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Regulating Street Traffic

The people of New York have witnessed during the last two weeks ample demonstration of the truth of the claims set forth by the surface railways throughout the country that congestion of traffic on city lines is due mainly to the utter incompetency and criminal negligence on the part of the city government in enforcing regulations governing the movement of vehicular traffic, particularly heavy drays and trucks. "London methods" have been introduced at several busy crossings, and the ease with which the much-sought relief has been secured wherever the plan has been tried has awakened public interest amounting almost to popular enthusiasm. The system comprises these essential features: Common sense methods of enforcing existing rules, strict attention by the police in the discharge of their duties and integrity and support on the part of superior officers. Surely it should not be necessary to go abroad for these essentials. Such an admission involves acknowledgement of a condition of public service not at all creditable or in keeping with our national pride. Yet the police department of New York and of every other large American city has found it impossible heretofore to cope with this matter until Deputy Commissioner Piper found that the London police experienced no trouble in handling traffic of much greater volume than is known in any city in this country. And now, after a few days' trial, relief is afforded at the worst points in the congested downtown district, and merchants and bankers, professional men and clerks, artisans and laborers, gather daily at these places to look on and applaud. We will not find fault with the present administration, nor will we criticise the acumen of the city officials who had to go abroad to learn such a simple lesson. Results are what the people and the street railway companies desire, and so far as the latter are concerned it makes no difference how roundabout the methods employed may be, so long as relief is afforded. It has been proven conclusively that present conditions are wholly unnecessary, and if the administration has sufficient moral stamina to extend this reform throughout the city it will earn the lasting gratitude of a long-suffering public, and it will certainly have the support and co-operation of the street railway management.

One of the rules that has proved most effective is to keep the heavy trucks off the railway tracks and make the drivers keep close to the curb in the crowded district. This leaves a clear passageway in the middle of the road for the lighter vehicles and the surface cars, and eliminates at once all the trouble and complications that have heretofore grown out of the breakdowns of drays on the tracks. This regulation should be enforced strictly in all large cities and wherever there is congestion of traffic. It does not deprive the teamsters of any rights, and it protects the general public in the enjoyment of theirs.

The Problem of Rural Railways

The report from the New Hampshire Railroad Commissioners, published in a recent issue, will furnish much food for reflection. On the face of the report electric railroading in the Granite State is not exactly a lucrative business. The majority of the lines did little more than pay their fixed charges, and no really respectable dividend was carned. It is not a pleasant outlook, and yet it hardly seems to us as generally discouraging as it looks upon its face. New Hampshire has only one city of even moderate size, and it has long been an axiom in the street railway business that roads in small cities seldom pay in virtue of the local traffic. The interurban and intertown, if one may venture to use the word, traffic is another matter, and often saves the balance sheet. In New Hampshire there is a considerable group of such roads, which appear on the face of the returns to have done anything but a land office business. They are unquestionably of very great benefit to the community and deserve every encouragement, so that their bad showing is a matter of rather serious import. If such roads cannot be brought into paying condition, even with the aid of considerable summer traffic, there must be some good reason for it. Either they were unwisely planned or badly designed, or, perhaps, injudiciously promoted, and they may suffer from a combination of these ills. But when roads of a kind in themselves desirable to the public fail to pay the reason should be investigated in search of a remedy. Perhaps it may appear that the case is not so desperate for the small road as would appear at the first glance.

The first question to be asked in this connection, and it applies to electric roads in every State, touches the matter of the real investment. Granting that the earnings are not sufficient to pay a dividend on the capital stock, were they or were they not sufficient to pay a fair return on the cash which actually

went into the property? If a small road pays its running expenses, its up-keep and depreciation, and 5 per cent or 6 per cent on bonds aggregating a quarter or a third more than what would have been the net cash cost of the system, it is not doing badly, but very well. If, in addition, it pays even a small dividend on its common stock (aqua pura) it may well be proud of the achievement. We are making no reference here to the New Hampshire lines, but the coat fits divers roads in divers parts of the country. At all events it does not follow that because a small electric road does not pay dividends it is badly planned or badly managed. There are plenty of cases in which the stock has scarcely any other purpose than to confer voting rights on the holders of the securities and was never seriously expected to pay dividends.

Putting this question aside, there are unquestionably some rural roads which have been very unwisely planned. Estimates of probable traffic are often difficult to make, and while, as a rule, trade follows the trolley more certainly than it follows the flag, the projectors of a road are sometimes deceived. This is particularly apt to be the case where a large fraction of the total patronage is expected to come from summer visitors. Such traffic is of a very deceptive character, for not only does it vary greatly from year to year, but it is extremely hard to estimate at any one time. There may, perhaps, be a couple of thousand summer visitors in the region during the season, but they are not all there at any one time or for any considerable part of the summer months. The average stay is usually rather shorter than it seems to the promotor, and it takes a very large population in August to compensate for its scantiness during the other eleven months.

And this brings us to the engineering part of the problem. If a road cannot count on large passenger traffic except during the summer months, it must plan both to keep down expenses and to do what it can to pick up freight, mail and express business. The freight franchise matter has been much discussed of late, but whatever may be said for or against it in general, it is quite certain that in rural roads it is a necessity not only for the prosperity of the line, but for the benefit of the community through which it runs. The rural railway is in competition not with trunk railroad lines, but with the farm wagon and the stage coach, and it ought to be given every opportunity to serve its patrons. When well administered in this respect it becomes of very great importance to the community and enhances very greatly the value of property along its line. As regards expenses it is much the same in building a railway as in building a house—the first estimate is generally exceeded, and there is continual temptation to add a little here and a little there until the total is swelled to a figure that is dangerously great. The art of building light railways for avowedly rural service is very little understood at present, and there is a steady tendency to put on the airs and graces of a big interurban line in situations where only the most modest expenditures are really warranted. It makes a deal of difference in the days of wrath, when the year's balance sheet is drawn up, whether the road has cost $10,000 per mile or $15,000, and whether the funded debt draws 5 per cent or 6 per cent. The nearer a rural road can come to being built on the net cash basis the more likely it is to pay, and when this fact is duly appreciated and acted upon the rural road will be upon a new basis of prosperity. It has excellent possibilities—not of the bonanza gold mine order, but such as are not to be despised in these days of lessening interest, and only needs caution and sound financing to win a worthy place for itself. A study of conservative light railroading is much needed in this connection, and will open a new vista of rural railroading.

The Waterbury Situation

It is now feared that the strike of the motormen and conductors on the Waterbury street railway will involve the entire business community of that city. Conditions have become intolerable, and the prospect of a protracted struggle has at last spurred the people into resentment against the lawless despotism that has ruled the town for several months. It is promised, too, that a determined effort will be made to shake off the yoke which was so complacently worn as long as it was imagined the interests of the wearers might be served by submission. Had the citizens and business men of Waterbury asserted their independence and manhood from the beginning, and insisted firmly upon the authorities maintaining order, the difficulty would never have reached the present stage, the differences between the company and the men would have been adjusted on their merits, and the city would have been saved the disgrace and humiliation of the blood-stained record of the last few months. But now the struggle has become too bitter to be lightly disposed of, and the protest of the business men against further intimidation and coercion is met by a threat of a general strike which would involve every employee in the city. This is the direct result of temporizing with the lawless element that for the present seems to dominate the labor organization of Waterbury. It may be viewed in the light of retributive justice, but it is nevertheless a menace to the welfare of the community and the material prosperity of the people involved. Fifteen manufacturing concerns located in Waterbury and employing at the present time upwards of 19,000 hands are threatened with a sympathetic strike unless they lend their approval and active assistance where necessary in enforcing the boycott of the trolley cars, and such local merchants as have incurred the displeasure of the labor leaders. The strikers have been driven to extreme measures through the obstinacy of their leaders in standing out for demands that could not be granted without practically turning the entire management of the property over to the union, and as the company has found little difficulty in filling the places of the strikers, the struggle has been continued by resorting to intimidation, destruction of property and even the shedding of blood. The experience is a costly one, but the lesson should not be lost on other communities.

Multiple Unit Systems on Low Voltages

All multiple unit systems depend in a greater or less degree upon magnets for the purpose of closing switch connections or locking or otherwise directing the movement of sub-controllers. It is, of course, necessary that these magnets act with precision and promptitude and, above all, reliably. As they depend for the line voltage on their energy it follows as a matter of course that they must be designed with as wide range as possible in order to operate reliably at the several voltages which are likely to be found on the line.

Many electric railways, particularly pioneer lines, hoping to improve their installations as the road develops earning capacity, are notably under coppered, and the voltage available at the cars is likely to vary all the way from 200 up to the power house maximum. Such installations must reasonably expect to encounter some difficulty with multiple-unit systems, and difficulties that would arise by failure of the magnets to act would be of a serious nature. The principal one is, of course, failure of the sub-controller to follow the movement of the master controller, and this would result in great inconvenience in operation.

A common device to make a magnet of large range is to

saturate the core so that on the low voltages the magnetism will be almost if not practically the same as high voltages applied to the exciting bobbin. This practice results in a new difficulty, namely, the residual magnetism in the magnets, which at times are heavily saturated and consequently are likely to retain magnetism enough to make them stick. This is particularly true in the case of magnets employing closed magnetic circuits. Even if such magnets are built of soft iron they will retain a considerable degree of magnetism after the current is cut off if the magnetic circuit remains closed. Once the armature falls away, the residual magnetism will very largely disappear, and the armature cannot be made to stick again by lifting it by hand. Hand manipulation, however, is impractical to apply in multiple-unit systems. It is, therefore, necessary to sacrifice the great efficiency of the entirely closed magnetic circuit in designing magnets for automatic purposes in this work. The magnet should never be allowed to close completely its magnetic circuit.

The possibility of trouble with multiple-unit systems on lines where there are many low voltage localities is sufficiently great to justify the insertion of a precautionary clause in the car equipment specifications, to comply with which the successful system must demonstrate its ability to operate with equal facility at the high and low voltages that obtain on the line. These values are capable of computation.

Fortunately multiple-unit systems are valuable chiefly where trains instead of single cars are to be operated, and where the class of traffic is of this character the installation is usually of such magnitude as to require carefully distributed sub-stations, thereby minimizing the trouble from inequalities of voltage on the line.

Fair Play for Corporations

Very few street railway companies escape an annual avalanche of damage suits for various real or alleged injuries, and it is no uncommon thing for the resulting legal expenses to reach, for somebody, an unpleasantly large figure. Now and then a gang of personal-injury swindlers gets to work, and is likely to get several verdicts before it is broken up. Sometimes a little adroit detective work will disintegrate it and send some of the promoters behind the bars to recuperate, but we have no doubt that many frauds of this sort are carried out successfully and undetected.

The nature of our present legal procedure is such that the plaintiff is enabled to retain the advantage of position in the game and to gain no small amount of undeserved sympathy as well as what properly belongs to him. The ease with which a large corporation is put in the apparent wrong and the facility with which the average jury may be pursuaded to mulct it in heavy damages, are facts well known to lawyers. The character of the evidence often produced in tort cases is notorious, and the tendency of a jury to swallow it whole requires no comment. Perhaps it is impossible to reconstruct the rules of law so as to insure the game being played fairly, but it does seem to us as though it would be feasible to improve them far enough to remove some of the most frequent causes of injustice.

We assume in the first place that a certain proportion of claims for injury are made in good faith and represent a real responsibility on the part of the corporation involved. Very many of this class are settled out of court, very probably with justice to both parties. But when the victim, let us say of a collision, is beset by attorneys of the baser sort, anxious to take the case on a contingent fee, it is quite certain to get into court, with a claim for damages representing not the real injury but the injury plus a large rake-off, plus an allowance for a verdict by general average, plus everything else in sight. Of course just claims likewise get into court, but also with the damages exaggerated by the evil tendencies common to fraudulent claims. And this brings us to one of the present difficulties that ought to be removable without great difficulty. This is the great uncertainty which sometimes exists as to the real parties to a suit. Ostensibly it may be a genuine contention between the injured plaintiff and the railway company. We pass by the question of attorneys working on a contingent fee, for that is a matter between lawyer and client, but it does seem to us that when the plaintiff has been hunted out and placed in litigation by professional corporation pounders the fact is pertinent to the damages claimed and ought, in some way, to get into the record. On the other hand, the real defendant is often a casualty company, the exact relation of which to the apparent defendant has sometimes an important bearing on the credibility of the evidence presented. And sometimes the litigation is really nothing but a struggle between two casualty companies, each striving to throw the blame upon the other's client. Under these circumstances the jury is likely to spend a deal of sympathy that had better be saved for some one who needs it more.

And whatever the real identity of the litigants may prove to be there is always trouble for all hands over the matter of expert testimony, which is usually much in evidence in damage cases. The whole practice of introducing expert testimony needs overhauling from the foundations up. There are all kinds of experts, but good, bad and indifferent are alike mishandled in court. Broadly, too little attention is given to their qualifications and too much to the exact form of their evidence. For instance, two physicians may be called to testify to the nature and probable results of a personal injury. Both may have been in active practice for a quarter of a century, but one may have seen 500 cases like the one in hand and the other only a dozen or two, while the relative value of their judgments seldom gets home to the jury. In actually giving testimony both respond to verbose hypothetical questions so adroitly framed as to admit of only the answer desired; both tell the truth according to their lights, and apparently contradict each other flatly. The jury does not get the fine shades of meaning in either question, hears both witnesses asked more hypothetical questions in the cross-examination, and finally sets them down inwardly as a pair of infernal liars, hired to deceive. Whereas, in the majority of cases, both are competent and truthful, and would be in full agreement on all essential points if at liberty to tell openly their full opinions. The net result of the misunderstanding is that the jury either discredits both or gives to the testimony of one a weight which the witness himself would be far from assigning to it, and either disagrees or brings in a verdict quite unwarrantable on the real facts. It has long seemed to us that the court, which has large discretion in such matters, ought to unravel the technical snarls by a few well directed inquiries on its own account.

Finally, we must refer to that abomination, the verdict by general average, from which corporations so frequently suffer. It often happens that a jury after wrestling with one or two obdurate members will come to a compromise on the amount of damages. The plaintiff may have claimed $50,000, and gets $500 by a compromise with a few jurors who believe he deserves nothing at all. There is a good deal to be said for an abolition of the unanimity rule in certain cases, and while it might occasionally work badly, we should hear less of verdicts evidently unjust and reached by a process as unjustifiable as trying to compromise between the truth and a lie.

THE PHILADELPHIA RAPID TRANSIT SYSTEM—I.

BY W. W. WHEATLY

Railroads, like men, have their individual peculiarities. So much has been written concerning the special features of the railway systems of New York, Boston, Chicago and other cities, and so little concerning Philadelphia that it might be assumed this staid old city had no special features. Such, however, is not the case. A strong individuality has been impressed upon the railway system of Philadelphia which makes it an instructive example of successful railway management. It may seem appropriate at the outset to remark that any large urban railway system which is being operated for less than 50 per cent of its gross earnings becomes of interest to others than those directly connected with it. To operate for 43 per cent to 45 per cent of the gross earnings is a distinction which few large railway systems can hope to attain. It is not the present purpose to attempt to enumerate all the elements which have made possible the remarkably successful operation of the roads comprising the Philadelphia Rapid Transit system, for to do that would be to portray the strong personality, indefatigble energy and keen business judgment of its executive head, to whom, with his staff, the credit is due. However, the policy which seems to have had great influence upon the result was tersely summed up when President John B. Parsons remarked to the writer:

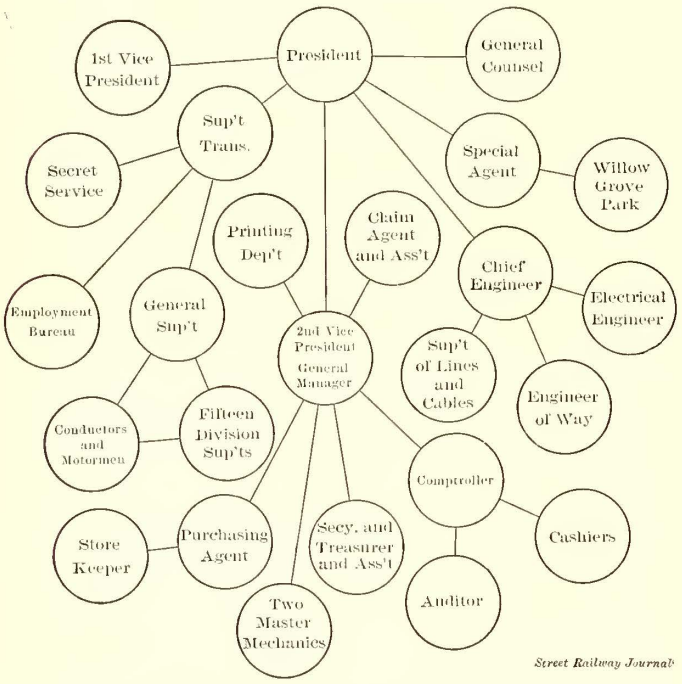


DIAGRAM SHOWING ORGANIZATION OF PHILADELPHIA RAPID TRANSIT COMPANY

"This road is run upon business principles. Before we spend a dollar we make sure it will in some form eventually come back and bring more with it."

This makes it clear that the successful results are largely due to the persistent application of plain business methods to the solution of a complicated and difficult problem. This paper will deal with some of those things which may be called distinguishing features of the system, and will present some interesting facts concerning the methods employed and the results accomplished in the principal departments.

ORGANIZATION

Preliminary to a description of the system and its traffic conditions attention is directed to the diagram above, giving the business organization of the company. It will be noticed that it differs in some respects from the usual plan of organization of many large companies, the differences being due to local conditions.

As tending to show the effect upon the business organization of the consolidation of roads into large systems the statement which follows indicates how the responsibility of railway officers is constantly increasing:

NUMBER OF OFFICERS AND EMPLOYEES IN PHILADELPHIA RAPID TRANSIT SYSTEM

	Six years ago	At the Present Time
Presidents	4	1
Vice-presidents	4	2
General managers	4	1
Secretaries and treasurers	4	1
Master mechanics	6	2
Conductors and motormen	4000	5550

The Philadelphia Rapid Transit Company now controls practically all the street railways of the city, and owns many franchises, including several recently granted, which have not yet been built upon. It was incorporated on May 1, 1902, with a capital stock of $30,000,000, and acquired by lease for 999 years from July 1, 1902, all the property and franchises of the Union Traction Company. It also acquired by purchase the capital stock and franchises of fourteen other companies, twelve of which were incorporated at the same time, on June 8, 1901, including the franchises authorizing the construction of a subway and an elevated road under or on Market, Broad, Chestnut, Fifth, Arch, Juniper and other streets.

The Union Traction Company, incorporated Sept. 6, 1895, with a capital stock of $30,000,000, leased for 999 years the People's Traction Company (consisting of eight subsidiary companies), the Electric Traction Company (consisting of six subsidiary companies), the Philadelphia Traction Company (consisting of nineteen subsidiary companies), and quite a number of small independent lines.

GROWTH OF SYSTEM

The track mileage of the roads now comprising the Philadelphia Rapid Transit system in 1897 was 424 miles single track, and at the close of 1902 it was 475 miles, showing an increase of only 51 miles during the past five years. This mileage will probably receive considerable additions during the next five years by the construction of new surface, elevated and subway lines to meet the steadily growing traffic.

Table No. 1 shows the population from 1860 to 1902 of the city, which is co-extensive with Philadelphia County.

TABLE NO. I.—POPULATION OF PHILADELPHIA (CITY AND COUNTY)

		Increase
1860	565,529	
1870	674,022	108,493 or 19.2%
1880	847,170	173,148 or 25.7%
1890	1,046,964	199,794 or 23.6%
1900	1,293,697	246,733 or 23.6%
1901	1,321,511	27,814 or 2.15%
1902	1,349,923	28,412 or 2.15%

It will be noticed that in the two decades from 1880 to 1890, and from 1890 to 1900, the increase was precisely the same in each decade, showing that the growth has been remarkably even. Surrounding Philadelphia there are many suburbs, ranging in population from a few hundred to several thousand, all of them directly tributary to the city transit lines. The suburbs are growing rapidly, and it is the company's intention to increase its suburban track mileage as fast as the conditions render it desirable.

Table No. II on the opposite page is a combination operating report of all the lines now comprising the Philadelphia Rapid Transit system.

From 1897 to 1902 the gross earnings show an increase of 35 per cent and the operating expenses an increase of 29 per

MARKET STREET, LOOKING EAST FROM CITY HALL

cent. An analysis gives the distribution of operating expenses shown in Table No. III for the years 1901 and 1902:

TABLE NO. III.—ANALYSIS OF OPERATING EXPENSES, 1901 AND 1902

Items	1901	Per cent of total	1902	Per cent of total
General expenses.....	$964,993	16.54	$1,063,034	16.60
Transportation expenses..	3,479,842	59.62	3,735,666	58.35
Maintenance of way and buildings.	696,375	11.93	790,909	12.35
Maintenance of equipment	694,975	11.91	812,729	12.70
Total.	$5,836,185	100	$6,402,338	100

The percentage of operating expenses to gross receipts was 43.4 per cent in 1901 and 45.1 per cent in 1902. To show how these figures compare with roads in other cities Table No. IV on page 475 is given:

Owing to the difference in prevailing conditions comparisons of this kind are not of great value unless accompanied by a full explanation of those features which influence the receipts and expenditures. The figures, however, furnish food for thought and investigation, and are submitted because they may be made the subject of an interesting inquiry by anyone who wishes to follow them up.

DEPRECIATION RESERVE

This company is one of the few that charges off at stated periods certain amounts for depreciation and places them in a reserve fund. In 1898 President Parsons inaugurated the plan and has since continued it regularly. Out of the gross earnings 6¼ per cent is placed in reserve for depreciation of roadway and track, 5 per cent for depreciation of power plant, and 3 per cent for the payment of damage or accident claims. It has been found that under ordinary conditions these amounts are sufficient to cover the purpose for which they are intended. The

TABLE NO. II.—STATEMENT OF PASSENGER EARNINGS, OTHER INCOME, TOTAL GROSS EARNINGS, OPERATING EXPENSES, LICENSES AND TAXES, FIXED CHARGES AND NET INCOME—1897 TO 1902, INCLUSIVE

	From Passengers	Receipts, Miscellaneous	Gross Earnings	Operating Expense	Licenses and Taxes	Fixed Charges	Net income
1897	$10,381,015	$99,631	$10,480,646	$4,949,850	$913,390	$5,469,341	*$851,935
1898	10,860,543	110,895	10,971,438	4,456,375	894,737	5,595,704	24,621
1899	11,793,858	242,409	12,036,266	4,793,366	991,101	5,634,726	617,073
1900	12,996,291	253,528	13,249,819	5,624,898	1,023,266	5,663,634	938,021
1901	13,269,465	162,215	13,431,681	5,836,185	1,029,963	5,704,265	861,266
1902	13,969,233	148,925	14,118,158	6,402,338	903,842	5,733,940	1,078,039

*Deficit

advisability of establishing a reserve fund to cover depreciation is generally conceded by railway accountants, managers and financiers; but the concession, freely made, usually has behind it the mental reservation: "It is a good thing. We would like to do it if we were able, but just now we need our funds so badly for dividends and betterments that we must wait for better times before we create a depreciation reserve." And the generally conceded good thing with most railroads still remains an iridescent dream. There is a general impression that only those roads most favorably situated can afford to indulge in the luxury of a reserve fund to cover depreciation, but conservative business methods are forcing this question to the front, and it may be expected that more roads will eventually adopt the plan.

CHESTNUT STREET, LOOKING EAST FROM BROAD STREET

TAXES

In the matter of taxes the company appears to be doing its full duty to the city and State. In addition to the requirement that it shall stand the expense of paving from curb to curb on all streets in which it operates, it also pays to the city an annual car license of $50 for each car which it operates; also an extra license of $50 on all cars which cross the Girard Avenue, South Street, Walnut Street and Gray's Ferry Bridges over the Schuylkill River. These licenses furthermore must be displayed in each car, subject to the inspection of the city authorities at all times.

The company also pays on a number of the underlying companies a tax of 6 per cent on all dividends in excess of 6 per cent paid by these companies during the year. There is also a real estate tax of $1.85 on each $100 of valuation of power houses, car houses, etc., owned by the company.

To the State the company pays a tax of one-eighth of 1 per cent on its gross receipts, a tax of 5 mills on the appraised valuation of its capital stock, and 4 mills on the value of all bonds issued by the companies.

In nearly all other cities the companies are required to pave only between the tracks and for 1 ft. on either side, and the Philadelphia requirement that the company must pave from curb to curb appears in the nature of an additional tax. In the company's books, however, this expense is charged to maintenance of way and not to taxes. The amount of indirect taxes, such as that just mentioned, the removal of snow and ice, the free transportation of policemen, firemen and city officials is difficult to compute, but it amounts to a large sum each year. When added to the $900,000 or $1,000,000 direct taxes per annum paid to the city and State, it probably makes this company the largest single taxpayer in the city of Philadelphia. Over $3,000 taxes for every day in the year is a large sum for one corporation to pay to help maintain the government. It should, in fairness, entitle the company to just and equitable treatment by the public, if not to the right of some voice in the conduct of the government which controls the expenditure of public money. It should be remembered that these taxes in the aggregate amount to over 8 per cent of the company's gross earnings—an amount larger than is paid to the stockholders and bondholders whose capital is invested in the property. Fortunately, the taxes must be paid before the stock and bondholders are given any consideration. It would seem, therefore, that with practically a guaranteed interest in the company's earnings of over 8 per cent per annum the city and State becomes a silent but not a modest partner in the business. It might be interesting in any large city to take from the assessment rolls of several years ago the valuation and the taxes paid on suburban real estate, and then compare this valuation and tax with the present time to show what the operation of the railroad company's suburban lines (often conducted for years at an actual loss) has contributed to the city treasury from increased valuation. At this time, when the tendency throughout the country is to impose fresh and unjust burdens of taxation on the railway corporations, the examples that are furnished from time to time showing that street railways are already too heavily assessed should not be lost sight of. It is well understood that all taxation is unpopular. Legislatures and City Councils, for this reason, seek to distribute the burden upon as few shoulders as possible and to favor individuals at the expense of the corporations.

INSURANCE

The insurance features of this company are decidedly unique and full details are of interest.

Immediately upon the formation of the Union Traction Company in 1895 the directors thought it advisable to set aside a certain amount of their original capital, to be invested for a nucleus, from which to start a fire insurance fund, in which to insure the properties and cars of their company. Accordingly, $250,000 were set aside which were invested in the securities of the underlying companies.

An effort was then made with the lessor companies to induce them to accept the fund as sufficient guarantee for the clause in their lease, which compelled the lessee company to insure their properties in fire insurance companies acceptable to them. After considerable delay and negotiations all of the various lessor companies agreed to accept the fund as sufficient guarantee for the clauses above referred to. A statement was then made showing the amount of premium which the company would naturally have to pay to insurance companies had they insured its properties, and one-twelfth of this amount was

TABLE NO. IV.—STATEMENT OF PERCENTAGE OPERATING COST TO GROSS EARNINGS AND DISTRIBUTION OF OPERATING EXPENSES OF VARIOUS RAILROADS

NAME OF ROAD	1901 Gross Receipts	Operating Expenses *	Per Cent	Per Cent. of Total Operating Expenses			
				General Expenses	Conducting Transport'n	Maintenance Way and Structure	Maintenance Equipment
Manhattan Elevated Ry	$10,253,271	$5,253,229	51.2	6.34	75.89	6.88	10.89
Boston Elevated Ry	10,869,495	7,336,597	67.5	9.51	68.86	11.96	9.67
Consolidated Traction Co., Pittsburg	3,279,189	1,362,565	41.6	19.82	63.55	5.68	10.95
Rochester Railway Co	1,000,259	605,551	60.5	8.80	61.85	12.17	17.18
Syracuse Rapid Transit Co	621,299	340,830	54.8	18.49	62.35	3.89	15.27
Twin City Rapid Transit Co	3,173,976	1,415,452	44.6	20.14	61.08	6.08	12.70
Brooklyn Rapid Transit Co	12,135,539	7,216,008	59.4	22.40	59 99	5.25	12.36
Metropolitan Street Ry., N. Y	14,720,767	6,755,131	45.9				
Massachusetts Electric Co's. Boston	5,778,133	3,915,456	67.7				
International Traction Co., Buffalo	3,092,016	1,587,407	51.0				
Chicago Union Traction Co	8,158,810	3,942,194	48.3				
Metropolitan West Side L. Co., Chicago	1,753,313	737,210	42.0				
Milwaukee Electric Ry. & Light Co	2,442,342	1,185,534	48.5	Not available			
St. Louis Transit Co	5,783,912	3,692,400	63.8				
Cleveland Electric Ry. Co	2,296,898	1,265,953	55.1				
Denver City Tramway Co	1,507,293	818,328	54.2				

* Exclusive of taxes

set aside monthly and a check drawn and placed to the credit of the fire insurance fund. From time to time the amount accumulated in this way was invested in securities, such as Philadelphia Traction stock, Electric & People's 4 per cent stock trust certificates and first mortgages on real estate of a number of the underlying companies, on which the operating company was obliged to pay the interest. These mortgages were assigned from time to time by the holders to the operating company and have been placed in the insurance fund.

Various losses have been paid out of this fund, aggregating $75,372.26, and there is to-day in the fund upwards of $1,000,000. The company, however, considers it prudent to carry insurances on some of the extra hazardous risks, such as properties in the extreme suburbs.

In order to prevent the possibility of fires the company employs two inspectors, whose duty is to continually circulate among the various properties and report the condition in which they are found, as to their cleanliness and whether there are any hazardous risks which should be overcome. These men make inspections at all hours of the day and night, have access to all properties of the company, and their reports are forwarded each morning to the general manager, who calls attention of the heads of the departments to any irregularities which are discovered and which are immediately corrected.

In addition to these rigid inspections once every six months a surveyor, who is employed by some of the largest and most influential insurance companies in the city, is employed at so much per day, to make an independent inspection of all of the properties. His reports are used to check up the work of the inspectors employed daily by the company, and to call their attention to any oversight and irregularity. His recommendations are followed out as to any matters which he considers advisable, in order to overcome as much as possible the likelihood of fire. The salaries of these inspectors and any printing, etc., necessary in connection with the department is charged directly to the department.

Herewith is printed a copy of the blank which is turned in daily by the inspectors. An accurate record of all of these reports is kept in book form and reviewed from time to time, with a view of securing better results.

The questions on the report to be answered by the inspector gives an excellent idea of the thoroughness with which the inspection must be made:

REPORT OF FIRE INSURANCE INSPECTOR

On property at.....

Philadelphia, ...190

1. In what condition is this property?
2. Were all trolley poles pulled off wire?
3. How many fire buckets are there?
4. Were all buckets filled and in their proper places?
5. Were any fire buckets used for other purposes?
6. Are all buckets used for fire painted?
7. Did you see any waste lying around loose?
8. Are there sufficient cans to take care of waste?
9. Is there any dirt, rubbish or shavings? If so, where?
10. Did you see any gasoline, or gasoline torches?
11. Did you notice anything on the cars that would be likely to cause fire?
12. Where are the oils and grease kept?
13. Is the building they are in fireproof?
14. If not, what precautions are taken to avoid fire?
15. Are all the hydrants in good condition?
16. Did you try any of them? How many?
17. Is the hose properly connected to hydrant?
18. Is the hose in good condition?
19. How many hydrants are there?
20. How much hose?
21. Is there a storeroom at the building?
22. Is it kept clean?
23. Are there any precautions taken in storeroom to avoid fire?
24. What are they?
25. Is there a stable at this building?
26. Is it kept clean?
27. Is smoking allowed in the stable?
28. Are any precautions taken to avoid fire? What are they?
29. Can you suggest any improvements that would reduce the possibility of fire?
30. How is building heated?
31. Are stoves in good order and safe?
32. Where is coal and wood kept?
33. What is done with ashes?
34. Are any steam pipes in contact with wood?
35. Are stacks safe where they go through roof?
36. What material are stacks and chimneys?
37. Are chimneys in good condition?
38. How is the building lighted? Arc, kerosene or incandescent?
39. Are any of the lights or wires obstructed or in contact with other wires?
40. Has any wire come loose from its proper fastening?
41. Are the light switches in a safe condition, or would the melting of any fuses expose any light inflammable material?
42. Are the car pits clean?
43. Are the boiler settings in good condition; are the boiler tops clean?
44. Are forges and furnaces securely arranged?
45. Where are the sweepings kept; is waste-paper removed from them?
46. How are the employees' clothes closets constructed, of what material? Are they open near the top?
47. Are they in close proximity to any woodwork?
48. Is the rule that all overalls or clothes should be kept suspended strictly enforced, and that they are not allowed on the floors or be kept rolled up under benches or in the lower portions of the closets?
49. Are there any painters' clothes, or did you notice any clothes soiled with paint about?
50. Are any rooms or portions of the premises not used? Are such portions kept locked, and what is their conditon?
51. Is there danger of fire from any outside sources? If so, what does it consist of, and how close are such sources located?

General remarks:

....., Inspector.

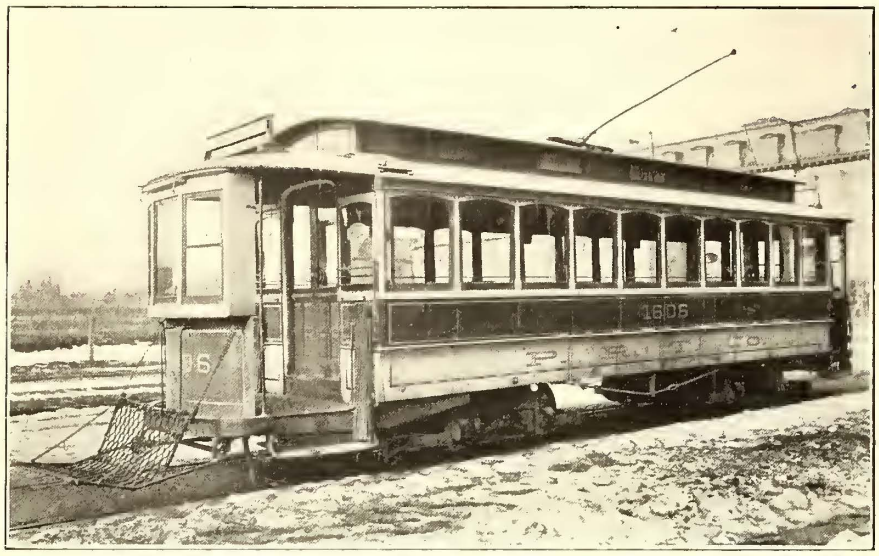
CAR EQUIPMENT

The total car equipment owned by the company is given in Table No. V for the years 1897 to 1902 inclusive:

TABLE NO. V.—STATEMENT SHOWING NUMBER OF OPEN AND CLOSED CARS OWNED FOR SIX YEARS

	1897	1898	1899	1900	1901	1902
Single-truck, closed	1478	1570	1571	1563	1267	1191
Double-truck, closed	4	4	8	8	300	554
Single-truck, open	1087	1152	1194	1156	1076	1077
Double-truck, open		4	....	160	160	160
Miscellaneous	244	247	243	270	270	301
	2817	2977	3016	3157	3082	3283

The closed car equipment is in three classes, viz.: 18-ft and 20-ft. bodies mounted on single trucks, 24-ft. bodies mounted on Brill maximum traction trucks, and 28-ft. bodies mounted on Brill 27-G trucks. The change in the relative proportions of single and double truck open and closed cars which commenced in 1900 was continued in 1901 and 1902. All new cars purchased have been of the double-truck type. Many of the single-truck cars were spliced and made into double-truck cars. Fifty new double-truck semi-convertible cars are now on order and some of them have already been delivered.

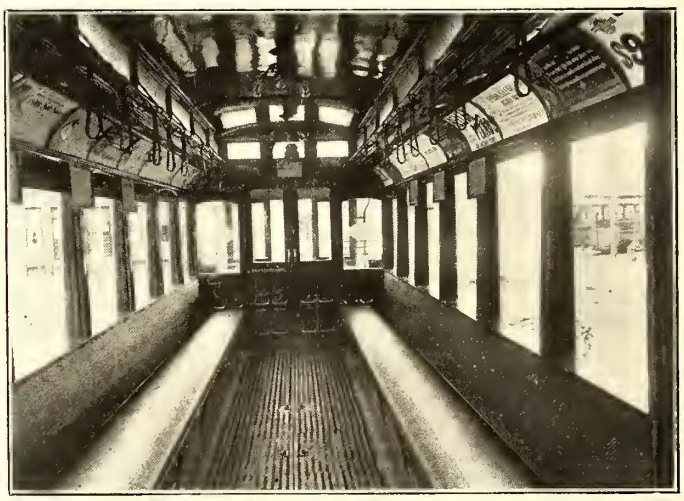


STANDARD SEMI-CONVERTIBLE DOUBLE-TRUCK CAR

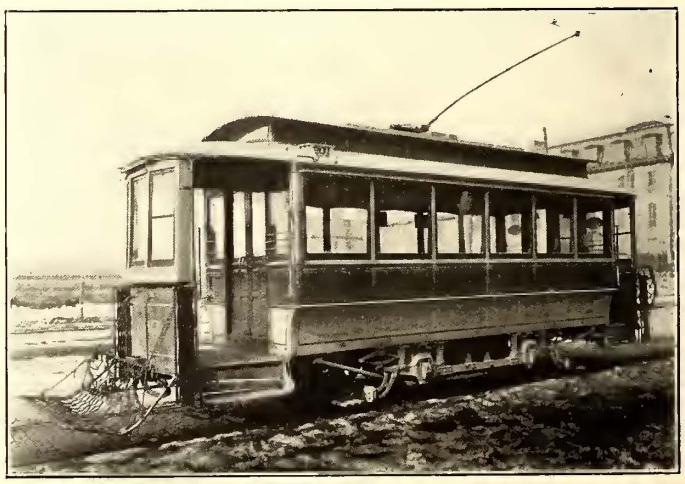
INTERIOR STANDARD SEMI-CONVERTIBLE DOUBLE-TRUCK CAR

The standard adopted is a double-truck semi-convertible 28-ft. body, 38 ft. over all. It may be converted into a partly open car by removing the sash and stowing them away for the season. The sash are made interchangeable so that one sash will fit any window. The ventilator sash of the monitor deck are made to swing open at the ends, and the open end may be changed to suit the direction of the moving car by turning the rod inside the car. The method of ventilating toward the rear of the car avoids objectionable drafts of cold air. The standard car is mounted on Brill 27-G trucks with four General Electric 800-motors, K-12 controllers, Christensen air brakes (motor compressors), in addition to the ordinary hand brakes, Philadelphia Rapid Transit Company's special sand boxes, General Electric automatic circuit breakers, Noark fuse boxes, Meeker and International registers. There are now 714 double-track cars (554 closed and 160 open), the most of which are equipped according to the standard. Not many companies have so many cars equipped with air brakes.

The 1191 single-truck closed cars are about evenly divided between 18-ft. and 20-ft. bodies. The 1077 single-truck open cars have bodies averaging about 30 ft. The motor equipment on these cars is divided between Westinghouse No. 3, No. 56, No. 12-A and Lorain, and the controller and truck equipment is considerably mixed, as might be expected where so many independent roads are consolidated under one management.



INTERIOR SINGLE-TRUCK CAR



SINGLE-TRUCK CAR

The number of motors, controllers and trucks of the different

TABLE NO. VI.—MOTOR AND TRUCK EQUIPMENT OF PHILADELPHIA RAPID TRANSIT COMPANY

Motors		Controllers		Trucks	
G. E. 800	4242	K	1596	Brill single	56
G. E. 1000	14	K2	2822	Brill max. traction	486
G. E. 1200	10	K10	330	Brill 27G	315
W'h'e 3	1870	K11	190	McGuire	205
W'h'e 12A	140	K12	450	Peckham	1190
W'h'e 56	300	K. R	13	Bemis single	958
Lorain	334	Lorain	200	Bemis double	10
		W'h'e "G"	684	Curtiss	134
		W'h'e 28	270	Lewis & Fowler	17
		W'h'e "D"	37	P.R.T.Co.'s special	141
				Miscellaneous	9
Total	6910	Total	6592	Total	3521

kinds owned by the company is given in Table No. VI, and needs no comment.

The expense per annum of the maintenance of equipment for six years is given in Table No. VII:

TABLE NO. VII.—EXPENSE OF MAINTENANCE OF EQUIPMENT, SIX YEARS, SHOWING AVERAGE PER CAR PER ANNUM

Year	Cars	Cost	Average per car per annum
1897	2,817	$575,063	$204
1898	2,977	398,504	134
1899	3,016	449,252	149
1900	3,157	560,681	178
1901	3,082	552,119	179
1902	3,283	662,366	202

If it can be considered fair to divide the number of cars owned into the cost of maintenance the column showing the average cost of maintenance per car per annum may be said to be approximately correct. In the event that any considerable number of the cars owned were withheld from service and stored during the year, thus becoming practically obsolete, the average cost per car per annum would not, of course, represent the actual operating equipment. The result, as shown, to say the least, is interesting.

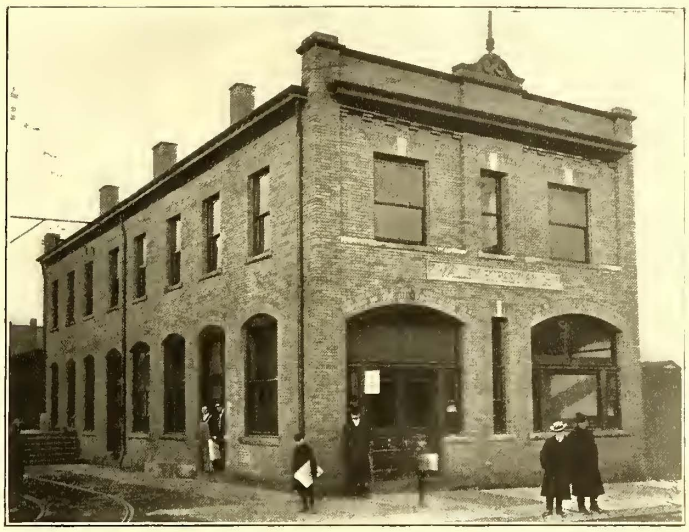
The distinguishing feature of the car equipment is that none of the closed cars is provided with heaters. There are probably not more than thirty days during the entire winter season in Philadelphia when real cold weather is experienced. It is an open question among the traveling public whether the discomfort of overheated cars for the greater part of the season does not exceed that of the absence of heat on a few cold days.

In the next issue the general traffic conditions of Philadelphia will be taken up.

SHARON TERMINAL STATION

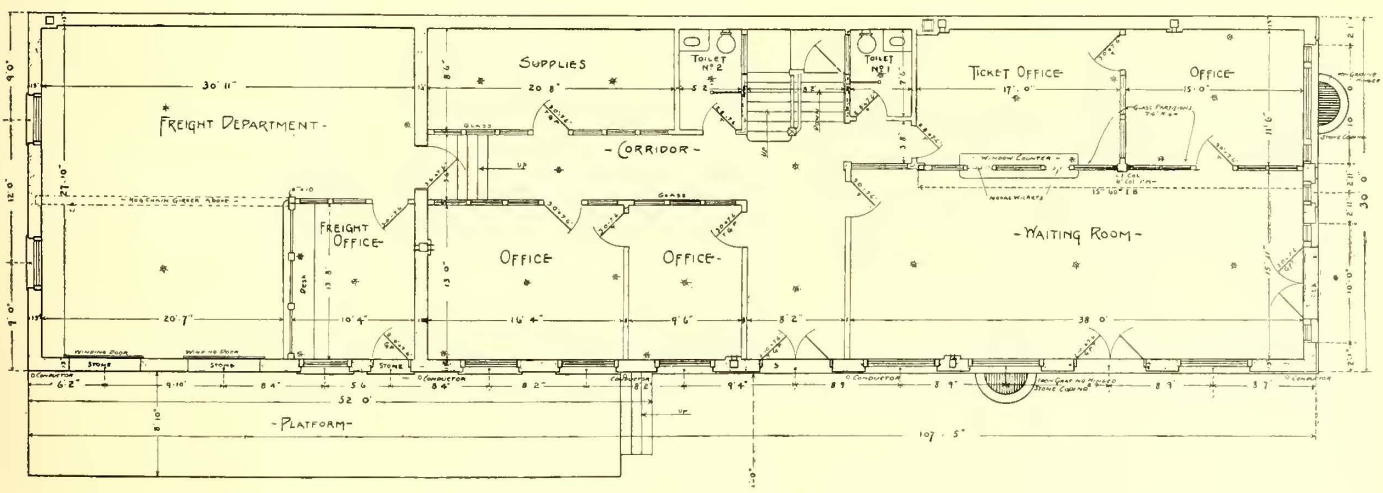
The Youngstown & Sharon Street Railway Company, of Youngstown, Ohio, has erected at its Sharon terminal a handsome freight and passenger station, which shows interesting details. The building is a two-story buff brick, 107 ft. long and 30 ft. wide. The interior finish is Georgia pine. Below the wainscoting is cement, which is painted, and walls which are plastered and painted white so as to give a bright appearance to the rooms. The front portion is devoted to waiting room with office for ticket agent and checkers and office for the lighting department of the company. In the rear are the offices of the general superintendent and the division superintendent and the supply department. In the rear of the building is a large freight department with office, and a platform of good size for loading and unloading freight. A spur from the street runs at the side of the platform so that freight may be unloaded directly from the car to the platform. There is also space for a driveway alongside the track, which enables teams to load to the car or platform.

The rear of the second floor is given up to the employees. There are lockers for all the men, with tables, chairs and a pool table, recently presented to the men by the general manager. The entrance to the offices is at the side, and on the right-hand side, as the men enter, is posted the bulletin board for the Valley Division. The building is heated by natural gas. It was designed after plans and specifications prepared by Sanderson & Porter, engineers for the Youngstown & Sharon Street Railway Company. The general plan of the first floor of the building is presented herewith.



HEADQUARTERS OF THE VALLEY RAILWAY

The roads using the station are the Valley Street Railway, the Sharon & Wheatland Street Railway, the Sharon & New Castle Street Railway and the Youngstown & Sharon Street Railway, which are allied properties. The freight business on these roads is developing rapidly, and they handle practically everything that a steam road carries.

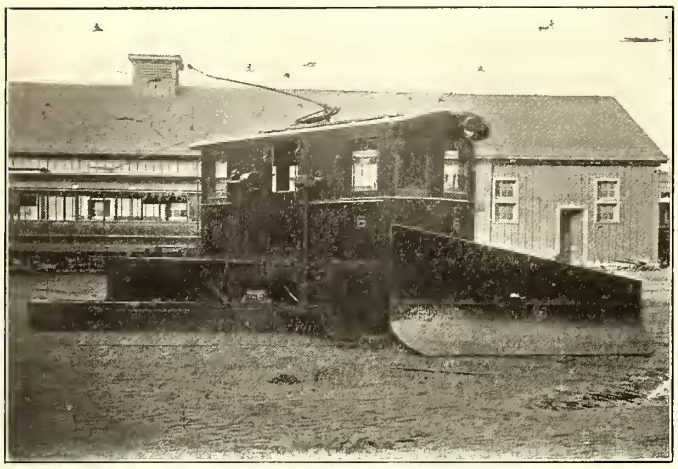


PLAN OF OFFICE BUILDING AND DEPOT OF ELECTRIC ROADS AT SHARON, PA.

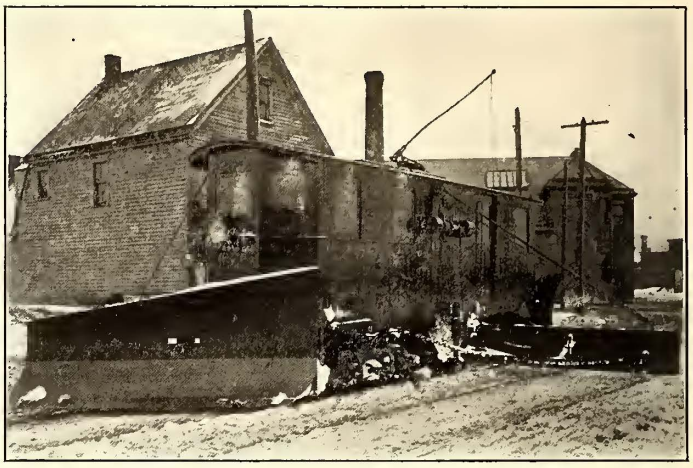
In a letter to the employees of the St. Louis, St. Charles & Western Railway Company, James D. Houseman, president of the company, calls attention to the fact that there has not been a damage suit against the road during the year 1902, and he thanks the employees for having done their duty. He adds that not one of the accidents which happened on the road during 1902 can be attributed to neglect of duty.

SNOW FIGHTING IN BUFFALO

Probably as severe conditions exist in the vicinity of Buffalo during the winter as in any other section of the country, and it is certain that the International Railway Company, of Buffalo, has taken as great, if not greater, precautions against having its lines tied up by snow as any other electric railway.



ONE OF THE SINGLE-TRUCK PLOWS



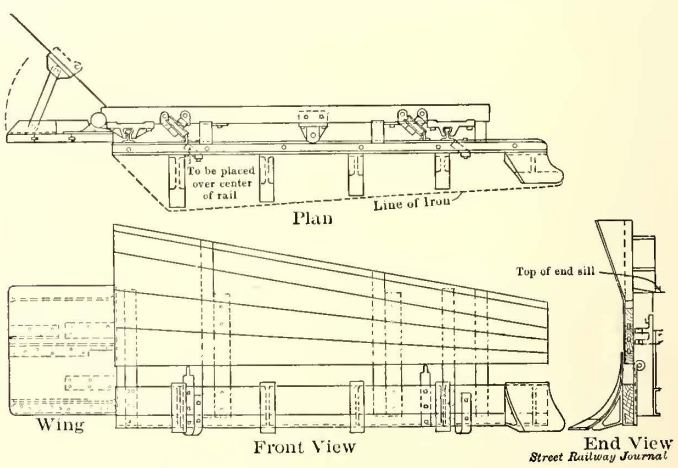
LARGE PLOW FOR CLEANING TWO TRACKS AT ONCE

The art of snow fighting in Buffalo has been reduced to almost an exact science, and during the heaviest storms of the last winter the management has been extremely successful in keeping its cars on their regular schedule. The International Railway Company includes among its subsidiary companies the Buffalo Railway Company, the Buffalo & Niagara Falls Electric Railway, the Buffalo & Lockport Railway, the Lockport & Olcott Railway and the Niagara Falls & Suspension Bridge Railway, so that it has both city and interurban conditions to contend with, and a great variety of equipment is required in carrying out the methods which have been adopted for securing an open track on all the lines at all times. Some fifty-two distinct pieces of apparatus are in commission during the winter, and at times nearly all of them are out upon the road.

For ordinary snow falls and city work generally there are twenty-five plows of the type shown in the illustration and thirteen of a similar type, though somewhat smaller. These two types of plows are designated by their colors, the larger ones being painted red and the smaller green. By this method an inspector on any part of the road can call out the type of apparatus required on his section, and in riding over the system the superintendent can tell at a glance what sort of apparatus is being used. During the bad weather sweepers are used to keep the tracks clear of slush and light snow falls, and two double-ended Thomson-Houston sweepers with revolving brushes are operated for this purpose. The company has built at its own shops, under the Ruggles patents, seven rotary plows of the type shown in the illustration. These plows are double-ended with single trucks. They are equipped with 1000-General Electric motors on the axles and with 800-General Electric motors on the flyers and vanes. These plows are about 25 ft. over all and 7 ft. 3 ins. wide. The headlight and gong are placed upon the front of the plow, as shown. There is one other rotary plow of peculiar construction which is also illustrated. This plow has revolving vanes in front, somewhat similar to the Ruggles construction except that they are in sets of two double and two single vanes, as can be seen from the cut. A peculiarity of this plow is that its body revolves on a vertical axis, so that the front can be swung out to one side of the road and cut away a high drift to a considerable distance from the track. In addition to the apparatus mentioned, the company operates two Taunton plows and one Lancaster of the ordinary type, these three plows being painted yellow. The equipment of all the snow plows, with but few exceptions, consists of 57-General Electric motors, the standard type of motor now in use on the road.

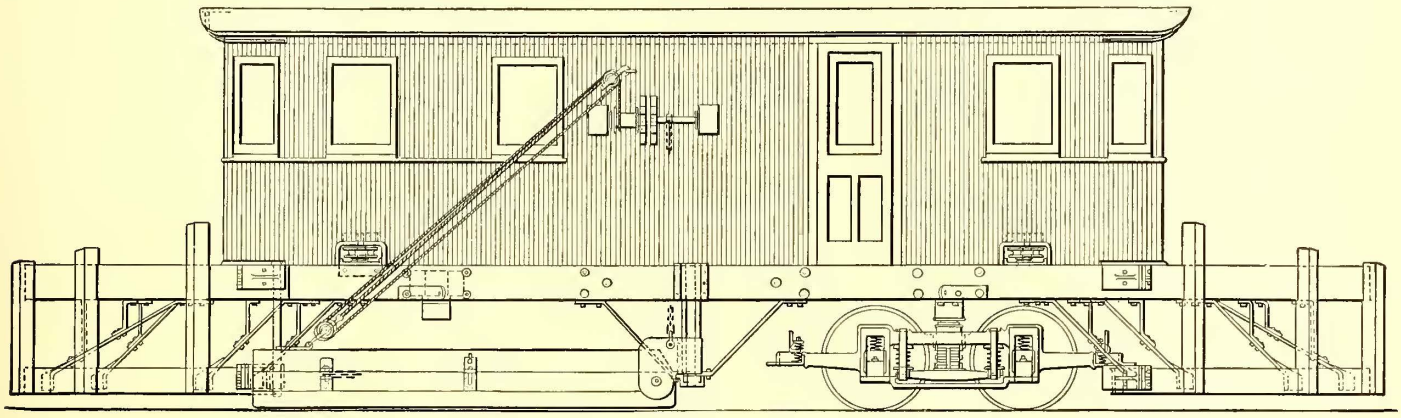
The most interesting piece of snow-fighting apparatus, however, which is being used in Buffalo is a large double-truck plow which was designed and built by the company. This is an evolution from an experiment tried last year, and which proved so successful that a more perfect model was made for this season's operation. A plow was made last year consisting of little more than a flat car, with a nose at each end sloping at opposite angles and a long vane near the middle which could be swung out to a considerable distance at the side. Very little

LARGE PLOW CLEANING ONE TRACK AND GIVING WIDE ROADWAY

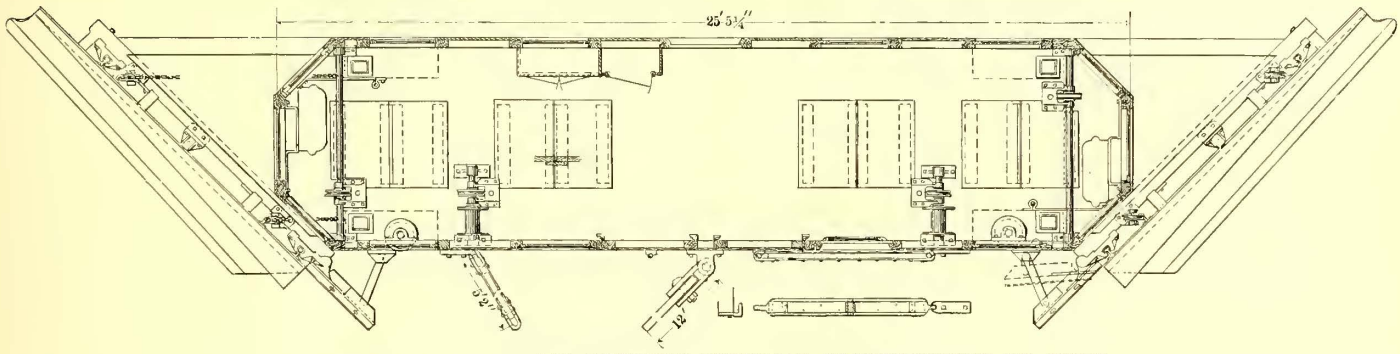


DETAILS OF FRONT OF LARGE PLOW

protection was afforded the operators of this plow, only a shield being provided in front of the motorman. The prevailing wind in Buffalo is toward the Niagara River and the lake, that is an east wind, and it was found that in operating a plow which threw the snow to the right in going north it was very liable



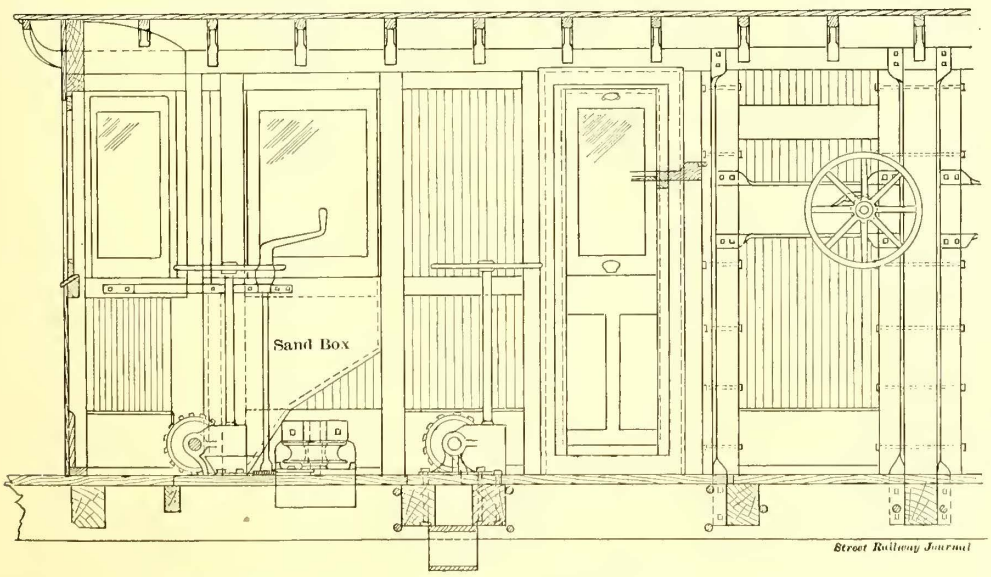
SIDE ELEVATION OF LARGE PLOW



PLAN OF LARGE PLOW, SHOWING PECULIAR CONSTRUCTION OF ENDS

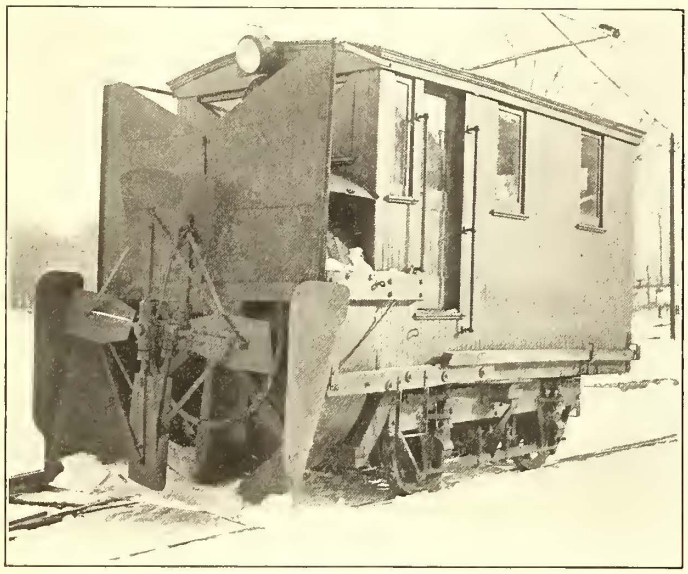
to drift back again immediately after the passing of the plow. The experiment was made, therefore, with the new piece of apparatus to throw the snow from the east track directly onto the other track by the nose of the plow and to throw it to the west side of the other track by the wing. This, of course, necessitated the use of both tracks and the stopping of the plow when a car was passing in the opposite direction, so that the wing could be swung back against the side of the plow. The experiment was eminently successful, however, and the plow shown in detail in the accompanying reproduced drawings was constructed. The front faces of this plow both slope toward the same point, that is, one side of the underframing is considerably longer than the other side, the angle of the faces being about 45 degs. On the longest side the plow is 34 ft. 10 ins. long, and on the shorter one it is 22 ft. 2 ins. long. The underframing is made of four heavy sills, the outside sills being 5½ ins. x 11 ins., and the center sills 6 ins. x 7¾ ins. The ends are securely fastened to the sills by heavy angle plates, and the frame is thoroughly braced throughout by heavy cross sills and ¾-in. tie-rods. The cab is a little bit longer than the shorter side of the plow, as shown in the plan. The width of the cab is 6 ft. 4 ins. over all, and the height from the bottom of the side sills to the top of the roof is 7 ft. 10 ins. There are a number of large windows in the body, the front of which is beveled off similar to a vestibule; and as all the motor resistances are placed within, the men operating the plow are in no wise uncomfortable.

The mechanism for operating the different noses, wings, etc., is extremely simple and efficient, although it is necessary to have considerable of it, as the parts are so heavy that it would be impossible to operate them without some mechanical means. In addition to the chains which run from the end of the wing to the two ends of the plow, and by which the wing is moved from one position to the other and held steady while in operation, a brace is provided, 5 ft. 2 ins. long, which rigidly connects the center of the wing while extended to the plow body. The inside end of the wing is attached to a heavy sill which slides upon a 3-in. vertical bolt at the side of the car. This axis for the wing is heavily braced by means of two iron braces, 1 in. x 6 in., running to the center and opposite side of the underframing and reinforced by vertical braces. This



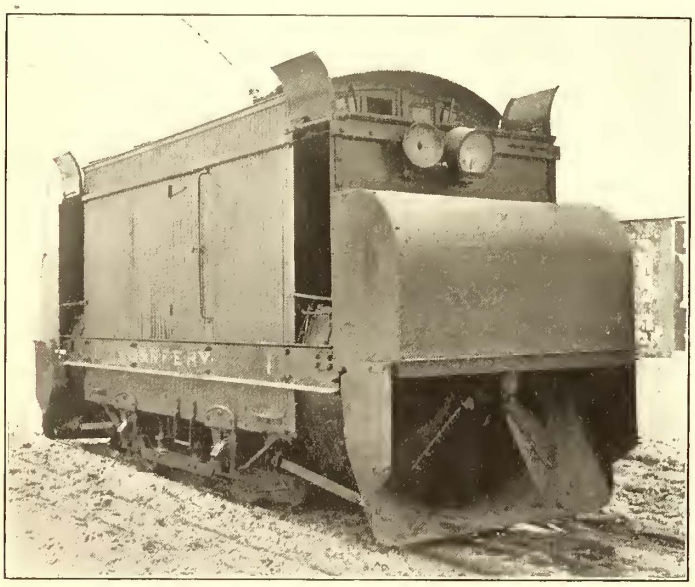
PARTIAL SECTION OF LARGE PLOW, SHOWING LIFTING MECHANISM

gives a construction which is substantial enough to withstand the effect of the great leverage necessarily brought to bear on the end of the wing, which not only has to remove the new snow from the other track but has to throw the snow removed by the nose to one side. Both the nose and wing have several inches of vertical play in order that different depths of snow can be handled successfully. The wing, of course, slides vertically on



ROTARY WITH REVOLVING BODY

its axis, a chain and windlass being provided at the inside end, and a windlass, block and tackle at the outside end. These windlasses are operated by vertical hand-wheels at the inside of the plow. The upper part of the nose is stationary but the lower part is made so as to slip up and down, the lower part of the sheet-iron with which the nose is faced overlapping the joint, as shown in the drawing giving details of the nose. Ordinary steel rails are placed vertically behind the nose, which serve as braces and guides and give the desired rigidity to the movable lower part. The nose is raised and lowered by chains



STANDARD ROTARY PLOW

running over pulleys about the level of the cab floor and attached to windlasses at the ends of the cab. It is intended later to add an auxiliary wing on the end of the nose, as shown in the front view of the details of the nose. This wing has not yet been placed in position, although the shaft upon which it will be hinged may be seen in the general view of the car. Some of the other plows on the system are equipped with wings of this description, and are giving excellent service in clearing the "devil strip" between the tracks, which in Buffalo is somewhat narrower than is the ordinary practice. The plow is equipped with four General Electric 57 motors and Christensen air brakes.

Although, of course, this type of plow has been designed especially for use on the interurban lines near Buffalo, its adoption might well be made on other roads. It is intended especially for clearing the tracks of snow where the wind comes from one direction only, as is the case in Buffalo. But most operators of interurban lines know that this condition is by no means peculiar to Buffalo, as observation has shown in many cases that the snow drifts almost always in the same direction on a given line. The plow is being given a very severe test this winter, and the results so far have been even better than were hoped for.

HEATING AND VENTILATING OF RAILROAD SHOPS*

BY J. I. LYLE, M. E.

As time progresses our standards for comparison are being constantly changed, being ever carried higher and higher and nearer the ideal. Things that filled our hearts with delight a few years ago on account of their excellency are to-day being discarded for something better and more up to date. This is especially true in all branches of engineering. To-day we demand the best, knowing that in all likelihood it will be surpassed by something still better in only a short time.

I very vividly remember, while serving my apprenticeship as a machinist in a railroad shop, the temperature in the shop often dropped below 40 degs. and frequently to freezing if the outside weather was within 15 degs. of zero. With a temperature of 40 degs. a workman's hands become numb and it is almost impossible to do good work with hand tools. This shop, a large well-arranged brick structure, was well equipped in every way except with large traveling cranes and a heating system. It was considered by those in charge as being amply heated with an overhead direct steam system. The employees, instead of working to keep warm, as a rule chose to loaf to keep warm, and I do not believe that the amount of work produced on such cold days, when estimated very conservatively, amounted to more than 75 per cent to 80 per cent of the normal output. In this building there were about 150 employees, earning approximately $250 per day, considering, however, the output to be 85 per cent, the loss on cold days amounted to something like $37.50.

An efficient heating plant for this shop would cost about $3,750 complete. Without considering the cost of steam, of which there was plenty of exhaust going to waste, allowing 6 per cent as interest on the cost, 5 per cent for depreciation, and 1 per cent for repairs and painting, making a liberal total of 12 per cent or $450 per year as the amount that the cost of the heating plant should earn. With the conditions mentioned it would take only twelve days with the thermometer below 15 degs. above zero to make the expenditure a paying investment. I do not mention the case to convince anyone here of the necessity of properly heating a shop, as that point is thoroughly understood in this country as being economical as well as a humane factor in manufacturing, but rather to show the advancement of the requirements along this line during the last few years.

The conditions in the plant existed only a few years ago, still it does not represent a modern railroad shop, for railroad officials and engineers as a class to-day lead the procession in an endeavor to procure the best and most economical plants. Practically all railroad shops have exhaust steam from

* Paper presented before the New York Railroad Club, March 20, 1903.

shop and electric lighting engines and air compressors which is available for heating, so any system not adapted to the economical use of exhaust steam should not receive serious consideration. In considering the advisability of utilizing exhaust steam and returning the water of condensation to boilers, the questions of back pressure and cylinder oil carried over with the steam should not be overlooked. Oil carried over into the heating system works through the stuffing boxes of valves, chokes the air vents, and acts as an insulator, materially reducing the efficiency of the heating apparatus. Oil in the feed water for boilers results in priming, reducing the efficiency of the boilers, and increases the cost of repairs, due to leaks and other defects. The ordinary type of separator will remove only that portion of the cylinder oil carried over mechanically and that portion of the oil vaporized, which in all probability will not exceed 1 per cent, will condense with the steam and return to the boilers, and it will be necessary to use feed water filter to remove the remaining portion of the oil. A sufficient amount of oil can be removed without any question to make the desirability of utilizing exhaust steam an attractive proposition.

Regarding the question of back pressure and the minimum required for the various systems of heating, it will be found that ordinarily 5 lbs. is carried on most installations, and while this could be reduced in moderate weather, the general practice is to establish this as the minimum and increase the pressure in extremely cold weather. With a carefully designed plant, however, this is higher than should be necessary unless there are some adverse conditions to be met. The minimum pressure required for circulation depends more upon a proper proportioning of the supply main, and the distributing branches, than upon the return main. The question of expansion of the steam and the proper removal of the condensation at the required points in the supply main should receive careful consideration. A great many plants to-day require a higher pressure to secure circulation than would otherwise be necessary had proper consideration been given to the dripping of the mains and its branches. The fall in pressure, due to rapid condensation, small mains and branches, frequently do not receive the consideration it is entitled to, to secure maximum results.

Wherever possible, the use of traps in return lines should be avoided, as a pump and receiver or the boiler feed pump controlled by a pump governor make the best kind of trap. By the use of one of the so-called "vacuum" systems, described below, exhaust steam can be circulated without back pressure on the engines, thereby procuring increased efficiency of the engines and at the same time procuring maximum results from the heating surface, owing to the removal of all air trapped in the system. The Webster system, which maintains a vacuum upon the return line by means of a steam pump, use thermostatic traps and valves on the drips and returns of the various units to prevent the steam passing to the return line and to allow air and water to pass freely. The Paul system is an auxiliary attachment for the separate removal of the air from the various units by means of a vacuum maintained on a system of air piping by the use of a steam ejector. To procure good results from either of these systems, extra precaution should be taken to have the workmanship on the system the best, as leaks which are very detrimental to the system will not be noticed as the leakage will be.

The three systems adapted to the use of exhaust steam are: Direct steam heat, consisting of pipe coils placed along the walls or overhead through the building.

Second—Direct hot water, where the exhaust steam is used in some form of feed water heater to heat the water which is circulated either by gravity or a force pump through the direct coils in the building.

Third—The fan system, where steam coils consisting of wrought iron pipe are placed on one or more groups and air drawn over these coils by a fan and forced into the building.

The sole advantage of direct steam for shops is its extreme simplicity, requiring for its operation the opening and closing of a few valves. This feature is a good one, but it is offset by the disadvantages of having the heating surface distributed through the shop where it is always subject to damage from many sources. Very often it is difficult to locate the coil surface to procure proper drainage.

With the installation of overhead cranes in shops covering considerable area, and especially those provided with a monitor type of roof, it becomes a difficult problem to install a direct system of either steam or hot water, and an installation of this type frequently requires changes in location of shafting and machinery to make room for the required amount of heating surface. As a rule, a great deal of glass surface with its high condensing influences require a large amount of coil surface that cannot be completely installed satisfactorily below windows and between door openings. Coils overhead do not secure an equal distribution of heat satisfactorily, and while the fan-like effect is obtained from the pulleys and belts when the plant is in operation, during the time the plant is idle the bulk of the heat is where it is least required. Often to secure a perfect circulating system it becomes necessary to install a considerable amount of trenching. Trenching as far as practicable should be eliminated from shops, as it becomes a pocket for the collection of dust, waste, etc., and not infrequently becomes full of water from leaks and its close proximity at times to hydraulic machinery, testing platforms, etc.

Direct hot water lays claim to the advantages in comparative simplicity and in the control of the temperature, which can be effected by controlling the temperature of the water or the rapidity of its circulation by means of a circulating pump, by locating the hot water heater between the low-pressure cylinder and the condenser where the plant is operating condensing, thus utilizing exhaust steam that would otherwise not be available. On the other side of the balance sheet it has the same disadvantages of having the heating surface spread throughout the shop subject to injury. The heating surface requires more attention and better work in the installation to prevent leaks. It cannot be shut down for any length of time in winter without completely draining the system in order to prevent it from freezing. Larger pipes are required. Cost of installation is greater in most cases than either a direct or blower installation. Frequently coils become short circuited and fail to give the required amount of heat. Damage resulting from broken fittings, unless immediately discovered, becomes a serious proposition in itself. It is necessary, as a rule, to use circulating pumps in connection with this type of installation, and in such cases it has the disadvantage of having moving machinery to be cared for.

The fan system has the advantages of having all the heating surface assembled in one place. Nearly all the heating surface can be set vertically, thereby procuring perfect drainage. The warm air being forced into the building, a constant circulation of the air is maintained, thus heating all portions of the building more evenly than with any other system. Because of this forced circulation there is less difference between the temperature of the air near the floor and that near the roof, than when natural circulation is used. Ventilation of such buildings as blacksmith shops and foundries can be effected. Control of the temperature can be effected either by varying the speed of the fan or shutting off any number of the heater sections. Its disadvantages are in having a fan and engine or motor to be cared for, and in having large hot air pipes placed overhead, which at times are difficult to place, owing to the height of buildings, cranes, shafting, etc. The fans installed in the various railroad shops differ very materially in their design. Two types of fans are used for heating, the disc or propeller type, and the centrifugal or steel-plate type. The latter is used almost exclusively, as the disc fans, except for very small in-

stallations, have not been a success, owing to their inability to produce a pressure, which is necessary for the proper distribution of the air through long ducts. With the centrifugal type of fan the most economical results for heating are obtained when running the fan in coldest weather at a speed so the periphery of the wheel will travel at a velocity of approximately 4500 ft. to 5200 ft. per minute. These velocities, which correspond to ¾-ounce and 1-ounce pressure per square inch, are sufficient to give a positive control of the air to effect the proper distribution through the ducts. In no part of fan system design does practice differ so greatly as in construction and location of the hot air ducts. Several schemes are used, the most common being to construct the ducts of galvanized iron and to carry the horizontal runs overhead through the truss work, with warm air outlets spaced from 15 ft. to 40 ft. apart, these outlets being placed from 8 ft. to 20 ft. above the floor.

In the early installations the idea was to distribute very thoroughly, through ducts running practically all over the shop, a relatively small volume of a high temperature and to discharge it 6 ft. or 8 ft. above the floor and direct it so it would blow on the workmen. This practice resulted in much adverse criticism of the fan system, as workmen in the line of the discharge were given colds and would be overheated, while those not in the direct path would not be heated sufficiently. The later practice for large shops has been to use large volumes of air at rather low temperatures, and to use much shorter pipes and allow the air to travel free in the building for some distance. The outlets are usually from 10 ft. to 20 ft. above the floor. In this design advantage is taken of the fact that the warm air discharged high up travels toward the walls where it is cooled and becoming heavier falls to the floor, thus the walls assist the circulation. The direction of the winds largely determine the coldest side of a building, and as the temperature of the wall will control to a certain extent the air currents, the coldest wall will cool the greatest amount of air, consequently the more air will be drawn in that direction. With the older installations of thorough distribution this was not accomplished so well, and generally one side of the shop would be better heated than the other. Another advantage in placing the outlets high is that no air currents are felt by the occupants on the floor. Heating plants in machine shops are in successful operation now where the air is discharged 100 ft. to 175 ft. from the ends of the building, and in foundries it is blown as far as 250 ft.

Masonry of concrete ducts located under the floor with standpipes placed at intervals and extending above the floor from 8 ft. to 12 ft., are in many cases used. In the Lake Shore & Michigan Southern, Collingwood, Ohio, shops, the underground concrete duct is used and connected to the hollow steel columns supporting the building, which are used for the risers, discharging the air about 8 ft. above the floor. Another method is used in Philadelphia & Reading Railroad shops, at Reading, Pa.; no distributing pipes are employed, but the hot air is discharged from the fan into the building overhead, and the air returned to the apparatus by means of underground ducts with openings located at the floor line and distributed through the shop.

The velocities of the hot air in the main ducts leading from the fans should never be greater than 2500 ft. per minute where it is possible to use lower velocities, and this velocity should be reduced gradually in the different branches so that the air is discharged from the outlets at from 800 ft. to 1200 ft. per minute. Where the outlets are high in large buildings, 1200 ft. per minute can be used without any objectionable results; but where a thorough distribution is desired, and the outlets are placed within 6 ft. or 8 ft. from the floor, the velocity of air from the outlets should not be greater than 800 ft. per minute.

In any shop installation, provision should be made for recirculating the air, also for the use of cold fresh air from the outside of the building. Occasionally it is found that a building can be heated easier by using part outside air and part return air than to use all return air. This is accounted for in the following way: Where the fan is blowing into and exhausting from the building, as in recirculating, the pressure maintained in the building is not greater than the outside, so the leakage of air around windows, doors and crevices may be very great. While by the use of a part fresh outside air a slight pressure can be maintained and to a large extent prevent this inward leakage. In either case cold air will, of course, be entering the building, but in the latter case the outside air will pass through the heater where it can be heated more economically and easier than by mixing it with the heated air in the building as it leaks in. This one point is not well understood, and if it was better understood heating plants that are to-day not giving entire success would be made to give very satisfactory results by simply using a portion of outside air through the heater instead of using entirely all return air from the building. In some cases it is found difficult to maintain uniform temperature throughout the buildings when using entirely return air, because it is difficult to keep the lower strata of air along the floor sufficiently warm, though in the upper part of the building the temperature may be as high as 80 degs. or 85 degs. This cold strata will be found in most cases to be caused by leakage into the building from the bottom of windows, doors, etc., and as this cold air drops to the floor it does not rapidly diffuse with the warm air. During the past winter in several buildings in which these conditions were found, by the use of a portion of outside air being taken direct into the heater, very satisfactory results were obtained. The natural in-pour of air from the bottom of doors, etc., was overcome and in some instances the currents were reversed, causing the floor to remain warm. This result was obtained without any change in the steam pressure, speed of apparatus or amount of heater used.

Various engineers have from time to time endeavored to develop a formula for determining the capacities of fans under all conditions. The majority of these formulæ, however, have been too complicated to use in everyday practice, and in the greater number of cases they also have the disadvantage of not being accurate on account of the impossibility of taking into account the local conditions of each case. As mentioned before, very little reliable data is to be found in any text books on this subject, for two reasons: First, very few engineers, with the exception of fan manufacturers, have had the opportunity of testing differently constructed fans under various conditions. Secondly, because the local conditions under which a fan is to be operated have to be taken into account in each instance, and this can be done only by the experience of the engineer, as no hard and fast rules can be laid down which could be used under all conditions. The friction, air pressure, length and size of flues, number of turns and their radius and temperatures at which the air is to be handled, all enter into the proposition to be given consideration. It is on account of this second reason that fan manufacurers are so loth to give out data regarding their apparatus, fearing that in inexperienced hands due consideration will not be given to local conditions and that their formulæ will thus be applied improperly and will reflect on them.

Nearly, if not all, of the fan manufacturers use empirical formulæ for fans under different conditions. The capacity of the steel plate centrifugal exhaust fan (inlet on one side only) when running under "free delivery" will be given approximately by the formula:

$$C = 1.57\ D^2WR$$

In which C = capacity in cubic feet per minute.
D = diameter of the blast wheel in feet.
W = width of the blast wheel at the periphery in feet.
R = revolutions per minute.

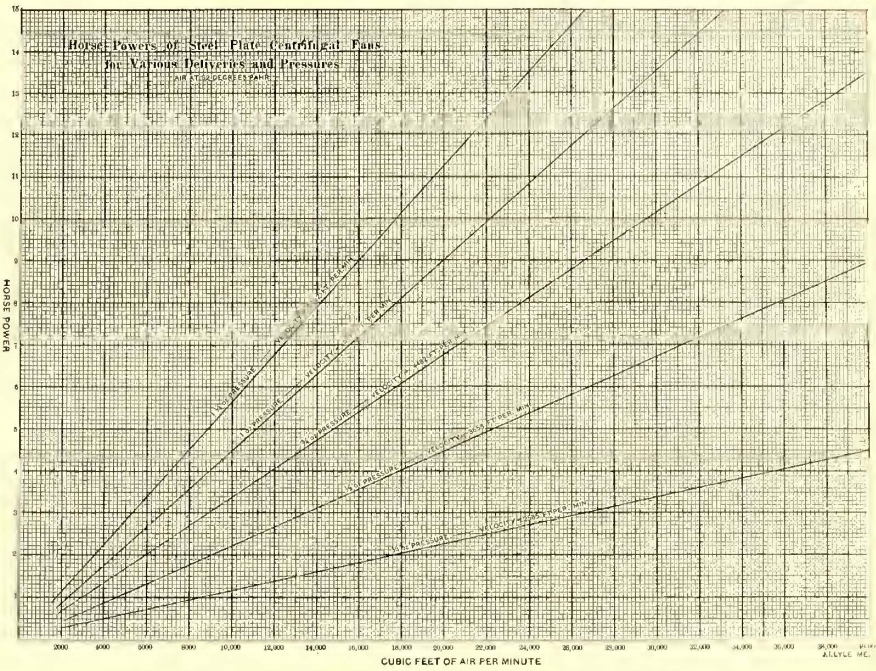
By "free delivery" is meant to set the fan in the room and

simply draw the air into the inlet and discharge into the same room without any piping, thereby avoiding ducts with the attending friction, other than the air passing through the fan.

In factory buildings, where short pipes of rather large diameter are used, thus reducing the friction, the formula $C = 1.25\ D^2WR$ will be found to be approximately correct. With long ducts terminating into many small outlets, the capacity will reduce from 10 per cent to 20 per cent, as given by this last formula.

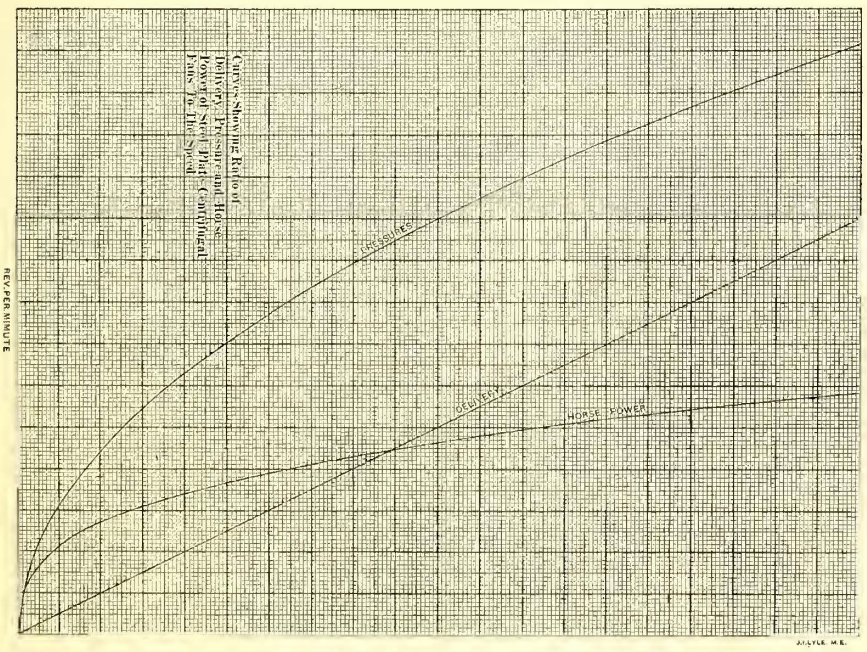
The delivery or capacity of a fan within the limits used in heating, varies directly as the speed of the fan. The pressure produced by the fan depends, first, upon the peripheral velocity of the blast wheel and varies as the square of velocity; second, upon the delivery; third, the temperature of the air. The horse-power consumed by a fan depends upon its delivery and pressure. It varies directly as the delivery and directly as the pressure. Since the delivery varies nearly as the speed, the horse-power varies nearly as the cube of the speed of the fan. By increasing the speed of a fan with other conditions remaining constant, the pressure will vary as the square of the speed. With the speed remaining constant by increasing the friction in the ducts, the delivery will be reduced and the pressure increased with a reduction in horse-power, but the delivery will be reduced in greater proportion than the horse-power. For this reason it is not good practice to use high velocities or long runs of piping where the same can be avoided. In a good installation with the fan running with a peripheral velocity of 5200 ft. per minute (approximately 1 ounce pressure with air at 62 degs.), from 2200 cu. ft. to 2500 cu. ft. of air per minute will be delivered per horse-power expended.

By proportioning the fan to meet the severest conditions of weather, say zero or colder, then in moderate weather of 20 degs. to 25 degs. above zero the fan will do the work easily at three-fourths the speed; the delivery varying with the speed and the horse-power which varies as the cube of the speed will be reduced more than one-half, giving 3850 cu. ft. to 4300 cu. ft. air delivered per minute per horse-power. As the number of zero days during the winter are comparatively few, it will be found in the majority of cases that the cost of power to run the fans on such days at 1-ounce pressure is less than the interest on the increased cost of a larger fan designed to operate at a slower speed in the severest weather.



CURVES SHOWING POWER REQUIRED TO MOVE AIR

As to whether a steam engine or electric motor is the better for driving the fan depends upon the local conditions. If there is not sufficient exhaust steam to do the heating, an engine-driven fan is the more economical, as its exhaust can be used. Of the steam supplied to the engine fully 75 per cent of its heat is available for heating, as the cylinder condensation and expansion will not amount to more than 25 per cent. An engine-driven fan also has the additional advantage of being independent of the electric plant; so the heating plant can be operated early mornings, nights or Sundays when the electric plant is shut down. Where there is sufficient amount of exhaust steam available for heating, some attention should be given to the economy of the fan engine. The way the valves are set on some fan engines make their action very much like a poor type of reducing valve, as the cut-off is often as late as ⅝-stroke instead of ¼-stroke, which is considered to be good practice for high-speed single-valve engines. Where electric current is constantly available, together with sufficient exhaust steam, an electric motor is the most convenient and economical, as it is probable the electric generating units in such cases are large, and consequently more economical than a small steam engine. If the fan apparatus is placed very far from the source of steam supply the condensation in high-pressure steam pipes necessary for an engine is an item well worth saving. Where engines are used it is preferable to have them directly connected, but belted electric motors are preferable wherever possible, because of the large and expensive motor that is necessary for direct connection on account of the slow speed of the fan.



RELATIVE SPEEDS AND CAPACITIES

Of the two curves here shown, one shows the horse-power required to move given volume of air at different velocities or pressures; the other shows the relative speeds, capacities and horse-power and pressures produced by steel-plate centrifugal fans.

ENGINEERING PRELIMINARIES FOR AN INTERURBAN ELECTRIC RAILWAY—IV

BY ERNEST GONZENBACH

TRANSMISSION LINE

I have already referred to a single transmission line, and by this is meant that no duplication whatever is provided. Experience has shown that to provide a reserve two absolutely independent pole lines are necessary, and if each follows its own route to the end of the line, so much the better. Such duplication is very expensive, and is not warranted in our case. By providing two separate circuits on the same pole line nothing is gained. Practically work cannot be done on one line while the other is carrying current, and six wires of small size on a pole are more troublesome than three wires of larger size. In the latter case they can also be spread farther apart. The cost of cross-arms, pins and insulators is reduced, and the whole line may be made more secure against interference. We have provided batteries at stations, and these are able to carry the entire load for, say, one hour. With cars in operation a lineman can reach any point on the line and make ordinary repairs in less than that time. Line troubles are becoming less disturbing as the art of line construction is becoming better understood, and for the ordinary interurban road with a straight run and no branches the writer believes that duplication of lines makes against rather than for good service.

We are gradually emerging from the days when we religiously copied the line construction which has served us well in city work, and are adopting standards suited to the open cross-country runs of transmission lines. Poles are being spaced farther apart, and in our example are recommended forty per mile, or 132 ft. apart. They need not be extra tall for such spacing, except where passing houses or crossing highways carrying other pole lines. They are assumed to have a standard height of 35 ft. for the D, E & F Railway, except as noted, where they may go as high as 50 ft. It seems difficult to believe that lines have actually been constructed with poles 80 ft. apart and 40 ft. high in open cross-country work, yet such is the case in at least one recent installation. The tendency of the future will no doubt be towards longer spans and possibly steel towers in place of poles.

It is a good investment to tamp poles well to within 1 ft. of surface, and after all pole work has been finished to fill around the pole with a good grade of concrete. This stiffens the work and insures longer life of the pole. When properly handled the cost of this concrete top dressing need not exceed $1 per pole.

Pins for several years past have been made of wood, often boiled in paraffine and otherwise prepared, on the assumption that they should form part of the insulation. This practice is now gradually being abandoned and pins and cross-arms are not so much designed to be insulators as they were formerly. The insulation is being put where it belongs, in the insulator. The latter are now made of porcelain for most transmission plants and are easy to obtain for voltages as high as 33,000, but they should never be installed without being tested on the ground. The pole line is the main artery of a long distance road, and since we have no reserve except the battery, which can only carry the load a short time, one cannot be too careful to use the proper material in its construction. Of course, the old controversy as to the relative merits of glass and porcelain still rages, but porcelain seems to be getting the better of the argument if its increasing use counts for anything, but as long as one concern in Utah and another in Montana successfully transmit power to 40,000 volts over glass insulators the controversy cannot be considered closed. The wires may be proportioned so as to give a maximum drop not exceeding 5 per cent to the farthest sub-station, and should be spaced in an equilateral triangle with wires 60 ins. apart.

DISTRIBUTING SYSTEM

It has already been mentioned that the proposition made by the manufacturing company proposing to equip this road included sub-stations about 15 miles apart. The writer's recommendation may seem to go to the other extreme by putting them an average of 7 miles apart. The power house would be located at O on the map (Fig. I, Street Railway Journal, March 7, 1903), and the sub-stations placed regardless of any uniform distance, but invariably as near the center of towns as the limitation imposed by high-tension line and the expense of real estate will permit. Going east from O the sub-station would be located and spaced as follows: At N, 4 miles; at M, 8 miles; L, 6 miles; E, 6 miles; J, 7 miles; H, 10 miles; G, 8 miles. This gives seven sub-stations plus one in the power house. The object of this distribution of stations is to let them serve as electric light and power stations for the places where they are located, also to allow them to become passenger, express and freight depots.

Any engineer who has ever operated a road equipped with sub-stations has invariably looked upon these adjuncts of power transmission as a necessary evil and a continuous source of trouble and annoyance, and on first glance it seems like multiplying these troubles to propose more stations rather than make a reduction in their number.

It is readily apparent that the primary object of these stations, as here proposed, is to serve as a central point where a representative of the company may always be found, where information may be obtained as to routes, rates, etc., in short the business to be handled in the same way as steam roads handle their traffic at similar points. Quite often one may observe small places of 1000 to 1500 inhabitants where steam roads may keep a day and a night station agent and a freight agent and freight handler in addition. Therefore, if the interurban is after the same class of business, why should it not employ at least one man in each town to be a representative, freight and express agent, and in this case a receiver of the electric lighting and power bills? Such a man may be paid a small salary and commission on all business done at his station. On this basis he should automatically commence to hustle for business. The fact that such a plan has not been extensively tried on interurbans seems another birthmark of horse car days, and is part of the sometimes heedless chase after reduction of operating expenses. One often gets the impression that the chief object in building some road was "to reduce operating expenses" rather than the hustling for net profits.

The duties here enumerated may leave the station attendant but little time to attend to electrical apparatus, and it is not intended that he should do so. The station and apparatus must be so designed and installed that the attention required by it is as small as possible. The attendant or agent need not be taught much about the apparatus except the simplest rudiments, and a competent man should be employed to visit each station once a day and examine the apparatus. Fig. 4 shows the outlines and plans of a station suitable for the D, E & F Railway, and combines many functions in a very inexpensive structure. The low basement is used as a battery room with ventilators extending to the roof like chimneys. The first floor is office and express and freight room with wagon platform on one side and car track on the other side. The second floor forms the living apartment of the attendant. The rotary converter room proper is an L, and is comparatively small. Room is provided for one rotary converter only, for a battery booster and motor-generator set. Any extension of service is very far in the future, and should it ever come it is believed that a change to a single rotary of longer size would be more desirable than a duplication of the first unit. A single unit gives the simplicity which is necessary for a minimum of attention required of the station. The direct-current switchboard is located so as to be in convenient reach of the office, and the hand-

operated alternating-current switch may be manipulated from the direct-current board by levers. In order to insure a reserve unit for any one of the stations it is advisable to have a portable sub-station, to be placed in a car and arranged for convenient cutting in at any one of the stations. This device has been in use for some years, has given excellent satisfaction and is worthy of being copied by railways desiring to keep their investment in apparatus as low as possible. The size of rotary converter units in our case will be 250 kw each, and the battery of 200 ampere-hours in each station. Stations being so close together and the attention required by apparatus being a minimum it is safe to have only one man on duty, especially since he has living apartments in the station. At places like H and P, where the business gives promise of warranting it, two station men may be employed from the very beginning, and possibly a third man, to be a general utility man. At the smaller places one man at the start will be sufficient and efficient, provided he is occasionally relieved for a day.

In order to make sub-station units of comparatively small size properly handle the load imposed by the presence of several cars near one station, it is necessary to have shunt-wound rotaries having a considerable droop in their characteristic curve between full load and 100 per cent overload. In this very simple way the load will be divided fairly well among two or three stations. At least one of the manufacturing companies continues to furnish compound-wound rotaries year after year in the face of the fact that the series winding has been abandoned long ago in the largest roads using alternating currents. Aside from the possibilities of a disastrous mixup in case of a reversal of the direction of the current in the rotary with the presence of a battery, the series winding gives the disadvantage of tending to furnish all the current from one station in case of an extra heavy load near that station. In consequence sub-stations have to be provided with larger units than if the load were divided among two or three stations. On trolley roads one sometimes sees long feeder lines carried out from sub-stations to a point a mile or more from the station before being tapped into the trolley line in order to accomplish practically what the shunt-wound rotary does. With the latter and the fairly steady load which is insured by a battery the power factor of the transmission line may be adjusted by hand adjustment of the rotary converter shunt fields.

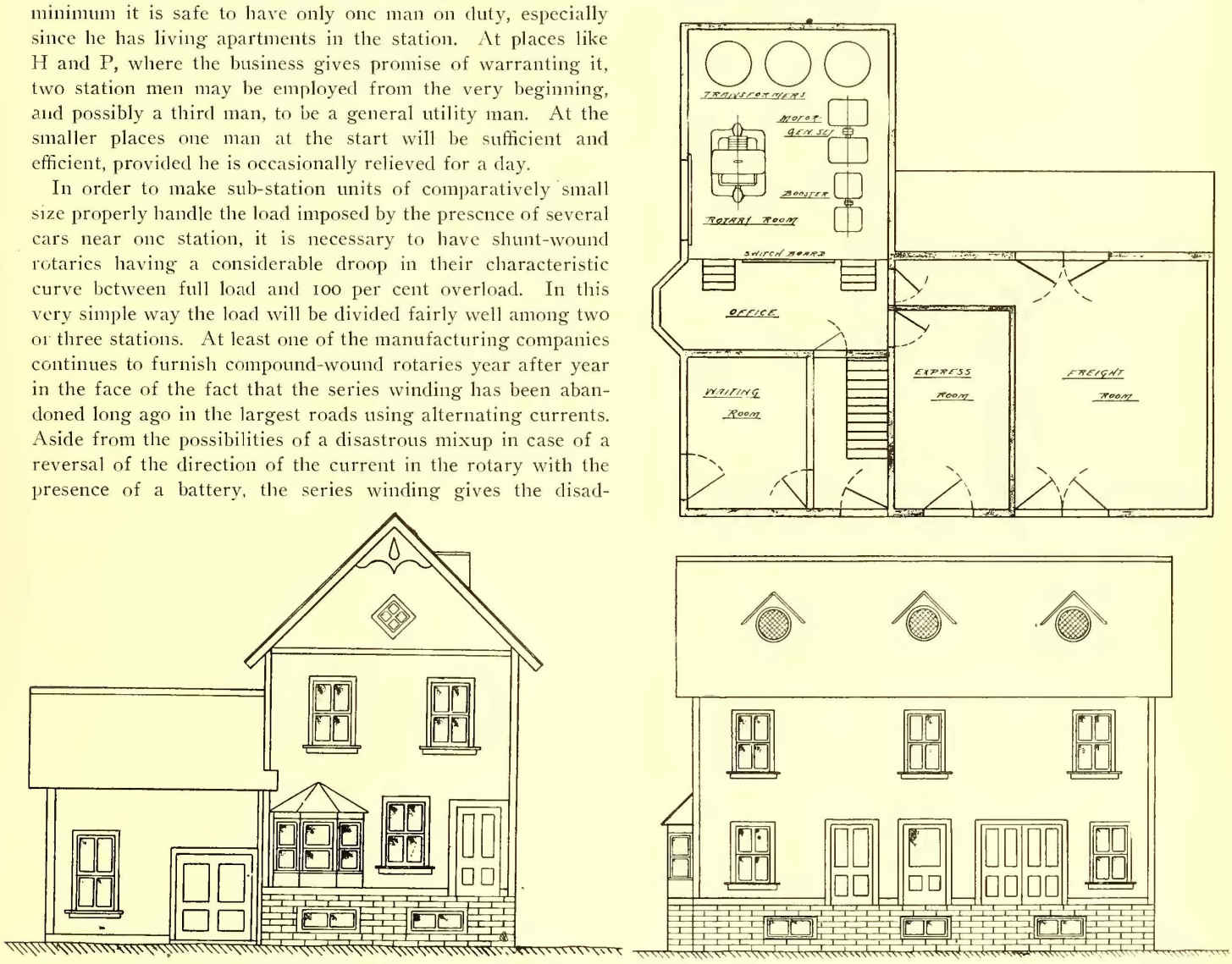


FIG. 4.—PLAN, FRONT AND SIDE ELEVATIONS OF A TYPICAL SUB-STATION, FREIGHT, EXPRESS AND PASSENGER OFFICE, AND DWELLING FOR ATTENDANT

Since the sub-stations are also to act as distributing centers for electric lighting and power the equipment for this purpose must be considered. The power house current being 25 cycles a motor generator set is a necessity. This is to consist of a 60-cycle, 2200-volt two-phase or three-phase generator of a suitable capacity directly connected to a synchronous motor. The latter type of motor will be practically independent of voltage fluctuations, and as the engine speed is constant, due to absence of load fluctuations, it furnishes a very satisfactory driving power. The writer recommends that this motor be a small rotary converter, deriving its power from the same step-down transformers which feed the railway rotary and its direct-current side connected across the storage battery. In case of failure or interruption of the alternating current the converter would act as a direct-current motor and the lighting and power supply need not be interrupted. As the lighting and power business will be a small part of the total station output, this arrangement will not interfere with any of the plans for the supply of the railway proper.

THIRD RAIL

It remains only to determine the size of rail and some of its details. It is taken for granted that the direct current is supplied at 600 volts. The steel for third rail, as already mentioned, is to have a minimum of carbon and manganese, and its conductivity is to be to copper as 7.5 to 1. The size of the rail is now only a question of permissible drop between stations. This "permissible drop" has proven a variable and elusive factor. With sub-stations only 7 miles apart and the class of service proposed few trolley lines would put up more than two 000 trolley wires, having an area of approximately 335,000 circ. mil. Assuming the two-track rails to have a combined capacity equal to approximately 1,000,000 circ. mil. copper, and a two-car train accelerating between two stations drawing

400 amps. from each station, this would give a drop of 230 volts, or 370 volts at the train. A single car accelerating would cause a drop to 485 volts. As there are frequently two cars between sub-stations, causing the voltage at the car to drop as low as 400 volts or less, more conductivity should be provided, although it is safe to say that in 80 per cent of interurban roads in operation to-day the drop is as much or more than this. Such excessive drop is exceedingly expensive to the railway company, not only on account of power lost, but because the motors are not worked efficiently. If the equivalent of two 000 wires is desired in third rail, then a rail weighing 30 lbs. per yard should be installed. Since we desire a higher efficiency of conducting circuit and car equipments in the D, E & F Railway it is proposed to install a rail weighing 70 lbs. per yard. Such a rail will have a conductivity equivalent to 933,000 circ. mil. copper (which is considerably below its theoretical equivalent, but for commercial work this figure should not be exceeded), and the drop during acceleration, figured on the basis above named, will leave a line voltage of 450 volts for a two-car train and 525 volts for a one-car train. This will insure a very satisfactory average line voltage. Fig. 3 is here reproduced from

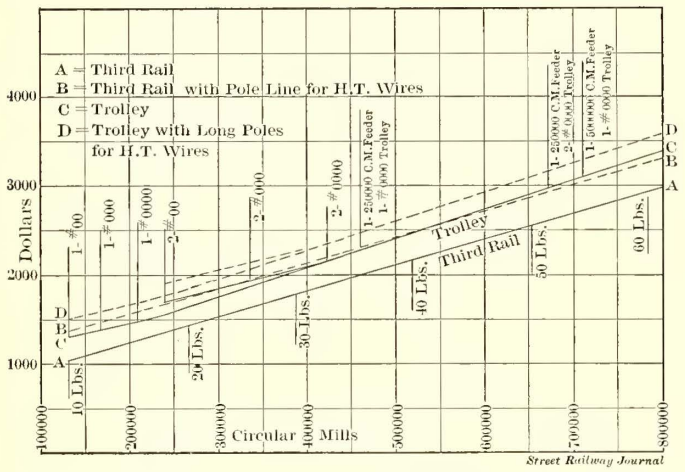


FIG. 3.—COMPARISON OF COST PER MILE OF OVERHEAD TROLLEY AND THIRD RAIL

Chapter I, to show comparative cut per mile over overhead trolley and third rail.

It has now become customary to locate the third rail on one side of the track, and the distance chosen for surface work seems to have become quite generally 27 ins. from gage line to center of third rail. This standard has many advantages, especially where heavy steam locomotives have to be operated over the same tracks, but for cars which have to operate over city streets there is the disadvantage of third-rail shoes protruding beyond maximum width of the car over the sides, thus necessitating lifting mechanism for the shoes in order to avoid the possibility of striking wagons, etc., which the car might pass but for the third-rail shoes. The elevated standard of 20⅛ ins. would seem to be very much better for cars operating through streets in terminal cities. With that standard the shoes will pass anything which the car will pass and need not be lifted nor current turned off from them.

Third-rail insulators continue to be very much below the standard of insulation which we consider necessary for overhead work or for almost any kind of work. Wood has been generally abandoned as worthless even in 110-volt work, and we sometimes go to great expense to secure a good grade of insulation in cases where not half as much is at stake as in the third-rail installation. It is certain that some time in the very near future we shall demand as high a standard of insulation for the third rail as we demand for other classes of work employing the same voltage.

At highway crossings the third rail has to be interrupted and the car drifts across. Experience has shown that this is not at all a drawback, in fact in practice it has many advantages. The chief disadvantage is that the lights in cars go out, and where crossings are numerous this becomes annoying to passengers. Numerous remedies have been proposed to cure this trouble. There is one, however, which has never been tried, to the writer's knowledge. It consists in extending the third rail into the public highway and protecting it by a fence and by automatic cut-out, leaving it dead except when a car passes over it. There is in every public highway a strip of waste land on either side of the traveled roadway, which it would not damage to occupy for third rail, leaving an opening 25 ft. wide in the center of the highway for teams. This can easily be spanned by the shoes, and lights thus remain burning. Such a plan necessitates the co-operation of the township authorities, who are always an uncertain factor. If, in return for this privilege, a light at each highway crossing were offered by the railway there are no doubt cases where such a plan would prove mutually satisfactory. Another way, of course, is to provide battery-operated lights, which commends itself as an advantageous plan which has its own merits.

For the bonding of the third rail only one type of bond has so far come prominently into use, and as its service has proven so universally successful but little is to be said on this subject except to repeat what has already been referred to in track bonding on the use of two bonds for each joint.

INTERURBAN LINES OF THE McKINLEY SYNDICATE

The syndicate represented by W. B. McKinley, of Champaign, Ill., sometimes known as the Portland syndicate, since its members are principally Portland (Me.) capitalists, has been very active in interurban construction at various points in the Middle West the last two years.

An insight into the extent of this syndicate's work was given by Mr. McKinley at a citizens' meeting at the Decatur Club about the middle of March. The syndicate proposes to build an interurban road from Champaign to Springfield, Ill., by way of Decatur, and the meeting was called to discuss the franchise through Decatur. Mr. McKinley met the Decatur citizens at the suggestion of W. A. Bixby, manager of the Decatur Gas & Electric Company.

Mr. McKinley said that the syndicate had purchased enough rails to lay 100 miles of track this year. It would complete the line from Danville to St. Joe, a distance of 25 miles. This is the Danville, Urbana & Champaign Railway. The syndicate already owns the Urbana & Champaign Railway, Gas & Electric Company, and the Danville Street Railway & Light Company, and in Indiana it has built the Fort Wayne & Southwestern Traction Company line, from Fort Wayne to Huntington, and is to build an extension from Huntington to Marion, 30 miles, which is to be finished this year. In the northern part of Illinois it is building the Illinois Valley Traction line from La Salle to Marseilles, 25 miles, and has projected a road west from La Salle to Princeton. Mr. McKinley said it would take 80 miles of rail to do this work enumerated as the work under way, leaving 20 miles, which it is proposed to put down this year in the interurban leading out of Decatur. Two routes are under survey from Champaign to Decatur.

He said that his company wished a franchise of its own through Decatur. It wanted a track of its own but would be willing that other interurbans coming into town later should use this track, paying part of the cost of construction. He thought it likely that a power plant would be established in Decatur at the place where the present electric light and power plant now is, so that exhaust steam could be used for a heating plant that is to be established by the Decatur Gas & Electric Company. Mr. McKinley said that coal could be obtained cheaper at Decatur than at Champaign or Danville. No ex-

clusive rights for running an interurban road through the town were asked, as it would be a benefit to have other interurban lines come in, but a separate franchise was desired, because investors wished to know the nature of the franchise before taking bonds. It was also desirable not to have the interurban cars delayed by the city cars. He said they would be perfectly willing to have an ordinance that would not allow interurban cars to stop for local passengers. The cost of a power house to operate 75 miles of line, he said, would be about $125,000. If a heating franchise could be obtained the power would probably be located inside the city limits.

Mr. McKinley said that the interurbans were a benefit to the small town. He did not know why the interurban did not injure the small town, but it did not. He cited Westville, a little town near Danville, as an example. It is twice the size it was before the interurban was built. He further said: "At Danville, West Main Street was nearly deserted before we came in. Last year a number of new buildings went up, and one four-story department store has been erected. Some idea of the size may be learned from the fact that it uses sixty big arc lights for which we furnish current. Those people have leased a building adjoining them and are paying $75 a month for it, giving the use of it free as a passenger and freight depot in order to bring the passengers right to the store."

THIRD RAIL FOR HIGH-SPEED ELECTRIC SERVICE

At the meeting of the Western Society of Engineers, in Chicago, March 18, 1903, Ernest Gonzenbach presented a paper on this subject. The principal points covered may be summarized as follows:

The majority of interurbans continue to use the trolley to supply power to cars. This is only natural, in view of the excellent service the trolley has given for so many years in urban and suburban practice. There are new conditions which present themselves, however, when the trolley is used to supply power to cars or trains drawing from 500 amps. to 1000 amps. at a speed of 40 m. p. h. The contact area of a single trolley is ample for the demands of ordinary street cars. Its behavior under interurban conditions is evident from the arc which can be seen at night when one of these cars is in the open country, running at maximum speed. There is a gratuitous illumination of the landscape due to this arc, which indicates the position of cars at night, like the vertical-beam headlights in use on fast steam trains, but the expense of such a display is prohibitive.

Trolley wheels are worn out at the rate of one every three to five days. Even the best do not last over one week. The trolley wire is rapidly worn and soon breaks at the weak spots. Unfortunately, no data is available from which the total maintenance cost per mile of overhead trolley may be obtained for interurban work. That this depreciation is a very high figure is generally admitted. Maintenance figures obtained in city work are not applicable to interurbans. Besides the high operating cost of trolley wires and wheels there is a serious chance for trouble when a trolley leaves the wire at high speed, in which case sometimes not only the trolley pole is ruined but the pipe brackets carrying the wires are ripped off the poles for a considerable distance and the car roof is damaged. The third-rail method of operation is particularly suited to meet these objections. If the railway is very largely on streets and highways or the right of way adjacent to and parallel with a highway, the trolley is by all means the most suitable method of conveying power to the car, and the more so because in such cases high speed cannot be successfuly maintained. Whenever a considerable portion of the roadbed is private right of way, not too close to the highway, the third rail becomes advisable.

LOCATION OF THIRD RAIL

The present practice of locating the third rail at one side of the track is to be highly commended on account of the facility with which it enables the ordinary track work to be done, and the ability to install the third rail at a higher elevation from the track than if it were placed in the center. This location of the live rail has become sufficiently standardized so that words in its favor seem wasted. The distance from gage line of track rail to center line of third rail is usually about 20 ins. in elevated practice and 27 ins. in surface work. The elevated standard is to be recommended for surface work, for in addition to the ability to interchange cars with the elevated, it gives an extreme width over the third-rail shoes which is no more than the width of the car itself, and thus avoids lifting mechanism and other devices intended to protect the shoe when the car is in city streets and using the trolley. For supporting the rail at one side of the track an extra long tie must be used. On elevated lines the insulators are usually about 5 ft. or 6 ft. apart. On surface lines the distance is 10 ft., which is likely to remain standard, because of the size of rail used and the absence of the vibration present on the elevated structure. The extra length tie should be, approximately, 9 ft. long. It is considered best practice to make the third-rail tie of some hard wood, like oak or chestnut, even if the other ties on the road are cedar.

INSULATORS

The early third-rail systems used wooden block insulators. It is noticeable that the most recent installations on elevated railways have not used wood. The insulators on the New York, New Haven & Hartford Railway were of wood, and its use on later surface roads was no doubt copied from this. Briefly, the objection to wood is that it absorbs water and allows a heavy leakage, which frequently destroys the insulator. As an example, the Albany & Hudson Railway may be mentioned. Its third rail is supported and insulated by wooden blocks dipped in insulating compound, and fastened to the ties by lag screws. The insulation resistance of the third rail was high for several months. Trouble with the wooden insulators did not appear until the spring following construction. Snow had been packed around the insulators and rail for several weeks without the least interference to service, but when it began to melt the ties and insulators became completely permeated with moisture and introduced a serious leakage. In several instances insulators were found burning. Almost invariably they were burned in the center, while the outside remained intact. It was impossible to determine the total leakage of current, because at the same time there was much trouble from the cables under the highway crossings, and the two sources of leakage could not readily be determined separately. After the spring thaws the sun and leakage current had dried out the insulators and the insulation resistance became higher. The writer has no recollection of insulation readings ever exceeding 12,000 ohms per mile. The average seemed to be between 6000 ohms and 7000 ohms, very often going as low as 2000 ohms under ordinary weather conditions. A single charred wood insulator would permit a leakage of 2 amps. It would seem that a higher standard of insulation should be demanded; and there is no reason why as good insulation as is demanded for overhead work could not be reached in third-rail work.

CONDUCTIVITY

A diagram was given, which was prepared by the writer, to determine the commercial value of worn-out rails for use as conductor rails. In this chart it was shown that a relaying rail with a conductivity one-twelfth that of copper may be sold for $24 per ton, and a soft low-carbon rail, rolled especially for the work, having a ratio of conductivity to copper as 7.5 to 1, could be purchased for $37.50 per ton, and still leave the balance in favor of the soft rail. Therefore, as a general rule, old rails

sold as relayers will net enough cash to buy a low-carbon rail of equal conductivity and leave a cash balance besides.

CONSTRUCTION DETAILS

A rigid alignment at the rail ends is important at high speeds, for any slight unevenness will cause the shoe to jump and flash. The Manhattan type of joint plate, adopted by the Aurora, Elgin & Chicago Railway, is giving very satisfactory service. All third rails, when new, cause some sparking at the shoes, and it requires several months of operation to wear down the rail to a smooth surface which will give a good contact without sparking. It is during these first few months, however, that visitors with a critical eye are most numerous, and thus many carry away the impression that this sparking is a regular feature of third-rail operation.

The expansion and contraction of the third rail is not as serious a matter as in the surface rail. A joint spacing similar to track rail spacing may be used; but the writer's experience leads him to recommend a close butting of the joints, leaving no space between rail ends and drawing the joint plate tight. The rail may then be rigidly anchored midway between two highway crossings. In this way the extreme movements of the rail ends at crossings may be as high as 12 ins. to 15 ins.

The highway crossings are an important part of the third-rail installation. The ideal way would be to provide standard underground single conduit and drawn-in cables, but this is expensive. If one is satisfied with low insulation it is easy to purchase ordinary triple braid waterproof cable and install it in a trough filled with pitch and tar. Paper cables, lead covered, would seem to be the most desirable. The terminals of each cable must be arranged so that there is no possibility of current leaking to the lead sheath. A small copper wire should be soldered by a lug to the lead sheath, and the other end connected to one of the track rails. It is also of the greatest importance to be able to disconnect conveniently and rapidly each cable from the rail for the purpose of testing cable and rail insulation and locating short circuits. In order to prevent the contraction and expansion of the rail doing mechanical injury to the cable it is good practice to make the connection between the two by three or four extra flexible pieces of cable, about 20 ins. long. One end of this is bonded to the rail and the other sweated into a convenient lug, which is attached to the cable terminal by a screw.

CONTACT-SHOES

The third-rail shoes carried by the cars weigh from 14 lbs. to 18 lbs. each, and are carried on links, which allow some freedom of movement. There is no force holding the shoe on the rail except its own gravity. When making renewals of shoes it has been the practice of the writer to have the surface cast concave with a radius of 12 ins., which is the radius given to the top of steel rails. Instead of a cast-iron shoe with chilled surface a mild steel shoe has been found very much superior. General observation by the writer leads him to believe that the average life of a shoe lies somewhere between 15,000 car miles and 25,000 car miles.

Lately W. B. Potter has designed a shoe which is worked by springs, and which will at once appeal to practical men. As put on the market it is designed to extend out horizontally and make contact with the rail under a covering. Whatever the merits of this protected third rail may be it is certain that the shoe designed for it, or a modification of it, would meet all the objectionable features of the present form of gravity shoe.

PROTECTION OF THIRD RAIL

The merit of a covering for the third rail seems to be open to question. Mr. Potter's design should avoid difficulty from sleet; but it remains to be seen if such a design would be suitable in an open country, where snow would be likely to drift and pack tightly between the rail and the covering. Coverings and protections of any kind have not been found to be necessary as a preventive of accidents.

SLEET

Sleet is probably the most serious of all objections to third-rail operation. After reviewing briefly methods used by several roads the writer concludes that the use of brine, judiciously distributed just ahead of a steel brush of the Boston Elevated type, will eventually be found most useful.

DESIGNING THE DISTRIBUTION SYSTEM

Choosing the size of the third rail for an interurban high-speed road corresponds to designing the distributing system of an ordinary electric railway. The number and location of the sub-stations will affect the size of the third rail. There seems at present to be a tendency to use fewer sub-stations and heavier rails. In the writer's opinion this is erroneous, although when sub-station attendance is high it may be apparently the least expensive. Unfortunately, a practice has grown up of making sub-stations miniature power stations and providing in them all sorts of engineering freaks in the way of apparatus. Such a station requires skilled attendance, and even when there are only two shifts wages form the largest item of sub-station expense. Again, sub-stations are often located by the manufacturer of the electrical apparatus, who places them so as to get the most ideal power distribution, quite regardless of any other useful purpose they might conveniently serve. Sub-station location is a subject beyond the scope of this paper, but in passing it is remarked that if sub-stations were located more frequently and judiciously, and more simply designed, so as to serve as passenger and freight depots, their attendance would become a small part of the expense chargeable to the motive power. In fact, there seems to be no reason why they should not become sources of income instead of being a dead weight on operating expenses.

IMPORTANCE OF RECORDS OF POUNDS OF WATER EVAPORATION

Michigan Electric Company
Detroit, March 5, 1903.

Editors Street Railway Journal:

I wish to call attention through your columns to the desirability of including in all central station data as to fuel consumption, kilowatt-hour output, etc., the "pounds of water evaporated," and stating the pressure (or temperature) to which same is raised, and if it is desired to be very exact also stating temperature of water before it enters heater or boiler.

In considering recently the results obtained in various stations and power houses, I found it extremely difficult to compare them with each other with a view to ascertaining the economy of operation due largely to the difference in quality and price of coal, and in some instances to the boilers, firing, heaters, etc. As all of these variable items are eliminated by using as a basis the pounds of water evaporated from a given temperature to another given temperature, and the station showing is thus divided into two parts—one the economy and cost of evaporation, the other the economy and cost of generation—I think the evaporation should hereafter always be included as data absolutely necessary if a comparison is to be made with other stations.

On this basis the pounds of water evaporated per kilowatt-hour output of the station is a factor permitting the direct comparison of stations using the cheapest and best fuel obtainable, with stations using the poorest and dearest fuel, and by taking into consideration the load curve and class of machinery equipment it can quickly be determined whether or not a station is operating economically, and the total economy of systems employing different methods of distribution, alternating current and direct current, rotary convertors and motor generators, also with and without storage batteries, can be determined, and a comparison made on a reliable basis.

Jos. E. Lockwood, President.

NEW CARS FOR DETROIT

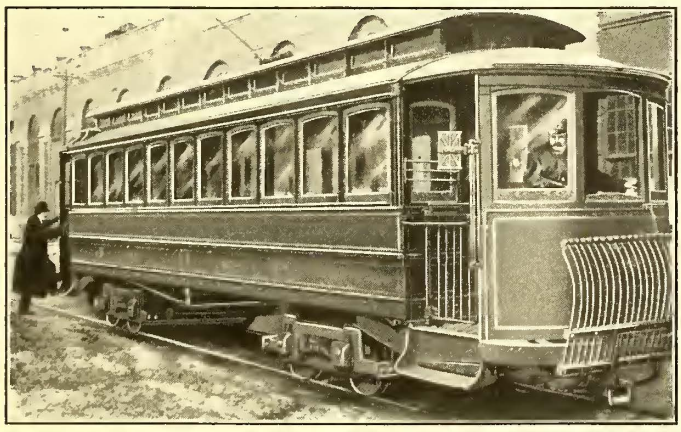
An account has already been published in these columns of an order filled by the St. Louis Car Company for twenty-five cars for the United Railway Company, of Detroit. The contract for these cars was placed Nov. 4 of last year, and shipments were begun twenty-eight days from that time. The reason that such a short time was given for filling this contract was that the Detroit company had ordered some cars from another company but was disappointed in receiving them.

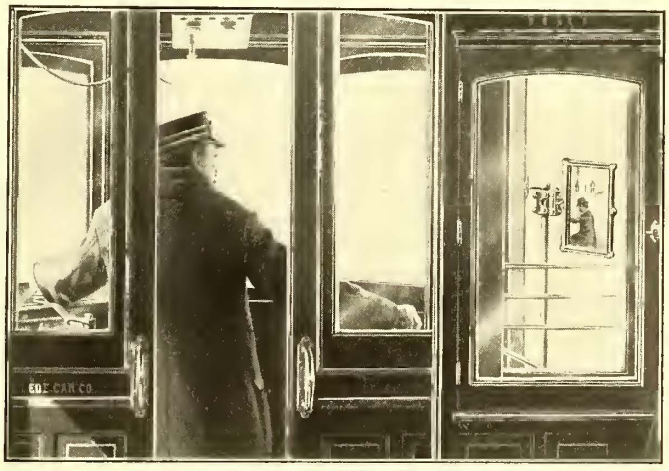
NEW CAR FOR DETROIT

The accompanying engraving gives a general view of the car body, which is shown without the truck, as the photograph was made in the works of the company before the trucks were attached. The car has a length of body of 28 ft., and a length over all of 41 ft. The exterior width is 8 ft. 3 ins., and the height of the car body 9 ft. The rear platform is 7 ft. in length, and is of the Detroit pattern with dividing rail. The interior finish is of quartered oak.

MOTORMAN'S MIRROR

A device for enabling the motorman to watch the rear platform of his car has recently been introduced on some of the lines of the North Jersey Street Railway Company, and is illustrated in the accompanying engravings. It is placed on the right of the car, and projects about 3 ins. beyond the car and at an angle of about 45 degs. The position of the mirror is such that not only is the motorman able to watch the passengers getting off and on the car by the rear platform, but the conductor also may see the rear platform when collecting fares near the front of the car, provided no one is standing on the front platform.





MOTORMAN'S MIRROR FOR WATCHING REAR PLATFORM

As will be seen by the engraving the mirror is hinged so as to be set in any position desired. The hinges are provided with springs so that if the mirror is struck by a wagon the springs are compressed and no harm is done to it. The mirror is also cushioned to protect it from blows of this kind. The cushion is made of a cork composition, which is placed behind the mirror, and is covered with a sticky compound to prevent the pieces of glass from flying and injuring passengers in case the glass should be broken. In addition, strips of cork cushion are placed over the front edges of the mirror. The frame of the mirror is of bronze, so that in case of a severe blow they will bend rather than break.

The device is manufactured by Harold P. Brown, of New York, who claims that it will reduce the proportion of damage suits against railway companies brought for injuries received by passengers getting on or off the car, and who are thrown down by its unexpected starting.

TRADE-MARK FOR DETROIT UNITED RAILWAY

Announcement was made last week of the award of the prize of $25, offered several months ago by the Detroit United Railway Company for a design for a trade-mark. It is stated that there were about 500 designs submitted for the prize, and that of these nine were offered by the winner. The qualifications through which this design is said to have won over its 499 competitors is its simplicity, which no one can deny. There were some hundred designs, which in workmanship, coloring and attractiveness, altogether surpassed the trade-mark adopted, but the mass of them were wholly unsuited for general use, and because of their intricacy and detail would have lost much in reproduction, as well as being expensive to copy.

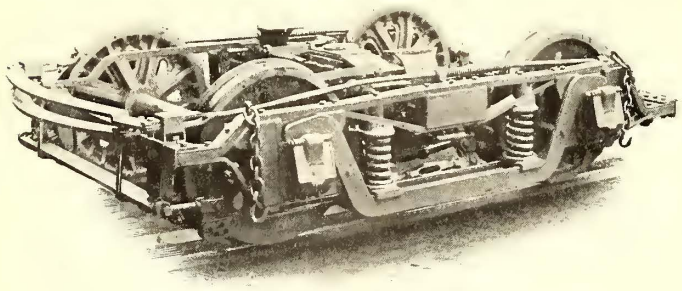
DETROIT TRADE-MARK

The committee on award, which included President Hutchins, agreed that the successful design included both the simplicity and novelty desired.

A complete telephone system is to be installed on the elevated lines of the Brooklyn Rapid Transit Company. An instrument will be placed in each station. By this means it is expected to enable agents to communicate with the police in case of trouble and to keep the officials of the company informed of conditions along the line in the event of delay or accident.

THE 23-D TRUCK

Several references have been published in recent issues of this paper to the No. 23-D truck manufactured by the St. Louis Car Company. As no particulars of this truck have been published in these columns, and as the truck is being used to a

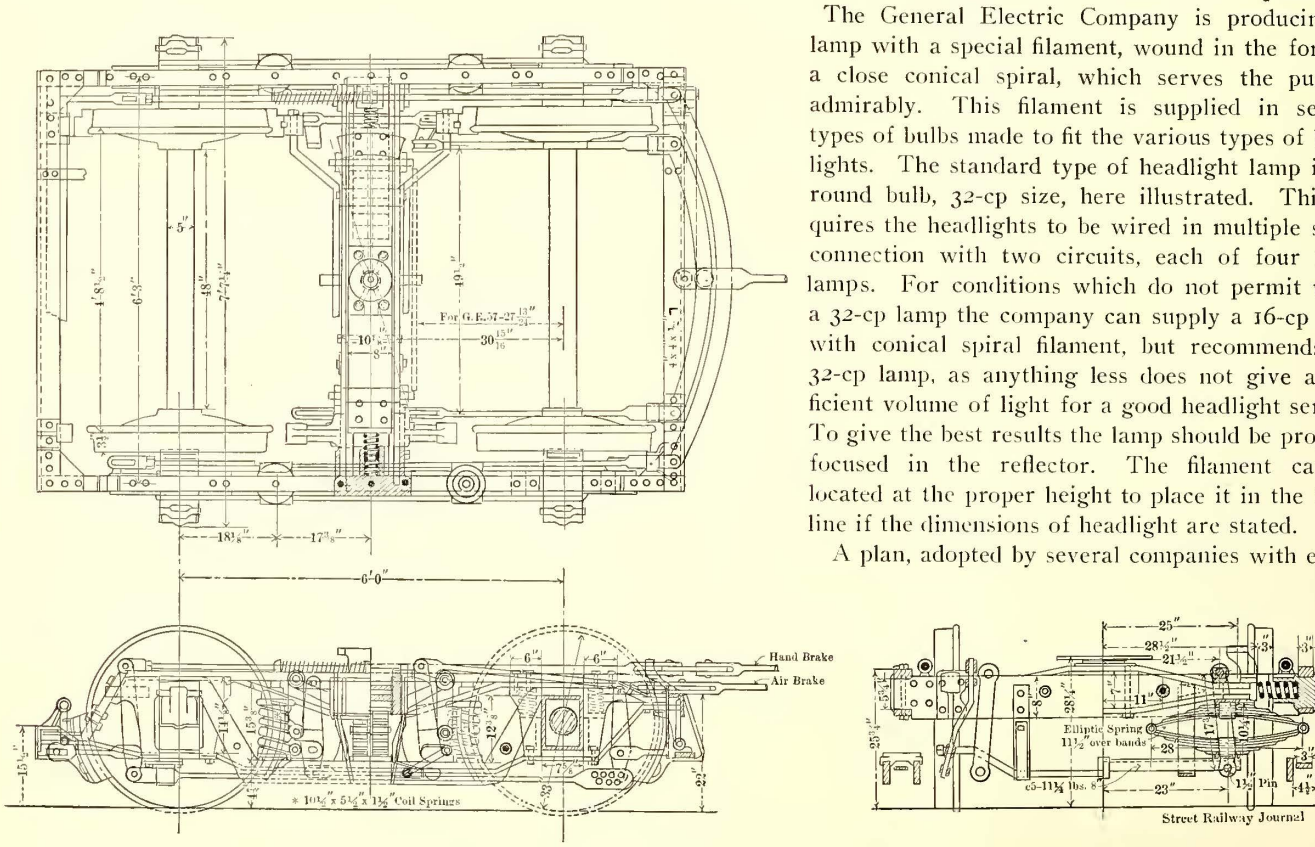


SIDE VIEW OF TRUCK

considerable extent in heavy interurban work, some views and particulars of it may prove of interest.

As will be seen the frame work and general appearance of the truck is similar to that of the standard M. C. B. truck, and it has an equalizing bar supported on the boxes with a spring bolster with elliptic spring support. There are several special features of the truck, however, which have been introduced by the manufacturers and which are designed to give easy riding. One of these is the use over each pedestal of two coil springs, one on each side of the box, so arranged that the bars of the side frame rest on these springs and prevent teetering. As also will be noticed the truck is fitted with two systems of brakes, one acting on the inside of the wheels and the other on the outside. The rigging for these two brakes is independent, and the inside brakes are intended for use with compressed air while the inside ones are hand brakes. All wearing parts are accurately machined.

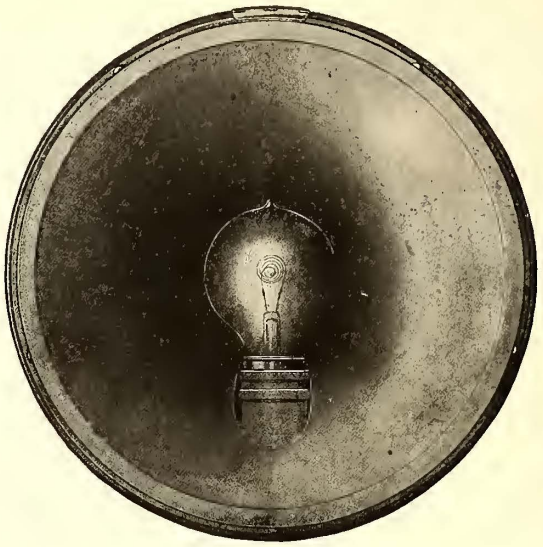
The total weight of the truck is 7250 lbs.



PLAN AND SIDE ELEVATION OF NO. 23-D TRUCK

INCANDESCENT LAMPS FOR STREET CAR HEADLIGHTS

With the growth of urban trolley lines and the high speeds of modern street railway service, effective headlights are a necessity. To be effective for such service a headlight must throw a brilliant path of light for a distance of at least 100 ft. ahead



INCANDESCENT LAMP HEADLIGHT

of the car. A parabolic reflector is the type desired for projecting the light. For good service with such a reflector the filament of the incandescent lamp should be compactly formed so as to concentrate the light as far as possible at a point.

The General Electric Company is producing a lamp with a special filament, wound in the form of a close conical spiral, which serves the purpose admirably. This filament is supplied in several types of bulbs made to fit the various types of headlights. The standard type of headlight lamp is the round bulb, 32-cp size, here illustrated. This requires the headlights to be wired in multiple series connection with two circuits, each of four 16-cp lamps. For conditions which do not permit using a 32-cp lamp the company can supply a 16-cp lamp with conical spiral filament, but recommends the 32-cp lamp, as anything less does not give a sufficient volume of light for a good headlight service. To give the best results the lamp should be properly focused in the reflector. The filament can be located at the proper height to place it in the focus line if the dimensions of headlight are stated.

A plan, adopted by several companies with excellent results, is to make the socket in the headlight adjustable both vertically and laterally. By the movement of a pair of thumb-screws this enables the motorman to focus the lamp positively and accurately. These headlight lamps have been in use for two or three years, and have given thoroughly satisfactory service.

PARIS LETTER

(From Our Regular Correspondent.)

The main interest in traction affairs in Paris at the present moment now concerns the Metropolitan. Extensions are going on in all directions in the city limits, and the line under the northern outer boulevards (line No. 2) has been opened up for service. This line has immediately made its influence felt on the existing omnibus and tramway lines under or parallel to which the new line has been constructed. Some of the lines operated by the Cie Générale des Omnibus have lost as much as 60 per cent of their traffic. As far as competition on the outer boulevards line is concerned, the Cie Générale des Omnibus is now endeavoring to compete with the new Metropolitan. On the tramway line running from La Villette to the Trocadero, which was previously operated by horse traction, with a ten-minute headway, are to be seen steam cars of the Purrey type. The carrying capacity of these cars is, of course, much smaller than the Metropolitan trains. This latter run from twelve trains to twenty-four trains per hour, and each train has a seating capacity of 400 passengers. The steam cars of the surface line just referred to have a capacity of forty-eight places per car, and run on a four-minute headway. No trailer cars are attached to the steam cars, due to the fact that the latter have difficulty in overcoming heavy grades. The grades of the Metropolitan line running parallel are, in fact, higher than on the surface lines, but each train is equipped with 150-hp motors, which, of course, can easily mount the grades.

Under these conditions and in spite of the great favor shown by the traveling public to the surface lines, and especially to the double-decked cars when the weather is favorable, the traffic of the Metropolitan line No. 2 has not been influenced by as much as 100 francs per day by the competition of the surface cars since the substitution of steam for horse traction. In fact that competition can be considered a negligible quantity. Close competition of the Metropolitan lines with a portion of the Western Railway is anticipated, and especially on that part of the latter running from the Gare St. Lazare to Porte Maillot. The exact figures of the loss sustained by the Ouest Railway are unavailable, but it is certain that they would show some important results. The cab traffic would also prove to be affected in a very considerable extent, but no figures are to be obtained.

It is now recognized that the omnibus or tramway lines will be able to keep their traffic by modifying their conditions and service so as to make themselves of use to the Metropolitan lines as feeders to the latter. It is desirable that this be done at once.

It has been rumored by the press that the Ouest Railway will apply electric traction to that portion of the Ceinture (belt) Railway running between Passy-Auteuil. This belt line is at present managed by the several railway companies through whose zone it runs, and it is evident that one cannot take up the question of electric traction unless the others are in accord. It is said that the Ouest Railway is waiting the lead of the Northern Line in the matter. It need scarcely be said that the service on this belt line is deplorable, and although a saving of several minutes in the schedule time has been effected in the present steam service its electric transformation is much to be desired. The present belt trains of the Ouest Railway portion have a seating capacity of 1500, and are composed of heavy double-decked cars, which are highly inconvenient from the point of view of quick service.

It has furthermore been announced that the Ouest Railway contemplates another extension of its existing electrical lines. This is in connection with its actual line running from Les Invalides to Versailles. On this line, as mentioned in a recent issue, there are now heavy electric locomotive trains and also Thomson-Houston and Sprague multiple-unit trains. The grades vary from 5 to 10 per 1000. The sub-stations on the line are supplied with current from a large steam power station of the Westinghouse Company at Moulineaux. It appears that the Ouest Railway contemplates using a part of this power for electric traction on a line to run from Les Invalides to St. Cloud. The greater part of the actual traffic on this route is now monopolized by the steamboats, which ply on the river with a headway, according to the season and the day, of five minutes to fifteen minutes.

The Orleans Railway must not be overlooked in this review. This progressive railway has recently decided that its existing suburban traffic could be handled better and be greatly increased by substituting electric traction for the present heavy steam-hauled trains. As is well known the company already operates a length of 5 km between its old and new terminus in the center of Paris. It is now decided to extend this electric service as far as Juvisy, a distance of 12 miles from Paris.

The local service will be handled by motor cars and locomotives, the orders for which have already been placed. The multiple-unit trains will be reserved for suburban traffic, and will be similar to those on the Manhattan Railway. The current will be three-phase, at 25 cycles, and two new sub-stations will transform this voltage to 600, which will be supplied by a third rail, as at present. The new locomotives will be capable of a speed of 80 km to 100 km an hour. The installation will be made by the French Thomson-Houston Company.

The so-called Tramways de Penetration, which are in reality surburban railroads with terminii in Paris, do not, as is well known, give great satisfaction as regards their regular service and operation. Some of the roads have been built very cheaply, and the construction does not bring credit to the trolley system already barely tolerated in Paris. Nevertheless it must not be supposed that the surface contact systems at present installed or the accumulator battery cars which still run are any more highly esteemed. One of the contact systems running in the Rue du 4 Septembre is being operated temporarily by the trolley system, and some storage battery car lines will soon be transformed. Provisional authorization has been granted these companies to modify their service and fares, and it is recognized that most of the weak points in the exploitation of these Paris tramway lines is due to their poor financial condition. The fares have been based on a uniform scale throughout Paris, but a recent authorization has changed this, and now the fares will be charged according to distance. The question aroused great discussion, and the following is a resumé of the results arrived at: Provisional authority was granted for the use of trolley lines, and the companies will not, therefore, be called upon to erect a costly line system. A basis of fares was agreed upon, the charge being according to distance. An increase of speed of the cars was agreed upon on certain lines.

The trolley lines, or recently converted surface contact lines, represent about a half of the Paris tramway system, and it is expected that other companies will institute similar claims to those just outlined.

A few words can be said regarding the state of the actual construction of the new Metropolitan lines.

One of the problems confronting the constructors of the Metropolitan lines in Paris is the bridging of the Seine. Aesthetic considerations made the choice of a site rather difficult, but the solution has been proposed as follows and seems likely to be adopted: A new passenger bridge was required to join two important thoroughfares, the ends of which were on opposite banks of the river, but not in the same straight line. These streets are the Rue de Rennes and the Rue de Louvre. The bridge formerly proposed for the Metropolitan Railway would have rendered necessary the demolition of a portion of the Institute de France, a prominent building opposite the Louvre on the left bank of the Seine. The new scheme obviates this difficulty and at the same time makes possible the junction of the two roads above referred to. The scheme consists in building a bridge in the form of an "X" across the Seine, two arms of the "X" joining the two ends of the Rue de Rennes and Rue de Louvre, and the other part being used for the Metropolitan Railway crossing the Seine at this point. The present bridge, nothing historical or handsome in any way, should, therefore, be removed and replaced by the "X" bridge, which, it is evident, will satisfy all parties while not offending the æsthetic beauties of this part of the city.

On the Place de l'Opera there will be three stages of galleries, this being the most important station of the Metropolitan network. The Auteuil-Opera line will be the deepest, about 21 m.

In this construction two great difficulties have to be faced. First, the interruption of the traffic by closing up the streets under which the station is to be constructed. This would be a very unpopular method of working, and the simple announcement made in the papers that the chief engineer was about to close a part of the Place for a short time was sufficient to arouse a great protest in all directions. The main technical difficulty is with reference to the infiltration of water, which is to be met with at a depth of 10 m. This will be overcome by a caisson construction similar to those used in the construction of the now famous bridge Alexander III. It is expected that the preliminary work will be finished in March, and the construction work itself completed in November. The inauguration will take place early in 1904.

On the small railway branch line joining two small places in the north of France and Belgium the Anzin Mining Company has just placed in service some passenger cars which are probably the largest in Europe. They each contain sitting places for 100 passengers, whereas the largest cars in France are those of the P-L-M Railway Company, capable of holding ninety people. The cars are 17 m in length, and are, of course, mounted on double trucks. They are lighted electrically by means of accumulator batteries placed under the car, and are heated by means of steam from the engine. The weight of an empty car is about 60,000 lbs. (26,500 kg).

FINANCIAL INTELLIGENCE

Wall Street, March 25, 1903.

The Money Market

An easier tendency, more particularly in time loans, has appeared in the money market during the week. It is significant, however, that advances for the more distant periods are more readily obtainable than those for the nearby dates. For four to six months the prevailing rate is 5¼ per cent; for sixty days it is closer to 5½, with lenders holding off in most cases for their full figure. The higher rate for the short-time loans, taken together with the 5½ per cent to 6 per cent call money rate on the Stock Exchange, undoubtedly reflects the opinion in banking circles that money will be comparatively easy in the late spring and summer, but that the relaxation during the interval between now and then will be very gradual. The reasons upon which this view is based are, first that currency is being held with unusual tenacity in the interior markets; second, that the Treasury is likely for the immediate future to draw from rather than to add to New York's cash supply, and third, that demands for money abroad being particularly heavy during the next month, it will not be possible to get renewal of foreign credits here unless we are willing to pay high for them. Last Saturday's bank statement showed unexpectedly a $12,000,000 reduction in loans, in consequence of which surplus reserves were raised $2,000,000. This item stands now about where it did a year ago, while the outstanding loan account is a trifle less. It is evident that the movement of local capital is likely to furnish a pretty close parallel to the one of last year, when surplus reserves barely held their own during the latter half of March, and did not begin to pick up to any extent until after the second week of April. Sterling exchange has risen sharply during the week, reflecting at once the easier position of our time money market and the continued hardening of the money markets abroad. The recent break in cereal prices, however, is a favorable sign in this connection, inasmuch as it points to heavy exports of agricultural commodities and a consequent strengthening of our credit relations with Europe.

The Stock Market

A recovery in prices, followed by another decline, has left the position of the general stock market about the same as it was a week ago. It is rather hard now to find adequate reason for the Wall Street depression purely in outside conditions. One hears a good deal about the hostile attitude of labor, and the threatened strikes in various parts of the country. The findings of the anthracite strike commission, made public last Saturday, while not interpreted as a positive victory for either operators or men, are likely to afford encouragement to the agitation for higher wages now going on in other industries. The expensive concessions which the New York and New Haven Railroad have found it necessary to make in order to avert a strike, are another significant sign indicating that the profits of capital are being steadily encroached upon by the demands of organized labor. This phase of the financial situation is certainly by no means agreeable. It is a fact also that money rates are unusually high for this season of the year, and that it is a serious question whether in reckoning the investment values of the future a permanently higher interest-yielding level must not be accepted as a necessity. Yet with all due weight attaching to these consideration the principal reason for the prevailing pessimism seems clearly to be in the fact that the outside public are afraid to buy stocks for a rise, that no powerful efforts are being made to sustain or advance prices, while at the same time a very strong speculative contingent, headed by some of the most daring professional operators, is working aggressively for a decline. According to the common gossip, which, in this instance, seems to have pretty good foundation, the animus of this raid upon the market lies in the fight for the mastery in the Southern Pacific property. That the minority faction in this company are not content with using law suits and injunctions to gain their point, but that their plan embraces an attack upon vested interests in general, appears now quite clear. Will the other party in the contest remain passive under this attack? Or will they in turn take the offensive and make things uncomfortable for the speculators who are selling stocks short? These are some of the queries which professional Wall Street is putting to itself. In the meantime the prudent person on the outside will doubtless conclude that he had better stand aloof.

Metropolitan shares were run up sharply toward the end of last week on what looked to be a well-executed drive against a large short interest. The rise was accompanied by talk of a favorable report from the District Attorney's office, which has been investigating the affairs of the company. But the stock reacted promptly with the rest of the list later on. Manhattan has had a special reason for its decline in the threats of a strike by its employees the outcome of which, at this writing, is by no means clear. The decline in Brooklyn Rapid Transit, on the other hand, has been entirely in sympathy with the general market. There is a favorable sentiment regarding this property owing to the approach of the season of heavy earnings, and the confident expectation that on account of the diminishing ratio of operating expenses the net returns will show up very handsomely.

Philadelphia

The Philadelphia traction stocks have shown considerable strength during the week in spite of the reactionary tendency elsewhere. There were some indications that the clique in Rapid Transit had resumed operations after a long period of inactivity. The stock was taken in hand at 13¼ and bid up rapidly to 14¾, without encountering any selling of importance. This movement was accompanied by a half-point advance in Union Traction, from 46¾ to 47¼; it was evidently entirely speculative, however. An odd lot of Philadelphia Traction sold as high as 98; but the regular market for the stock did not go above 97½. American Railways was strong at a gain from 50 to 50¾. Consolidated Traction of New Jersey sold at 65 and Reading Traction at 30.

Chicago

Union Traction shareholders have scarcely taken any advantage of the offer to extend the period for depositing the stock until April 2. Their reluctance to do so is presumably due to the uncertainty of the coming city election. The common stock on one or two single trades advanced to 10¼ during the week. City Railway was steady, selling at 210 and 212, West Chicago recovered to 84, while North Chicago fell from 158 to 157. There is some hope among the surface line managements that the Republican city ticket will be successful, in which event it is thought that the chances for extending the franchises will be greatly improved. Rumor has it that the City Railway has an independent franchise plan to present to the new City Council as soon as it is elected, and will leave the Union Traction to go it alone. There is no confirmation, however, for this story. Scarcely anything at all has been done in elevated shares during the week. A few trifling sales only are reported in Metropolitan preferred at 82, South Side at 108 and Lake Street at 5½. It is not believed that the Lake Street Company will be allowed to default on the July interest on its first mortgage bonds. Such action would work seriously against the interests of the Northwestern Elevated, and as the people back of the latter road are identical with the Lake Street party, it is likely that a way will be found to meet the payment, and so prevent foreclosure.

Other Traction Securities

The Boston stocks did not change their position much on the week, with the exception of Boston Elevated. These shares recovered from 145 to 148, and showed some firmness at the higher figure. Massachusetts Electric common did not go below 35 nor above 35⅜, but the preferred rose a half point from 91½ to 92. West End common was steady between 96½ and 96, and later sold ex-dividend at 94¼. The preferred lost a half point to 115. In Baltimore the United Railway issues were strong on favorable prospects for a steady increase in the company's earnings. The income bonds benefited most by the buying, advancing from 68 to 68¾. The general 4s were steady at 93¾, and the stock at 13. Other Baltimore sales for the week included Knoxville Traction stock at 30, Baltimore Traction 5s at 117¼, North Baltimore Traction 5s at 120½, and Anacostia & Potomac 5s at 100. The only feature of the New York curb dealings during the week was an attempt to stimulate speculative interest in New Orleans Railway securities. The common stock ran up sharply from 13 to 15¼, and the preferred from 37 to 38. But no buying from outside sources appeared and the common stock yesterday yielded to 14¼. It took only a few hundred shares to move the quotation either way.

Other curb sales for the week comprised Interborough Rapid Transit (70 per cent paid in) at 107, United Railways of St. Louis preferred at 81½, American Light & Traction preferred at 99, Brooklyn City Railroad 5s at 108½, and St. Louis Transit 5s at 95 and 95¼.

Tractions were comparatively quiet on the Cincinnati 'Change last week. Sales numbered about 2400 shares of stock and $150,000 worth of bonds. Toledo Railways & Light led in the stocks, 982 shares selling; opening was 30⅞, and the close 34. Northern Ohio Traction common was again popular, 522 shares selling at 26¾ to 27½. Cincinnati Street Railway continued firm, 473 shares in small lots selling at 140¼ to 142. The demand for Indianapolis Street Railway 4s continued strong, and $67,000 worth sold at 88½. Northern Ohio Traction 4s sold to the extent of $36,000 worth, at 62½ to 63½. Columbus, Delaware & Marion 5s continued stationary at 101, $28,000 worth selling.

Traction sales on Cleveland Exchange numbered 2786 shares of stock and $13,000 worth of bonds. The nomination of a strong Republican candidate, who is openly in favor of extending the franchises of the city lines, caused sharp demand for the issues of both the Little and Big Consolidated Companies. Sales in Cleveland Electric numbered 950 shares, advancing during the week from 85 to 88. Three hundred Cleveland City sold at 102 for the opening and 105 at the close of the week. Northern Ohio Traction sold to the extent of 855 shares and declined from 26 to 25; all sales were from one to two points lower than on the Cincinnati 'Change. Lake Shore Electric improved slightly, 450 shares selling on an advance from 11 to 12¼. A small lot of Aurora, Elgin & Chicago preferred sold at 89, a decline from 92½ last sale. Monday the bull movement on the Little Big Consolidated was renewed. Three 100-share lots sold at 86¼ with 87⅜ asked at the close. Bidding on Little Consolidated advanced to 106, but none was sold, as holders asked 110. Cleveland & Southwestern sprang into prominence and 300 shares sold at 25 and 25¼, which is a decline of five points from last sale.

Securities Quotations

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

	Closing Bid	
	March 17	March 24
American Railways Company	49½	50
Aurora, Elgin & Chicago	a29	a30
Boston Elevated	145	147½
Brooklyn R. T.	64⅝	65¾
Chicago City	210	212
Chicago Union Tr. (common)	9½	9½
Chicago Union Tr. (preferred)	42	42
Cleveland Electric	83	86½
Columbus (common)	74	74
Columbus (preferred)	104	105½
Consolidated Traction of N. J.	64	64
Consolidated Traction of N. J. 5s	108	108
Detroit United	83¾	a86
Electric People's Traction (Philadelphia) 4s	98	98
Elgin, Aurora & Southern	52½	52½
Lake Shore Electric	a11½	12¼
Lake Street Elevated	5¼	5
Manhattan Railway	*140¼	138¾
Massachusetts Electric Cos. (common)	35	34½
Massachusetts Electric Cos. (preferred)	91	91½
Metropolitan Elevated, Chicago (common)	33½	32
Metropolitan Elevated, Chicago (preferred)	81	81½
Metropolitan Street	133⅝	*134¾
New Orleans Railways (common)	12¾	14
New Orleans Railways (preferred)	a42	38
North American	99½	102
Northern Ohio Traction & Light	a26	25
Northwestern Elevated, Chicago (common)	—	—
Philadelphia Rapid Transit	13	14¼
Philadelphia Traction	97½	97½
St. Louis Transit (common)	27½	27½
South Side Elevated (Chicago)	108	107
Syracuse Rapid Transit	—	—
Syracuse Rapid Transit (preferred)	a80	a79
Third Avenue	122	122
Toledo Railway & Light	30	—
Twin City, Minneapolis (common)	114¼	115½
United Railways, St. Louis (preferred)	—	81⅜
United Railways, St. Louis, 4s	84½	84½
Union Traction (Philadelphia)	46¾	47⅛

a Asked. * Ex-Dividend.

Iron and Steel

The strongest feature of the present iron situation is the extraordinary demand for finished products. In bar iron, wire and wire products, sheet steel and structural material consumption continues in enormous dimensions, and far outruns production. This great activity in the higher branches of the industry naturally filters through pretty much the entire market. The pig-iron trade, both East and West, shows increasing activity, and purchases are being made very freely now for the second half of the calendar year. There is also an increased inquiry for foreign articles, in foundry iron and iron ores particularly, growing out of the fact that at the high level of domestic prices it has become just as cheap, or even cheaper, to import than to buy at home. Quotations are $22.00 for Bessemer pig, $30.50 to $31.00 for Bessemer steel, and $28.00 for steel rails.

Metals

Quotations for the leading metals are as follows: Copper, lake, 14¾ to 15 cents; tin, 29¼ to 29¾ cents; lead, 4⅝ cents, and spelter, 5¾ cents.

THE SUIT RESULTING FROM THE INQUIRY INTO METROPOLITAN FINANCES

The hearing on the summons issued by William N. Amory, requiring Herbert H. Vreeland, president of the Interurban Street Railway Company, of New York, to appear and show cause why he should not be prosecuted for criminal libel, was opened Tuesday, March 24.

The hearing was begun a few minutes after 2 o'clock and was continued until 5:30, when an adjournment was taken until Wednesday, March 25. Throughout the entire hearing on Tuesday Mr. Amory was submitted to inquiries from Mr. Nicoll, of counsel for Mr. Vreeland. The purport of these inquiries was to justify the terms Mr. Vreeland had used in his denunciation of actions credited to the plaintiff, in reply to the attack that Mr. Amory was alleged to have instigated against the Metropolitan Street Railway in a newspaper publication of March 11. Straight through the examination Mr. Nicoll held the position of attempting to show that Mr. Amory was inspired by motives of gain in his activity concerning the affairs of the Metropolitan Street Railway Company, and he pressed many of his questions as to the personal acts and connections of Mr. Amory so close that there were repeated controversies between the counsel as to whether the questions should be admitted.

Some of Mr. Amory's testimony resulted in Mr. Nicoll declaring that the plaintiff was engaged in an organized attack on the Metropolitan Street Railway Company for "stock jobbing purposes," aided by some of the most active stock jobbers and speculators of Wall Street. Later, in putting the question as to Mr. Amory's business, Mr. Nicoll received the reply that Mr. Amory's sole business is "none except this railroad affair." Then, in direct reply to the question, "What railway affair?" Mr. Amory replied: "Why, the Metropolitan Street Railway, which I have been investigating for more than a year."

After the adjournment had been taken Mr. Vreeland issued a statement concerning the recently-published report by Max Teichman dealing with the affairs of the Metropolitan Street Railway. The statement explains the second report by Mr. Teichman, which was offered in evidence and rejected at the hearing. In this Mr. Vreeland says in part:

"Mr. Teichman was asked to furnish us with a copy of his report, which request seemed reasonable in view of the fact that it had been published in incomplete and garbled form. Mr. Teichman, in view of the misunderstanding which had been created by the partial publication of his report, has spent several days in New York in consultation with our accountant, Mr. Little, and in the course of his investigation made such an examination of our books as seemed to him necessary to clear up the several questions covered by his original report. Mr. Teichman made it plain that his original report was so qualified, in view of the exceedingly limited data at his disposal, that had it been published as a whole it would not have been useful to those who have sought to injure the Metropolitan Company.

"Mr. Teichman then placed in my hands a supplementary report entirely exonerating the company."

It was also brought out that the report made by John C. Hertle had been rejected as unworthy of consideration by Hoskins & Sells, expert accountants, to whom it was submitted by Amory, who advised him that "the claim would be thrown out of court."

ELECTRIC RAILWAYS IN NEW JERSEY

Interesting figures concerning the electric railways of New Jersey are contained in the supplemental annual report of the State Board of Assessors, which has just been issued. It is shown that with an investment of over $150,000,000 in electric railways in the State the stockholders in the various lines by which the State is traversed, received but a little over $500,000 in dividends in the year ending Dec. 31, 1902. The figures compiled by the State assessors show that in addition to the sums included in the $150,000,000, which amount represents the cost of the railroads, the sum of $5,091,290 is required in a year's operation of the road for repairs, superintendence, management and the like.

According to the report, the total number of miles of track in the State foots up to 891.284. The issued capital stock amounts to $83,353,940, and the total of the paid-up capital stock is $80,672,931. The funded debts of all the corporations amount to $56,257,500, while their other debts amount to $10,776,256.85.

The exact amount of the cost of the construction of the electric railways, including equipment and appurtenances, is $150,041,915. The gross receipts, expenditures and dividends that have been declared, as compared with the Board's report of a year ago, show an excess of receipts over the expenditures of $130,400, and that the companies have paid in dividends $54,000 more than during 1901. The following statement will show the material points of difference between the reports:

	Gross Receipts	Expenditures	Dividends Paid
1902	$8,894,254.41	$5,091,290.79	$540,640.00
1901	8,137,076.28	4,464,513.22	486,640.00

Of the sixty-three chartered companies in the State fifteen are not in operation. The majority of this number have yet to commence the construction of their tracks, the roads being merely projected, and on which work will be started some time in the future. Nearly all of the capital stock has been subscribed for in the case of these companies and paid in.

INTERURBAN COMPANY'S QUARTERLY REPORT

The Interurban Street Railway Company, of New York, reports earnings as follows:

Quarter ended Dec. 31, 1902—

Gross receipts	$3,875,179
Operating expenses	1,920,084
Net earnings	$1,955,095
Other income	185,185
Total net	$2,140,280
Fixed charges	2,187,838
Deficit	$47,558

Cash on hand, $1,081,763; profit and loss deficit, $55,802.

The balance sheet of the company as of Dec. 31, 1902, shows:

ASSETS

Cost of road, etc	$509,332
Stocks and bonds	5,898,143
Construction Mount Vernon Division	3,905
Accrued interest	170
Supplies on hand	82,808
Open accounts	985,326
Cash on hand	1,081,764
Prepared insurance	40,731
Open accounts	2,606,908
Contract account with Metropolitan Street Railway	7,202,000
Profit and loss deficiency	55,803
Total	$18,466,891

LIABILITIES

Capital	$5,880,000
Three per cent debenture notes	2,640,000
Taxes accrued	329,061
Rentals accrued	723,155
Open accounts	577,596
Due for supplies	1,173,059
Open accounts	7,144,019
Total	18,466,891

President Vreeland, of the company, is quoted as stating that the deficit of $47,558 was due to the coal strike, which increased the cost of power from three to five times the normal in a large part of the time covered by that report, and also in a less degree to the fact that in this quarter the increased wage schedule on the Metropolitan system went into effect.

THE ELECTRIC CLUB OF PITTSBURG

The first annual report of the Electric Club, of Pittsburg, Pa., is issued in the form of an attractive booklet under date of March 19, 1903, the anniversary of the club's organization.

This pamphlet, of artistic design and illustration, gives the constitution and membership of the club, the scope, plans and personnel of the various committees and an outline of the work accomplished and proposed.

A feature of this work which has proven very valuable is the formation of classes for the study of technical subjects under the instruction of engineers of the Westinghouse Electric & Manufacturing Company. These classes, or sections, constitute "self-exciting" engineering societies within the parent body, each section pursuing a separate and definite line of study.

As a further aid there is a well-equipped technical library, including the various electrical and mechanical magazines.

But that "Jack" may not be a "dull boy," the social side of life is directed by the committees in charge, of which not the least is that known as the "ladies' committee"—an ever-to-be-desired element in any club.

ELECTRIC CAR HOLD-UPS IN CALIFORNIA

For the third time since Feb. 18 electric cars operating in the vicinity of Los Angeles, Cal., have been held up in true Western style. In each of these hold-ups the bandits made good their escape, and this despite the fact that in the last hold-up, which occurred March 21, one passenger was killed and three wounded. The first hold-up was that of a car of the Los Angeles & Pasadena Electric Railway, and was carried out half-way between the two cities by two masked highwaymen. There were thirty-two passengers on the car, fifteen of whom were women. It is estimated that the robbers secured $500 in money, fifteen gold watches, numerous rings and other jewelry. Only one shot was fired, and that was intended for a passenger who refused to give up his money.

The second hold-up was that of a car of the Central Avenue line of the Los Angeles Railway Company, on the night of March 15. This hold-up was executed by a woman, who had as accomplices two men. The conductor of the car was relieved of $35.

The third and most atrocious of the series occurred on March 22, on the Los Angeles-Pacific Railway Company's line, between Los Angeles and Santa Monica. It was executed at the head of a deep cut. The robbers had placed a steel rail, a large bench and a cement barrier on the track. The motorman saw the obstruction when the car was several hundred yards from it, and at once turned off the current and ran slowly to the place. The moment the car struck three masked men sprang from the weeds alongside the track. One boarded the front end of the car and the other two the rear end. The first man commanded the passengers to put up their hands, and when one of them did not comply he fired a shot. The passenger returned the fire, and then the other two highwaymen began shooting right and left through the car. In all four passengers were struck by the bullets, one man being shot dead, while the others were severely injured. The robbers secured no bounty. A reward of $1,000 will be awarded by the company for the capture of each of the robbers.

THE ANNUAL FIGHT IN CONNECTICUT

The prediction made some weeks ago that the present session of the Legislature of Connecticut would record the fiercest war that has yet been waged at Hartford between the steam and electric railway interests in Connecticut is being borne out. Ever since the opening of the session there have been serious tilts between the interests, but it is the plan to repeal the present railroad law, now before the joint judiciary committee, that is receiving the attention of all the railroad interests of the State, besides scores of outside interests. However, in the present struggle there is not the clean cut division of the steam and electric railway interests that has characterized most of the other struggles for supremacy, for there is a division in which steam and electrics combined are arrayed against steam and electrics combined. In fact, the real struggle seems to be between the resident steam and electric railway interests in the State and the proposed Middletown & New Haven Railroad and the Middletown & Hartford Railroad. Both of these companies are promoted by the same interests, and under the present railroad laws have the right to condemn land and build their lines. As has previously been stated in the Street Railway Journal the companies plan to build between New Haven, Middletown and Hartford, paralleling the New York, New Haven & Hartford Railroad.

Demanding repeal of the present law appear representatives of the New York, New Haven & Hartford Railroad, the majority of the street railways, and the Connecticut Lighting & Railway Company, agent of the Philadelphia United Gas Improvement Company. Against the measure to repeal the law appear the Connecticut representatives of James F. Shaw & Company and Gay & Company, bankers, of Boston, who are financing the New Haven & Middletown Company and Middletown & Hartford Company; the old Connecticut Western extension people and the Vermont Central Railroad. Seventy members of the House, belonging to the Farmers' Association, have also placed themselves on record as opposing the repeal bill.

If the repeal measure passes it will mean that in the future no railroad company can be incorporated in Connecticut without the permission of the General Assembly. It will cut out all foreign corporations from building roads in the State, and give to the Legislature unprecedented control of the railroad situation.

IRISH TRAMWAYS

An interesting Parliamentary paper dealing with Irish tramways has been issued by the Board of Trade. Twenty-five years ago the amount of capital authorized for the construction of tramways in this country was £739,076. In June last the figures were £3,338,802, of which sum £2,077,652 had been paid up, and £2,825,928 actually expended. In 1878 there were only 32 miles open for public traffic, while 163 miles were available in 1902. Last year there were 1290 horses and 596 cars employed in the traffic. The number of persons who traveled on tramcars in Ireland in 1878 was 8,878,859. Last year the number had increased to 81,567,477. The gross receipts in 1902 amounted to £439,569, while the working expenses were £294,193, leaving the net receipts at £145,376. There are at present in Ireland 161 miles of tramway, divided as follows: Electric, 89 miles; steam, 29 miles; horse, 43 miles. The aggregate number of miles run in 1902 by all these cars was 11,286,273. There are twenty independent systems in Ireland, the principal of which are in Belfast, Dublin and Cork. The amount of money expended in the construction of the Dublin lines has been up to the present £1,861,972. The Belfast Street Tramways Company, which has working control over the Belfast & Ligoniel and the Belfast Corporation lines, as well as its own lines, has 31 miles open, upon which £440,851 has been expended. The Cork Electric Tramway Company has control of 15 miles of lines, and the capital expended on the system up to June 30 last was £172,342.

ELECTRIC RAILWAY PROPOSITIONS IN ONTARIO

There has been presented to the Ontario Legislature, which went into session on March 10, a batch of electric railway proposals which provide for the construction of new roads, the extension on a considerable scale of roads now in operation, and the building of municipal lines. Incorporation is asked for a road to run from Stratford along the Huron Road through Sebringville to Mitchell and the townships of Downie and Blanchard, and West Zorra to St. Mary's and Embro. A somewhat similar proposal is that embodied in an act to incorporate a radial railway company which proposes to run through the townships of West Zorra and North Oxford to Beachville, through East Zorra and West Zorra to Woodstock, through West Zorra and Downie to Stratford, and through East Nissourie or Downie to St. Mary's.

The city of St. Thomas is applying for a commission to place its street railway system in the hands of a board of commissioners and for the right to build to Port Stanley through Yarmouth Township.

A charter is asked for the Sarnia, Petrolia & St. Thomas Railway, which proposes to connect Sarnia and St. Thomas by way of Petrolia. The right to operate ferries from Sarnia to Port Huron is also asked.

Application is made for a charter for the London, Parkhill & Grand Bend Electric Railway Company. The plan of this company is to build from a point on the south shore of Lake Huron through the townships of Stephen, McGillivry, West Williams, East Williams, Lobo and London to the city of London, taking in the town of Parkhill.

A bill has been presented in behalf of the Huron & Bruce Electric Railway Company amending its charter and changing its name to the Ontario West Shore Electric Railway Company. It proposes to run from Dungannon to Lucknow, Walkerton and West Wawanosh and East Wawanosh, to connect with the Canadian Pacific Railway at Wingham. The company also wishes to connect with London and Sarnia, a proposal which was defeated at the last session of Parliament.

Another application seeks to extend the powers of the Guelph Radial Railway to enable it to build lines to surrounding towns and villages, including Elora, Fergus, Arthur, Mount Forest, Erin, Puslinch Lake, Galt, Hespeler and Preston.

An application which will largely increase the electric systems of the Niagara Peninsula is one to incorporate the Niagara, Queenston & St. Catharines Railway. This company has in view a triangular system which will connect Queenston with Niagara-on-the-Lake, St. Catharines and Queenston.

The Toronto & Mimico Electric Railway & Light Company, under the control of the Toronto Street Railway Company, is renewing its application for the right to build through York, Peel, Halton and Wentort Counties to Hamilton.

The Toronto Suburban Railway is seeking permission to extend its road on Davenport Road through York Township and the city to East Toronto and Little York.

The city of Ottawa is applying for power to incorporate and build a street railway system of its own.

The North Lanark Railway is seeking permission to extend its line eastward to Ottawa and west to the Madawska River, in Renfrow County.

Reincorporation is sought for the Kingston & Gananoque Electric Railway Company, whose charter has lapsed.

ANOTHER NEW YORK-NEW JERSEY TUNNEL

The Hudson & Manhattan Railroad Company, of New York city, was incorporated March 20, with a capital of $3,000,000, to construct a tunnel railroad approximately 1 mile long from Broadway and Cortlandt Street, New York city, under the bed of the Hudson River to the boundary line of the State of New Jersey, there to connect with the railroad of a New Jersey corporation extending westwardly to a point in Jersey City. The directors of the company are: George P. Lester, of Bloomfield, N. J.; Howard Slade and William H. Siegel, of New York city; Clinton Graham, of Flushing; Robert Maroney, Charles H. Aron, James Davidson and A. F. Richter, of Brooklyn; A. B. Proctor, Jr., of Boonton, N. J.

William G. McAdoo, president of the New York & New Jersey Railroad Company, which is building a tunnel from Fifteenth Street, Jersey City, to Morton Street, New York, is interested in the new company, but he refuses to discuss the project.

It is understood, however, that the plans for the new tunnel have been drawn by Jacobs & Davies, of 128 Broadway, New York, the engineers who drew the plans for the Pennsylvania tunnel and also for the one between Jersey City and Morton Street. It is also understood that they will supervise construction work. Extensive operations in real estate in the vicinity of the company's proposed New York terminal lead to the statement that the terminal is already provided for.

BIDWELL PATENT DEFEATED

The decision of Judge Cochrane, on Feb. 20, 1903, dismissing the suit of Benson Bidwell, Clara E. Bidwell and Charles F. Bidwell against the Consolidated Street Railway Company, of Grand Rapids, in the United States Circuit Court for the Western District of Michigan, dissipates the claims of the Bidwells of collecting large damages and profits from the electric street railway interests.

The basis for the suit was patent No. 318,594, dated May 26, 1885, by which the Patent Office granted Benson Bidwell claims, which the Bidwells alleged broadly covered any and all practical means for propelling and lighting cars by electricity supplied from a central station, and lighting the way stations and track as well, the lamps and car motors being supplied with current by a single set of conductors connected with the generating station.

The broadest in terms of the claims of this patent is the first, which reads as follows:

1. In an electric railway, cars having an electromotor, a line circuit, movable circuit connection between the line circuit and said motors, a branch circuit in said movable circuit, and an electric lamp with switch mechanism in said branch circuit, substantially as shown and described.

The third claim specifies branches for lamps and switches "along the line of way."

The patent expired last year. It should never have been granted. First, because the proposed use and also the actual use of all the elements found in its claims, arranged in the same way, and for the accomplishment of the same purpose, had been described in publications available to the Patent Office for some

years prior to Aug. 14, 1884, when the application for the patent was filed; and, second, for the reason that since electric lamps for lighting a car and station and track, and a motor for propelling the car, act independently of one another (each in its own way producing the result for which it is used, just as if none of the others were present) there is no co-operative action between the lamps and motor to produce a resultant or combined effect. Therefore, there appears to be no basis for a claim valid in law. In other words, a claim which includes lamps for lighting the car, stations and track and a motor for propelling the car, merely recites an aggregation of independent devices and not a combination of interacting elements, and hence is not patentable, and ought not to have been allowed.

The Bidwells appear to have forced several small Western companies during past years to take out licenses under the patent and before it was sustained, and also to have organized companies to collect damages for infringement from trolley companies.

FORMAL OPENING OF THE WILKESBARRE-HAZLETON ROAD

The protected third-rail interurban line between Wilkesbarre and Hazleton, Pa., which was described in the Street Railway Journal, March 7, 1903, was formally opened on March 20 by the officers of the company, assisted by representatives of the business interests of both cities. For the present the schedule calls for a train in each direction every two hours, and later in the season it is proposed to operate on an hourly headway. This road will enter into direct competition with the Pennsylvania and Lehigh Valley roads, both of which operate lines between the cities named, but the electric line enjoys many advantages, including a shorter and more direct route, and it will give much more frequent service.

THE SITUATION AT WATERBURY

The situation at Waterbury, Conn., where the employees of the local lines of the Connecticut Railway & Lighting Company are on strike, remains practically unchanged. The regular service of cars is being operated and more passengers are being carried every day. Since the breaking off of negotiations between the representatives of the company and the union last week, no effort has been made to arrange further conferences between the men and the company. The company states that no concessions will be made and that the strikers will positively not be reinstated. The rumor is revived that a plan is being considered for calling out all employees of the company on its various lines throughout the State.

ORDER FOR HEATERS ON THE SUBWAY

The Consolidated Car Heating Company has just closed a contract with the Interborough Rapid Transit Company, of New York, for furnishing 12,680 electric heaters. Twelve thousand of the heaters are of the panel type and 680 of the cross-seat type for cabs. There will be twenty-four panel heaters in each car, twenty of them being placed under the longitudinal seats and four under stationary cross-seats, which are to be paneled.

The panel heaters are of Consolidated standard construction with cast-iron front and back, but somewhat smaller than those shown in the company's catalogue. In an equipment of twenty-four panel heaters and two cab heaters there will be 1 mile of wire per car used in the heater coils. The heater fronts are to be finished in black japan, and the heaters will be arranged for three gradations of heat.

This order was awarded to the Consolidated Company in competition with the other car heating companies and after competitive tests. It is the largest order ever placed for electric heaters with the exception of the Manhattan Railway order for 21,600 heaters, given the Consolidated Company in July, 1901.

The Consolidated Company has received the following large orders during the last three weeks: Manhattan (Elevated) Railway, of New York, 2300 panel heaters and 125 cab heaters; St. Louis & Suburban Street Railway, equipments for 100 cars, sixteen heaters per car; Ford, Bacon & Davis, equipments for thirty cars for Kansas City, twelve heaters per car, and twenty-five equipments for Nashville; Washington Railway & Electric Company, equipments for twenty cars.

The orders for the St. Louis & Suburban and for the Kansas City cars were taken by the Chicago office; all others by the New York office.

A BILL FOR MUNICIPAL OWNERSHIP IN MICHIGAN

There is now before the Legislature of Michigan a bill looking to the complete ownership by municipalities of their streets, as especially giving them the power to construct, purchase, condemn or otherwise acquire, own or operate street railways. This bill, drawn primarily for the purpose of paving the way for municipal ownership in Detroit, where franchises are shortly to expire, is permissive only. It gives authority to the Legislature to pass acts to enable any city to hereafter acquire—when existing franchises expire—the ownership of street railway tracks. Under it also, by the same legislative provision, the city may operate street railways in the future when it becomes the owner of the tracks and facilities. But the city cannot acquire the tracks except by permission of the Legislature, supported after the legislative enactment, by the authority of the Common Council and the vote of the citizens.

It gives authority as an abstract principle that may in the future become operative, when circumstances make it necessary and the people vote for it. Nor does it authorize any changes of ownership or operation except under lawful means when the franchises terminate, and then only upon fair terms of purchase for the physical property, and under the regulation of the Constitution, which provides that private property shall not be taken except by due process of law and for a just compensation.

In short, the privilege is given to the city to own street railway tracks, if the Legislature, at any time in the future, allows that privilege by an enabling act, and then only by a vote of the people; and it is further stipulated that no acquisition of property shall take place until the franchise has expired and the right to use the street has ceased.

NEW PUBLICATIONS

Die Strassenbahnen in den Vereinigten Staaten von Amerika, by Gustav Schimpff, 196 pages, 224 illustrations and 2 plates. Price 6 marks. Published by Julius Springer, Berlin.

That Mr. Schimpff has been a close student of American street railway methods, none will gainsay who has read his book just published on the street railways of the United States. This book gives the results of a special study which Mr. Schimpff made of the street railways in this country two years ago, supplemented by other information obtained by correspondence and otherwise. All branches of American practice is described, but greater attention is given, perhaps, to station construction than to any other feature. In the chapter on this subject plans or sections of most of the latest and most important stations are given, and a table is published, extending over six pages, giving the main dimensions and other important data of the principal stations. Mr. Schimpff does not indulge in comparisons to any extent, so that it is not possible to obtain his idea of the relative merits of American practice in this or any other department of railway operation as compared with that in Germany. Nevertheless the treatise is exceedingly interesting and reflects great credit on the author and publisher.

Conductors for Electrical Distribution, Their Material and Manufacture, by F. A. C. Perrine, A. M. D. Sc., 287 pages. Price $3.50. Published by D. Van Nostrand Company, New York, 1903

This work is a comprehensive treatise on conductors for electrical distribution, covering the entire subject from the materials and methods of production to the calculation of circuits and the use of the wire in the transmission of electrical current. A chapter is devoted to insulation methods and material, testing and standards for rubber covered wires. Another chapter is devoted to cables, their classification and the methods and materials employed for insulating them. Under "Calculation of Circuits" the author considers numerous wiring charts that have been generally recognized, and their application to commercial work. Many practical suggestions are presented in the chapters devoted to the construction of overhead lines and the construction of the material employed. The necessity for underground construction, especially in large cities, is emphasized and the standard methods are fully described.

There is a valuable index appended to this book, which will be appreciated by those who have occasion to use it as a work of reference.

How to Become a Competent Motorman, by Virgil B. Livermore and James Williams, 232 pages. Price $1.00. Published by D. Van Nostrand Company, New York.

This is the second edition of this popular handbook, which is a practical treatise of the proper method of operating street railway motors. It has been widely adopted as a book of instruction for motormen, and the plan of the work is to make it easily understood. The authors occupy the positions of chief instructor and shop foreman of the Brooklyn Rapid Transit Company.

Electrical Problems, by William L. Hooper and Roy T. Wells, 8vo., cloth; 170 pages, with diagrams. Price $1.25. Published by Ginn & Company, Boston.

This is essentially an educational work, and contains sets of problems typical of those met with in electrical laboratory and engineering practice, with very brief treatment of the methods of solution. It is intended to meet the need for collection of numerical problems in the classes of colleges and technical schools, and may be divided under the following headings: Twelve sets of problems and calculations on combinations of electro-motive forces and resistances in series and multiple grouping; distribution and fall of potential in railway and lighting circuits, inductance of coils, capacity of condensers, thermo-electricity, electro-chemistry, and output and efficiency of batteries, generators, motors, etc. (Four sets of problems on combinations of alternating electro-motive forces and currents and the impedance of circuits with constant and with varying values of resistance, inductance, capacity, and frequency. Five sets of problems on calculating and making winding tables and drawings for direct and alternating-current armatures, armature reactions, field windings, etc. Problems on winding and operation of transformers, rotary converters, and induction motors; and on testing of dynamos and transmission of power. Answers are given to all problems, many in the form of curves showing the effect of varying the constants involved, such as temperature, frequency, capacity, resistance, and inductance. The text contains about forty explanatory diagrams.

The authors' experience in technical instruction has impressed them with the necessity for furnishing a book of this kind for students and others who are engaged in practical engineering work.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED MARCH 17, 1903

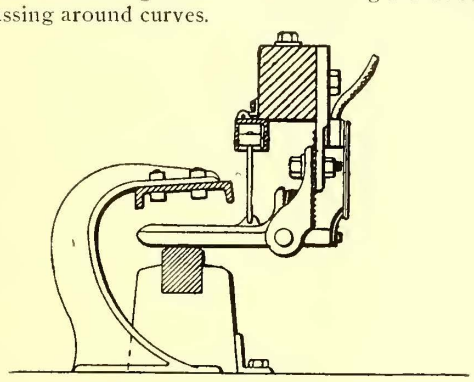
722,691. Life Guard for Tram Cars; G. Geiger, Cleveland, Ohio. App. filed Dec. 8, 1902. Comprises two independent fenders arranged one in advance of the other and adapted to co-operate in preventing a body or obstacle in the path of the car from being injured.

722,773. Elevated Railway Structure; G. H. Thomson, Ossining, N. Y. App. filed July 17, 1902. Details of construction.

722,786. Divided Car Axle and Journal Box; W. P. Westcott, Jr., Jersey City, N. J. The axle is divided at its middle, each section thereof carrying a wheel rigidly secured thereto, a journal box for the adjoining ends, whereby the wheels on opposite sides of the car are permitted to turn at different speeds or to be independently locked against rotation.

722,795. Railway Coach; C. Ansorge, Chicago, Ill. App. filed Jan. 17, 1902. Panels in the side of the car are automatically released to provide exit from the car in case of accident.

722,862. Trolley; S. H. Limbert, Springfield, Ohio. App. filed May 8, 1902. An arrangement for maintaining the wheel upon the wire in passing around curves.



PATENT NO. 723,115

722,989. Railroad Car Brake; J. J. Kennelly, New York. App. filed July 12, 1902. Details.

722,990. Sanding Device; J. J. Kennelly, New York. App. filed July 16, 1902. The actuation of the valve to release the sand at the same time operates a rocking shaft to agitate the sand to prevent it from caking.

722,991. Rail-Bond for Electric Railways; T. Kerr, London, Canada. App. filed Aug. 5, 1901. The fish-plate contains a groove in which the bond wire is confined.

722,992. Rail Coupling for Electrie Railways; T. Kerr, London, Canada. App. filed Aug. 5, 1901. A modification of the preceding patent.

722,995. Side Bearing for Cars; H. D. Lauchlin, Chicago, Ill. App. filed April 14, 1902. Consists of the combination of a bearing-plate, a bearing surface over which the bearing-plate is arranged to reciprocate, and an interposed anti-friction device, the surface of the bearing-plate remote from the anti-friction engaging surface thereof being convex both longitudinally and transversely.

723,024. Locomotive and Car for Use on Single-Rail Elevated Railways; E. S. G. Rees, Wolverhampton, England. App. filed Dec. 24, 1901. Relates to improved means for checking the rocking of a locomotive or car used upon single-rail elevated railways.

723,062. Third-Rail Insulator; S. B. Stewart, Jr., Schenectady, N. Y. App. filed Sept. 29, 1900. The insulator is provided with projections upon which the rail rests to prevent adherence thereto by deposits of rust.

723,115. Circuit-Breaker for Third-Rail Shoes; M. M. Wood, Schenectady, N. Y. App. filed Aug. 25, 1902. When the shoe drops downward after running off the end of a section of a third rail it opens the circuit to the shoe, so that contact with other objects will not cause trouble.

PERSONAL MENTION

MR. CHARLES JOHNS, of London, Ont., has been appointed manager of the St. Thomas Street Railway, of St. Thomas, Ont.

MR. R. A. PHILIP, of the Seattle Electric Company, who has been in Boston in connection with some Western polyphase power transmission work, has left for the Pacific Coast.

MR. A. D. CAMPBELL, multiple-unit control and equipment expert of the Boston Elevated Railway Company, has gone to the Seattle Electric Company to become master mechanic under Manager Howard F. Grant.

MR. GUY W. BOUDINOT, for several years private secretary to Mr. E. W. Moore, of the Everett-Moore syndicate, has resigned to become associated with Mr. Carl S. Russell, a prominent stock broker of Cleveland.

MR. T. E. FELT, formerly with the Cleveland City Railway Company, of Cleveland, Ohio, has been appointed superintendent of the Ohio Central Traction Company, with headquarters at Galion, Ohio. He succeeds Mr. E. A. Spellman, resigned.

MR. EDGAR N. SMITH, formerly roadmaster on the Burlington & Missouri River Railroad, in Nebraska, and previous to that with the New York, New Haven & Hartford and the Boston Elevated Railway, has accepted a position with the Railway Appliances Company. He will give his time particularly to the Q and C-Bonzano rail joint.

MR. E. R. LARTER, who has been connected with the Pennsylvania & Mahoning Valley Railway Company for the last two years in the capacity of superintendent of shops, is in the East studying power houses, repair shops and methods of the street railways of the large cities. Mr. Larter has resigned his position with the Mahoning Valley Company, and has not decided upon his future location.

MR. HOWARD ABEL, president of the New Hampshire Traction Company, has resigned, and Mr. Charles H. Tenney, of Hartford, Conn., vice-president of the New Hampshire Traction Company, has been elected as Mr. Abel's successor. General Superintendent Charles R. Fredericks, of Chicago, who has been identified with the company, has severed his connection in that capacity. Mr. Frank V. Dunham, of Chicago, who had charge of the amusement resorts last year, has also resigned, and General Manager Franklin Woodman now has full charge of the system. The two latter vacancies, according to Manager Woodman's statement, will in all probability remain unfilled.

MR. OREN ROOT, JR., who has been assistant general manager of the Metropolitan Street Railway Company, of New York, has just been appointed general manager of the company. Mr. Root is only twenty-nine years of age, and has been associated with the Metropolitan Street Railway Company for nine years. He joined the company soon after graduation at Hamilton College, and has served in practically every capacity connected with the operating department. Mr. Root's first position was with a construction gang laying track, after which he was appointed timekeeper. Later he was appointed a motorman on the system, and after he had served in that capacity for some time he was promoted to be a conductor. In all of these departments Mr. Root showed a capacity for doing hard work and doing it well. After a connection with the system of about two years he was selected by Mr. Vreeland as his assistant. In this position he demonstrated his thorough knowledge of street railway affairs as well as his operating ability, and was finally appointed assistant general manager of the company. Mr. Root has presented several papers before the State and National Associations on operating topics. He is a son of Professor Root, head of the mathematical department at Hamilton, and is a nephew of Secretary of War Elihu Root.

NEWS OF THE WEEK

CONSTRUCTION NOTES

FLORENCE, ALA.—The City Council has granted franchises to J. W. Worthington and associates for the right of way through the streets of Florence for an electric railway to be run from Tuscumbia and Sheffield and for the lighting of the city. The franchises cover a period of thirty years and require that the work shall be commenced in thirty days and be completed in eight months.

BIRMINGHAM, ALA.—Papers have been filed in the probate office granting rights of way to the Metropolitan Rapid Transit, Light & Power Company for the building of a railroad line in the vicinity of North Birmingham. The corporation mentioned is one within the Birmingham belt, and its filing of the right-of-way grants means that the latter's lines are to be considerably extended in the near future, completing its belt circuit of Birmingham's industries.

NEW DECATUR, ALA.—The question of granting an electric railway franchise to W. R. Hall, of Selma, Ala., and associates has been referred by the City Councils of both Decatur and New Decatur to the street committees for investigation.

SAN FRANCISCO, CAL.—Three surveys, said to have been made for the North Shore Railway Company, have just been completed from a point between Manzanita and Millwood stations to Bolinas, with the admitted intention of building an electric railway to connect Bolinas with the main line of the North Shore Railway.

SAN MATEO, CAL.—The South San Francisco Railroad & Power Company has been incorporated with a capital stock of $100,000, to build 13½ miles of electric road in South San Francisco and San Mateo. The principal stockholder of the company is William J. Martin, secretary of the South San Francisco Land Company.

LOS ANGELES, CAL.—The Pacific Electric Railway Company, the Southern Pacific and several prominent Eastern capitalists are said to be interested in a gigantic enterprise to make the harbor town of San Pedro a large seaside resort. Between $800,000 and $1,000,000 are to be spent in constructing a hotel, bathhouse, observatory and pavilion. The proposed site, consisting of many acres, is on the high bluff overlooking the outer harbor. Both railroad companies own valuable railway franchises crossing and surrounding the grounds.

LOS ANGELES, CAL.—A number of Los Angeles capitalists are interested in an electric railway venture in Lake County, under the name of the Clear Lake Electric Railway & Power Company. Articles of incorporation have just been filed, with a capital stock of $1,000,000, and local stockholders are Dr. W. R. Prather, owner of Adams Springs; W. C. Phillips, H. C. Healey, W. H. Hartwell and H. R. Bingham. The road is to run between Cloverdale and Lakeport, Cal., a distance of about 40 miles. It will touch all the principal places in Lake County, and tap a thickly-settled section of country that is without railway connections. At Cloverdale the road will make connections with the North Pacific Coast Railroad.

LOS ANGELES, CAL.—The first electric car to enter San Pedro from this city was on March 11, over the interurban line of the Los Angeles Traction Company. No freight cars will run over the line for the present, although they are provided for in the franchise.

LOS ANGELES, CAL.—Five acres of land have been purchased at Fifteenth and Alameda Streets by H. E. Huntington to be used in the construction of additional car shops for the Pacific Electric Railway Company.

SAN BERNARDINO, CAL.—The Redlands line of the San Bernardino Valley Traction Company has been placed in operation. It connects San Bernardino and Redlands.

VISALIA, CAL.—The franchise for the construction of an electric railway through Tulare County, as applied for by John Hays Hammond, of New York, and Harold Wheeler, is to be sold at public auction on April 8. Eugene L. Scott is County Clerk.

LOS ANGELES, CAL.—In addition to the six applications recently made by the Los Angeles Railway Company for franchises covering about 9 miles more of city streets, six other applications for franchises have been filed with the City Council. The latter applications cover about 11 miles of streets. The latest applicants are City Treasurer W. H. Workman, Lee A. McConnell and M. T. Collins. They want three franchises, while Alexander Culver would also take three. Culver's petitions are thought to have real estate subdivision interests in the suburbs back of them. One of the petitions by the Workman aggregation is east on Seventh Street to Boyle Heights, a number of miles, through what lacks but a block or two of being the center of the city.

DENVER, COL.—The Denver & Northwestern Railroad, which owns the Denver Tramway, is about to let contracts for building an electric railway to be operated in connection with the Denver Tramway, from Denver to Golden, and from Denver to Boulder. If present plans are carried out work on the roads will commence within a month, any they will be running within four months. Both lines will start from Berkeley, and the expense of their construction is estimated at $750,000. The line to Golden will be about 10 miles, and to Boulder about 22 miles. The formal incorporation of the two new roads will shortly be made. As the survey has already been completed it will not take long to lay the rails after the start is made.

MERIDEN, CONN.—It is announced that a third-rail electric service will be established between Meriden and Middletown by the New York, New Haven & Hartford Railroad. The Meriden Division, which runs from Waterbury to Middletown, will be electrically equipped between this city and Middletown soon, so it is said, and it is expected a third-rail service will also be established between Meriden and Waterbury.

DANBURY, CONN.—The Westchester Traction Company, which owns the Danbury & Harlem Traction Company, is making arrangements for an early resumption of construction operations on the interstate electric railway between Danbury, Conn., and Goldens Bridge, N. Y.

WASHINGTON, D. C.—It is understood that the Capital Traction Company will extend its Chevy Chase line, which now extends from Washington to Chevy Chase Lake, to Rockville, Md., in the near future.

WILMINGTON, DEL.—The Morton Traction Company, of Wilmington, Del., capitalized at $100,000, has been incorporated by Elzy B. Van Atta, of New York city; Frank A. Field, Samuel K. McCall, Samuel S. Morton, of York, Pa.; David H. Lincoln, of Marion, Ohio.

JACKSONVILLE, FLA.—D. M. Baker, of Jacksonville, has been awarded the contract for building 4 miles of line here for the North Springfield Street Railway Company.

ATLANTA, GA.—Application has been made to the Secretary of State for a charter for the Piedmont Electric Railway Company, which is to build an electric railway from Atlanta to Roswell and from Roswell through Alpharetta to Cumming. The capital stock will be $500,000. The incorporators named in the petition are E. S. Brazelton, of Birmingham, Ala.; Charles S. Kingsbery, E. C. Akins, T. J. Hightower, C. W. Hunnicutt, John F. Stocks, H. L. Hunter, B. F. Curtis, Charles K. Maddox, F. M. Stocks, Thomas F. Stocks, R. E. Bondurant, J. A. Tiller and John Burnett, of Atlanta.

BOISE, IDAHO.—The County Commissioners have granted to the Intermountain Electric Railway Company a franchise to construct and operate an electric railway over certain highways of the county. The life of the grant is fifty years.

GALESBURG, ILL.—The Galesburg & Aledo Interurban Railway will be incorporated to build the proposed electric railway from Galesburg and Aledo. The company will organize as follows: Luke W. Sanborn, president; C. L. Gerould, secretary and treasurer; J. J. Welsh, attorney.

ROCKFORD, ILL.—The material for the new Freeport line has been purchase, right of way completed and all arrangements made for building, so when the frost leaves the ground construction work will be begun. It is hoped that the line will be completed by November.

ROCKFORD, ILL.—The Rockford & Interurban Railway Company is relaying about 7 miles of track with 70-lb. rails. The company has applied to the Council for a franchise to build a number of new lines.

MOLINE, ILL.—The Illinois Electric Railway Company has been incorporated to construct an electric railway to connect Galesburg, Monmouth, Aledo, Moline, Rock Island and Macomb. The amount of the capital stock is $10,000, divided into one hundred shares of $100 each. The incorporators and members of the first board of directors are: John S. Brown, I. M. Kirkpatrick and William H. Sexton, of Monmouth, Ill.; Robert P. McGeehan, of Kansas City, Mo., and James E. Gregg, of Colorado.

CHICAGO, ILL.—The extension of the South Side Elevated Railroad to Englewood, which was undertaken under the nam of the Southwestern Railroad Company, has been reported upon favorably by the Council committees on streets and alleys.

CHICAGO, ILL.—The Chicago, Riverside & La Grange Railroad Company was granted an ordinance March 16 for a half-mile of track on West Twenty-Second Street, to connect with the tracks of the suburban railroad.

FORT WAYNE, IND.—R. S. Vivian, of Chicago, has applied to the County Commissioners for a franchise for the construction of an electric railway. The plan of Mr. Vivian and his associates is to build to connect Fort Wawne, Hicksville and Bryan. The line will be known as the Fort Wayne, Hicksville & Bryan Railway.

MUNCIE, IND.—It is stated that the Muncie, Hartford City & Fort Wayne Traction Company, which recently began to operate between Muncie and Hartford City, will buy the franchise of the Muncie & New Castle, and extend its line south to New Castle, 19 miles.

MISHAWAKA, IND.—The Common Council is to be asked to grant a franchise to a new company, which proposes to build an electric railway from Mishawaka southward. It is to reach Osceola, Wakarusa, Etna Green, Nappanee, Rochester and, ultimately, Logansport. Report says the project will be financed by H. E. Insley & Company, of Denver, Col.

VINCENNES, IND.—It is said that the proposed interurban electric railway from Vincennes to Jasper, Ind., is to be extended from Jasper to Rockport, Ind., and thence to Owensboro, Ky., and that the Union Trust Company, of New York, will finance the road with a capital of $2,000,000. According to report, work will begin on the road this summer. It will traverse a hitherto undeveloped but rich agricultural and coal country. Vincennes will be the headquarters for the road. N. H. Kennedy, of Rockport, is the principal promoter.

INDIANAPOLIS, IND.—The Indianapolis & Northwestern Traction Company has commenced grading on its extension from Lebanon to Crawfordsville. Work commenced March 18 at Crawfordsville.

MANNING, IA.—An electric railway is projected to Kimballton by the Manning & Kimballton Railway Company.

LOUISVILLE, KY.—The survey and estimates of construction of the Louisville, Anchorage & Pewee Valley Electric Railway, now known as the Louisville & Eastern Railway, have been completed for the extension from Lakeland to Shelbyville, and nearly all the right of way has been secured. As soon as the weather permits work will begin in earnest.