going deeper where necessary to secure a firm foundation. The outside walls consist of brick piers 16 ins. x 20 ins., 18 ft. center to center, connected by 8-in. brick curtain walls. The interior fire walls have the piers increased to 20 ins. x 24 ins.; otherwise they are the same as the outside. The walls are built of hard-burned brick, laid with Portland cement mortar. The interior exposed angles of the piers are laid with bull-nose brick. The brick piers carry the steel trusses, built of plates and angles of 48-ft. span, 18 ft. apart and 16 ft. from floor to bottom of truss.

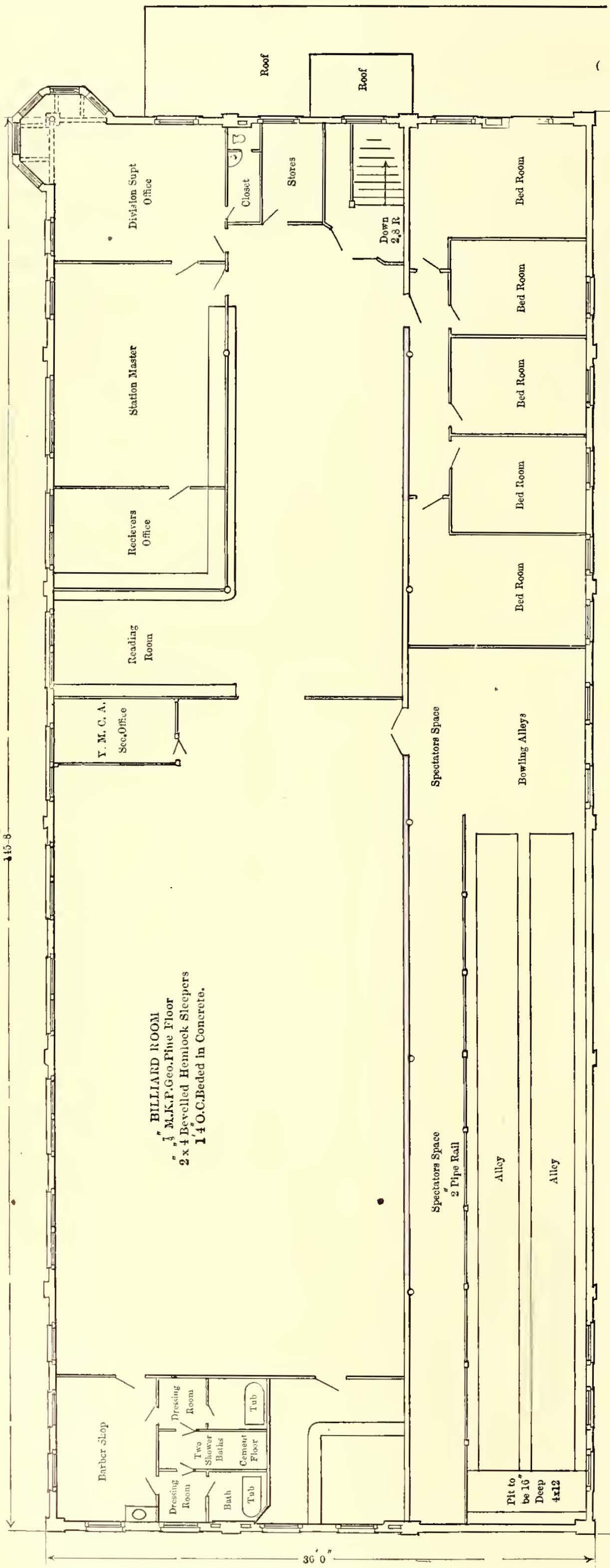
The front of the building has a second story, in which is located the office of the division superintendent and his assistants. The station-master's and receiver's offices are also located here. There are maintained under the direction of a secretary of the Young Men's Christian Association, lounging rooms for the men, containing billiard tables, bowling alleys, reading rooms, tub and shower baths, barber shop and sleeping rooms. It is believed the accommodations for the men during their off-duty hours are more than usually complete. The running of a barber shop within the car house is considered a new feature, and one that the men will appreciate. As will be noticed from the plans, somewhat elaborate provision has been made for bed rooms. The rooms are neatly furnished with cots and toilet and other requisites. The rooms are already popular, and it is probable that during the winter months the sleeping accommodations will be taxed to the full capacity, especially during storms. A charge is made to the men of 10 cents and 15 cents per night for a cot. A register is kept much the same as a hotel register, and the men enter their names for the time they want a room. The rooms are assigned in the order of application. The beds are made and the rooms kept neat and clean by a janitor. The tub and shower baths are the most popular feature of the house.

Entrance to the second story is had through a one-story entrance hall on the north side of the building, and so arranged as to avoid using any of the storage space of the car house proper for the stairway. The entrance hall is extended to contain the toilet rooms for the men, and here is also located the heater for the hot water used in the bath and toilet rooms. Adjacent to this is also the one-story addition for storage of coal used in the car stoves and for sand.

The two-story portion extends across the entire front of the building, and has a width of three bays, or 54 ft. x 144 ft. It is of steel frame construction, the posts being encased in the brick walls and piers, and the floor is of reinforced concrete. The steel work was furnished and erected by the Archbold-Brady Company, of Syracuse, N. Y. The roof of the main portion of the building has 4 x 12 wooden purlins bolted to clip angles on the trusses and spaced about 5 ft. apart, on which are laid the 2-in. matched roof boards. On the two-story portion steel channel purlins are used. The whole roof is covered with an asphalt slag roof. The fire walls extend 3 ft. above the roof and have tile coping, as have also the front and rear walls.

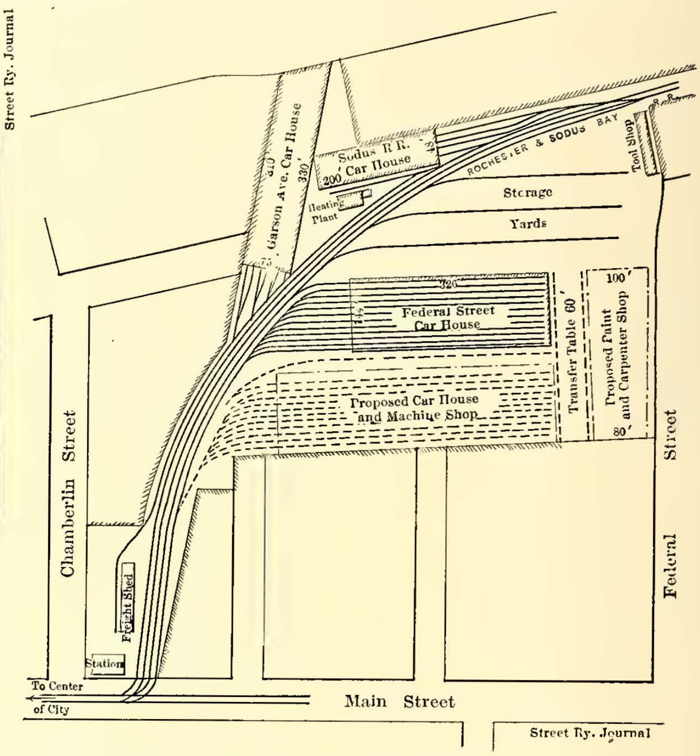
There are no windows in the first story. The second story, however, has windows at front, side and rear, those overlooking the roof being protected by iron shutters. The division superintendent's office, in the northwest corner of the building, has a bow window, so that he can observe from his desk what is taken place along the entire front as well as over the larger portion of the yards surrounding the building.

The interior of the car house proper is well lighted by large skylights furnished by the National Ventilating Company. The skylights are about 5 ft. x 10 ft. in size. Two are placed in each bay, one on either side of the ridge, thus giving about 4500 sq. ft. of lighting surface. Ventilation is secured by 12-in. Globe ventilators at the ridge. The building is lighted at night by electric lights from current supplied by the local lighting company. Arcs are used in the car house proper and in the yards, and incandescent lights in the offices, rooms, etc.

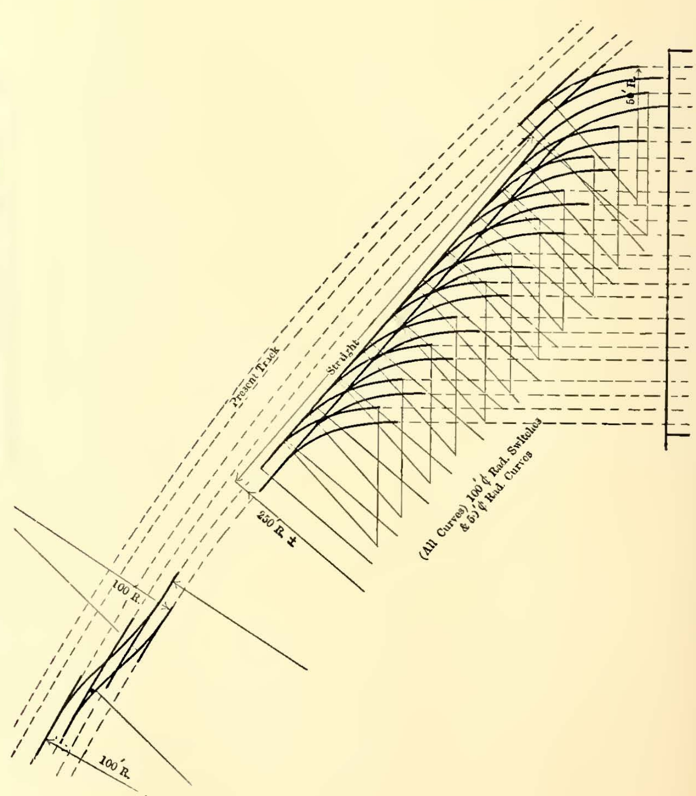


PLAN OF SECOND STORY OF THE FEDERAL STREET CAR HOUSE, SHOWING THE LOCATION OF THE COMPANY'S OFFICES, EMPLOYEES' RECREATION ROOMS, BOWLING ALLEYS, SLEEPING APARTMENTS, ETC.

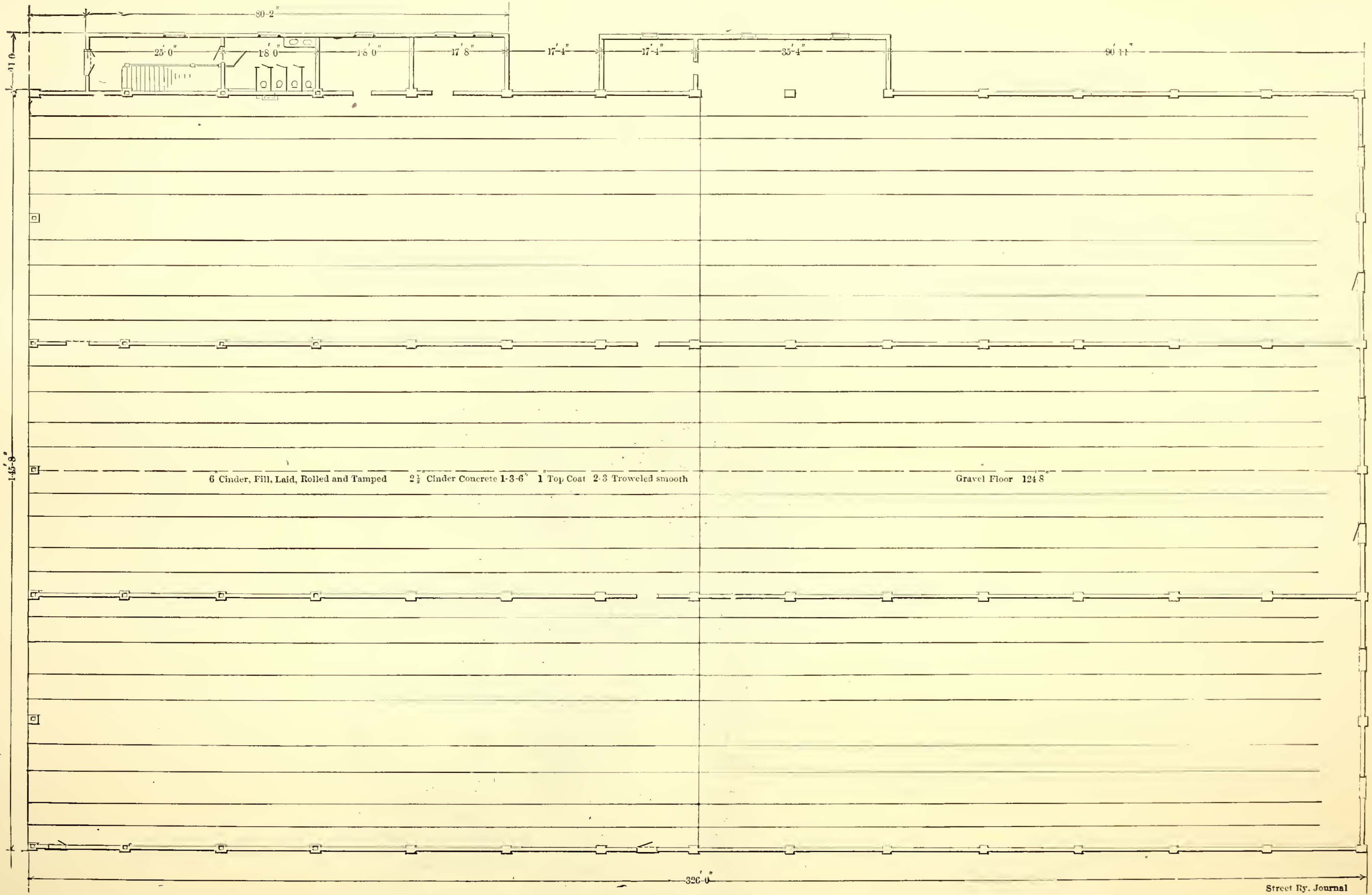
All connecting doorways between the sections of the car house are furnished with self-closing fire doors. The front of the house is closed by Kinnear steel curtain doors. Under all tracks inspection pits are built of gravel concrete walls 12 ins. in thickness. The pits are 4 ft. wide and 4 ft. 6 ins. deep, capped with an 8 x 10 timber fastened by bolts anchored in the concrete walls. To this timber the track rails are spiked. Beyond the pits cross-ties are used under the rails. The pits do not extend the full length of the building, but run for 175 ft. into the house, commencing at the front end of the building. The pits have cement steps at one end. The pits under the



PLAN OF YARDS AND CAR HOUSES, EASTERN DIVISION OF THE ROCHESTER RAILWAY COMPANY



DETAIL OF ENTRANCE TRACKS AT THE STREET CAR HOUSE OF THE ROCHESTER RAILWAY COMPANY



PLAN OF THE LOWER FLOOR OF THE FEDERAL STREET CAR HOUSE OF THE ROCHESTER RAILWAY COMPANY first four tracks in the section on the north side of the house are to be used as repair pits, and are 9 ins. deeper than the others, and have tracks for the operation of a pit jack in them. These pits are all connected at their inner end by a cross pit 5 ft. in width. Here are located, between tracks, two cranes for handling motors and wheels, and opposite the end of the cross pit is built a one-story addition, 10 ft. x 35 ft., for a small repair shop. Minor repairs only are made here. As the curtain wall in front of this room is omitted for a height of 10 ft., the wall above is carried on steel channel lintels. This serves to give additional width to the room. Connected with the shop is a small storeroom and a toilet room for the car house men.

The floors between the pits consist of a 6-in. layer of cinders, on which a 3-in. Portland cement floor is laid. Beyond the pits in the rear half of the building, which will be used for storage, there is a cinder floor only, except in front of the repair shop, where a cement floor is laid. The pits have a cement floor and are provided with floor drains. There are three lines of 6-in. tile drains running transversely across the building, connecting to all pits and the down spouts from the roof, and to an 8-in. tile sewer running parallel with the building about 10 ft. outside the north walls. This connects by a 10-in. tile to the city sewerage system.

The building will be heated by steam from the heating plant of the other car houses, located about 100 ft. north of the new building. This contains a locomotive type of boiler of 65-hp capacity. It was deemed of sufficient size to heat the new building in addition to the other buildings, if a good return and circulation could be maintained. This the company expects to obtain from the "Paul" system, which has been installed. The steam main, return pipe and air lines of the "Paul" system cross the building at the front end of the car pits. The valves and connections for each pit are enclosed in a pipe duct, and are reached by a trap-door manhole in front of each pit. The pits have a coil of pipe along each side, placed in a recess built in the concrete wall, so that the full width of the pit can be used by the workmen.

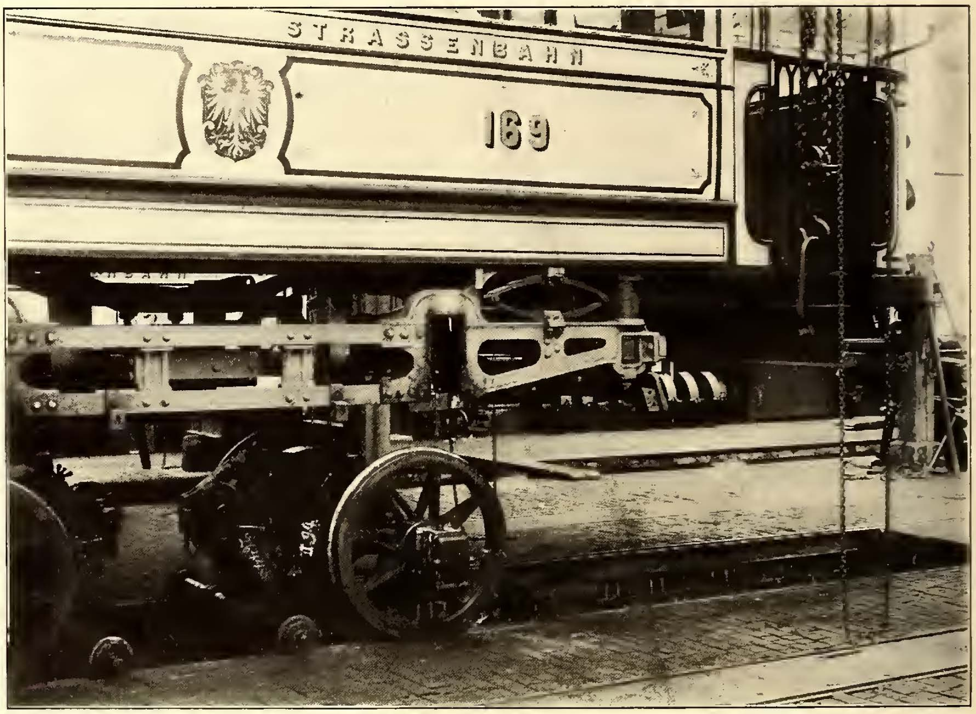
The pit coils furnish the only heat on the first floor. The second-story offices have radiators attached to a steam line tapped from the main supply on the ground floor. The water pipes are laid in the same duct with the steam pipes. Between each track is a floor valve, to which a small hose can be attached for the washing of cars. For fire protection a 3-in. water main extends along one wall of each section, having standpipes about 100 ft. apart, to which are attached coils of about 60 ft., of standard fire hose with nozzle. The standpipes are supplied with gate valves and sealed, and are not to be used except in case of fire. Underwriters' chemical fire extinguishers are placed at convenient points.

The trolley wire in the building is insulated from the wires outside by the breakers at the front doors, and is fed by No. 0000 feeders entering the side of the building back of the two-story portion and crossing transversely, tapping each trolley wire. This feeder is controlled by a switch in each section, placed on the wall near the entrance.

The tracks from the building connect with the approach tracks from the street by Lorain 70-lb. T-rail section, 100-ft. radius switches and curves of 50-ft. radius.

NOVEL METHOD USED IN FRANKFORT, GERMANY, FOR REPAIRING CARS AND TRUCKS

An ingenious method of removing motors and axles from single-truck cars is employed in the repair shops of the Frankfort Street Railway, Germany, and is illustrated in the accompanying engraving. The pedestal jaw-bit bolts are first removed to clear the journal boxes. The nose end of each motor is then dropped down onto a jury axle and pair of wheels which are held in place by the malleable-iron brackets on the motor shown in the illustration. The motor leads are then loosened and the brake levers and shoes are removed. The car body with attached truck side frames is then lifted up by chain block hoists connected to I-beams slipped under the ends of the car. Four chain blocks are used, each having a capacity of 6600 lbs., and requiring only one man apiece for efficient operation. This permits running out the "repair unit," namely, the combination of the car axle, car wheels, motor, gearing and journal boxes. As soon as this combination has been removed, a reserve unit is rolled into place ready for service. By this method it has been found possible in emergency cases to replace the operating equipment in one or two hours instead of five to ten hours. While this exchange is in progress, other workmen inspect the controllers, car wiring, trucks, springs, etc.



VIEW SHOWING METHOD OF HOISTING CAR-BODY AND TRUCKS, LEAVING THE WHEELS AND MOTORS TO BE REMOVED ELSEWHERE

The removal of the motor and wheel combination to a more convenient place than the dark pit under the car body naturally makes the necessary inspection and repairs much easier and quicker, and also avoids the interference arising between men where they must work all over the car at the same time. The handling of repairs in this fashion is the standard policy on the Frankfort system, except where important truck repairs are required, in which case the entire truck is run out.

The following advantages are claimed for this method of making repairs: Space is saved in the shop, because it is usually unnecessary to run out the entire truck; time is saved because the complete truck is not separated from the car body; greater ease is secured in handling a heavy portion of the equipment through the use of the auxiliary running axle and wheels; and a better distribution of the shop work results from the use of reserve units.

CORRESPONDENCE

THE LOCATION OF TOILET AND SMOKING COMPARTMENTS ON INTERURBAN CARS

New York, Nov. 23, 1905.

Editors Street Railway Journal:

Your editorial upon the above subject in the issue of Oct. 28, and Mr. Gonzenbach's letter and accompanying proposed plans of an interurban car appearing in the issue for Nov. 18, have opened up a question of considerable interest in the construction of interurban cars. Since the demands of various interurban roads differ greatly in many important features, it will never be possible to completely standardize an interurban car, but it seems as though it should be possible to establish some recognized standard of construction in the less important details which have no effect upon clearance, dimensions, schedule speeds or other fundamental consideration in the design of the system.

The location of toilet and smoking compartments has become pretty well standardized in steam railroad practice, and while the greater variety of demands upon an interurban car somewhat complicate the solution, there does not appear to be any inherent reason why the many different interior arrangements now in vogue should not be reduced to at least four or five standards adapted to certain general classifications of cars. It is tentatively sugested that all electric cars might be classified under one of the following heads with respect to their interior arrangement:

Street railway open cars.
Street railway closed cars.
Interurban passenger cars.
Interurban combination passenger and baggage cars.
Interurban freight and express cars.

Of these five groups the interurban passenger car is the most difficult to standardize, since it must of necessity meet a great variety of demands. It must be possible to operate the car in either direction at will, so that the inside arrangement should be as nearly symmetrical as possible. It must be arranged to carry not only the maximum seated load, but also be designed to carry under an emergency the maximum standing load. It must be designed to load and unload passengers with the least possible delay. Provision must be made for the motorman and his controller and braking apparatus. Provisions must be made for a heating and lighting system, and there must be toilet and smoking compartments, and the car must be designed so that a reasonable amount of personal baggage will not obstruct the free movement of passengers.

Mr. Gonzenbach's proposed design for such an interurban passenger car certainly contains a number of desirable features, some of which he has himself omitted to mention. Among these latter are: The large seating capacity of the smoking compartments per square foot of allotted floor space; the possibility of opening the windows of the smoking compartments much wider in both summer and winter than would be possible if the partition were not there to prevent a strong draft from one side of the car to the other, and the fact that it will not be necessary to clean the smoking compartments at each end of the line. This latter advantage is of considerable importance, for with the usual arrangement of the smoking compartment in one end of the car, the accumulation of ashes and other refuse soon becomes very objectionable to ladies who are compelled to pass through the compartment in reaching their seats.

There are, however, a few rather serious drawbacks to the proposed arrangement. The isolation of the smoking compartments, just referred to as an advantage, might easily become a nuisance, since there will always be a tendency to neglect to clean the compartments as often as necessary and leave them in an unsanitary condition. This neglect will be fostered by the comparative difficulty of sweeping under the long longitudinal seat and removing the refuse. Another difficulty will be met in arranging a satisfactory system of wiring for the car lights, since there must be enough groups of lights to insure that the burning out of one of a series of five lamps will not leave either smoking compartments, toilet room, platforms, passenger compartments or the aisle between the smoking compartments in darkness.

Another possible objection is that while the aisle between the smoking compartments has the same width as the aisle in the remainder of the car, yet this aisle will be much more easily blocked, since it will be impossible for a person standing there to temporarily crowd between two seats as can be done in the rest of the car. It would also appear that this arrangement of partitions is somewhat wasteful of available standing room. Another objection is that the conductor will be more or less isolated from the other passengers while collecting fares from the smokers, and this might necessitate the installation of electric push buttons at each seat, a practice which has not always met with success.

Any compartment in the center of the car has the disadvantage, of course, as pointed out in your editorial of Oct. 28, of obstructing the view ahead for half of the passengers.

Your discussion of the relative merits of locating the toilet room in the center or at the end of the car naturally applies to Mr. Gonzenbach's proposed location. It would seem that the eventual solution must be to locate a toilet room at each end of the car, although it is realized that the objections to be urged against it are serious.

F. A. Giffin.

TROLLEY WHEELS

Galveston Electric Company

Galveston, Tex., Nov. 18, 1905.

Editors Street Railway Journal:

In looking over the question box of the Mechanical and Electrical Association, published in a recent issue of your paper, there are some replies to the questions on trolley wheels, trolley bearings, etc., with which I do not entirely agree.

Thus, under Question 20 there are several compositions for trolley wheels, one of which will make a trolley wheel entirely too hard, as it will be liable to wear the trolley wire nearly as much as it wears itself. It has been pretty well proven that it is cheaper to renew wheels, even to a very large extent, than to renew trolley wire. Everything else being equal, a trolley wheel should be as soft and of as good conductivity as is possible; otherwise the wire will suffer instead of the wheel.

Under Question 31, "What can be done to increase the life of the wearing out of all trolley wheel bearings?" one of the most important factors has not been noticed. This is not only an important factor in the life of the bushing, but also in the life of the wheel itself and in the smoothness of its running. I refer to the absolute balancing of the wheel and the exact centering of the bushing in the wheel, and of the hole of the bushing in the bushing itself. From experiments covering quite a number of years with every make of trolley wheel that I have been able to obtain, including quite a number made by ourselves, it has been clearly demonstrated to me that one-half of the undue wear on any trolley wheel, and especially on the bushing, is due to the fact that the wheel is not in perfect balance. I have taken this question up during the past year with quite a number of manufacturers, and, curious to say, have only found one taking sufficient interest in the matter to go into it thoroughly. These manufacturers write me that they have found this to be true, and in order to take full advantage of it have put in special machines that accurately balance the trolley wheel. The wheel should not only be balanced radially, but there should be just as much metal on one side of the center of the groove as there is on the other, as tests have shown that if the groove is not exactly central on the wheel, the wheel tends to wear to one side or other. I feel certain that if all the users of trolley wheels would insist upon having a wheel that was absolutely perfectly balanced, even at the cost of a few cents more per wheel, they would find, as I have, that the difference in cost pays a very large interest in the additional life of the wheel—other things being equal. The other factors in this case are that the tension should be correct for the service to be done by the wheel; that the base should work perfectly free and be quite sensitive to any change in the direction of either the car or the trolley wire, and that the overhead work should be in at least reasonably good condition. No one can expect to obtain a large mileage where the tension is too heavy, where the trolley base does not respond quickly to the changes of the wire, either vertically or horizontally, or where the overhead work is such as to give constant blows and twists to the wheel.

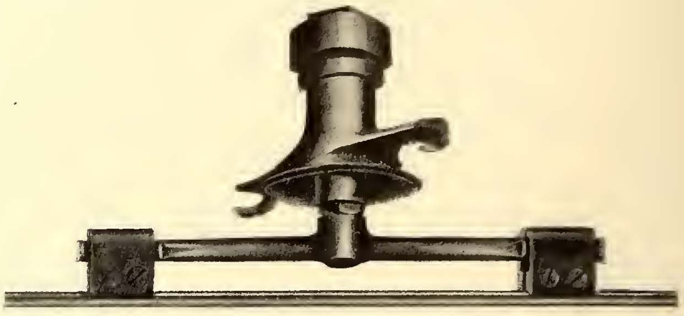
Question 23 is too indefinite for anyone to answer. Local conditions, speed, size of wheel, height of trolley wire, etc., are all factors that would make the mileage of a trolley wheel vary greatly. Under ideal conditions of both wheel, trolley and overload work, I have obtained from 35,000 miles to 40,000 miles, but in actual practice one-half to two-thirds of this we consider very good life.

Under Question 25, in regard to tension in pounds that the trolley wheel should have against the wire, this depends very largely on the height of the wire, the size of the wheel, the character of the overhead work and the speed of the car. For ordinary urban work where the average speed of the car does not go over 10 m.p.h., a tension of 15 lbs. will give perfect contact at the end of a 12-ft. trolley pole, provided that the overhead work is not so high that the trolley is to assume an angle of over 75 degs. From this, which is the lightest safe tension that can be run, it will run up to 35 lbs. on high-speed interurban lines using large and heavy wheels. The most simple way to determine this pressure is to buy an ordinary spring balance having a range of from zero to 50 lbs., loop the ring on top to the trolley rope, hook the hook under the coupler, let up the trolley to its average height and adjust the trolley springs until the spring balance shows the tension desired in pounds. This is but a moment's work, and every trolley newly put on should be tested in this way. Every trolley should be tested in this way at least once a week, as dust, dirt and rust tend to change the tension of the springs, as also do extremes in temperature between summer and winter. These balances may also be used to test the easy movement of the trolley base, as a perfectly working trolley base should not cause a pull on the spring of over 1½ lbs. to 2 lbs. when the trolley is pulled sideways by the balances. H. S. COOPER.

FLEXIBLE SUSPENSION FOR GROOVED TROLLEY WIRE

With the usual rigid suspension of the trolley wire there is a well-known tendency for the wire to break near the ends of the ear, owing to the continual and abrupt flexure of the wire at such points, caused by vibration of the free spans. This tendency is aggravated where soldered ears are used, on account of the effect of the heating of the wire, during the soldering operation, in impairing the mechanical strength of the wire locally.

A device to overcome this trouble has recently been brought out in England by the British Thomson-Houston Company, and is known as the B. T. H. patent flexible suspension ear. As shown in the illustration, the wire is held in mechanical clamps, which are so supported as to allow practically free movement in any direction without producing unnatural curves or abrupt bends, while preserving an even path for the trolley wheel and firmly supporting the wire in position. The upward movement of the wire and clamps, which is caused by the trolley wheel in passing under the ear, is practically parallel, and since the clamps are capable of a limited longitudinal displacement on the supporting bar, the wire takes up a natural curve in which there are no abnormal stresses in any part of its section.



FLEXIBLE SUSPENSION EAR FOR GROOVED TROLLEY WIRE

This improved form of suspension further obviates the objectionable hammer blow which takes place when the trolley wheel passes on to a suspension ear of the ordinary rigid type, thus conducing to smoother running of the trolley wheel and minimizing repairs to the trolley head.

These flexible ears are supplied either with a mild steel drop-forged body, with drop-forged clamps, or with a mild steel drop-forged galvanized body, with gun-metal clamps.

This hanger has been employed in Germany for a number of years, and has been in exclusive use on the trolley lines in Berlin for some time with satisfactory results.

RECENT DEVELOPMENTS IN MEXICO CITY

Before Dec. 12, when the great feats of the Virgin of Guadalupe will be celebrated, the officials of the Mexican Electric Tramways, Ltd., expect to receive from St. Louis the fourteen first-class cars which were ordered in that city some time ago. These cars will be somewhat larger than the present ones now in service, and they will be put on the lines which are most in need of extra service.

A project which the company now has in view is the purchase of observation cars, which will be employed in a special service, to be known as "Seeing Mexico" department. These cars will be built on the lines of the railway observation cars, with large glass windows, and they will run to all the important points in and around the city, wherever the company's system extends. In conjunction with this service the company intends to issue a neat little pamphlet that will contain accounts of the various points of interest along the system. These pamphlets will be distributed around the hotels and at other places where they can be seen and read by tourists and persons desiring to visit the interesting scenes in the neighborhood of the capital. This service is now being seriously considered by the street railway management, and it is possible that it will be inaugurated early during the coming year.

Charles H. Cahan, general attorney for the Mexican Light & Power Company, in speaking of the power that his company is about to furnish to the Tramway Company, states that he expects to be able to furnish some power in about three weeks, but the full power for which a contract had been made will not be furnished until the new machinery which General Manager W. W. Wheatly is about to purchase in the United States had been installed, which, according to Mr. Wheatly's statement, will be about Oct. 1, 1906. The temporary power for the street railway company will be furnished from the electric plant of San Ildefonso.

NEW CARS FOR THE SOUTH SIDE ELEVATED RAILROAD, OF CHICAGO, ILL.

Several shipments of cars have been received by the South Side Elevated Railroad Company, of Chicago, Ill., from the Jewett Car Company, of Newark, Ohio, which company is building seventy cars for the above-named road. Several new features have been introduced in these cars, one being the construction of the cab. The cab is formed by curtains, so that when curtains are raised all that can be seen of the cab is the top and corner pillar, which is an iron pipe. The engineer's valve, gage and other operating mechanism is placed between the outside and inside lining of end of car. The inside lining has a hinged door over the operating mechanism, which hangs down when this mechanism is used. When not in use, the door is closed and the end has the same appearance as the opposite end. Each cab has two individual seats, the one nearest the end of the car being arranged with levers to slide on top of the other seat, so as to give room for the motorman to sit facing the end window. The cab when not used by the motorman will seat two passengers, while in the former cars the cab cannot be used at all by the passengers.

Another change from the former cars is the location of the end doors. The former cars have the end doors near the side of the car, while in the new cars the door is located in the center, thereby increasing the seating capacity two at each end or four per car, so that with the change in the cab, the total seating capacity of the new cars is eight more than the former cars, it being forty-four for the earlier cars and fifty-two for the later rolling stock.

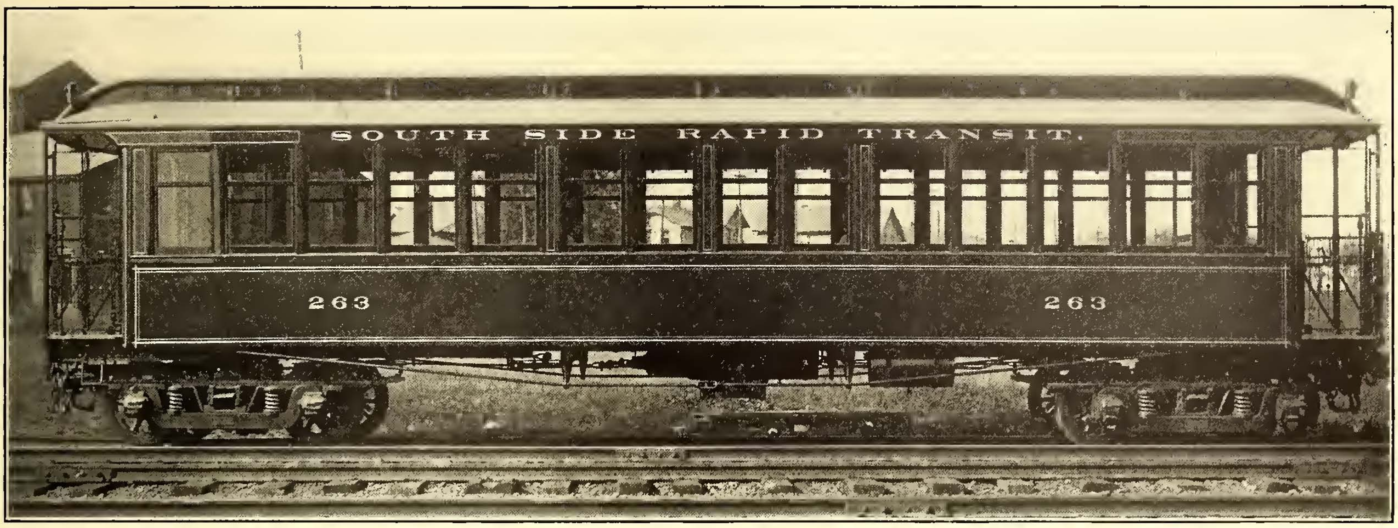


FIG. 1.—AN EXAMPLE OF THE LATEST TYPE OF CAR FOR THE SOUTH SIDE ELEVATED RAILROAD COMPANY, OF CHICAGO, EMBRACING NEW STYLE OF MOTORMAN'S CAB AND DOUBLE FOLDING GATE

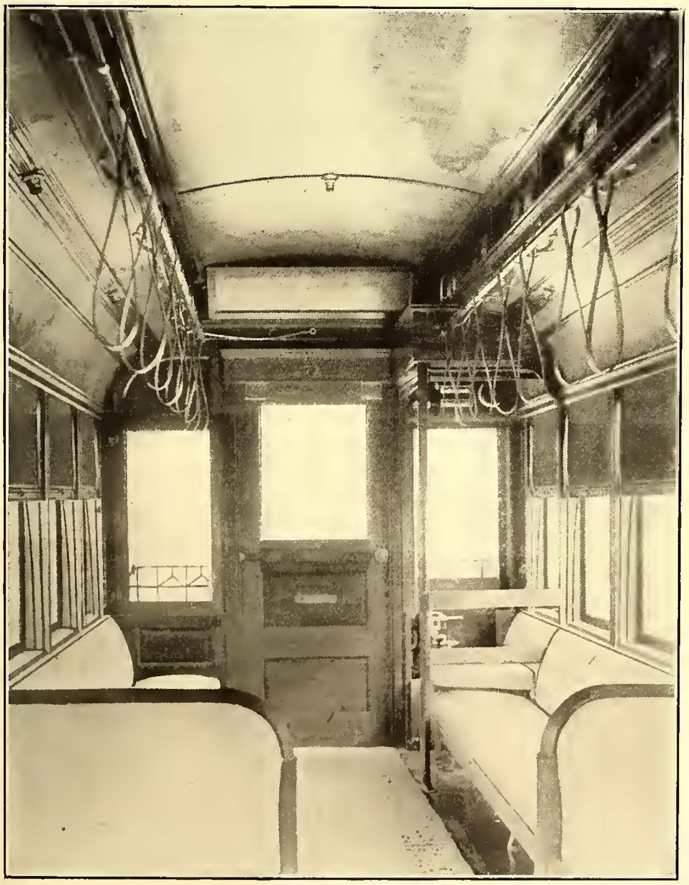


FIG. 2.—SHOWING OPERATING MECHANISM AND CAB CURTAIN RAISED

FIG. 3.—SHOWING CAB CURTAIN DOWN IN THE LATEST SOUTH SIDE CAR

Another new feature is the Jewett double folding gates on the platforms instead of the single gate as on the former cars. This is also a great improvement, as it gives a good deal more room on the platform when these gates are operated, and facilitates the rapid unloading of passengers. Quite a change was made from the former cars in the construction of the platform, this change being from wood to steel.

FIG. 4.—VIEW OF CAR INTERIOR, SHOWING THE LONGITUDINAL SEATING AND CROSS SEATS IN CENTER

The cars are finished in mahogany, the headlining being quartered oak. The seat cushions and backs are covered with rattan. The curtains are of pantasote material and have pinch handles. Polished plate glass is used throughout the car, except the deck glass, which is ornamental glass. Trimmings are of bronze.

The new features in these cars were suggested by M. Hopkins, general manager of the South Side Elevated Railroad Company.

A RECENT IMPROVEMENT IN FAN CONSTRUCTION

Experience has shown that in handling hot gases with a fan, as in a plant producing induced draft for boilers, it is impossible to give the fan shaft a suitable bearing at the inlet side. A bearing here would necessarily be situated in the inlet area and would be constantly surrounded by hot flue gases. Much better results have been obtained by the use of an overhung wheel having, in addition to the two engine bearings, a bearing on the engine side of the fan, but none on the inlet side. The usual form of construction—that is, providing for a third bearing separate from the engine—has, however, given trouble from the fact that this bearing cannot readily be lined up with the two engine bearings.

In Fig. 1 is shown a new method of construction designed by the American Blower Company, of Detroit, to overcome this trouble. All these journal boxes are cast in the engine frame (Fig. 2) and can all be bored with the same boring bar. Thus it is impossible for them to be out of line. The fan bearing is water-cooled and ring-oiled. From the fact that all bearings are bored at once, a self-aligning bearing, such as would otherwise be necessary, is not required here, still further simplifying the arrangement. In addition to these points, it will be noticed that the bearing is supported by the engine bed and not by the housing of the fan, as would otherwise be the case. This simplifies the construction by doing away with the additional bracing usually found on fan housings.

FIG. 1.—SHOWING TYPE OF FAN CONSTRUCTION ADAPTED TO KEEP ALL THE BEARINGS IN LINE

The wheel (Fig. 3) is varied somewhat from the ordinary construction. In place of the usual three spiders is substituted one heavier one, built of I-beams cast into the hub. The blades are braced upon each other as shown in cut. A wheel constructed in this manner has been shown to be fully as strong and rigid as the ordinary three-spider form. By the use of a single spider the necessity for more than one hub on the shaft is obviated. In this manner the load of the wheel is concentrated upon a comparatively short length of shaft. Moreover, with the deep cone in the casing, as shown in Fig. 1, and the fan bearing sitting far in, as it does, the load of the fan is placed very near to the fan housing. In fact, the bearing is included within the width of the fan blades. This point is of great importance, since, were the fan of the ordinary three-spindle design, the center of gravity would be some distance

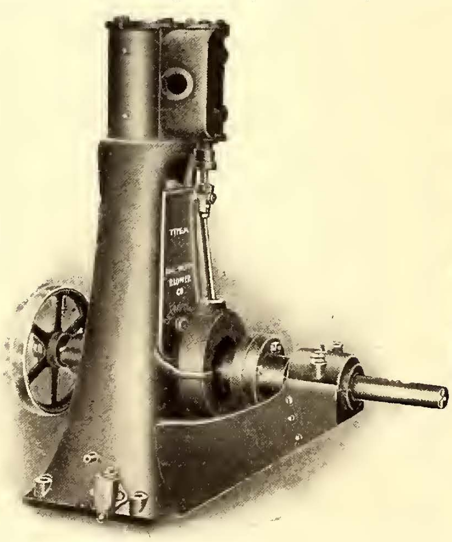


FIG. 2.—ILLUSTRATING THE CASTING OF THE JOURNAL BOXES IN THE ENGINE FRAME

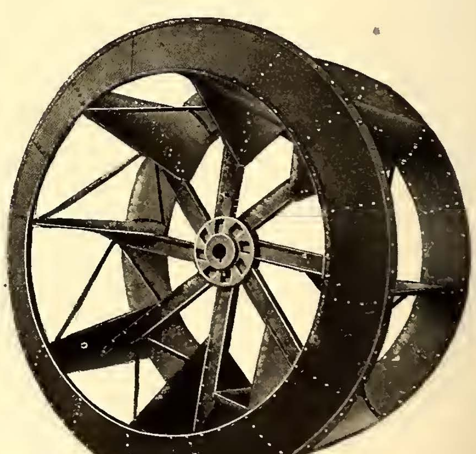


FIG. 3.—NEW TYPE WHEEL COVERING THE USE OF SINGLE I-BEAM, SPIDER CAST INTO THE HUB

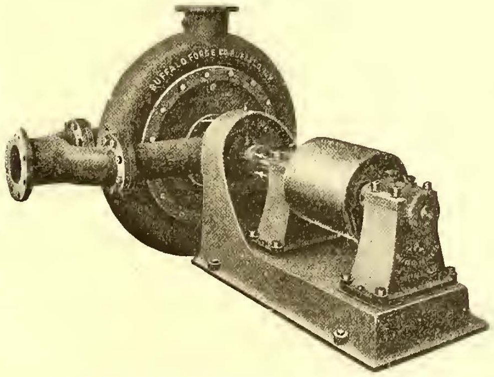
out from the bearing and there would be the tendency of the shaft to move on the fan bearing as a fulcrum and cause an upward thrust in the engine and on the engine journal caps. With the single spider this trouble is not encountered.

The engine is of the enclosed type, oiled by a recently devised pump which distributes copious streams of oil all over all of the reciprocating and revolving parts, even lubricating the eccentric outside of the frame. Tests in actual practice have proven that it will run several months without oiling or adjustment.

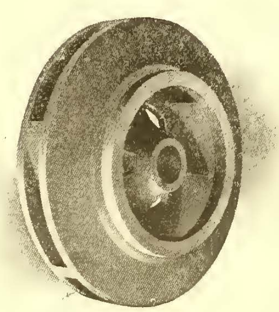
CENTRIFUGAL PUMPS

For the engineer as well as the layman, the centrifugal pump has long stood for a rather crude device, consisting of a shell within which revolved a spider with paddle-shaped arms. When inlets and exits were placed in connection with the center and periphery, such a pump could handle large quantities of water delivering against a head of a few feet. Its sole claim to recognition lay in its ability to handle nearly anything in the way of solid matter which the pipes would accommodate, coupled with the fact of its large capacity and simplicity. A plausible explanation of the operation of such pumps might have been that any liquid subjected to such a vigorous churning would strive to escape the nearest way and thus produce the pressure head. At any rate, logical inquiry and experiment brought little improvement in centrifugal pump design until the last few years. Although denied the stimulation often offered such objects by engineering societies and technical school research, the centrifugal pump has been developed and perfected until results are obtainable to-day which are in the nature of a revelation to those not closely identified with the subject, and which make its relation to the direct-acting pump almost identical with that of the steam turbine and reciprocating engine.

As an indication that the centrifugal pump is coming into its own, it will be remembered that three centrifugal pumps of a capacity of some 35,000 gals. per minute against a head of some 160 ft. supplied the water for the grand cascade at the St. Louis Exposition. Now the city of Buffalo is installing a multiple-stage turbine pump to augment its triple-expansion pumping engine service, with the expectation of superseding one of the engines by a second centrifugal if the first proves satisfactory.



A TURBINE CENTRIFUGAL PUMP AND DIFFUSION VANES

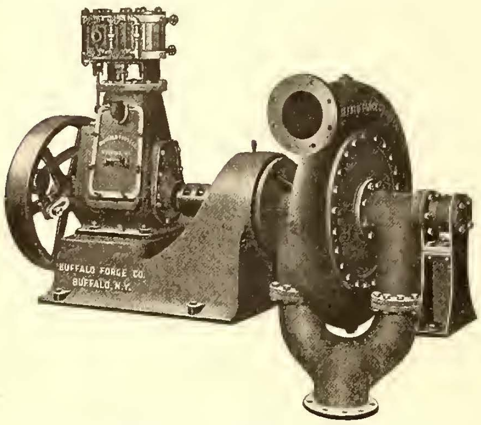

TYPE OF ENCLOSED RUNNER

Aside from improvement in detail, the modern centrifugal pump design shows three distinct departures from its spider-and-paddle progenitor. The rotating element, variously called the "runner" or "impeller," is now of the enclosed type, permitting the liquid to pass undisturbed from inlet to periphery through a continuous passage. This will be better understood from a reference to the accompanying cut. This shows a five-bladed impeller with a single entrance. It will be observed that there is no opportunity for loss by eddies or leakage, and the connection between the rotating element and shell is at a machined surface, and therefore susceptible of accurate fitting.

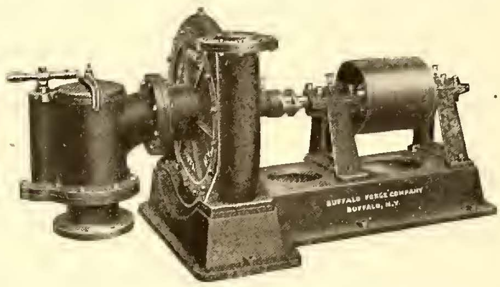
The determination of the proper curvature of these blades or partitions, together with the angles at which the liquid is received and discharged, is the second step in the development of the centrifugal pump as we know it to-day. It has been found that changes in the curvature of these blades will produce marked differences in the behavior of a pump as the operating conditions vary. Thus, an impeller whose blades terminate radially has the property of preserving a constant head, irrespective of the volume of water delivered, providing its speed be kept uniform. This design is applicable for city water supply, boiler feeding, condenser circulating pumps, etc. On giving the blade tips a curvature in the direction of rotation, such an impeller will increase its head with its delivery, providing an ideal means of maintaining a constant pressure at any distant point in a distributing system. Drawing off a large volume at such a point increases the liquid velocity, and therefore the friction head, which is compensated for by the increase in head as supplied by the pump. For dry dock, caisson or excavating work, it is desirable to have a pump which will run at constant speed and full load as the head increases with the removal of water from the enclosure. This necessitates that a large volume of water must be handled at the start, gradually diminishing as the head increases. This situation is met by giving the blades a curvature toward the direction of rotation, when such a pump will deliver liquids against an increasing head with a decreasing volume at a practically uniform efficiency. This control of the relationship of head and volume proves of practical value in the operation of these pumps by motors. Any increase above the normal horse-power delivered by the motor, such as might be occasioned by an accidental reduction of head, would be liable to overload and possibly burn out the motor. Such an accident is prevented by the nature of the impeller surfaces, which may be so laid out that any appreciable diminution of the head after a fixed limit will not be accompanied by an increase in volume delivered, and the horse-power delivered by the motor will not show a dangerous increase.

The third marked improvement in centrifugal pump design is the use of what are called "diffusion vanes," situated in the periphery or shell of pump next to the runner. These are so designed as to receive the water as it comes with a high velocity from the runner and, through the shape and area of the water passages they form, reduce the velocity to pressure head without disturbance or unnecessary friction. As the problem of the centrifugal pump is essentially that of giving a continuous stream of water a high velocity and then allowing the reduction of same to static head and ordinary pipe velocities, the most efficient pump will be the one which accomplishes this with the least shock friction, loss by eddies and leakage. In the high-efficiency pumps these diffusion vanes play an important part in gradually changing the velocity to pressure head without loss by shock. These diffusion vanes are a replica of the guide vanes of a water turbine and are responsible for the name assumed by such pump as "turbine centrifugals."

With the improvements the efficiency of the centrifugal pump has steadily advanced until a figure of 75 per cent has been shown by creditable tests, with the result that there has been an enlarged field open to its use and a demand created for such pumps capable of delivering against comparatively high heads. For such service an ordinary centrifugal pump requires either an extremely high rate of rotation for the runner or a shell of an impractical diameter, and in either case, due to the increased hydraulic friction at high speeds, there will be a serious loss of efficiency. The multiple-stage centrifugal

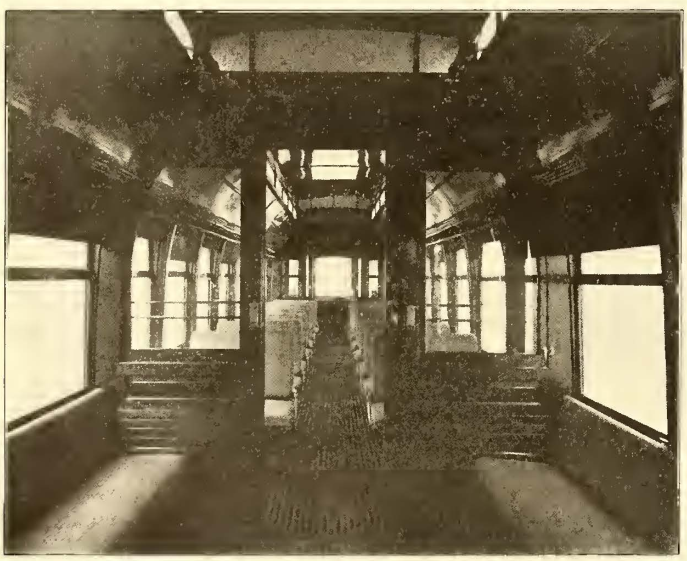


HIGH-SPEED, DOUBLE-ACTING ENGINE DIRECT CONNECTED TO A CENTRIFUGAL PUMP



CENTRIFUGAL PUMP WITH HAND PRIMER FOR STARTING UP

obviates both these disadvantages and can now be built for all heads up to 2000 ft. A multiple-stage pump is primarily a series of single-stage pumps mounted side by side and with



INTERIOR OF CLOSED SCHUYLKILL CAR, SHOWING CROSS SEATING IN THE MAIN COMPARTMENT, AND LONGITUDINAL SEATING IN THE SMOKERS' SECTION

runners driven by a single shaft. The liquid passes through each in succession, receiving its proportionate increment of pressure at each "stage." Practically the several single pumps are incorporated in one casting, with waterways arranged so as to lead the water from the periphery of one runner to the inlet of the other with the least possible loss.

The use of high pressures and velocities in pumps of this nature has necessitated careful design of impellers so that there shall be no unbalanced forces to be taken up at wearing surfaces. The manufacturers of certain pumps claim a perfectly balanced impeller with no resultant end thrust under all conditions of service. In one instance a four-stage pump showed, under a careful test, an efficiency of 72 per cent when delivering 250 gals. of water per minute against a head of 650 ft.

Among other improvements in centrifugal pump design has come a reduction in the speed, so that they become readily adapted for direct connection to high-speed engines. Thus a most compact and effective unit is provided with a capacity far exceeding a direct-acting pump of the same weight.

For general service the centrifugal pump seems a well nigh ideal piece of apparatus. Commercially considered, its first cost is low, its maintenance expense a minimum, and its effective life a long one. Its operation is too simple to require skilled attendance, and its property of handling liquids of a corrosive nature and containing large quantities of solid matter in suspension renders it indispensable for certain situations. Its high maintained efficiency, quiet operation, absence of heavy foundations, with no danger in stopping and starting under full water pressure, are unmistakable advantages pointing to a widespread use in the future.

The chief disadvantage of the centrifugal pump is its inability to prime or start itself, and unless it is so situated as to be submerged or have water enter the pump at a slight head, some device is necessary to prime them. This may be effected either by filling the shell with water from a tap to water mains, or by an ejector where steam pressure is available, or by a hand pump, as shown in the accompanying cut. On the score of fuel economy, the centrifugal cannot compete with the high-duty pumping engine, inasmuch as it does not include in itself the element of a prime mover. With the advent of the steam turbine, so eminently suitable for direct connection, the centrifugal pump threatens to relegate to the past even these splendid examples of engineering skill.

One of the companies which have given especial attention to the development of the centrifugal pump is the Buffalo Steam Pump Company, from whose apparatus, in fact, the accompanying illustrations were reproduced. Although they represent only a few of the types manufactured, they give an idea of the construction and appearance of this kind of pump.

FINE CARS FOR GIRARDVILLE, PA.

An interesting shipment of six grooveless-post convertible cars to the Schuylkill Railway Company, of Girardville, Pa., has just been made by the J. G. Brill Company. Girardville is in the center of the anthracite region, in the east central part of Pennsylvania, and is connected by electric railway lines, operated by the Schuylkill Railway Company, with a number of important mining towns in the Shenandoah and Schuylkill

THE SCHUYLKILL RAILWAY COMPANY'S LATEST TYPE OF DOUBLE-TRUCK CONVERTIBLE CAR

Valleys, including Shenandoah and Pottsville. The region is thickly settled and the towns populous and close together. The power stations of the system are located at Girardville and

Mahanoy City, and the repair shops are at the former place. Two amusement parks are reached by the company's lines.

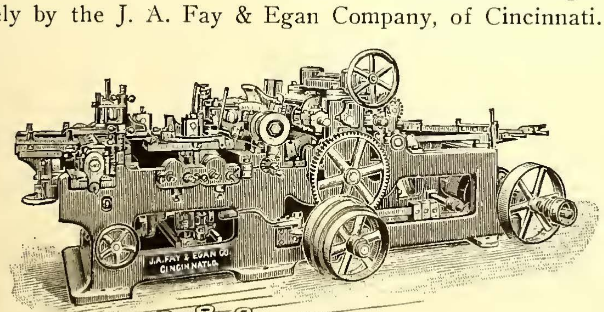
The special feature in connection with these cars is the smoking compartment, which occupies but 6 ft. 5 ins. of the 28-ft. 4-in. body. The compartment has longitudinal seats, which accommodate five passengers each, and with the wide standing space between the seats, the compartment has room for twenty passengers. If at any time it is deemed advisable to use transverse seats in this compartment they can be readily installed and the panels can be made operative without difficulty; but it is hardly likely that the compartment will be changed from the present arrangement, for the larger capacity due to longitudinal seats is an important feature. Smoking will also be allowed in the vestibule which adjoins the compartment, and with the doors opened into the vestibule there will be sufficient ventilation from the outside doors and the deck ventilators to carry away the smoke.

The passenger compartment seats thirty-four passengers. The seats are 35 ins. long and are upholstered in spring cane, with push-over backs. The side posts of both compartments are 2 ft. 7 ins. from center to center. When the panels and sashes are raised into the roof pockets, the clear space from the sill to the center of the arch is 5 ft. 5¾ ins. Between the compartments is a hardwood partition with glazed door and sides. The platforms are the standard length, 4 ft. 8½ ins. from end panels over the vestibule sheathing, and the timbers are reinforced with angle iron in the usual manner.

The side sills are 8¾ ins. x 7 ins., with 8-in. x ⅝-in. sill plates on the outsides; cross members are 3½ ins. x 5⅞ ins., with 2¾-in. x 4½-in. diagonal bracing at the center. The open steel bolsters are 9 ins. wide and 6⅞ ins. deep at the centers; from king-pin to king-pin is 17 ft. 4 ins. The general dimensions are: Length over the end panels, 28 ft. 4 ins., and over the vestibules, 37 ft. 9 ins.; width over the sills, including the sill plates, 7 ft. 7¼ ins., and over the posts at the belt, 8½ ins.; sweep of the posts, 3½ ins.; width of the aisle, 20½ ins.; height from the track to the under side of the sill, 2 ft. 5½ ins., and from the under side of the sill over the roof, 9 ft. 3¼ ins.; from the track to the tread of the platform step, 15⅞ ins.; from the step to the platform, 13 ins., and from the platform to the car floor, 7⅝ ins. The surface of the running boards is 19½ ins. from the track, and from the running board to the car floor is 17 ins. The cars are mounted on No. 27-G-1 trucks, having 4-ft. wheel base, 33-in. wheels and 4-in. axles. Four 35-hp motors are used per car. The weight of the car and the trucks, without motors, is 26,500 lbs.

A NEW INSIDE MOLDER

An improved molder for heavy work has been brought out lately by the J. A. Fay & Egan Company, of Cincinnati. It



INSIDE MOLDER FOR HEAVY WORK

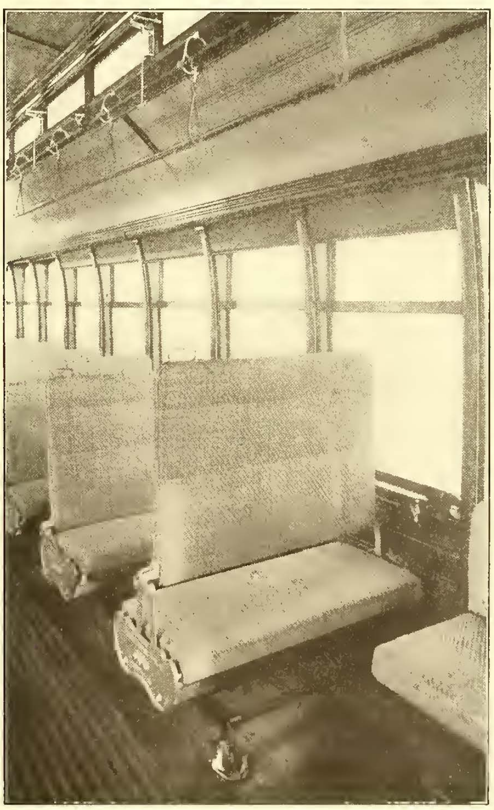
has a capacity for molding lumber up to 6 ins. thick and 12 ins. or 15 ins. wide. The maker has built a large number of molders, and all the points of excellence that could be suggested from long and successful experience have been embodied in the make-up of this one. The following data covers some of the more important features of this machine:

The frame is of a new type—square, open, ribbed inside, strong and rigid. The four steel cylinders are slotted on four sides and their pulleys taper-fitted. The upper head is double-belted and mounted on a housing, raising and lowering on ball bearings, and operated by a crank. The pressure bar of this head is also carried on this housing, raising and lowering with it, and also has vertical adjustment, and to and from the head. The chip breaker of this head is in sections, each independently adjustable, and all pressing close to the cut. The lower head is at the feed-out end, is made single or double-belted, and its frame is vertically adjustable. The pressure bar before this head, also the table after the head, adjusts vertically and horizontally. Both heads are easily accessible. The side heads are of a new construction, and are fitted with many devices and improvements for facilitating operation and permitting fine work. There are four feed rolls, the upper sectional, and either smooth or fluted rolls can be easily inserted.

The feed is driven by cone pulleys, tight or loose pulleys, or by binder. Any desired speed can be furnished for operation.

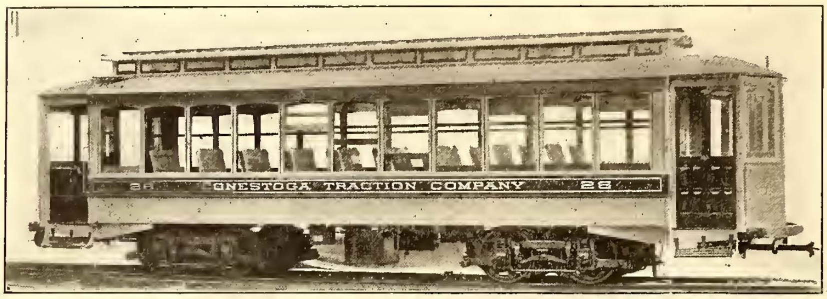
CARS FOR NEW DIVISION OF CONESTOGA TRACTION SYSTEM

About 50 miles directly west of Philadelphia is the manufacturing city of Lancaster, Pa., with a population of about 50,000. This is the operating center of the Conestoga Traction Company, whose lines run out in all directions. A branch



INTERIOR OF CONESTOGA CAR, SHOWING PERPENDICULAR POSITION OF ONE SEAT-BACK TO EXPOSE THE REVERSING LEVERS

of the system, which has recently been completed, extends to the southeast, a distance of 8½ miles to Quarryville, connecting the towns of Refton, New Providence and Camargo. The company has used Brill semi-convertible cars on its various divisions for a number of years, and has just received a further shipment from the car manufacturer for the new branch to Quarryville. The cars include the new "grooveless-post" semi-convertible window system, and an excellent idea of the appearance of this neat arrangement of the posts may be obtained from the illustration of part of the interior of the car. This illustration also shows the style of seats, and one of the seat backs has been pushed half way over to show the simple but strong system of levers for reversing the back. It will be seen that the seat cushions are of the tilting type, and that the levers are so placed as not to come in contact with the bodies of seated



ONE OF THE NEW SEMI-CONVERTIBLE, DOUBLE-TRUCK, VESTIBULED CARS RUNNING ON THE LINE OF THE CONESTOGA TRACTION COMPANY

passengers. Attention is also directed to the compactness of the lever mechanism at the end of the seat next the window. It is evident that the body of a seated passenger may come against the side lining, which is set in between the posts, thereby adding to the comfort of passengers, by giving them a 36-in. seat and permitting their bodies to extend beyond the cushion at either end. The seat is manufactured by the car builder, and is the type most largely used in the city and suburban cars of this manufacture.

The width of the car over posts is 8 ft. 2 ins.; therefore, with 36-in. seats the aisle is 22 ins. wide. A gain of over 7 ins. is claimed by the builder on account of this style of seat and the fact that there are no wall window pockets.

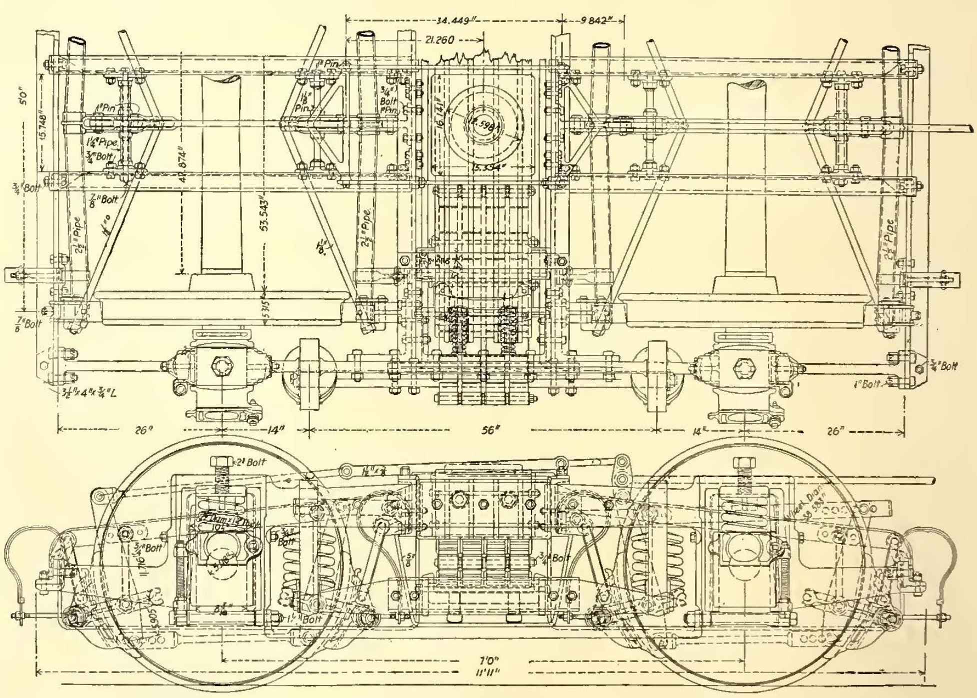
The interior of the cars is finished in mahogany, rubbed to a dull gloss; the heads of the posts are neatly carved, and the paneling is inlaid with a striping of holly. The birch head linings are painted a robin's-egg blue and decorated with a simple design. The standard form of bottom framing of this style of car is adhered to in the design, and includes 12-in. x 3/8-in. steel plates on the inside of 4-in. x 7 3/4-in. side sills; the center sills are 3 1/2 ins. x 4 1/2 ins.; the end sills, 5 1/4 ins. x 6 1/2 ins., and the crossings, 3 1/2 ins. x 4 1/2 ins. A pair of 3-in. x 4-in. x 1/2-in. angle irons, 14 ft. 6 ins. long, support the center of the platform at either end. Besides the seats, the cars are equipped with channel-iron drawbars, sand boxes, platform gongs, signal bells, brake handles, angle-iron bumpers, vestibule folding door controllers and other patented specialties of the builder's manufacture. The cars are mounted on No. 27-G trucks. The wheel base is 4 ft., and the track gage, 5 ft. 2 1/2 ins.; diameter of wheels, 33 ins., and the diameter of the axles is 4 ins.

The Toledo, Bowling Green & Southern Traction Company has inaugurated limited service between Toledo and Findlay with three special cars each way daily, making the 50 miles in 1 hour and 50 minutes, as compared with 2 hours and 30 minutes for local cars.

AN INTERESTING TRUCK FOR THE MILAN EXPOSITION

At the International Exposition to be opened at Milan, Italy, in April, 1906, the J. G. Brill Company will show, in the large section which it has engaged in the transportation exhibit, a pair of the largest trailer trucks ever built for electric service. The diagram herewith shows the truck in detail, and it will be seen that it is no less than 11 ft. 11 ins. over the frame—considerably larger than the four-wheel trucks in use on American steam railroads, and powerful enough to carry the heaviest Pullman cars; in other words, it has a carrying capacity equal to the largest six-wheelers. The truck is similar in size and type to those which were supplied to the Milan-Gallarate third-rail system three years ago.

The special features of its design consist of a means of adjusting the height of the quadruple elliptics, which carry the bolster; large diameter bolts, which, by being screwed down, take up the wear of the journal bearings; adjustable pedestal gibs, which take up the wear caused by the friction of the journal boxes, by means of long bolts passing through lugs on the sides of the pedestals by means of set screws; and an arrangement of outside and inside brakes which are operated by one rod. Each side frame is composed of a single solid forging 11 ft. 11 ins. long; the center of the side frame is 7 ins. wide and 1 3/8 ins. thick; the extensions are 6 ins. wide and 1 1/2 ins. thick, and the pedestals are 4 ins. wide and 4 ins. thick, with the top of the yoke 6 ins. across. Nine-inch channels compose the transoms, and are secured to the side frames with double and single corner brackets 1 in. thick, forged from a



PART PLAN VIEW AND SIDE ELEVATION, SHOWING THE CONSTRUCTION DETAILS OF THE LARGE TRAILER TRUCK TO BE EXHIBITED AT MILAN

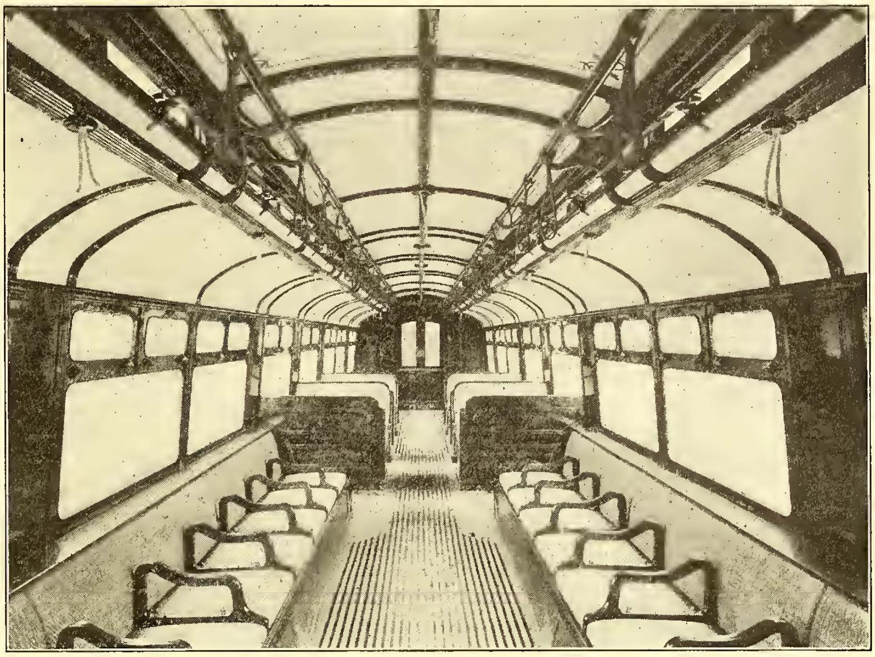
single billet. The end crossings are made of 3 1/2-in. x 4-in. x 3/4-in. angle iron, secured at each end to the palms of the extensions with two 1-in. bolts. The frame is thus made capable of keeping the truck square, and the nature of the metal renders it proof against crystallization.

The spring system is composed of three sets of springs working in series, each having to do with the equalization of the load. Instead of having the load bear upon the center of the side frames, it is brought upon them at wide-apart points near the yokes by means of spring links, thereby holding the frame down upon the journal springs with leverage against the wheels and brakes. Besides producing an effective leverage in favor of stability, placing the links near the yokes relieves the center of the side frames of much of the strain; in other words, the load is carried close to the points where the frames are supported upon the axles. Being outside the wheels, the spring links furnish a wider link base than possessed by any other truck, a feature which results in the diminishing of the rocking motion of the car. At the same time they amplify the vertical motion of the elliptics and impart smoother motion to the car. At the entrance to curves the spring links swing outwardly, and at the end of the swing the springs in the links are compressed, driving the car body gently out of the line of its momentum into the new direction without jar or lurch. The wheels share the benefit of this cushioned side swing, as the flanges are not forced violently against the rail-heads. The equalizing bars and spring plank are rigidly secured together, forming a cradle for the bolster. The links which suspend this cradle from the frame enclose what are known as equalizing springs, but these equalizing springs must not be understood to directly equalize the load upon the wheels, as in the "M. C. B." type, for the truck is doubly equalized—that is, the load is equalized upon the frame before it is equalized upon the wheels. The Brill Company will also exhibit a pair of equalizing short base trucks, No. 27-E-1 type; a pair of "Eureka" maximum-traction trucks and a single truck, type No. 21-E; also models and sections of cars and trucks.

STEEL CARS FOR A LONDON UNDERGROUND RAILWAY

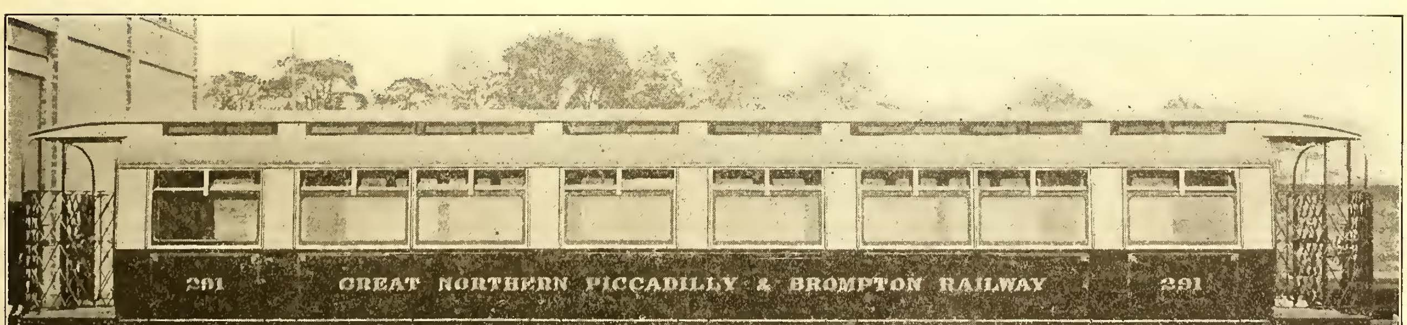
The Great Northern, Piccadilly & Brompton Railway, which is one of the later underground electric lines of the Yerkes system in London, has recently received the first of its steel frame cars. Exterior and interior views are shown in the accompanying engravings. Mr. Yerkes was one of the first advocates of non-combustible cars for underground railways, and, as previously described in this paper, the District Railway has a number of non-combustible cars built of chemically-treated timber. The accompanying illustrations, however, show the latest development in the direction of this class of car. The Great Northern & City Railway, of London, has ordered eighteen steel cars of a similar type. The accompanying table gives the main dimensions and weights of the cars on the three lines which are referred to in this article.

As will be noticed, the saving per passenger seated is 261 lbs. between the Great Northern steel car and the Metropolitan District wooden car. Both of these cars, as well as the Great Northern & City steel cars referred to in this article, were built by the Brush Electrical Engineering Company, of London.



SEATING ARRANGEMENT OF NEW TYPE OF STEEL CAR FOR LONDON UNDERGROUND RAILWAY

Descriptive	Great Northern & City Railway		Metropolitan District Railway		Great Northern, Piccadilly & Brompton Railway Steel Car	
	Ft.	In.	Ft.	In.	Ft.	In.
Length over body	40	8	35	8	41	8½
Length over platforms	49	6	49	9½	49	9½
Width over end posts	9	4	8	9	8	8
Extreme width	9	4	8	10½	8	9
Height from floor to roof	8	6½	8	5	7	6
Height from rail to top	12	4½	12	3¼	9	5⅜
Wheel base	6	1	6	6	5	0
Truck centers	34	6	33	10½	33	0
Diameter of wheels	3	0	Motor, 3′ 0″; Trail, 2′ 6″		2	6
Seating capacity	58		52		54	
	Lbs.		Lbs.		Lbs.	
Weight	42,112		47,600		35,550	
Weight per passenger seated	726		918		657	



EXTERIOR VIEW OF THE NEW STEEL CAR FOR THE GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY (UNDERGROUND), LONDON

PROGRESS ON THE MEXICO CITY TRAMWAYS

W. W. Wheatly, president, and Paul H. Evans, chief engineer and purchasing agent, of the Mexico Electric Tramways, Ltd., reached New York this week for a short visit. Mr. Wheatly, it will be remembered, went to Mexico as manager of the tramway system in the spring of 1904. He had previously been general manager of the Public Service Corporation, of Jersey City, and before that had been connected for a period of six years with the Brooklyn Rapid Transit Company. Mr. Evans was appointed to the position of chief engineer of the Mexico Company in June, 1904, after an experience in Mexico extending over many years. He went to Mexico first in 1889 as superintendent of construction of the Thomson-Houston Company. Later, upon the organization of the General Electric Company, he became engineering expert for the Mexican branch of that company, during which time he placed to his credit the construction of some of the most notable electric power transmission plants in the Republic, among them being that of the Guadalajara Electric Light Company and the Regla-Pachuca plants. Before going to Mexico, Mr. Evans was for three years with the Atlanta, Ga., street railway system.

W. W. WHEATLY

According to Mr. Wheatly, electric operation on the electric tramways lines in the City of Mexico was commenced in the year 1900, and at the present time there are in operation about 285 electric cars, 200 mule cars and about 85 steam railway cars. There are 106 miles of electric track, 116 miles of mule track and 15 miles of steam track, making a total of 237 miles.

One of the principal causes of the delay in beginning electric operation in the City of Mexico was on account of the high price of coal, which even now costs about $10 gold per ton, and furthermore, the possibility of bringing cheap hydraulic power to the city from some of the numerous waterfalls in the Republic. The work of converting additional mule lines to electric operation, although temporarily suspended during the past year, is now being resumed and will be carried along without any intermission until practically the entire system is converted to electric operation.

The Mexican Electric Tramways, Ltd., has recently made a contract to receive hydraulic power from the Mexican Light & Power Company. This latter company is now completing the installation of its hydraulic plant at Necaxa, where there are about 40,000 hp under process of development, with an additional 40,000 hp held in reserve. The tramways company expects to receive current from these falls about the middle of 1906, and will take all of its power from the Necaxa power plant. The amount contracted for at first is about 5000 kw, but this must necessarily be increased during the next few years to 8000 kw, on account of the conversion of additional mule lines to electric operation and the natural increase of the traffic. According to Mr. Wheatly, his especial mission here at this time is to purchase the electric apparatus for the installation of the company's four new sub-stations which are to receive the alternating current from the Necaxa Company's plant. At the same time he is taking advantage of his presence in New York to make purchases of a large quantity of additional materials for his company.

When asked about the general outlook for business in Mexico, particularly in regard to transportation and railroad enterprises, Mr. Wheatly said that most of the capital for the development of these industries of the Republic of Mexico up to the present time has come from the United States, Canada and England. Mexico to-day, in its physical development, is in about the same state of progress as were the Western Territories of the United States some thirty or forty years ago. The Pacific Coast States of Mexico are still practically virgin and will not receive great impetus toward their development until railroad facilities are forthcoming. The Mexican Central Railway and the Kansas City, Mexico & Orient Railway are now pushing their lines toward the Pacific Coast, and it may not be more than another year until that portion of the Republic is opened up for development. To most of the American people Mexico is somewhat of an unknown country, but there is no reason why, on account of its being one of their two nearest neighbors, it should not be quite as well known to them as are the provinces of Canada. The natural resources of Mexico are not excelled by any other country in the world, and Mr. Wheatly said that he was somewhat surprised to find upon going to Mexico about one year and a half ago that the American people have not taken a greater interest in the development of this rich and fertile country.

In answer to a question as to some of the special characteristics of the tramway system in Mexico, he said that one of the things which impresses the newcomer is the up-to-date character of the company's plant and equipment, which, in his judgment, is second to none in the United States. A distinguishing feature of the operation is the separation of the classes. Although nearly all of the steam railroads of Mexico operate first, second and third-class, the tramway system has only first and second-class cars. A large portion of the public who patronize the tramways is of the poorer classes, and for their especial benefit the second-class service is operated. The fares on the second-class cars are, as a general rule, about 60 per cent of the first-class fares, and second-class operation is confined entirely to what might be termed the suburban lines, as distinguished from the city lines. The rate of fare on the city lines is 6 cents, with no second-class, and on the suburban lines the fares range from 4 cents to 16 cents for the second-class and from 6 cents to 30 cents on the first-class cars. There are altogether seventeen different rates of fare on the company's suburban lines, graded according to distances.

Another especial characteristic of the operation of the Mexican city lines is the handling of the funeral service. Included in the company's equipment are seventy-five to eighty funeral cars. All of the large cemeteries of the city and suburbs are reached by the lines, and the company provides funeral cars for more than 95 per cent of all the people who die there. There are no hearses in Mexico as they are known in the United States, except such as are furnished by the tramway company for working in connection with its trolley lines.

The company's present steam power station has a normal capacity of 3200 kw, and contains three 800-kw steam-driven generators and two 400-kw steam-driven generators. The power plant is as complete as it is possible to make it, and the company has every facility for economical operation.

RECENT WORK OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION

As authorized at the Philadelphia meeting, the executive committee of the American Street and Interurban Railway Association has established a permanent office in New York City, in charge of Bernard V. Swenson, secretary and treasurer. Quarters have been selected on the sixth floor of 60 Wall Street, a location which is in the center of the financial district and close to the engineering district. For these reasons it will be convenient for street railway men visiting the city. The telephone number is 5882 John. At these quarters Mr.

Swenson is organizing the department of information outlined in the address of the president, and is also engaged in preparing for publication the report of the association. Two subjects have been given special attention at the office of the association since its establishment. One is the question of municipal ownership, on which the secretary has been compiling data. The other is the subject of fire insurance. It will be remembered that the American Street Railway Association has a standing committee on car wiring, which consisted last year of W. A. Pearson, chairman; Richard McCulloch, of St. Louis; C. B. King, of Detroit; Henry M. Ballard, of Boston, and E. A. Sturgis, of Worcester. This committee met last year with a committee on behalf of the Underwriters' National Electrical Association and representatives of the General Electric and Westinghouse companies, and formulated the rules for car wiring which were published in the Street Railway Journal for July 16, 1904. During the past year, the resignations of Messrs. Pearson and Ballard have been received, and in their places the president has appointed M. G. Starrett, of New York, and John Lindall, of Boston. In view of the completeness with which the committee did its work last year, no formal meeting of the committee will probably be called this fall and no changes are proposed in the rules for car wiring already published, except a short paragraph in the section relating to car heaters. This amendment and the general subject of a national insurance code will be considered at a meeting of the Underwriters' National Electrical Association which is to be held Dec. 6 at the auditorium of the New York Edison Company on Duane Street, New York City. The Underwriters' National Electrical Association, it will be remembered, is the body which is in charge of the broad subject of a national insurance code, and of which the committee on car wiring, referred to, reports. The association is composed of representatives from the American Street and Interurban Railway Association, American Institute of Electrical Engineers, American Society of Mechanical Engineers, National Electric Light Association, National Institute of Architects, Underwriters' National Electrical Association and other bodies. Frank T. Sloan, insurance engineer of the Brooklyn Rapid Transit Company, has been appointed as the delegate of the American Street and Interurban Railway Association at the conference, and Secretary Swenson has also been invited to attend as a guest.

LONDON LETTER

(*From Our Regular Correspondent.*)

The London County Council, after considerable opposition, has finally adopted the recommendation of the highways committee to promote a bill in Parliament next session for the supply of electrical energy in bulk to London. This bill will be, as may be naturally supposed, in opposition to the administrative and county bill which was promoted last session by a Northern syndicate, of which Mr. Merz was the leading spirit. The latter bill, as will be remembered, failed to reach its third reading before the end of the Parliamentary session, and will doubtless be brought forward again the next session. In addition to these two schemes, three other bills will be promoted in Parliament, practically with similar aims. First of these three is a group of borough councils, including those of Hackney, Stepney, Bethnal Green, Shoreditch, Islington, Deptford, Bermondsey, the urban councils of Leyton and Walthamstow, and the Corporation of West Ham, which propose to combine for the purpose of producing and selling electricity in bulk. The fourth is a combination of the electric lighting companies which propose to extend their present works, and the fifth is a combination of railway companies for the production of electrical energy for sale to themselves or to whatever boroughs may desire to purchase. Next year's session will therefore be a lively one electrically, and at this moment it is absolutely impossible to foresee what the result will be. As regards the London County Council proposal, a serious note of warning has been made by Lord Welby and others on behalf of the finance committee as to the financial position of the London County Council, as some of the more conservative of the officials believe that the London County Council has involved itself in sufficient expenditure without adding the huge expenditure necessary for the installation of an enormous electricity scheme of this kind.

Mr. Baker, chairman of the highways committee of the London County Council, stated that it is hoped to have the new system of tramway cars, which are to run in the subway which has been constructed under the new streets, Aldwych and Kingsway, which were recently opened for public use by the King, in service by the end of the year. These tramways are to run from the Strand in this subway to a point in Southampton Row a little beyond Holborn, where they will come to the surface and continue to the Angel, Islington. As only single-deck tram cars will be used in connection with this system, owing to the size of the subway, the highways committee is suggesting the use of trailers, which are at present forbidden by the board of trade, which will be approached with a view to obtaining special permission for this particular portion of their system. The London County Council has also recently invited tenders in connection with the reconstruction of the old lines of the North Metropolitan Company, which are at present being operated by horse traffic. The work will begin early next year and will probably be finished by the end of 1906. Already certain contracts have been placed, more notably that for the steel rails, which contract has been given to Bolckow, Vaughan & Company, of Middlesbrough. The committe has asked the Council to approve of estimates in connection with this portion of their work totalling more than £800,000.

Another scheme for the general distribution of electric current in London has also recently been published, the plan being to build a generating station on the banks of the Ouse in Huntingdonshire, where arrangements can be made for an excellent supply of cheap coal. The current would be transmitted to London by means of high-pressure cables at a pressure of about 15,000 volts, and distributed in the metropolis by means of sub-stations. The company that is to be formed will have a capital of about £2,000,000, but so far no details are available.

The new car building and repair shops of the Manchester Corportation Tramways, at Hyde Road, were recently formally opened by the Lord Mayor. The members of the tramways committee with their guests assembled at the tramways office in Piccadilly and went on a car to the new works. These adjoin the large car-shed opened about two years ago. Before the erection of the new works the land upon which they stand was used for the storage of the large quantities of permanent way materials necessary for the construction and repair of the 150 miles of tramway track within the city and suburban districts. The works are said to be thoroughly modern and up to date. On the one side there are the woodworking and car body shops, and on the other side the mechanical and electrical shops. The main avenue is 50 ft. wide, and is provided with a traveling crane for lifting and transporting car bodies and trucks. The woodworking side contains the machine shop, the cabinet-makers' shop, the general car body repairing and building shop, and the paint shop. On the mechanical and electrical side are the smithy, the brass foundry, the machine shop, the truck shop and the electric shop. The area of land taken up is about 4 acres, 2½ acres of which are under roofs, and the total cost of the works and equipment has been £54,200.

England will very soon have the distinction of three towns equipped with the surface contact system, each of the towns having adopted a different system from the others. The first of the towns, as is well known, is Wolverhampton, where the Lorain system has been in successful operation for some years. Torquay, one of the beautiful English watering places on the south coast, adopted the Dolter system some time ago, and the work is now well along toward completion, and had it not been for disputes between the Dolter Electric Traction Company and the Corporation as to the provision of the necessary power for operating these tramways, they might have been in service by this time. The Dolter system is perhaps best known in France, but it is understood that a great many important improvements have been made, especially in the contact boxes, over anything which the company had previously installed in that country. The other system, which is also approaching completion, is that in the city of Lincoln, where the Griffiths-Bedell system has been adopted. The work has been progressing on this installation for several months, and it is now only a question of a very short time before the cars will be in operation. Electrical engineers, and tramway engineers in particular, are looking forward with great interests to the results of these two systems, so that they may be compared with the results of the Lorain system, which are now pretty well known, and with the results of any ordinary overhead trolley installation.

We referred last month to the extension of the Bournemouth Tramways to Christchurch, which system of tramways also extends in the other direction to Poole. There has recently been brought forward a proposal to build an electric tramway system from Bournemouth, though not by the Corporation, to Swanage via Camford Cliffs, Poole Harbor mouth and Studland. The district is a very beautiful one, and has, to a very large extent, been totally unopen by means of any communication to the tourist or traveler. The difficulty of access to Studland has been, of course, the barrier of Poole Harbor mouth, but if this difficulty can be overcome by means of a bridge, a most delightful sea front would become accessible. The proposal for providing the connecting link between North and South Haven includes the erection of a conveyor bridge, a few of which are now in successful operation in various parts of the world. The cars would be transported from one side to the other by means of the conveyor, and the only difficulty that appears in the way now is the difference of opinion between the Poole Harbor Commissioners, the Poole Corporation and the promotors, as to the necessary height of the bridge above high water and the necessary width of the clear span of waterway.

A deputation to the Manchester tramways committee from the Oldham Corporation has submitted a proposal that a through service of cars be established between Piccadilly (Manchester) and Waterhead (Oldham). Each corporation would provide and run its proper proportion of rolling stock, the whole of the earnings on the Manchester lines would be handed over to the Manchester Corporation, and the whole of the earnings on the Oldham lines handed over to the Oldham Corporation. The general manager, Mr. McElroy, was instructed to confer with the manager of the Oldham Corporation Tramways with a view to the preparation of a detailed scheme for the consideration of the two committees.

At Falkirk a system of electric tramways has been completed, officially inspected and opened to the general public. The service is to be a five minutes' one under ordinary circumstances. The system supplies a populous and scattered district, comprising Falkirk, Bainsford, Carron, Stenhousemuir, Larbert and Camelon. The car houses are between Camelon and Larbert, and from thence the track passes through Camelon, across the Forth and Clyde Canal to Falkirk, through Newmarket Street, Vicar Street and Graham's Road, across the Forth and Clyde Canal again, through Bainsford on to Carron and Stenhousemuir, returning via Larbert and the Stirling highway. The track is a single one, with double lines where necessary. The electric power is supplied by the Scottish Central Electric Power Supply Company from the power station at Bonnybridge to a sub-station close to the car sheds at Carmuirs. The cars are all double-decked and each measures 28 ft. 6 ins. x 6 ft. 6 ins. Each car is driven by two motors of 60-hp combined, and is provided with lifeguard, folding steps, etc. The accommodation is 22 inside and 26 outside. Messrs. Bruce, Peebles & Company (Ltd.), Edinburgh, installed the system, the cost of which was estimated to be £60,000.

Recently the Perth tramways, as reconstructed and electrified by the Corporation, were formally inaugurated. Along with Lord Provost Love, the magistrates and members of the Town Council a large number of influential citizens were invited to the opening ceremony. The company were driven to the electric station, where Lord Provost Love called upon Councillor Wotherspoon, convener of the electricity committee, to explain the arrangements. Mr. Wotherspoon then gave a brief description of the plant, which includes switchboard, engine and dynamo, and stated that they had provided power to drive more than forty cars. Mrs. Wotherspoon then started the engine. Mr. Lauder, on behalf of the engineers and contractors, presented Mrs. Wotherspoon with a silver bowl as a memento of the occasion. Ex-Dean of Guild MacNab, convener of the reconstruction committee, turned on the current. Mrs. Love, wife of the Lord Provost, who started the cars, was presented by the engineers and contractors with two silver vases as a memento of the occasion. The proceedings were watched by a large number of the general citizens. The system, which is 6 miles in length, has cost between £80,000 and £90,000, which sum includes the purchase price, £21,800, for the old system.

The linking-up of the Wolverhampton tramways with the lines of the British Electric Traction Company, whereby Wolverhampton is looking forward to inter-communication with Bilston, Dudley and other towns, appears likely to become an established fact. A car has been brought from Dudley and fitted up with the necessary mechanical appliances at the depot in Cleveland Road, while several of the Lorain cars are, in turn, being fitted up with the standard trolley to qualify them for the other system.

A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

It may not be generally known that in France, State subsidies for promising tramway and light railway schemes are still obtainable. The law authorizing these subventions was passed in 1880, and when the yearly budget is passed the sum which the Minister of Public Works then requests for each year is credited. In 1904 the sum of 1,000,000fr. ($200,000) was authorized for such subventions, and of this sum about a half was spent, a sign of the small number of new enterprises then being promoted. For the present year, however, although 1,000,000fr. was again authorized when the budget was passed in March last, the sum has been exceeded, and the Minister of Public Works and the Minister of Finance have deposited at the Chamber of Deputies a supplementary law authorizing the expenditure of the 500,000fr. not so used in 1904, on tramway and light railways at present being promoted, this making a total State subvention for 1905 of nearly 1,500,000fr. for this class of enterprise.

There has not yet been installed in France any single-phase tramway or railway system beyond the experimental line in the south of Paris, about 1000 yds. in length. In the Auxerre district, however, where a rather extensive light railway scheme has been authorized, plans are being made for the installation of single-phase equipments, and there is considerable discussion of the details of the concession and conditions under which the operating company will be permitted to accept the single-phase system. The Departmental Council, whose duty it is in this case to give the concession of the lines, is endeavoring to make rather stringent regulations, especially concerning the public safety, which is considered to be rather carefully guarded in France, in the face of the new enterprises. Among other conditions for the concession, will probably be included a proviso that, if at the end of one year the single-phase lines do not give satisfaction, they shall be either replaced by the direct-current system, or single-phase system with a low voltage, comparable to the usual direct-current 550-volt distribution. In view of the successful introduction of single-phase motors outside of France, the system has met with favor and, unless legislation or other onorous conditions interfere with the natural expansion of light railways on this system, it will probably be adopted in several interurban and departmental schemes at present under consideration where direct-current lines would scarcely pay the outlay on the necessary network.

The Paris-Metropolitan Railway authorities have now officially stated that the southern part of line No. 2 will be opened for service about the end of January. This line consists of both underground and overhead construction, and it is the construction of two bridges over the Seine which has so long delayed exploitation, although the nature of the foundations in the section passing through the catacombs (Montparnasse district) in any event would have made immediate service inadvisable directly the tunnels and viaducts were completed.

Some time ago the conversion of existing steam tramway lines between Paris and St. Germain was authorized, and the trolley lines were expected soon to replace the cumbrous locomotives still in use. Difficulties of a financial nature, however, have prevented the execution of the work, and this has given rise to a recent protest on the part of the Minister of Public Works.

Nothing definite is officially known regarding the solution to be adopted by the Paris Municipality in respect to the tramway situation in Paris, which is notoriously far from satisfactory, especially as regards some of the newer lines built since 1900. An amalgamation of several of the more important lines would appear to be the best solution, but there are many local difficulties in the way of its realization. Some of the financial papers here state that a group of capitalists is considering the proposal made in this respect to build a large central power station for supplying current to the various tramway installations, one or two of which are about to make additions to their equipment.

Some experimental high-speed suburban cars are receiving their equipment at the Tempelhof works. The equipments are arranged for single-phase alternating currents at 6000 volts, stepped down on the car itself to 750 volts, and to 300 volts near stopping places. The motors are built for 115-hp and a speed of 50 km per hour is expected. The cars are similar to those destined for the Hamburg-Altona route, and tests are about to be made on the equipments, which it is said will also be adopted for the neighborhood of Berlin.

In Algiers, where there is already an extensive tramway system, the Town Councils are somewhat closely connected with the undertakings, although they do not go to the length of municipal ownership. The town of Constantine has just voted a subvention of 350,000fr toward a light railway, uniting Bugeaud with Bone. The former place is a well-known pleasure resort of Algerians.

CALIFORNIA MIDLAND RAILWAY COMPANY

John Martin and E. J. de Sabla, Jr., of San Francisco, have incorporated the California Midland Railway Company, with a capital stock of $3,000,000, the purpose of the corporation being to construct an electric railway connecting the towns of Marysville, Nevada City and Auburn. Mr. Martin has been actively engaged for some months with the preliminary arrangements of the proposed new road, which have progressed so far that it is announced construction operations will be in progress within a few days. The road has been surveyed over an easy grade, and practically all of the rights of way have been obtained. Much of the right of way has been obtained by a citizens' committee of Marysville. Marysville is keenly anxious to see the road constructed, and the citizens' committee has prevailed upon many property owners to grant free rights of way over their lands. The committee expects to have the entire right of way completed in the near future. Mr. Martin already controls the electric line between Grass Valley and Nevada City, which will be operated as part of the new system connecting Marysville and Auburn. The new road will be operated by electric power, to be furnished by the California Gas & Electric Corporation, which is controlled by Martin and de Sabla.

NEW CAR SHOPS IN ST. LOUIS

The United Railways Company, of St. Louis, has made announcement of plans for the construction of its new car shops on part of the land recently purchased between Park, Grand, Vista and Spring Avenues. Six separate bays will be built over an area of 400 ft. x 350 ft., space to the east being left for the construction of four additional bays when needed. Each bay will have its own separate fire wall, and steam railway tracks will be run into all of them to permit of the direct delivery of carload lots of lumber and other material. The buildings will be for woodworking and repairing, and will include a planing mill and paint shop, the latter to replace the present paint shop at Jefferson and Gravois avenues. The bays will be equipped with the most modern machinery for woodworking, and electric motors will be used exclusively for driving.

The company is undecided as to the future disposition of its property at Jefferson and Gravois Avenues. The paint shop there is an old car house, and if the company uses that corner, it will be necessary to tear the wooden structure down and erect a new building. Work on the new buildings will begin in the early spring and they will be ready for occupancy in June or July, employing about 200 men. The grading of the land will be done during the winter. The bays will be single story structures, and besides the steam railway tracks, the company will run its tracks into them, so that cars needing repairs can be turned into the buildings.

SUBWAY SERVICE IN PHILADELPHIA FOR HOLIDAY TRAFFIC

President Parsons, Vice-President Widener and Chief Engineer Twining, of the Philadelphia Rapid Transit Company, after inspecting the Market Street subway a few days ago, are reported to have announced that orders had been given to work night and day in order that cars can be run underground from Fifteenth Street west by Dec. 15. The company hopes to operate cars in the subway for the relief of the Christman congestion. Ordinary surface cars will be used for the time being and will be added to the Market Street and the Lancaster Avenue lines. The management of the company is of the opinon that these extra cars, which will run at uninterrupted high speed between Fifteenth, Nineteenth and Thirtieth Streets, will do much toward handling the crowd that rides west of Broad Street. The cars will stop at Nineteenth Street on their east and west trips. Temporary waiting rooms will be furnished and every means taken to insure the comfort of subway passengers. The entrances to the temporary station at the starting point will be on the north and south sides of Market Street between Fifteenth and Sixteenth Streets. The entire station, which will be the largest in the subway, will not be completed until the work of building the loop around City Hall is well under way. Only the finishing touches remain to be put on the subway proper. The tracks are down, laid in a solid bed of concrete. In a trip through the subway recently the officers found the air to be pure and fresh and there was an entire absence of odors of any kind. The underground drainage system is in working order and the light is good. The temperature was only 1 deg. lower than on the surface. This indicates that the air supply is constant and ample. It is hoped to make the first test run on Dec. 10.

PENNSYLVANIA COMPANY BUYS ELECTRIC RAILWAY

A controlling interest in the Allentown & Reading Traction Company, operating 34 miles of electric railway from Allentown to Temple by way of Kuntztown, has been bought by the Pennsylvania Railroad Company. The Pennsylvania, it is understood, will come to Allentown by this route, the Berks County terminal of which is a few miles from Reading and the Pennsylvania Schuylkill Valley branch. The electric railway parallels the East Penn branch of the Reading Railway. The company was chartered April 25, 1903, with a capital of $250,000. The cost of the road and equipment was $951,000.

AN ELECTRIC RAILWAY ON PRIVATE WAY BETWEEN BUFFALO AND NIAGARA FALLS

The International Railway Company proposes to build another electric railway between Buffalo and Niagara Falls. It has made application to the city of Niagara Falls to extend two streets there to meet its right of way of the new line. The present electric railway, which was originally the Buffalo & Niagara Falls Electric Railway Company, and was later absorbed by the International Traction Company, is built on a public highway. It is the idea to build the new line on a right of way entirely private, and in that way a faster schedule between Buffalo and Niagara Falls will be made possible. The present time between the two cities is an hour and a quarter. It was shortened to an hour with express cars a year ago, but they were not found to be satisfactory. The private right of way for the new line has not been entirely secured, but it is understood part of the new tracks will be laid on the Buffalo & Lockport right of way, which is the old Erie's line from Buffalo to North Tonawanda. From there to Niagara Falls land will have to be acquired. The building of the new line does not mean that the present route will be abandoned. The new one will be used for higher speed equipment, and when it is finished it will be possible to go from Buffalo to Niagara Falls by electric railway in 40 minutes.

DELAWARE & HUDSON PURCHASES ALBANY SYSTEM

The Delaware & Hudson Railroad has purchased another street railway property. Its latest acquisition is the United Traction Company, operating 86 miles of line in Albany, Troy and Cohoes and between those cities. The purchase is to be financed by the issue of $5,000,000 of 4 per cent preferred stock and $2,500,000 of 3¾ per cent debentures of a company, the securities of which will be guaranteed by the Delaware & Hudson Company. Speyer & Company have bought these securities. The $5,000,000 of stock of the United Traction Company, which is to be purchased at 150, may be deposited under this offer up to and including Nov. 28. The new securities will only be issued in the proportion in which the stock of the United Traction Company is deposited. The Delaware & Hudson's purchase of the United Traction Company of Albany follows its recent purchase of the Schenectady Railway, which runs from Albany to Schenectady. This line was formerly owned by the General Electric Company.

A NEW WOODWORKING CATALOGUE

In bringing out the fourth edition of its catalogue, the American Woodworking Machinery Company, of New York, has presented to users of woodworking machinery what is undoubtedly the finest and most elaborate catalogue ever published on this subject. Even a hasty glance through this publication will show that the scope of this company's work is so great as to cover practically every kind of machine needed for woodworking purposes. Quite a number of the machines shown in this book have been illustrated and described in the Street Railway Journal, but no railway management can form an adequate idea of the great variety of the American Working Machinery Company's apparatus for car woodwork without carefully examining this splendid catalogue. Where so much is given it is useless to single out particular devices, but it may be of interest to note that excellent descriptions are given of numerous types of resaws, saws, rippers, saw tables, timber sizers, planers, matchers, single and double surfacers, molders, shapers, borers, lathes, sanders, grinders, veneer presses, carvers, etc. The book contains fully 320 pages, 9 ins. x 12 ins., and is handsomely bound in gold-stamped cloth.

BALL OF ROCHESTER EMPLOYEES

On Tuesday evening, Nov. 14, the Rochester Railway Employees' Benefit Association held its sixth annual ball in Mirror Hall, Powers' Hotel. Three hundred couples attended and enjoyed a programme of twenty numbers. The cover of the programme was quite an innovation, differing radically from the conventional order of dance. A motorman and conductor in uniform were shown at the top of the cover, between which, tastefully arranged, one was informed that the sixth annual ball of the Rochester Railway Employees' Association is being held in Mirror Hall, Tuesday, Nov. 14, 1905. Directly beneath this heading appeared a half-tone engraving of the handsome double-truck private car "Genesee" of the Rochester Railway Company, with an illuminated dash sign bearing the words "Mirror Hall" and the car number, 1905. The car has been brought to a stop in front of a canopy at the entrance of the hall, and the motorman and the conductor are represented as cupids, the conductor being in the act of welcoming a lady and her escort, who are alighting from his car at the end of their destination, to the hall. The committees in charge of the dance were composed of the men and officials employed in the different departments of the company. The ball was voted the most successful one ever held, not only from a social standpoint, but from a financial one as well, the treasury of the association being enriched by about $525.

ELECTRIC TRAMWAY IN ROTTERDAM

Electricity as motive power for tramcars was used for the first time in Rotterdam Sept. 19, when the motive power of the tram line Honingerdyk-Parklaan was changed. This line runs through Rotterdam from east to west, and is 3.22 miles long.

The work of equipping the old Rotterdam horse car lines, which have been bought by the Rotterdamsche Electrische Tram-weg Matschepy (Rotterdam Electric Tramway Co.), with electricity, has been prosecuted for some time, and other lines could now be operated if the motive power was obtainable. The power is, however, in accordance with the company's contract with the city of Rotterdam to be furnished by the latter, and the plant at present owned by the municipality can only furnish motive power for twenty to twenty-five cars. A large electric plant is now being built for the city, but will not be finished before July, 1906.

A NEW USE FOR THE GASOLINE CAR

The Dayton "Journal," published at one end of the Appleyard properties in Ohio, besieged General Manager Stebbins of those properties for some months to run a car out of Dayton about 3 a. m. so as to permit the delivery of papers along the line of the road. As it was impracticable for Mr. Stebbins to comply with this request because of the discontinuance of service during the early morning hours, he suggested that the paper buy a gasoline motor car for use in this service. This the paper did, and a service is given that is satisfactory as regards newspaper requirements.

At 2:45 a. m. the car is placed on the tracks of the People's Railway at Jefferson and Second Streets, where it is loaded for the trip by boys with carts who hustle the papers from the "Journal's" circulation department to the car. Springfield is loaded first, then Urbana, Xenia, Yellow Springs, Goes, West Liberty, New Carlisle, Mail, Medway, New Carlisle, Osborn, Fairfield and Harshman in order named, so that the man in charge can handle without confusion as the car speeds on the run. Between 3:10 and 3.30 the car is backed down to Third Street and switched to the tracks of the City Railway Company, which are used to Springfield Street, where the D. S. & U. line begins. There the driver speeds up for the first stop, at Dead Man's Crossing viaduct. The pilot gets his orders from the despatcher at Medway, which are generally a "clear track to Springfield," and the car speeds to Harshman, where the first bundle is thrown to the waiting agent. Then the car, without a stop, drives to Osborn, where the second stop of the run is made. Then several stations are passed and, after a hard climb on Masonic Hill, the car arrives at the Fountain, where Crew Manager Minear with his fifteen carrier boys, who handle the Springfield papers, meet the car. Then begins a hustle of bundles. Urbana, Yellow Springs, Goes station are loaded on waiting traction cars. West Liberty, Bellefontaine and other bundles are hustled to the depot, while the pilot is reporting the safe arrival to the despatcher at Medway, after which the return trip is begun.

The speed shown by the car is remarkabe. One stretch of 6 miles has been made several times in 7 minutes, and the best time to Springfield, with three stops, is 48 minutes.

WESTINGHOUSE MANAGERS' MEETING

The annual convention of the district managers of the Westinghouse Electric & Manufacturing Company was held, Nov. 13-16, at the general offices of the company at East Pittsburg, R. L. Warner, New England manager of the company, acting as chairman of the meetings.

At the opening session addresses were delivered by E. M. Herr, first vice-president of the company; Frank H. Taylor, second vice-president, and by other officials. During the four days of the convention papers on topics of general interest were read by many of the officials and managers and by representatives of allied companies. On Wednesday evening, Nov. 15, the delegates and representatives of the local Westinghouse Companies were entertained at the Hotel Schenley by E. M. Herr.

At no time in the history of the company have the managers spoken with more enthusiasm of the business conditions in their respective territories. Speaking on the prospects for export business, Mr. Coster, manager of the export department, said: "The outlook for foreign trade has never been brighter in this country than at present. The superiority of American machinery, as compared with European manufacture, is being demonstrated every day, and in these markets where the Germans and English have heretofore enjoyed a monopoly, America is now gradually obtaining the lion's share of the business." Various district managers from different parts of the United States also made a number of glowing predictions concerning the business of the company for the coming year.

NEW IOWA ROAD

A. E. Park, of Des Moines, Ia., who has been promoting the construction of an electric railway from Des Moines to Winterset, Macksburg and Creston, during the past year, has finally reached that point where the actual fulfillment of his plans is assured. At a meeting of those interested in the project, held at the Elliott Hotel in Des Moines Nov. 23, 1905, articles of incorporation were adopted, officers elected and, in a measure, plans were completed which assure the construction of the line during the coming year. It has been decided to name the company the Des Moines, Winterset & Creston Interurban Railway Company. Headquarters have been established at Des Moines. The company proposes to build from Des Moines to Winterset, thence to Macksburg and from there to Creston. Two surveys for a route have been made. It is understood that the company will enter Des Moines over the Valley Junction line of the Interurban Railway Company and the Ingersoll Street line of the Des Moines City Railway Company. The new line will be constructed south from Valley Junction and will be about 44 miles long from Valley Junction to Creston, and 49 miles from Des Moines to Creston. A. E. Park, who has been promoting this line, has gone about it in a new way and has thus taken longer to get things in shape to form an organization. His plan has been to educate the people through the territory where is was proposed to build the line to the benefits of the road, and thus gain their confidence and cooperation. He has taken several months to do this, addressing public meetings, giving figures and statistics as to the cost of the road, its probable business, and also showing the value of such a road to the community through which it passes. He has also endeavored to interest the moneyed men of the cities and country, and in fact stated that he would make no attempt to organize until he secured a certain number of business men and capitalists in Des Moines, Winterset and Creston to take an active part in the enterprise. The officers of the company are: President, W. D. Skinner, vice-president and general manager of the Hawkeye Insurance Company, of Des Moines; secretary, Milo Ward, secretary of the Des Moines Commercial Club; treasurer, S. D. Alexander, vice-president of the First National Bank of Winterset and a wealthy land owner; general manager, A. E. Park, of Des Moines; general counsel, Nathan E. Coffin, of Des Moines. The members of the board of directors are: Charles A. Ainley, president of the Des Moines Fire Insurance Company; E. B. Steere, with the Bodman Shoe Company, of Des Moines; C. H. Philpot, vice-president of the Des Moines Fire Insurance Company; William E. Ballard, proprietor of the Munger Hotel; Ben F. Elbert and F. E. Thompson, representing Marshall Field; J. H. Wilson and J. H. Mack, owners of the First National Bank at Macksburg, and wealthy land owners; Martin Rowe, of Macksburg; John Ramsbottom and A. S. Linn, farmers south of Macksburg; Richard Brown, city attorney of Creston, and Charles A. Gover, of Omaha, banker and capitalist, and also the officers named above.

EQUIPMENT FOR JAPAN

The Yokohama Electric Tramway Company, Yokohama, Japan, has closed a contract with the Japanese engineering and contracting firm of Takata & Company, Tokio, for some additional rolling stock, and orders have been placed in this country, through Takata & Company's New York office, 10 Wall Street. Six No. 21-E Brill trucks, having a gage of 54 ins.; wheel base, 6 ft.; diameter of wheel, 30 ins.; axles, 3¾ ins., have been contracted for. Upon these trucks will be mounted 18-ft. closed car bodies, the length over platform being 25 ft. and the width from out to out of sills 6 ft. These car bodies will be built in Japan, and the trucks will be arranged to take Sterling brakes which have been ordered from the Sterling-Meaker Company by Takata & Company. The order to the Brill Company includes, in addition to the trucks, 14 pairs of wheels and exles which are to be supplied as spares. The motor equipments for these trucks have been ordered from the Westinghouse Electric & Manufacturing Company, as follows: Six double-motor equipments, each equipment to consist of two Westinghouse 12-A, 25-hp railway motors, the motors to be nose-suspension, and will be complete with suitable gears, gear cases, pinions, etc. Each equipment will be supplied with two Westinghouse No. 211 electric brake controllers, and will also be supplied with double trolleys, with 14-ft. poles, the distance between trolley wires being 18 ins. The order to Westinghouse also covers spare commutators, armatures, traley poles, brushes, gears, pinions, etc. For the trucks of these cars, Takata & Company have ordered from the W. T. Van Dorn Company, through its representative in New York, Ervin G. Long, 6 pairs of Van Dorn automatic draw bars No. 5, with ball joint, suitable for pulling a trailer weighing 20 tons.. Takata & Company have also ordered from the Ohio Brass Company necessary headlights, switches, gongs, etc., for use on the cars. This apparatus forms an addition to the equipment which Takata & Company supplied some time ago to the Yokohama Electric Tramway Company, and duplicates the previous installation.

NEW PUBLICATIONS

Government Regulation of Railway Rates. By Hugo Richard Meyer. Published by the Macmillan Company, New York. 486 pages. Price $1.50 net.

This is a live treatise on a timely subject by an author who has a well-established reputation as an authority upon the subject on which he writes. Prof. Meyer points out the evils which would result from a close regulation of railway rates by the Government, and justifies his conclusions by a strong array of facts and figures. Prof. Meyer is among those economists who are opposed to municipal ownership of street railways, and the same clear logic which combatted the theory of State or municipal ownership in the series of leaflets which he issued on that subject in the fall and winter of 1903-04, in Denver, is displayed in his discussion of the rate question on steam railroads.

High-Tension Power Transmission. A series of papers and discussions presented at the meetings of the American Institute of Electrical Engineers, under the auspices of the committee on high-tension transmission. Republished by the McGraw Publishing Company, New York. 466 pages. Price $3.00 net.

The rapid progress in electrical inventions has made it necessary for the student of the subject of high-tension transmission to turn to the proceedings of the scientific bodies of the country rather than to single treatises. The proceedings of the American Institute of Electrical Engineers have been particularly rich in this respect; in fact, there are few phases of high-tension transmission which have not been discussed at its meetings; for this reason the collection of these papers into one volume was suggested, and this plan, it is thought, will render the facts contained therein much more available than they otherwise would be.

Alternating-Current Machinery. By Prof. William Esty. Published by the American School of Correspondence. 412 pages. Illustrated. Price $3.75.

This book, like the other publications of the publishers, is designed especially for the busy worker in the field, and no mathematics are employed beyond trigonometry. The theory and principles of design of the alternator are first considered, after which the synchronous motor, transformer, rotary converter, etc., are taken up in detail. Graphical methods are used largely in place of analytical ones, and by means of examples scattered through the book to illustrate his meaning, the author has succeeded in making a most readable and easily understood treatise.

A description of the Städtische Strassenbahn, Frankfort-on-Main, Germany, published by the Frankfort Municipal Street Railway; 99 pages, 12½ ins. x 9½ ins.; illustrated. Price 15 marks.

Originally this book was published in honor of the Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen (German Society of Street & Interurban Railway Managements) on the occasion of its tenth annual convention held at Frankfort-on-Main. The text and illustrations were prepared entirely by the officials of the railway, and for this reason alone the book is unique, since every department of railway operation is treated in the most practical manner. In all there are ten chapters, covering the following subjects in order: History, management and personnel, hours and wages of employees, ameliorating institution for employees, schedules, mail transportation, fares and free tickets, rolling stock and shops, including some interesting repair shop kinks, one of which is illustrated in another column of this issue of the STREET RAILWAY JOURNAL, transmission system, economies in the use of current, and a description of the overhead construction. The work is splendidly bound, printed and illustrated, and forms an excellent description of modern German street railway practice in cities of medium size.

Telephony, Part VI.; Switchboards and the Central Office. By Author Vaughan Abbott. Published by the McGraw Publishing Company, New York. 271 pages. Illustrated. Price $1.50.

This book concludes the valuable series written by the author by a treatment of the most vital part of the central telephone system. Central office practice has seen several revolutions during the past ten years; first, from the series-multiple board to the branch terminal, and then to the common battery automatic signal board. The author discusses the auxiliaries, such as the power plant, as well as the boards themselves, and gives a chapter on "traffic," in which he discusses rates and similar subjects.

Tibet and Turkestan. By Oscar T. Crosby, F. R. G. S. Published by G. P. Putnam's Sons, New York. 321 pages. Illustrated. Price $2.50 net.

To those who were associated with the author in his pioneer electric railway work, or who are acquainted with the success which attended his efforts in developing the electric railway motor and in studying train resistance at high speeds, this book will be particularly interesting. The same energy which characterized Mr. Crosby's electric railway experiments has followed his important work as an explorer. His trip through Russian and Chinese Turkestan and across the western corner of Tibet, though attended with considerable personal risk, was productive of important geographical discoveries, and an account of it is most readable.

PERSONAL MENTION

MR. THOMAS DAVIS, for several years chief engineer of the central power station, Boston Elevated Railway Company, and late of Pittsburg, Pa., has been appointed superintendent of power stations of the Boston Elevated Railway Company.

MR. C. B. KING, of Detroit, has been appointed manager of the London Electric Street Railway, of London, Ont., to succeed Mr. C. E. A. Carr, who has become connected with the Helena Railway Company, of Helena, Mont.

MR. FRED GRIFFITH, superintendent of the Hamilton Street Railway Company, of Hamilton, Ont., has been appointed to a position in the office of the Cataract Power Company, and Mr. D. N. Milles has been chosen as his successor with the Hamilton Company.

MR. SIDNEY SPROUT, electrical engineer of the Ocean Shore Railway Company, of San Francisco, has gone to Chicago, where he will consult with the engineering firm of Sargent & Lundy regarding some of the details of the power house equipment for the new road.

MR. W. W. WHEATLY, president and general manager of the Mexico City Electric Railway Company, which controls all the street railway lines in the city of Mexico, is on a visit to the United States in the interest of the properties of which he is in charge. Mr. Wheatly is stopping at the Astor, New York.

MR. H. T. EDGAR, for the past four and one-half years vice-president and manager of the El Paso Electric Railway Company and the International Light & Power Company, both of El Paso, Tex., has resigned to accept the position of second vice-president and manager of the Northern Texas Traction Company, of Fort Worth, Tex., which operates the local lines in Fort Worth and the interurban between Fort Worth and Dallas. All the properties mentioned are under the general management of Stone & Webster, of Boston.

TABLE OF OPERATING STATISTICS

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

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Oct. '05	84,577	46,897	37,680	22,967	14.713
	1 " " '04	78,013	42 839	35,174	22 467	12,707
	10" " '05	801,091	427,907	373,185	230,270	142,916
	10" " '04	747,727	406,522	341,205	226,128	115,077
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Sept. '05	43,809	23,623	20,187	9,333	10,853
	1 " " '04	38,886	21,432	17,454	9,333	8,121
	3 " " '05	140,794	70,506	70,288	27 839	42,449
	3 " " '04	127,259	63,887	63,372	27,839	35,533
BINGHAMTON, N. Y. Binghamton Ry. Co	1 m., Oct. '05	22,728	12,262	10,467	7,282	3,185
	1 " " '04	19.431	11,572	7,859	6,867	992
	4 " " '05	110,583	51,978	58,605	28,847	29,758
	4 " " '04	98,248	48,763	49,485	27,808	21,677
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Sept. '05	63,770	31,628	32,143	------	------
	1 " " '04	46,786	22,868	23,918	------	------
	3 " " '05	209,974	97,674	112,300	------	------
	3 " " '04	158,857	76,129	82,728	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Oct. '05	62,028	23,030	38,998	------	------
	1 " " '04	55,625	17,812	37,813	------	------
	10" " '05	473,891	195,872	278,018	------	------
	10" " '04	379,902	143,556	236,346	------	------
CINCINNATI, O. Cincinnati Northern Tr. Co	1 m., Sept. '05	51,910	------	------	------	------
	1 " " 04	47,581	------	------	------	------
	4 " " '05	206,512	------	------	------	------
	4 " " '04	197,404	------	------	------	------
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Oct. '05	21,872	* 12 183	9 688	6,658	3,030
	1 " " '04	19,758	* 11,844	7,915	6,683	1,231
	10" " '05	207,190	* 119,196	87,995	67 373	20,622
	10" " '04	191,948	* 114,002	77,946	66,973	10,973
Cleveland & Southwestern Traction Co.	1 m., Oct. '05	48,728	26,343	22,386	------	------
	1 " " '04	44.171	24,150	20,022	------	------
	10" " '05	449 432	261,806	187,626	------	------
	10" " '04	397,243	248,289	148,954	------	------
DETROIT, MICH. Detroit United Ry	1 m., Oct. '05	447,462	* 282,039	165,423	92,388	73,035
	1 " " '04	401,837	* 237,085	164.752	88,585	76,167
	10" " '05	4,305,992	*2551475	1,754,517	921,574	832,943
	10" " '04	3,819,289	*2311791	1,507,498	891,655	615,843
DULUTH, MINN. Duluth St. Ry. Co	1 m., Oct. '05	57 506	27,906	29 600	17,388	12,212
	1 " " '04	51,642	26.077	25 565	16,514	9,051
	10" " '05	547,179	281 308	265,871	170,178	95,693
	10" " '04	513,536	272,377	241,159	164,984	76,175
FINDLAY, O. Toledo, Bowling Green & Southern Tr. Co	1 m., Oct. '05	26.766	12,927	13.839	5,879	7,960
	4 " " '05	112,418	55,385	57,033	23,516	33,517
GALVESTON, TEX. Galveston Electric Co.	1 m., Sept. '05	24,699	15,208	9,491	4,167	5,324
	1 " " '04	24,264	------	------	------	------
	5 " " '05	125,544	74,526	51,018	20,833	30,185
	5 " " '04	119,780	------	------	------	------
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Sept. '05	20,338	11,203	9,135	3,713	5,422
	1 " " '04	18.451	9,498	8,953	3,388	4,565
	12" " '05	170,196	169,112	1,084	42,588	† 41,503
	12" " '04	192,079	131,530	60,548	37,874	22,674
HOUSTON, TEX. Houston Electric Co.	1 m., Sept. '05	45,432	24,402	21,031	9,042	11.989
	1 " " '04	33,616	19,404	14 212	8,318	5,893
	12" " '05	492,070	294,400	197 670	103,522	94,149
	12" " '04	334,211	319,364	14,847	95,806	† 80,959
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Oct. '05	280,536	128,763	151,773	80,076	71,697
	1 " " '04	280,386	130,197	150.189	78,790	71,398
	10" " '05	2,669,333	1,285,404	1,383,929	769,217	614,711
	10" " '04	2,656,481	1,323,307	1,333,174	756,734	576 440
Milwaukee Lt., Ht. & Tr. Co	1 m., Oct. '05	50,475	19,845	30,629	21,331	9,299
	1 " " '04	38,727	17,155	21,572	17,670	3,902
	10" " '05	514,702	214.140	200,562	210,097	90,465
	10" " '04	387,462	183,041	204,421	168,016	36,404
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Sept. '05	454,062	176,032	278.030	103,208	174,822
	1 " " '04	373,944	166,017	207,926	91,842	116,085
	9 " " '05	3,482,688	1,578,150	1,904,538	897 008	1,007.529
	9 " " '04	3,208,172	1,510,168	1,698,004	817,133	880,871
MONTREAL, CAN. Montreal St. Ry. Co	1 m., Oct. '05	249,789	141 681	108,107	21,063	87,045
	1 " " '04	222,276	121,637	100,639	18,947	81,692
	12" Sept. '05	2,707,474	1,650,566	1,056,908	------	------
	12" " '04	2,463,823	1,510,996	952,827	------	------
OAKLAND, CAL. Oakland Traction Consolidated	1 m., Sept. '05	127,291	62,776	64,516	33,776	30,739
	1 " " '04	111,053	56,227	54,827	26,525	28,301
	9 " " '05	1,057,212	543.692	513,520	289,126	2 4.394
	9 " " '04	925,421	479,717	445,704	238,974	206,731
San Francisco, Oakland & San Jose Ry. Co.	1 m., Sept. '05	45,751	21,590	24,161	13,425	10,735
	1 " " '04	40,408	16,371	24,038	10, 75	13.763
	9 " " '05	392 059	171,358	220,701	119 564	101,137
	9 " " '04	297,959	131,371	166,588	77,640	88,948
OLEAN, N. Y. Olean St. Ry. Co	1 m., Sept. '05	11,332	6,058	5,275	2,570	2,704
	1 " " '04	9,492	5 080	4,412	2,631	1,781
	3 " " '05	38,160	17,776	20,384	8,157	12,226
	3 " " '04	32,841	16,157	16,655	7,894	8,791
PEEKSKILL, N. Y. Peekskill Lighting & R R. Co	1 m., Sept. '05	11,453	*5,668	5,786	------	------
	1 " " '04	10,843	------	------	------	------
	3 " " '05	35,945	*17,688	18,258	------	------
	3 " " '04	33,116	------	------	------	------
PHILADELPHIA, PA. American Rys. Co	1 m., Oct. '05	132,498	------	------	------	------
	1 " " '04	115,382	------	------	------	------
	4 " " '05	597,987	------	------	------	------
	4 " " '04	530,453	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Oct '05	152,571	78,628	73,943	28,848	45,095
	1 " " '04	127,104	70,320	56,784	27,036	29,748
	10" " '05	1,470,765	777,387	693,379	277,320	416,059
	10" " '04	1,238,207	678,973	559,233	266,246	292,986
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Sept. '05	614,055	------	------	------	------
	1 " " '04	617,642	------	------	------	------
	9 " " '05	5,187,343	------	------	------	------
	9 " " '04	4,911,994	------	------	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Sept. '05	48,721	29,044	19,678	10,561	9,117
	1 " " '04	46,843	26,099	20,744	10,613	10,131
	12" " '05	574,022	336,383	237,639	126,791	110,848
	12" " '04	535,579	303,742	231,837	125,678	106,159
SEATTLE, WASH. Seattle Electric Co	1 m., Sept. '05	222,588	140,892	81,696	23 594	58,102
	1 " " '04	196,295	134,167	62,128	25,771	36,357
	12" " '05	2,482,012	1,657,115	824 897	297,451	527,446
	12" " 04	2,266,785	1,582,927	683,859	281,894	401,965
SYRACUSE, N. Y. Syracuse Rapid Transit Ry. Co.	1 m., Oct. '05	83,727	46,073	37,654	20,495	17,160
	1 " '04	71 828	41,133	30,695	20,338	10,357
	4 " " '05	336,375	185,120	151,255	81,775	69,480
	4 " " '04	291,235	162, 42	128,593	81,129	47,464
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Sept. '05	54,988	30,715	24,273	10,829	13,443
	1 " " '04	52,149	28,707	23,442	9.664	13,778
	1 " " '05	604,687	394,953	209,734	118,334	91,400
	1 " " '04	552,070	367,136	184,934	112,539	72,394
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co	1 m., Sept. '05	44,968	*22,062	22,906	------	------
	1 " " '04	37,194	------	------	------	------
	12" " '05	395,547	*212,095	183,452	------	------
	12" " '04	340,099	------	------	------	------