STREET RAILWAY JOURNAL

WEEKLY NEWS ISSUE

SATURDAY, SEPTEMBER 29 1900.

PUBLISHED WEEKLY BY

THE STREET RAILWAY PUBLISHING COMPANY

MAIN OFFICE:

NEW YORK, BEARD BUILDING, 120 LIBERTY STREET.

BRANCH OFFICES:

CHICAGO.....Monadnock Block
PHILADELPHIA.....929 Chestnut Street
LONDON.....Hastings House, Norfolk Street, Strand

Correspondents in other Principal Cities of the World.

Long Distance Telephone, "New York, 4044 Cortlandt."
Cable Address, "Stryjourn, New York."—Lieber's Code used.

TERMS OF SUBSCRIPTION.

In the United States and Canada.....$4.00 per annum
In all Foreign Countries, per annum.....$6.00 / 25/ / 31fr.

Subscriptions payable always in advance, by check (preferred), money order or postal note, to order of C. E. WHITTLESEY, Treasurer.

Entered as second-class matter at the New York Post Office.

EDITORIAL NOTICE.

The news issues of the Street Railway Journal are devoted primarily to the publication of street railway news and current happenings related to street railway interests. All information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in its columns.

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

Address all communications to

THE STREET RAILWAY PUBLISHING CO.
120 Liberty Street, New York.

Contents of this Issue

THE CONVENTION OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION

The convention of the New York State Street Railway Association, held in Buffalo, Sept. 18 and 19, was the most successful convention in the history of the association. This is saying a great deal, for the association has always been a vigorous one, and particularly during the last four or five years, under the presidency of G. Tracy Rogers, has enjoyed a most healthy growth. This has been shown not only by the increased attendance at the conventions and the greater value and interest of the papers presented at the meetings, but also by the increased support given to it by street railway companies in the State, and by the important and influential work which it has carried on for the benefit of the industry in general. The re-election of President Rogers and Secretary Robinson was a well-deserved recognition of the faithful services of these officials, while the executive committee, consisting of Messrs. Vreeland, Ely, Nicholl and Rossiter, have been untiring in their efforts to promote the best interests of the association, and through it all the street railways of the State. The future outlook for the association is most bright and promising. The street railways of the whole State, both large and small, are working harmoniously for the common end, *i. e.*, to make the association a power in the State, that it may be the greatest possible benefit to the individual members.

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We have often had occasion to commend the organization and the work of the New York State Association many times, and have expressed the hope that railway men in other States would give their State associations the support accorded to that in New York State. While it is undoubtedly true that many of the State associations are doing good work and have the hearty co-operation of the street railway managers of the States in which they exist, it is undeniable that it is not true of all of them, while many States have no associations at all. That many benefits are to be derived from co-operation and united action is indisputable, and as the street railway companies are largely under the supervision of State authorities, membership in State bodies furnishes the means by which the companies can best unite to present their claims and to secure the benefit which organized action is sure to bring.

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Some of the State associations are organized and conducted purely for executive action, others largely for social purposes. The New York State Association has, wisely we think, always made the discussion of technical questions involved in street railway operation the important feature of its annual gatherings. This has attracted the attention of the operating officials and managers of the smaller roads, whose time is devoted principally to questions of operation. The papers have usually been of high merit; this year extremely so, and, being limited in length, between ten and a dozen subjects are usually brought to the attention of the delegates for discussion. The advantages of a convention of this kind are shown by the fact that the attendance at Buffalo last week was not limited to railway managers in New York State, but, although purely a State convention, companies of other States were represented and participated in the debates. Under these circumstances, it may seem somewhat ungracious to criticize in any respect the meetings of the association. We still believe, however, that the value of a convention of this kind lies chiefly in the discussion which follows the readings of the papers, as this discussion not only brings out the opinions of the different delegates on the subjects treated, but even elicits additional points from the person reading the paper. We hardly think that this point will be questioned, so that any method by which the discussions can be encouraged is worthy of serious consideration. We believe that this can best be accomplished by following the practice of most scientific bodies in conventions of this kind in having the papers printed and distributed to the members some time before the convention, and appointing leaders who will be prepared in advance to open the discussion on their respective

topics. Under the present plan, while a delegate may be apprised of the subjects of the papers to be read, he can have no idea of the way in which these subjects will be treated or the points to be brought out by the authors of the papers, nor can he always remember all the facts stated in a paper, upon hearing it read once at the convention. If, however, he had the paper before him in type before he went to the convention, he could discuss the subject under consideration to much better purpose than would otherwise be possible. That this is true is proved by the fact that the "special topics for discussion," of which notice had been previously given, brought out much more experience than did the remarks on the papers themselves. Again, if the papers were printed, the time of the association need not be taken up by the reading of them in full. Instead they could be presented by title or abstract, and the entire time at the disposal of the association could be devoted to discussion.

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Another point of value to the association brought up in the discussion was in regard to attendance, and a reference was made by Mr. Vreeland to the methods employed in regard to the attendance at the meetings of some of the steam railroad associations. In these associations regular delegates are sent from the different companies to the conventions, and the fact as to whether they attend the meetings to which they are delegated is ascertained by a roll-call at the beginning of each session. In this way the presence of each delegate is assured, and if any point requiring the concerted action of the members is brought up, the association as a whole knows that a delegate from each road interested is present, either to give his approval or to name his reasons for dissent. While this arrangement, in one sense, may be more important for steam railroads, which interchange rolling stock and thus need certain standards to a greater extent than do street railways, yet we see advantages in a course of this kind. Whether or not any such regulations will be adopted by the association, the suggestion is certainly worthy of consideration.

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Taking up now the papers themselves, we find that they divide easily into five classes: First, the relations of the officers of a company to the employees, represented by Mr. Connette's paper; second, the relation of the company to the public, represented by Mr. Uebelacker's paper; third, technical papers, relating to electric railway operation, covered by the papers of Messrs. Mann, Nostrand, Henning, Norris, Nicholl and Armstrong; fourth, the legal department of railway operation, as related to damage suits, covered by Mr. Patterson's paper; and fifth, new motive powers, discussed by Mr. Cooke.

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Mr. Connette's paper, which was printed in our last issue, was received very favorably by the association, and showed that the principles laid down by him were regarded by those in attendance as sound in every particular. Mr. Connette's position indicates that the most successful managers at present do not regard their employees as machines but as fellow-citizens, and that corporation managers and directors have souls, even if the corporations themselves do not. He believes that this position is not only sound ethically, but profitable in a business way, and that that road is the most successful which insures the co-operation of the employee as well as his service. The discipline should be kind and considerate, and at the same time firm and positive, and there should be no prejudice or favoritism in the management of the men. At the same time merit should be rewarded, where possible.

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The paper presented at the convention by Mr. Uebelacker treated of the management of a combined system affording electric railway, gas and water service. Consolidations are the order of the day, and our readers are familiar with those which comprise several railway companies or railway and lighting companies. That all the public utilities can be combined under one management is not so familiar an idea, although Mr. Uebelacker believes certain economic advantages can be derived from such an organization. This lies not so much in the reduction of the operating force as in a better utilization of its energies and a co-operation between the different departments.

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The technical papers presented at the convention were of a high standard. The increased use of the storage battery as a station auxiliary was strikingly shown by three papers, one of which described its use on a small road, while the other two treated of its use on a large system, as in Buffalo. In all cases the authors considered that the benefits derived from its use were considerable. Mr. Armstrong took up the subject of electric railway power transmission, a subject of growing importance with the increase of electric railway mileage and the distance to which the power is transmitted. Mr. Mann discussed the power station, outlined the principal losses and showed where economy is possible. He believes the greatest liability to loss is in the fire room, and too much attention cannot be given to insuring a perfect combustion under the boilers. Mr. Danforth read two instructive papers, one on "Rotary Transformer Stations," the other on "Snow and Snow Plows." The former described the general practice of the International Traction Company, whose work in the utilization of alternating current for railway service has been of the pioneer character, and this paper is of great value to those who employ or are intending to employ alternating current for driving rotary converters. His paper on the snow plow was a careful consideration of this question, and as this company has developed, from its own experience, a number of different plows, his conclusions will be useful to those who have heavy snow falls to contend with. His opinion is, briefly, that under the conditions existing in Buffalo, several different plows are required: a nose or share plow for light and medium work, a rotary for heavy work, and a steel broom sweeper for packed or wet snow. The Rochester & Sodus Bay Railway was described by Mr. Nicholl, of Rochester, whose paper was listened to with much interest. The line is a new one, embodying the latest improvements in interurban work, and is a good example of this popular type of road.

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The subject of Mr. Patterson's paper was on the best method of handling accidents from the legal standpoint. This is an important subject—much more important than managers often think, until postponed damage suits rise up to confront them and condemn procrastination. Mr. Patterson called attention to a growing evil in the rapid increase of damage suits, and showed that in the case of his own company, claims for damages have increased very rapidly during the last few years, and these entirely out of proportion to the actual injuries sustained. This would seem to call for legislative relief, and some way should be devised for preventing the unreasonable damages too often awarded by oversympathetic jurors.

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The paper by Mr. Cooke on the "Compressed Air Motor" was the first paper on this subject presented at a street railway convention, and attracted great attention. The managers of the New York system think so well of this power that they are going to great expense to determine its value for railway service, and Mr. Cooke's paper, as defining what has already been accomplished, was a most valuable contribution to the science of street railway operation. The paper received the careful attention of those present.

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A word should be added in regard to the large attendance of supply men at the convention. This attendance has come to be a feature of all street railway conventions, and properly, too, as the manufacturer is as much interested as the railway manager in making a success of electric railroading. The number of these "outside delegates" at the Buffalo convention was extremely large, and the interest taken by them in the technical proceedings greater than usual, both of which facts were favorably commented upon by the delegates present.

As a whole, the convention was marked with more solid work with less diversion than ever before, and added greatly to the already high prestige enjoyed by the New York State Association.

The Annual Convention of the New York State Street Railway Association

Four of the papers presented at the Buffalo meeting of the New York State Street Railway Association, on Sept. 18-19, were published in the last issue of this paper. The proceedings of the convention follow:

TUESDAY, SEPT. 18

The convention which met at the Iroquois Hotel was called to order by G. Tracy Rogers, of Binghamton, N. Y., president of the association, at 10:45 a. m. After the roll-call the president delivered his annual address. This was published last week. Secretary Robinson then read the report of the executive committee. It is given below:

REPORT OF EXECUTIVE COMMITTEE

MEMBERSHIP

The tendency of the times continues to cause the consolidation of existing railroad properties, and necessarily leads to the withdrawal from active participation of many of the old and valued members who have, for a long time, been associated with us. In spite of this loss, we are happy to have enlisted the support of several new companies, which are about to embark in active construction. Our membership now consists of those companies which represent the bulk of capital invested in the street railway enterprises of the State.

We have pleasure in stating that the Elmira & Seneca Lake Railroad Company, the Black River Traction Company and the Rochester & Sodus Bay Railroad Company have joined our association during the present year.

We regret to find that there is a number of companies which are not members of the association, and urge upon the present members that determined and persistent efforts be made to secure the union of every outstanding road in the State with the association.

LEGISLATION

The State Legislature last year continued to be the producer of a large number of bills. While 245 different bills touching organization, construction, operation and taxation were introduced, but few of them made progress. Only one objectionable bill reached the Governor, and was terminated by his veto. Such a volume of legislation required watchfulness and care on the part of the officers of the association, and careful study by the counsel of the various members.

Many members of the Legislature are entitled to an acknowledgment of the unvarying courtesy and attention shown by them to the street railways in their careful consideration and just disposition of the numerous bills presented to the committee.

The association is to be congratulated on having for its counsel before the Legislature Meyer Nussbaum, of Albany. Mr. Nussbaum's early connection with the Senate has been of great assistance in securing for the association a proper presentation of various legislative measures, while the result attained has been mainly the result of his conscientious and felicitous presentation of the matters in hand.

H. H. VREELAND,
W. CARYL ELY,
T. J. NICHOLL,
C. L. ROSSITER,
G. TRACY ROGERS,
Committee.

A resolution was then passed ratifying the action of the executive committee in postponing the date of holding the convention from Sept. 11-12 to Sept. 18-19.

The treasurer's report was then read:

SUMMARY OF TREASURER'S REPORT

Total receipts during year	$7,050.64
Total expenditures during year	4,948.15
Balance in hand	$2,102.49

Then followed the reading of the paper on "Railway Power Transmission," by J. H. Armstrong. This paper was published in full last week.

Mr. Norris.—How much more current will be required with induction motors than where direct current is used?

Mr. Armstrong.—About 15 per cent as an average; 15 or 20 per cent for railway work. With stationary motors it is possible to get along with from 12 to 14 per cent, but in railway work fully 20 per cent more would be required than in the direct-current system.

The next paper read was on "Accidents on Street Railways, Methods Employed in Handling Same, and Preparation for Trial," by D. W. Patterson. This paper was also published in the last weekly issue.

Mr. Nicholl.—I would like to inquire of the gentleman what method he uses to precede the action of these ambulance lawyers?

Mr. Patterson.—That is a matter of detail for the operating department. The moment an accident occurs it is reported by the crew of the car at the depot. It is then telephoned down to the claim department, and some one is immediately sent to look after it. The witnesses are at once interviewed, and their statements taken. After that, the case goes into the hands of investigators; each report going through two or three departments in that way, so that when the case is brought to suit, we have a fairly good idea of what the accident is about.

Mr. Nicholl.—Do you find that you generally make a better settlement by being promptly on the ground, or by waiting for the parties to show up?

Mr. Patterson.—That is a difficult question to answer. There are some cases which it is always better to settle in the first instance. There may, perhaps, be an injury on the spine, similar to a case that happened in Brooklyn. It could have been settled for perhaps about $100 before the lawyers got hold of it, but by the time they finished with him he was brought into court on a stretcher. A great many cases are settled immediately after the accident.

Mr. Robinson.—Mr. Nicholl, in answer to your inquiry, I would state that so far as the Metropolitan is concerned, we divide these accidents into several classes. Of course, those which arise from collision of cars and defective machinery are settled at once. We have investigators, trusted men, who are given money and sent to the injured parties' houses to make as prompt a settlement as possible. So far as street crossing cases are concerned, we do not look for the injured parties at all. The accidents are so numerous that we feel that after they come down to suit and are about being reached for trial, two years being about the shortest time in New York, settlement in that class of case can then be made as speedily as in the beginning. Of course, there are serious accidents which you cannot settle quickly. They run for periods of three or four months before anything can be done with them, and even then it is quite impossible to bring about a reasonable settlement. It is very difficult to say, when the cases get into the hands of lawyers in New York, what is the best method of handling them as a general proposition. There are a great many lawyers who live on accident business in New York. They know the value of a case; do not wish for a settlement, and do not allow their clients to settle. We prefer, as a matter of protection, to litigate with them. There are a great many lawyers having cases against us who have been victims of the company. We have succeeded in defeating them, and in those cases we can settle with the plaintiffs as if we had seen the plaintiffs before. Sometimes we have as many as sixty cases on the calendar, but they will dwindle down to fifteen or twenty when it comes to the time of trial. As I say, the system we use depends as much upon the lawyer who has it for the plaintiff as it does upon the character of the accident.

Mr. Wason.—When a case gets into the hands of a lawyer, do you always settle with the lawyer, or do you sometimes go direct to the injured party?

Mr. Robinson.—That depends upon the class of lawyer.

Mr. Cooper.—Of course, it is considered unprofessional for one lawyer to settle a case after it gets into the hands of another. But don't you think it is a good rule, where a lawyer gets a claim against a street railway company, and instead of going to the party against whom he has the claim, goes direct to the court house with it, don't you think then that we are justified in settling it outside of the lawyer?

Mr. Robinson.—That is a question of legal ethics which is very difficult for me to answer. I occupy rather a divided position, in being both a director and a lawyer of the Metropolitan Company. I can only say from our own standpoint, that there being so many of these cases we do not feel it an insult for lawyers to bring a lawsuit. As soon as they do, we throw up our hands and tell them that they had better litigate, as age will improve the quality of their claim. (Laughter.) I found the other day that I had about six thousand cases brought by lawyers which had never got beyond the serving of summons and complaint.

Mr. Vreeland.—There are just two points in Mr. Patterson's paper to which I wish to refer. With reference to what has been said later, there is a question I would like to speak upon. One was the number of accidents, which was spoken of in the paper. With our system of handling the accident business in New York City, which was started some seven years ago, and has been changed from time to time, better methods introduced, etc., we determined that it was necessary to investigate everything. We found, a few years ago, when our accident cases were handled by several lawyers representing the several properties that make up the whole system, that all the records in the office of the lawyer were the reports furnished by the motorman and conductor on the accident; and also, that only what might be classed as accidents that resulted in severe injury, were reported. Not long since a manager of one

of our syndicate properties came to New York and asked what our monthly report and yearly record of accidents showed. We told him, and also stated the number of car miles, and the number of miles of street covered. He said, "That is something awful," and he cited their record. When we inquired the character of accidents they investigated, we discovered that it was simply where somebody had a leg off, or an arm off, or a skull fractured. Our system is that if a person falls and gets up and brushes his clothes off, apparently unhurt, it is the duty of the conductor to report it. We hold so rigidly to that rule, that our discipline with motormen and conductors is more strict in that particular than in almost anything else. If an accident report comes to the office indirectly, and not through the men who are handling the cars, we mete out the severest discipline that is administered in any connection. Our sixty accidents, in their final result legally, as indicated by Mr. Robinson, may melt down to ten; but we have the information. We found that the worst cases presented to us were often of this small class which were not considered worthy of investigation, and when it came to a question of suit we had no defense; did not even know on what car it occurred.

With reference to the question of stopping cars, distances, etc., a few years ago we had marked on one section of our track the distances, and then had cars run over this section at the maximum speed attainable. They were then to be stopped by the men, who were not to touch their brakes or grip until warned by a torpedo, at which time they were to stop the car as quickly as possible. The distance was measured, and made a matter of record.

When the Railroad Commissioners of the State of New York made their brake tests on our system, they had the best mechanical appliances for indicating speed, distance, etc. In their tests the car under trial was filled with newspaper men, and the man who had charge of the brake that was being exhibited wanted a speed of 15 miles an hour, in order to show in what distance the car could be stopped, and it was found impossible to run the car 15 miles an hour. We could not get up that speed. I immediately turned to the Railroad Commissioners and all who were in the car and said: "Gentlemen, I would like a record made of that. There never was an accident in New York City where it was not reported that the car was bowling along at 45 or 50 miles an hour. Now, here is an opportunity to show that that is impossible." Of course, you know that our lines are run through congested districts. For instance, on our cable road the cables run 6, 9 and 14 miles an hour. By this speed test we have had put very fully before our men the matter of the distance it takes to stop these cars, even with the most improved braking appliances. There were all kinds represented; track brakes, electric brakes, and a combined track and wheel brake; and the tests were very carefully kept by our men, so that we have a record of the distance actually traversed by these cars under all braking conditions before they could be stopped; and I am free to say myself, that I should have understated rather than overstated the distance in which it was possible to stop one of these cars if it had not been for the record.

Mr. Schoeplin.—I am manager of a small suburban street railway, and we have had a number of accidents. My experience has been that the best thing to do is to get ahead of the ambulance lawyers; keep the case out of the hands of the attorneys, if possible. Our road had been in operation about three weeks when we had two serious cases. I immediately started to keep the cases out of the hands of the attorneys. There were thirty or forty in the case, all the neighbors working for some attorney or friend; but I succeeded in settling the cases without any attorneys for $2,500 each, which I think a very good settlement. We have had a number of accidents in the last two years, and I have found that the best thing to do was to keep them out of the lawyer's hands, and settle them just as quickly as possible. We had one case which it was necessary to fight in the courts, and the witnesses we had, the conductor's witnesses, were chums of the young man who was hurt, and were unreliable. The only record that helped us was the police record. If you can get a police record of the accident, it goes a great way with the jury, and it was in that way we won. The jury brought in a verdict of no cause of action. It caused us three weeks of labor, and cost much money to prepare the case. It would have been cheaper to have settled it. Of course, city street railways who have attorneys they pay by the year, can afford to carry cases along for two or three years, but I think most of us find it more desirable, and I believe the Buffalo Street Railway Company has adopted a system of settling of cases quickly.

Mr. Wason.—On our suburban road it is a question whether we have more accidents on the highways or on the private ways. There are several of the suburban roads which have private rights of ways, and have serious accidents. They are bound to cross streets, and people are bound to walk on the track. Where we are paralleling or running on a highway, the man driving on the highway is continually on the watch for a car, and it would almost seem to me, from our experience in both directions, that there are really less accidents on the tracks by the highway than on the private roads. This, on the face of it, would seem a little peculiar, but I am inclined to think it is a fact. I haven't the figures, but I think that of two roads, one running east and the other west, one on the private right of way all the way, and the other on the highway, our accidents have been, in point of dollars and cents, about the same. We try to settle our claims as soon as the accidents occur, rather then let them go into the hands of lawyers. We cannot afford, as a suburban road, to employ lawyers by the year, as city roads do, and I agree with the gentleman of the suburban road, who spoke just now, that for a suburban road it is best to settle the claim promptly. We have settled a number of our fatal cases considerably cheaper than the gentleman who spoke. On our city roads, of course, it is about the same, in a small way, as Mr. Vreeland outlined as the policy of the road in New York.

Mr. Cole.—Mr. President, I have recently been in a number of cases as an expert, and I have noticed that nine times out of ten the case has been sent to the jury to determine upon the question of speed; where they might possibly have obtained a non-suit if it had not been for the question of speed. If, as soon as the accident occurs, the master mechanic, with the witnesses, took the car out and put a speed indicator on, there would be no question as to the speed of his car. Twice recently I have obtained a non-suit where it has been just the question of speed.

Mr. Hasbrouck.—Corporations have no souls, you know, but it is wise to show a sympathy. Before it grew to such tremendous proportions with us I used to show a good deal of sympathy, and I have settled a case for $1000 sometimes, giving a man $100 in money and $900 in sympathy. (Laughter.) It really worked very well. They often say: "Yes, you soulless corporations never come near us." I received a letter from one of that class of lawyers who always now takes the precaution to serve us with a notice of lien after he serves his summons. He told me that Mrs. Fagin had been injured; that she lived so and so. I immediately went to see Mrs. Fagin myself, and within an hour I settled with her for a small sum. The lawyer was highly indignant when he found that I had been to see Mrs. Fagin and settled with her. I told him that there was a certain courtesy between lawyers, perhaps, but I did not own a cent's worth of courtesy. (Laughter.)

Mr. Harrington.—I am manager of a little road down in Camden, N. J. We average about five or six accidents a day, including everything. We sometimes settle behind the lawyer's back, in the case of lawyers for whom we have not any respect, of which we have a few. We have more accidents on open than on closed cars. We have several cases where employees have been injured and which came up after they had been discharged. We found that our accidents cost us each year about 2½ per cent of our receipts. Last year it was 7 per cent. We think it due to the fact that the public is becoming bolder, and it is a question, in our mind, whether it is expedient to settle as promptly as we do.

Mr. McCormack.—When I was with the Brooklyn Rapid Transit Company a verdict was given there on account of a contractor being killed on the Third Avenue line, and several witnesses claimed that the car was running 30 miles an hour. The same car was tried and the best speed obtainable was not quite 22 miles an hour.

Mr. Hasbrouck.—Examination of a case will sometimes elicit some interesting facts. I remember one case where a party claimed to be injured for life, having lost a finger. When we got down to the facts we found he was a gambler, and could not handle the cards without the finger he lost; therefore his occupation was gone. (Laughter). I recall a very interesting suit brought against the People's Line of Steamers a good many years ago, where the man made out his case. He was sleeping in the under berth and the man above him broke down somehow and fell upon him, and, as a result, he lost an eye. He got a verdict for $5000 or $6000. The People's Line carried the case up. In the course of two or three years it happened to occur to them that this suit was brought in 1866 for the loss of an eye, and they discovered, on examination of the military records, that this man had been examined for military duty when the draft occurred in 1863, but was rejected because he had but one eye—two years before the accident occurred.

E. G. Connette then read a paper on "How Can We Increase the Efficiency of Employees?" This was published last week.

Mr. Godfrey Morgan.—This paper introduces a subject which has been up at least four times in this association, and once or twice in the National Association, and that is the matter of rules and regulations for conductors and motormen, and the standardizing of a certain form of rules for them. I have discussed this matter with the inspector of the board of Railway Commissioners of the State of New York, Mr. Barnes. He asked me a short while ago if we had a book of rules. I said no; that we had had a number of discussions at the Street Railway Association of the State, at which they were going to take up and standardize a set

of rules for the government of motormen and conductors. I rose more particularly to find out where that resolution had gone and what probability there would be of our ever getting a standard set of rules for motormen and conductors.

The President.—If I remember correctly, this question was dropped on account of objections of some of the small roads to some of the rules proposed because they would not be applicable to them. The fact is, it would be impossible to adopt a set of rules governing the Brooklyn Rapid Transit, the Metropolitan and my little road, as well as some other roads.

Mr. Morgan.—I do not believe the association can make rules; in fact, I would be opposed to a set of rules which would be fit for New York or Buffalo, but would not be applicable to a line like the one of which I am manager. Now, of course, I don't wish to get up a set of rules and have another set adopted by the association put before me, and have to go to the expense of printing this other set later on. If there is any likelihood or probability of any such rules being formulated, I would like to at least know what we are going to do before we get our old rules printed.

Mr. Cooper.—The National Association had a committee appointed and got up a set of rules which we supposed to be a general set. I would like to ask if you know whether the Railroad Commissioners have any idea of formulating a set of rules for this State.

The President.—All I know is that two or three years ago they suggested a set of rules, and further suggested that this association take up the matter, and the outcome was as I stated before. I remember that on account of the difference between the large and small roads a uniform set of rules could not apply.

Mr. Cooper.—Would it not be as well to make it the sense of the association, in the form of a resolution, to ask the Commissioners not to do aything?

Mr. Ely.—The secretary suggested a resolution which, it seems to me, would be a very good way to deal with this question, and for the purpose of getting the matter up on the question, I will offer the following:

Resolved, That the committee to which this subject was heretofore committed be, and the same is hereby discharged, and that the president is authorized to appoint a new committee of five, to consist of representatives from roads in large and small cities and suburban roads, to take this subject under consideration and report to the next convention.

The motion being put to the meeting by the president, it was carried unanimously.

Mr. Vreeland.—I just want to say a word on that rule question. I had more or less to do with it, as there was considerable work done in my office in connection with the matter. We were putting in, at that time, a set of standard regulations. So far as the question of large and small roads is concerned, I was a member of a committee that was appointed to formulate a standard code of rules and train orders for the steam railroads of the United States. We had an engineer come to the East who knew nothing about our train orders or our general methods, and there was a case to be heard in the upper part of this State where there were three railways using one terminal, night and day, and every one of them had a different method of giving train signals with lanterns in the same yards. The same thing occurred over in New Jersey, and it was decided that we could standardize the essential rules for the government of employees. There was an objection made by the small roads at the association meeting, and it was decided that there should be a certain code of rules formulated, running from one to 106, and the same as to train orders, etc.; and that any railway which, by reason of single track or any local peculiarity, required it, could add to any rule. If the rule was No. 80, they could make a rule 80A or 80B, but they could not depart from the regular numerical order of the rules. There is not a railway company in the United States which is not working under those rules. There is not an engineer on the Pacific Coast who could not run under the train orders of the Boston & Maine or Maine Central. The train signals are exactly the same throughout the United States. A brakeman on one road for twenty years can go to another road and have nothing to learn but the local peculiarities.

We have a number of regulations that are general in their character, and would refer to the work of a motorman in any part of the country. It is necessary now, if we get a motorman from any part of the country, to find out how he has been following regulations. Our men took up the subject and made a standard set of rules, which apply on all the roads we are running. You will find throughout the United States that where there are single-track roads the rule is that trains traveling in one direction for twenty-four hours have the right of way. If by reason of the local conditions of single-track roads it was necessary to change that, the change was made by a rule A and rule B, that trains for twelve hours running in a general way had the right of way, etc. We are working under a set of rules now in the Metropolitan. I obtained a set of rules of every large system in the United States, and put a special committee of my men to work on them to pick out what they considered the best and to standardize a set of regulations general in their character. I then gave every superintendent and foreman the right, if necessary, to make changes in those rules. We are working under one set of rules on all our New York properties, and any others around the country under the control of the syndicate.

The next paper read was entitled "Storage Battery; Its Use on Small Roads," by B. B. Nostrand, Jr. This was published last week.

Mr. Nostrand (in answer to questions.—The small engine that we usually operate, running a 60-kw machine, is a simple engine. It just happened so. The other is a compound engine—Westinghouse. The batteries have been in operation since June, 1899. The only expense in the way of repairs have been in the neighborhood of $20. We have had no difficulty with the plates buckling, or anything of that nature. We operate three cars in the morning, and from about noon we run four cars, except on holidays, when we run five cars. We have no arrangement with the manufacturers as to depreciation. We bought outright the batteries without any guarantee as regards depreciation.

Mr. Blizard (of the Electric Storage Battery Company).—In reference to the matter of maintenance, there was a time, when we first started in business, when we had to overcome a very unfortunate reputation the storage battery had made. It was then necessary to give a guarantee, but now we find it is not. We not only guaranteed our batteries, but we guaranteed the men who operated them. Of course, a battery is not indestructible. We have no control over the men who operate the batteries, and there is no reason, under these circumstances, why we should give a maintenance guarantee. The average cost will vary from 3 per cent to 8 per cent or 9 per cent in residential plants, where the batteries are handled by gardeners. In railway service it will run from 5 per cent to 6 per cent. That does not mean that you spend 5 per cent every year, but at the end of five years you may have to spend 20 per cent of the original cost.

The convention then adjourned.

AFTERNOON SESSION

The meeting was called to order by the president at 3 o'clock. The first paper was by Thomas Henning, superintendent of the power house, Buffalo Railway Company, Buffalo, N. Y., and was entitled "Storage Battery." This will be published in the issue of Oct. 6.

The next paper read was entitled "Description of the Rochester & Sodus Bay Railroad" (41 miles), by T. J. Nicholl, vice-president Rochester Railway Company, Rochester, N. Y. This is published elsewhere in this issue.

Mr. Nicholl.—I was asked about the maximum speed that is made, and I will say that I judge it to be about 35 miles an hour. We can make 50 miles, but don't get a chance to get up to that speed.

The President.—I notice that some of the roads are draining their tracks on their own right of way, the same as steam roads. What is the custom of the suburban roads in Ohio?

Mr. Wason.—Where we can, we follow the steam railroad practice. I would like to ask whether the suburban railway managers attempt to keep the weeds out of their tracks? There are advantages and disadvantages in having weeds in your tracks; they do away with the dust but at the expense of your ties.

In reply to Mr. Wason's question on the subject of weeds, it was stated that it was the practice of one road 4½ miles long to trim the weeds down to the height of the rails during the summer and to grub them clean in the fall to prevent catching the snow in winter.

The President.—We have a little road that is grubbing weeds all the while.

Mr. Nicholl.—I have quite a good many miles of suburban road outside of this Rochester & Sodus Bay Railroad, where we have a great deal of grass and weeds, and we keep them down by salting the track. We put several carloads of salt on the track every spring, and that keeps the growth down. It is only about three years ago we started that practice. So far, there are no evidences of deterioration in the rail bonds.

The President.—In regard to draining the track, where we covered it up and the weeds grew, I had to put in new ties, and where we drained it the ties are in fair condition to-day.

Inquiry was made of Mr. Nicholl in regard to his telephone stations along the line, and what method he used for dispatching trains.

Mr. Nicholl.—We have a telephone station wherever we have an agent; that is, at all the villages and at one or two points besides, where we are obliged to use men. For instance, at the car houses

and sub-stations. The form of train orders is very similar to that used by the steam railroads. The train dispatcher gives the order over the telephone, and then has the operator repeat it back to see that he has got it all right, but with the conductor's signature. Of course, we cannot possibly have the conductors coming in and repeating to the train dispatcher; therefore, we rely upon the agent.

The next paper was entitled "Tests Buffalo Railway Power House," by Prof. Norris, Cornell University, Ithaca, N. Y. It is published elsewhere in this issue.

The president then appointed a nominating committee, consisting of Mr. Cooper, Mr. Cole and Mr. Brackinridge, after which the meeting adjourned.

A trip was then taken to the Cold Springs station of the International Traction Company, and later to the Pan-American Exposition grounds, as described last week. The annual banquet was held in the evening, and an account of it was published in the last issue of this paper.

SECOND DAY'S PROCEEDINGS

The meeting was called to order by the president at 9:45 a. m. The first paper read was on "Precision in Steam Power Making," by A. S. Mann, assistant engineer Metropolitan Street Railway Company, New York. Owing to the sickness of Mr. Mann, Mr. Robinson will read the paper. This paper is published elsewhere in this issue.

The second paper presented was by H. D. Cooke on "Compressed Air Motors," and was read by Mr. Himely, of New York. This is also published elsewhere in this issue:

Mr. Thompson (general manager Buenos-Aires Tramway Company).—It seems to me that there is one word in the paper which needs a little explanation, and that is reciprocation. The great thing steam railroads are looking forward to is the substitution of motors for steam. I understand that in compressed air cars there is considerable jolting, which I attribute to the reciprocating action of the motor, and my only reason for rising is to ask the gentleman whether any attempt has been made to employ compressed air in the rotary motors, which will do away with the reciprocating action leading to the jolting.

Mr. Campbell (of the Compressed Air Company).—I would say in answer to the gentleman who asked about the rotary engine, that while they have been experimented with for a great many years, they have never become of commercial value. There is no economy in them; there is a loss. The mechanical engineers have never been able to obtain the same results as with reciprocating engines. As to the question of unbalanced motion mentioned, it depends entirely upon the reciprocating parts; but the lighter the reciprocating parts the nearer we approach to a perfect motion. But where the parts become very much over a 20-in. cylinder, then it becomes a serious matter and causes a hammer blow, while this does not exist in small motors.

Mr. Thompson.—The gentleman has missed my point. The drift of his argument is that it does not affect the structure of the carriage. The question of balancing motors is one upon which every one has an opinion. At any rate, it produces severe jolting. The question of discomfort to passengers is one which relates more to the proportion between the weight of motor and car. In the case of a street car motor, the motor is scarcely too light.

Mr. Campbell.—I can say that in relation to balancing, we have two conditions; these are the weight and reciprocating power. If we move them about, if we take the 20-in. wheel and counter-balance, we have a different result at 20 miles an hour than we have at 30 miles an hour. We cannot counter-balance that perfectly; we can partly. Theoretically, it does exist in any motor, any size, any weight of motor. It exists, but when we come to a smaller motor, the resistance and the effect of vibration is resisted by the weight upon the wheels. It is always the downward motion on the counter-balance that makes the pressure, or what we call the hammer blow; and that is why we have to consider conditions when we come to reciprocating parts; and while I say it does not exist in street car motors, I say it is of such small moment that we do not feel the effects of it.

Mr. Thompson.—Is it not the case that every compressed air motor hitherto made has produced a jolting motion in the car greater than any electric motors?

Mr. Campbell.—Yes, I agree with you that it would be more perceptible than in a rotating motor.

Mr. Thompson.—The compressed air motor is put forward as a competitor of the storage battery; but the only advantage I can see is that it is not so likely to trouble in winter. The practical working objection to the compressed air motor I have always understood to be the jolting sensation produced. In the course of your remarks you said that the rotary motor had not yet been made a commercial success for such small motors as you use on street cars. The only suggestion I threw out was to put the compressed air motor on a more equal footing with the electric motor.

Mr. Campbell.—There is no increase of power in a rotary motor. We have got a fundamental principle in mechanics; it is that in a position a number of pounds moved a given distanee determines the power. The difficulty has been in mechanical work in making these positions strike. Again, in getting the extension of same, we have not yet been able to make all joints tight on a rotary engine that will give the best results. We have not been able to operate the extension. For the purposes it has been put to for torpedo boats, economy is no object. It is speed at any expense. If it can be developed it is a very great advantage, and may answer all purposes for a reciprocating engine.

The next paper was by C. F. Uebelacker, of the Elmire Municipal Improvement Company, on "Practical Experience in the Operation of Combined Public Franchises by One Company. Its Advantages to the Public and the Corporation." It was read by Mr. Robinson, and is published elsewhere in this issue.

Mr. Fenner.—Our plant, originally a railway plant, did buy in electric light and power, but didn't find any particular additional expense attending it, so far as the power house was concerned; and we did buy the gas plant, but did not make gas. We bought it under a ten-year contract with Dunkirk, where the gas was made and piped to Fredonia. That is about to run out now. Our power house burned last winter, and we are putting up a new one, in which we expect to manufacture gas, and we expect to manufacture all the gas we need, which will be about 6,000,000 ft. in a small town, with the addition of one man, because other employees can be utilized. In that way there certainly will be great economy, and we can probably make gas much cheaper than if we had an independent plant. If we did not have this property, our combination, which combines a lot of capital, would be valueless. There are not passengers enough, although the fare is 10 cents, between Fredonia and Dunkirk. There are only about a quarter of a million during the year, which would not be enough to pay any return. But with the steam heat we put in, using our exhaust steam, we get about $5,000, which is like found money. Taken all together, it is a valuable plant and the stock is par; but if it were not for the combination the stock would be worthless.

Two papers by R. E. Danforth, superintendent of the International Traction Company, were then presented to the association, one on "Snow Plows," the other on "Rotary Converter Sub-Stations." They will be published later.

The President.—The first topic for general discussion is "Repair Shop Methods, Including Handling and Distribution of Supplies."

DISCUSSION ON REPAIR SHOP METHODS, INCLUDING HANDLING AND DISTRIBUTION OF SUPPLIES

Mr. Nicholl.—I did not come here with the idea of being called upon to make any remarks on a subject of this kind, but in order to bring the matter before the meeting I will say that our plan of handling supplies is quite a complete one. At any rate, we have a book we call our inventory book, which is printed and in the hands of all our employees. It gives a number to every article that we use on the railroad, so that when a requisition is made we only have to put down the number of the article. For instance, every screw has a number, etc. The manner of handling our supplies is this: We have a purchasing agent, who does all our purchasing of every name and nature. Every piece of work ordered, even outside, is made on a requisition to the purchasing agent, so that there may be a proper order for that work or material as the case may be. He has a system of keeping the inventory constantly before him, which is quite a complicated affair, and it would be hardly possible for me to describe it without having the blanks to show you. But it is arranged so that as each article comes into the storeroom, numbering about 2500 in all, it is put on this special sheet for that purpose, under that head and number, and kept up for each day, week and month. On the other side of the sheet is an account of the articles as they go out. We have a box set apart for each kind of supplies.

That will probably suffice to give you an idea of the storeroom. Each foreman of each shop, whether in the armature room, the field room, the truck repair shop, the carpenter shop or whatever it is, makes requisition which goes to the master mechanic for his verification. This goes to the storekeeper, and the articles are issued. Then, each job that comes into the shop, of whatever kind, is numbered, and all material that goes into that job and the labor is charged to that job by the foreman of the shop. In that way we get a pretty good idea of things. Each day we know just exactly what we are doing. In fact, I have a report on my desk every day showing in detail everything purchased and that which has gone out. It serves to keep the office in line. They don't know but that I go over each item. Our repair shops are divided into a carpenter shop, paint shop, machine shop, truck shop, armature winding room and coil room; each one under a foreman, and

all under the master mechanic. Of course, space won't permit me to go into all details, but this will start you.

Mr. Tully.—Our supply department is so very large, and there are so many different kinds of operations, that it is somewhat difficult to describe it. We have over five thousand horses; that means a very large supply department. We have a cable system, which necessitates another system of supplies. Then we have the underground electric, and are now experimenting with the storage battery and compressed air; so that we have five different lines of supplies, three of them very large. Our supply department is one which requires a great deal of attention. I have my requisitions numbered consecutively. I commenced several years ago with No. 1, and I can account for every requisition that has been used; so that any false requisitions that may turn up can be told at once. We check off our bills consecutively on the face of the requisition and copy book. We are just about preparing for a new storeroom. I shall commence in that a card system, keeping an account of material received, etc. I judge from my conversations with the number of railway men who have been to see me, that while we differ in the matter of some details, in the main we are about on the same basis. I report to the auditor once a month.

Mr. Danforth.—Until this year the Buffalo Railway Company reported weekly, but we found we were able to reduce the amount of labor by making monthly reports. At the beginning of the month a list is furnished, having thirty-one spaces, a space for each day, on which the materials issued from stock are entered. The amount issued to each job is marked with the proper date, each day, as the requisitions of the foremen are checked off by a clerk. At the end of the month it is checked up, and a recapitulation sent to the office. We use separate job numbers for mechanical, track and shop work, giving the minor repairs and accounts in the maintenance of those departments a standing job number, which is balanced up every month. The auditor is advised daily of any new work or job numbers issued, with a description of the work. He keeps his accounts by a card system, and can, in a very few minutes, give the management the cost of any piece of work under construction.

The President.—If there is no further discussion or other questions to be asked, we will pass on to the next topic, which is "Selection and Management of Employees, and Methods for Increasing Their Efficiency by Benefit Associations and Other Means."

DISCUSSION ON INCREASING THE EFFICIENCY OF EMPLOYEES

Mr. Vreeland.—In 1881 I was a member of the American Society of Railway Superintendents. Some railways had then had nearly half a century of work, discipline and methods of handling employees. Last Saturday I was requested by the president of the Society of Railway Superintendents to appear before their meeting in October, in New York, and talk on this subject. A committee has been in existence in that society since the early seventies. Men have been changed, other men have worked on the committee. The question of standardizing the time of the United States was a matter of ten years. The question of the standard rules, which this association was going to dispose of for street railway purposes in one year, was up in my early railway days (and I have been in the business for twenty years), and was settled only two or three years ago. It is absolutely impossible to deal with a question of this character without the association, and settle a time for a discussion of each question. Then, if those of you who manage and own railways will say to your employees and your heads of departments who come to this association meeting, "If you can't attend the meetings of the association you can stay home," we will get along very well with this question. It seems to me—and I can speak on this question as a member of the executive board of this association—that it is not fair to the members and president of this association to ask a gentleman who has spent six months in preparing data, to get up and read his paper to a beggarly array of empty chairs. It is not the custom in railway circles of this country. The Association of Master Car Mechanics makes every man sign his name that he was at the association meeting. They do not allow a man to answer for another, and the railway companies keep check of those who attend the session of the convention. The same thing is true of the American Society of Railway Superintendents. There is not a session of that association, and never has been in the past, when every moment is not used for the business purposes of that association. If a man in the room wanted to go downstairs he asked the chair to be excused long enough to go there. And it is impossible for this association to consider questions of a continuous character, unless the members attend the meetings of the association and discuss the questions. A man can get up and generalize on these questions, but I have been working for seven years in street railway circles for the point where we would have some good method for the care and benefit of our employees, and I think we have only started; and if this association can dispose of this matter in ten or fifteen minutes, or one, two or five years, they are decidedly superior in ability to any of the societies of the United States.

The only way to treat the question is as a standing subject of this association. If we want to take it up and discuss it, we must have it stand as a regular topic of discussion of the association. As I said before, it has been before the American Society of Superintendents for twenty years, and this year it is brought up again for discussion. We have had a few words on it for the last few years, but it really has never amounted to anything, as there has been no set time given to it. In the American Society they generally give half an hour to the discussion of that subject in their meeting.

Mr. Clark.—I am quite sure that all in attendance at this session will heartily enjoy all Mr. Vreeland has said in relation to the delegates attending the business session. I know, of my own personal knowledge, that the president of this association and the executive committee have made a determined effort each year to secure at the meeting a large and representative attendance. That they have been successful is evidenced by the increase of attendance each year; but, as Mr. Vreeland has said, it is a deplorable fact that only a small percentage of those in attendance at the convention take an active part and participate in the benefits to be derived from the business meetings, and I think that the president and executive committee will be justified in laying down rigid rules and asking the railways of the State to see to it that their representatives attend the business session.

In relation to the discussion of the very important topics to which Mr. Vreeland has alluded, I would like to suggest if the meeting thinks it pertinent that the subject of "how to increase the efficiency of employees" be divided into several topics or divisions, to be arranged by Mr. Vreeland, and that the president of this association allot to the representatives of the different railways throughout the State such of these topics as he thinks would be most applicable to the situation and geographical location. I think the matter can be taken up in this way so that next year it can be considered as it should be, as it is of vital interest to railways as well as to the country at large. Therefore, I offer the following resolution:

Resolved, That the topic of "How to Increase the Efficiency of Employees" be separated under different heads, to be suggested by H. H. Vreeland, of New York, and that the president allot to the various street railways throughout the State the various sub-topics suggested, and that the representatives of the respective roads prepare to discuss same at the next annual meeting.

Carried unanimously.

The President.—The next topic is "Pavements."

DISCUSSION ON PAVEMENTS

Mr. Cole.—I saw in the papers that Mr. Boyle had a long litigation at Utica, and I wanted to know what the decisions were in those cases. It was largely a case, I think, where they were going to pave with asphalt, and the franchise of the Utica Belt Line stated that where the railways were laid should be paved with a pavement in every way suitable for street railway purposes. The claim was made by the engineer of Utica that asphalt was not suitable, as the concrete overlying the tie caused a vibration, and this vibration separated the pitch from the concrete so that the water trickled through. There was also a recent decision in which the courts determined that the 2 ft. of pavement to be laid outside the rails really meant 4 ft. I wanted to know whether such a decision had really been rendered.

Mr. Nicholl.—I have had a good deal of trouble with the paving question, and I have been trying to get an opinion on that 4-ft. matter. With us it is 2 ft. on either side of the track, and I don't think there has been any decision to the contrary.

Mr. Cooper.—I was told by an attorney the other day that the matter had been decided by the courts, but it was a decision which was subject to reconsideration by a higher court; that it meant 2 ft. on each side of the track. That decision was made last week.

The President.—If there is no further discussion on that subject there is another question we have been asked to talk about, viz.: "Snow Plows."

DISCUSSION ON SNOW PLOWS

Mr. Danforth.—I suggested that this question of snow plows was of great interest to the operating men of this State, and one which could stand considerable discussion. We do not all agree as to the best form of plows, or the best method of operation. It is only a few years, within a decade, that our plows were anything more than a walkaway or scraper. Last winter, in this city, thirty of our plows were levered, placed diagonally across the track under the wheels, and run by electric motors placed in the cab. We have been slowly arriving at the conclusion in this city that this plow is a very pretty affair, but for handling the snow is not what we want. A few years ago, the Thomson-Houston Company

got out a sweeper. The Buffalo Railway Company purchased two. These sweepers were equipped with steel brooms. While the motors last these sweepers are as fine a machine for city work as can be obtained. It is impossible to spoil them; they will cut anything short of hard ice. They fail in a large drift beeause of the inability to throw the snow over the sides of the bank. A few years later Captain Ruggles, of Charlotte, devised a rotary plow. He met with fair success and we tried one in Buffalo. The first was rather crude, but we managed to go through 13 ft. of snow; not rapidly, but more rapidly than with shovels, and with less expense. The following winter the Buffalo Railway Company and other lines built rotaries somewhat heavier and double-ended. These rotaries are still being nsed by this company. We find that in heavy work and deep drifts on the suburban line, and particularly on lines running north and south, these plows are invaluable. They fail in heavy wet snow, as may be imagined, from mechanical defects, not from the faet that the scheme is not right. We have slowly got around to the idea that a snow plow, to be effective in city work, must have traction. We therefore, last winter, built thirteen-ton, four-wheeled plows; double truck share plows. We placed on these what we supposed were pretty fair flangers. In December the men operating the roads in Western New York had a wet snow before the frost entered the ground. The result was rather disastrous for some of us. The rails, after 6 ins. of snow had fallen, became chilled; wagons and sleighs got in ahead of our ears, squeezed out the water, and there was an inch of iee on the rails. Our light plows were useless; our sweepers would not touch it. Our heavy plows went 100 ft. and then into the gutter. We squirmed out of the difficulty by using rather a unique flanger. Our life guards are so constructed that they are hung to a ring on the platform—an eye rather. We took our switch irons and dropped them through the eye and in front of the back cross pieee of the sweeper, and plaeed a man to rip out the ice as they went along. Later, when 18 ins. of snow had fallen and the light plows had become crippled, this section of Main Street was covered with 15 ins. of snow, pushed down by the sleighs, and no cars or plows on the street, our rotaries happened to be working on outside lines where we could get hold of them. In thirty minutes they were down here, and in another twenty minutes the lines were open. They picked this snow up, tight as it was, and I am sorry to say in some instances broke a few windows. The people in Buffalo knew nothing about the threatened tie-up. When they got up the lines were running beautifully. Later, when we were visited by 4 ft. of snow, our share plows proved invaluable. The levelers were useless after the first 2 ft. had fallen. These heavy share plows, without pushing, kept the lines open and the cars very close to schedule time. They demonstrated their value to us at that time very nicely. Within the next four or five days, when the wind commeneed to blow up drifts on the suburban line and these drifts had time to become hard, we found it impossible with a 25-ton, four-motor equipment behind a 13-ton plow, to make any headway through these drifts. We brought out our rotary plows, and while they went, perhaps, only a mile or mile and a half an hour, they went through the drifts. That proved to us conclusively the particular serviee for whieh our rotaries could be used. Following this, we have this year constructed heavier double-truck share plows, following practically the same lines in the matter of construction as the year before. A few years ago, as an experiment, we bought a rattan sweeper. I put it on one of the inside lines where the service was heavy, so that there would be plenty of grass and not too much sand to handle. We put it in the hands of the best inspeetor we had, and asked him, as a speeial favor, to make a sueeess of the sweeper. At the end of the month he wanted to be relieved of his position. He said he would rather have two 6-ton passenger cars any day than that sweeper. We shunted it onto another division with the same result. The man did not know how to handle the sweeper, and I would like someone to tell me.

Mr. Reed.—The handling of snow varies according to local conditions. The rotary plow, while very valuable on suburban lines, would raise a howl in New York City. Our snows are not, as a rule, very deep. We use the rattan sweeper. The first year we had some trouble because the sweeper itself was not constructed satisfactorily. We run them frequently, otherwise we would not run them at all. In the heavy snows we keep sweepers on not more than ten minutes headway. I have some share plows, but they have not proved successful. We follow up the sweepers with the old-fashioned walkaway, drawn by horses, to keep the snow back from the track as far as possible. In the storm of two years ago, which was the first storm we had to contend with on our underground system, we ran our cars at rather irregular intervals until, I think, about 5 o'clock Monday afternoon, when we were tied up by the conduits filling. After being tied up, it became a matter of shoveling the snow, for which we fortunately had about seven thousand men to call on. We use the electric sweeper entirely upon the electric roads, reinforcing it with the old-fashioned walkaway. We do occasionally have to use on switches, etc., hand power to keep the snow back far enough so that the sweepers can work properly. Last winter we had no trouble whatever, and never have any trouble except when our eonduits fill. Nor had we at that time a suffieient number of sweepers. We immediately got other sweepers and share plows, but I do not think a share plow was ever made that was of good service. We keep a good supply of brooms on hand. We have never used the steel brooms at all.

Mr. MeCormack.—Our experience with the snow plows that manufaeturers give us, a four-wheeled ear plow, is that it is hard work to keep the front wheels on the track. In Brooklyn we made a suggestion to the manufacturers which largely obviated that trouble, by putting a lever just beside the rear wheel, so that the force against that would help keep the front wheels on the track.

The eommittee on nominations then reported as follows:

President, G. Tracy Rogers, Binghamton.

First vice-president, John Boyle, Utica.

Seeond vice-president, Edward G. Connette, Syracuse.

Seeretary and treasurer, Henry A. Robinson, New York.

For executive eommittee:

G. Traey Rogers, Binghamton.

Herbert H. Vreeland, New York City.

Clinton L. Rossiter, Brooklyn.

T. J. Nieholl, Rochester.

W. Caryl Ely, Buffalo.

These nominations were elected unanimously.

Rochester was seleeted as the next place of meeting.

At the close of the meeting a trip was made of the cars of the International Traction Company to Niagara Falls, and thence to Dufferin Café on the Canadian side, where lunch was served, and the party enjoyed the view of the upper rapids. Thence the party left for Queenstown, and erossed the lower suspension bridge to Lewiston, returning to Niagara Falls by the Gorge Route, after whieh they were taken to Buffalo. The trip, which stands unrivaled for beauty of the natural seenery presented, was heartily enjoyed by all, who unqualifiedly expressed themselves as heartily appreciating the hospitality of the International Traction Company.

Practical Experience in the Operation of Combined Public Franchises by One Company *

BY C. F. UEBELACKER

The combination of public service enterprise is the rule of the day. We are all more or less familiar with such combinations as street railway and electric light, or electric light and gas, or, perhaps, all three under one ownership and more or less under one management. We say it is a good thing, that large economies must result, etc.; but when we come to look into the details of organization it is less evident just where the large savings are to be realized. We will leave out of the discussion entirely ornamental office holders on fancy salaries. The constant demand of the publie for decreased prices and increased facilities is rapidly replacing them with the working president and treasurer. Combinations are not necessary to aehieve these economies.

The advantages whieh do exist and which are the direct outcome of eombination must be divided into two classes.

First.—Those affeeting the income.

Seeond.—Those affeeting the expenses.

Of the first class the most prominent is the decrease in losses from bad aecounts resulting from service charges all passing under the eye of one manager and through the hands of one set of aecountants. Railway business being on a strietly cash basis, is little affected. The ineome from lighting charges is first relieved from much of the drain of unpaid aecounts, and second inereased by the absence of the necessity for annoying many applicants for service with the demand for a deposit. The requiring of a deposit gives offense to nine out of ten applicants. It brings forcibly to their attention the fact that they are dealing with a monopoly and this is to the small customer the same as the red rag to a bull. He becomes immediately insulted because his honesty is doubted, and not infrequently ends with the statement: "Well, if I've got to put up that deposit to get it I don't think I want gas," and goes out of the office explaining to whoever happens to be in hearing that the only way for the down-trodden to obtain their rights is for the city to own and operate the gas plant.

The ability to grant concessions in one class of service to obtain

* Paper read before the New York State Street Railway Association Sept. 19, 1900.

additional custom in others is of great advantage to the management in dealing with large consumers. Many an important deal turns up some small pique or fancied wrong of the customer in his dealings with the public service corporations, and a small concession to this feeling will frequently accomplish more than a plain demonstration of saving in expense, or an improvement in facilities.

The consolidation of the influence of several corporations is another great advantage in obtaining business. The trade of the companies themselves in the different lines is a large factor in the town in which they are located, and when there is added to this the trade and influence of the companies' employees, the result is generally the most powerful concrete influence in the whole town.

Last of the first class of advantages is the absence under combined management of a whole host of small jealousies and conflicts between the managements of the different companies when they are separately operated. The common use of the street by all public service corporations is a frequent source of complications. The gas company wishes to repair a main which lies under one of the railway company's tracks. The gas people wish to stop waste that is going on and the railway does not want to lose the use of the track a single day. Even supposing that an agreement is reached without a lawsuit, there is still the trouble that the gas company will want to do the work in the summer, just the season when the railway can least afford to have its services interrupted. If the railway manager comes out on top (he usually does) the gas manager will feel somewhat put out, and sooner or later will either use his influence against some scheme of the railway, or what is equally undesirable, he fails to second it. Under the combined management this source of loss should disappear entirely. The money all goes to one account, and it is only a question of judgment and a few figures to determine which of the conflicting interests is the most important.

Turn now to the other side of the question, the economies of combination. There is quite, or nearly the same, amount of work to be done in the companies combined as in the same companies separate. The railway must run just as many cars, the electric light company must turn out just as many kw-hours. There are undoubtedly some few operations which are duplicated in the companies separated, such as inspecting and meter reading; the bulk of the work, however, is unaffected by the combination. It is there and must be done and paid for just as much as before. The economy does not lie then so much in the reduction of labor as in more fully using the full time and ability of each man employed.

First of all comes the concentration of responsibility. Each plant is just as much in need of a superintendent as ever, but where before that superintendent was either actually or in effect the business manager as well, his position now becomes a purely technical one. If the same man is retained after the combination as before, his time is now fully devoted to the technical side of his plant, and he should introduce economies there which he was too busy to see to before. If a new man is decided upon, technical ability alone is required, and this is much more readily obtained alone than combined with business experience.

Another class of labor with which we are all familiar and which can be reduced by combination is the "necessary" man, the man for whom we are constantly finding something to do so as to have him on hand for certain intermittent work.

The street departments of all public service corporations always contain some men of this class. The railway retains its track foreman, the lighting plant its line foreman, the gas company its tapper, and others of the same class. After combination much of this work can be thrown into one street department, thus reducing this class of permanent employees to a minimum.

The economy in the combination of the railway and lighting power houses is self-evident. The addition of the necessary machines for generating the railway power necessitates no increase in the watch force at the plant. The whole increase in running expense is the coal and repairs required for the railway machinery. By the use of double-end generators, in fact, the combination of the railway and lighting loads can be effected with a considerable economy in both first cost and coal consumption.

The peaks of the railway and lighting loads seldom if ever fall at the same time, so that the machines required for the peak on the railway can also serve to carry the lighting load over its peak.

In the office the amount of work can be somewhat reduced by having accounting systems of the different departments uniform and by uniting the accounts of all parties from whom material is purchased for the different departments in one purchase and sales ledger, ruled with a debit and credit column for each department. This book brings all the various small personal accounts outside of the service ledger together, and much reduces the clerical labor, especially in checking up and vouchering the small local bills. Still further economies in office labor can be accomplished by combining the bank account and voucher system, but these are so perfectly evident that it is useless to go into them in detail.

The saving in the amount of money locked up in stores is also quite a large item in the advantage of combination. It is self-evident that of such articles as are used in common by the various departments a much smaller surplus is necessary for the several departments run as one company than where each department is run by itself without reference to the others.

To sum up the foregoing, when companies, previously well managed, are combined, the advantages and economies lie not so much in broad, sweeping reductions as in the attention to the smaller details of the combined organizations. The advantages lie not so much in the line of actually reducing the whole amount of labor required to accomplish the combined result as in the economical division of that labor. The use of the whole instead of a portion of each employee's time and assignment of similar work in different departments to the same employee accounts for reduction in operating expense much more than the reduction of the actual amount of labor required for the production of the product.

Compressed Air Motors

BY H. D. COOKE

Compressed air for street railway operation is the subject assigned to me for treatment in this paper, and I find it difficult to place all the facts for an intelligent consideration of this subject before this convention in the twelve minutes allotted.

The question of liquid air was also coupled with this subject, but I do not deem it necessary to touch on this question more than to say that nothing has yet been accomplished in the manufacture of liquid air which will warrant its consideration as a factor in the operation of street railways at this time. The present method of its production is to start with compressed air at 2000 lbs. pressure, and by expanding many volumes of air at this pressure, thereby producing intense cold, to liquify a small volume of air. The only advantage which liquid air has is the small form in which it can be stored, 800 ft. being compressed into one, but, on the other hand, as in this form it is the ice of air, the additional cost of heat necessary to return it to ordinary air for use in cylinders, adds unnecessary expense. In other words, you cannot get out of a thing more than you put in it, and the expense in this case is prohibitive.

The subject-matter of our theme, therefore, will be confined to the latest and most improved compressed air cars now in actual service in three cities of the United States, which are started, kept running and stopped by compressed air. When it is considered that one of the earliest applications of air in railway service was its use for air brakes as a stopper of trains, it is passing strange that its use as a starter and operator of trains did not earlier occur to mechanical minds.

Space precludes any general review of the past history of air except to state that it was one of the earliest known of what may be termed the secondary forces or powers. Authentic records of the application of air are found among the writings of the Alexandrians, 300 years before Christ, and, later, water was used in connection with steam, but not much progress was made with either of these until the present century, during which such advances have been made in the manufacture of iron and steel, which have been used in the construction of engines, boilers, tubing, etc., as to make the use of steam the most important factor in modern life.

Although the application of compressed air to the propulsion of vehicles is of comparatively recent date, the fact that it is used in practically the same way as steam gives it the benefit of all that has been done in the way of the perfection of the steam engine. In fact, there are many instances where steam boilers have been charged with compressed air, and engines operated therefrom, and in one instance a locomotive was charged with compressed air and run about the railroad yards and used for switching, etc. For such purposes, however, specially designed machines are better.

Limited space precludes any but the most general review of this important subject, and certainly nothing is more important to street railways than the question of a power which can be economically applied to all conditions of service, and which is of so simple a character as to make its operation and maintenance equally economical. Recently, however, it has been given serious consideration, and all the claims made for it have been fulfilled. It has proved itself reliable, unchanging, and where it has once performed a service it has always, under the same conditions, con-

* Paper read before the New York State Street Railway Association Sept. 19, 1900.

tinued to perform that service. Unlike steam, compressed air does not have to be used as it is generated. It can be stored up, and is ready for use when needed. Compressed to any required degree, it will always return to its normal atmospheric density.

Briefly described, the construction and operation of an air car is as follows:

The most approved form of motor now in use in this country, and of which a number have just been constructed for the Metropolitan Street Railway Company, of New York, for its crosstown lines, consists of two small reciprocating engines underneath the car body, each connected directly to one pair of the car wheels, according to the most approved form of locomotive engineering practice. The pair of wheels so driven is connected by parallel connecting rods to the other pair of wheels, thus making all the wheels under the car drivers. The air, before passing into the cylinders of the engine, passes through a reheating tank of water, heated to an initial temperature of 300 degs. The reheating of the air before use returns to it all, or a very great portion of, the heat units which were taken from it during compression. To illustrate this, a test was made of a motor in Rome, N. Y. This motor, which carried 35 cu. ft. of storage, was run with cold air, until all the air was exhausted, and covered only 8 miles. Afterward, the same motor was run, using the reheating apparatus, and 15 miles were covered. The heating of the water in the tank is done by attaching a steam connection directly from the boilers which furnish steam to the compressors, to the reheating tank on the motor, and passing the live steam into the water.

In order that the minimum amount of difficulty might be experienced by the average motorman, a controller was devised, which, in appearance and operation, is very like an electric controller. An air brake is one of the features of these motors, and an ingenious contrivance in the way of a starter, is also controlled by the brake handle. The valve motion is exceedingly simple, and gives a range of cut-off of from 1-10th to 5/8ths of a stroke. There is no appreciable exhaust, and the operation of the motors is practically noiseless. The air brake used on these motors is operated from air stored on the car, and is absolutely noiseless, both in its application and release. Being operated by the same handle which starts the car, there is no danger of the motorman leaving his brake on and trying to start the car at the same time.

Cars of this type are in their sixteenth month of operation on the North Clark Street cable line in Chicago, doing the night or owl service on that line, and sometimes hauling two trail cars. During the severe winter weather and snow storms which prevailed in that city last winter the compressed air cars were the only ones to perform their regular schedule. Compressed air cars have been in use in France for several years, and also in Switzerland, and in some places in those countries are used to haul two and three trail cars, but the American motors are pronounced by both our own engineers, and engineers from other countries, to be far superior to those of European manufacture.

The storage tubes under the car are of mild steel, capable of withstanding a pressure of 5000 lbs. to the square inch. Bottles of this character are used, both in the power house and on the car; the initial pressure in the power house being about 2500 lbs., and on the cars about 2000 lbs., which pressure on the cars is, by means of a reducing valve, reduced down to about 150 lbs. to the square inch before going through the reheating tank, and thence passing into the cylinders. It will be seen, therefore, that there is an ample factor of safety allowed by the storage tubes, and all precautions which can be are provided. It is apparent that the farther the cars travel the greater the factor of safety becomes. The storage on the car is underneath the seats, or the car floor, and the cars, in appearance, resemble the standard Broadway, New York, cars, none of the storage or machinery being in sight, and no paying space being taken up by either.

We now come to the power house: Air compressors, driven by an economical stationary steam engine, or by water or other power, compress the air from atmospheric to 2500 lbs. pressure to the square inch, and as the air is compressed, it is stored in a battery of steel bottles of the character of those above mentioned. During compression, however, great heat is developed, and a system of water jacketing is used which reduces the temperature of the air to that of the surrounding atmosphere. By means of a special separator all the moisture contained in the air is separated from the air as it passes from the compressor to the storage, thus securing perfectly dry air. It is well known that expanding gas or air develops an exceedingly low temperature, but the use of the separator, removing all water from the air before storage, obviates freezing upon expansion, and the passing of the air through the hot water before use in the working cylinders restores to the air the heat units which were taken from it during compression, and also furnishes enough moisture in the form of steam to assist in lubricating the cylinders. The exhaust from the engine cylinders never falls below 70 degs.

In order to recharge the storage on the car it is only necessary to connect the storage in the power house with that on the car, and equalize the pressure between the two. This is usually done at the end of a run, and while the car is waiting, and takes about two minutes. In Chicago, however, this is done on the street, and while the car is on its route, and has never caused any delay or stoppage of the service, even though done while the air cars were running between cable trains.

During the last four years experimental and actual demonstration of air cars in the service have reasonably determined the following facts, viz.:

That the cars operated in Chicago during a period of six months consumed an average of 409 cu. ft. of free air per car mile, and that the cost of maintenance of these motors is much less than that of the ordinary steam engine, as there is no boiler to be cared for.

We have been furnished figures by the most responsible builders of air compressors in this country, estimating on a volume of 6800 cu. ft. of free air per minute, which should be sufficient to operate one hundred cars, which show that 2.8 cents will compress 1000 cu. ft. of free air to 2000 lbs. pressure. This estimate is approximate for local conditions, and coal is figured at $2.90 per ton for a twenty-four hours' service, taking 2 lbs. per hour for indicated horse power. This includes attendance of engineers, helpers, firemen and laborers, and also for oil and waste, and allows for 10 per cent per annum for depreciation.

It is believed that compressed air cars have a place in every large system already installed, whether cable or electric, either for performing night service where it is not advisable or economical to run a large plant for the operation of a small number of cars, or where feeder or crosstown lines are necessary, and the installation of the overhead or underground trolley would not be permitted.

In brief, the advantages of compressed air for the operation of street railways may be summed up as follows, viz.:

1. A system of independent motors, which, after receiving their charges, do not rely upon the power plant, and which will always finish their run, should anything happen to the power plant; which also do not need any special outdoor construction, either underground or overhead, with the attendant cost of maintenance.

2. Slow moving machinery, both in the power house and on the car, which is easily maintained.

3. Opportunity for charging cars, and storage in power house, during light hours, for use during the rush hours.

4. Spring-supported motors and load, doing away with excessive jarring and pounding on the track, and thus greatly prolonging the life of the roadbed, the life of the motors, and contributing to the easy riding of the cars.

5. Low first cost of plant; low cost of maintenance, and opportunity for making repairs and adjustment without stopping operation of cars.

6. Freedom from liability of delay in transit from snow, ice or sleet.

Storage Batteries in Railway Power Stations *

BY PROF. H. H. NORRIS, CORNELL UNIVERSITY

Within the past few years more attention has been given to the refinements of station operation than was possible at the time of the rapid change from horse and cable to electric traction. By the use of the many engineering devices now popular the coal consumption in stations supplying power to electric railway systems has been reduced to a very respectable figure, not greatly exceeding 4 lbs. of coal per output horse-power in first-class plants. This accomplishment is remarkable when the nature of a railway load is taken into account. This load fluctuates greatly in two ways: First, from instant to instant, especially in small roads, and also on account of the variable nature of the business during certain hours of the day. These fluctuations tend to prevent economical operation of engines, boilers and generators, while the "peaks" and the extremely light loads reduce the load factor of the station.

Careful selection of sizes of machinery tends greatly to economy, but there has long been felt a need for an automatic regulator of the load which should be economical and convenient. The storage battery has always been considered a theoretically ideal device for the purpose, but patent litigation and other difficulties interfered with its commercial development until quite recently.

FINANCIAL FEATURES

The financial features connected with the application of the storage battery to railway work form the determining factor in their use. There is no doubt, from an engineering standpoint, that

* Paper read before the New York State Street Railway Association, Sept. 18-19, 1900.

they are a success. They have not been in use in this country in railway work for a long enough period to determine absolutely their depreciation, but apparently this does not amount to much more than that connected with moving machinery. The experience of a number of large users of the storage battery has been obtained, and during the short periods in which the batteries have been in use, practically no money has been spent in repairs. The oldest battery of which data is at hand, has been in use five years, but most of the batteries have been installed within two years. The depreciation which one of the largest manufacturers figure upon is from 2 per cent in the best managed stations to 8 per cent in small plants considerably overworked. Six per cent they consider to be a conservative figure under reasonable conditions.

The first cost of a battery is considerable, being, in average size plants, not far from $100 per kilowatt output when discharged in one hour. The same battery will have a much larger capacity when discharged more slowly. In order to obtain a general idea of the proportion of size of battery to capacity of station, data was obtained from a number of well known plants. Out of the station capacity of 43,560 kw the battery installed had a total capacity of 28,560 amperes for one hour, or an average capacity of two-thirds of an ampere hour per kilowatt output. Assuming a capacity of station of 1000 kw a battery of 666 amperes output for one hour would be chosen. The exact amount varies with the nature of the work demanded of it. For "peak" work a larger battery would be needed than merely for regulating work. If a battery of 270 cells were used, assuming an average pressure of two volts per cell, the cost of such a battery at the above figure would be about $35,950. At 6 per cent depreciation and 5 per cent interest, the annual cost of this battery would be about $3,955, exclusive of booster, attendance and building. The booster is necessary if a close regulation of voltage is desired, and the cost of such booster is between $50 and $150 per kw. If the booster produces a pressure of 50 volts its capacity is about 9.25 per cent that of the battery, so that its price in the above illustration would be somewhere between $1606 and $4818. Assuming depreciation on booster at 8 per cent and interest as before, the annual cost of booster would be between $21.20 and $63.60 per year, the exact amount depending on local conditions. Attendance usually involves no extra expense as the regular employees of a station are able to give the necessary amount of time without interfering with their other regular duties.

Cost of extra building is a purely local matter, and amounts to very little except in the case of large buildings, as some spare room is to be found about most stations. To offset the extra expenditure due to the use of the battery, there should be a considerable reduction of expenses in operating the boilers, engines and generators. This saving should result from the increased efficiency of the apparatus due to more effective loading; to reduced depreciation on machinery from the same cause; to the saving of wages through shutting down of plant during light loads; to the saving of copper in the lines when the batteries are installed in sub-stations, and other reasons following from these. The almost universal testimony is that the saving more than counterbalances the increased expense, and that, therefore, the battery is an economical adjunct to a railway power station.

ENGINEERING FEATURES

Viewed from the engineering standpoint, a storage battery serves a number of very useful purposes in a railway station or sub-station. First, by reducing the fluctuations of the load, thus allowing the machinery to be operated under more advantageous conditions. Second, by acting as an energy reservoir for the supply of excessive drafts of power, and thus permitting the installation of a smaller number of units than would be otherwise necessary. Third, by placing the batteries in sub-stations the pressure over the system can be made more uniform, for the battery will be charged when the draft of power is small, and discharged when this becomes excessive. Fourth, by drawing upon the battery at times of very light load the machinery can be often shut down and the load operated from the battery alone. This feature is especially applicable to small stations, when the night load is very light and where accidents to machinery often cause annoying shut-downs.

The use of an energy storage reservoir is common in many applications of mechanical laws. For example, in the steam engine the fly-wheel absorbs the energy supplied very irregularly from the piston. If the load on the engine be steady, the fly-wheel regularly absorbs energy when the piston pushes more strongly than is necessary, and gives out enough to supplement the effort of the piston when this falls below the amount required to overcome the resistance of the load. The pressure on the piston may vary from 100 lbs. per sq. in. at the beginning of the stroke down to 5 lbs. or 10 lbs. at the end. Through the medium of the fly-wheel this effect is averaged and may deliver a steady effort equivalent to a uniform pressure of, say, 40 lbs. per sq. in. on the piston. If it were not for the inertia of the moving parts, the engine would stop before the load reached the average value of the piston effort. Still more so is this true when the load also is irregular. Here, the fly-wheel acts as a buffer between the variations on both sides.

It is exactly in this way that a storage battery neutralizes the fluctuations in the current of a circuit when connected in parallel with it, for it absorbs energy and stores it in chemical form when the load is light, and restores energy to the circuit when the load is heavy.

It is in "peak" work even more than as a regulator that a storage battery demonstrates its utility. It is certainly uneconomical to install machinery which will operate for but a few hours each day. A heavy draft of current from a battery will not injure it materially, so that a small battery will carry a very heavy load for a short time. It does this at a reduced efficiency, but the loss in energy in the battery does not amount to as much as the saving effected. W. E. Harrington, general manager of the Camden Suburban Railway Company, of Camden, N. J., states that a reduced coal consumption of 23 per cent; an increased capacity of station of 300 amperes on account of a more economical load upon the engines; a material reduction in expense for repairs upon machinery, are some of the results of the installation of a battery in his plant. The capacity of the station is 1615 kw, and the battery has a capacity of 300 amperes per hour, somewhat below the average stated earlier.

John Murphy, general superintendent of United Traction Company, of Pittsburgh, Pa., reports curtailed operating expenses equivalent to 24 per cent of cost of battery.

The use of batteries in sub-stations, particularly where the distribution of power is accomplished by the use of alternating current at high pressure and rotary converters, results in very high economy. The rotary converter is loaded uniformly, so that its highest efficiency can be maintained, and thus an efficient supply of power is at hand directly where it can be used to the best advantage. Rotaries are used with great satisfaction in the Buffalo Railway Company, of Buffalo, N. Y.; the Rhode Island Suburban Railway Company, of Riverview, R. I., and many others. In the immense system of the Metropolitan Street Railway Company, of New York City, twenty-one 1000-kw rotaries will be used. W. A. Pearson, electrical engineer of this company, states, as the benefits due to the use of the battery in this connection, that it "decreases the load variations at the different stations, gives us reserve to fall back upon at times of heaviest loads, and allows us to shut down sub-stations for work on high-tension wires and on steam plants at hours of lightest loads."

The ability to shut down a station for even a few hours a day not only effects a saving in running expenses, but it allows time for repairs and inspection of machinery. It is better for the men, as it shortens the hours of labor, and it is better for the station. In addition to the matters already mentioned, the battery is of great assistance in enabling the generating units to be kept fully loaded, as the load increases and decreases. In fact, in very large stations this is one of the principal uses of the battery. It is the custom to install several generating sets and to start and stop them as the load demands. Without the battery the load on the different units would be fluctuating, but with the battery the latter furnishes part of the power until it is found economical to shut down a unit, and then it gives out power until the load has fallen to about one-half the capacity of the unit next to be shut down. The reverse of this is true with an increasing load. This point will be brought out more fully in the discussion of the Buffalo Railway plant.

A most important feature of storage battery installation is its use in line work. It is a well known fact that the average power carried by a line is very small in comparison with the occasional heavy demands: Thus, if a line be designed for a given drop with the average current, the drop with unusual drafts of current will be excessive, which naturally occurs when the pressure should be highest. To put enough copper into a line, especially when the latter is long, is impossible from a financial standpoint, so that a compromise has to be effected between excessive drop and financial economy. It is the emergency drop that has to be looked out for. Just here the storage battery is very effective. By locating it at some distance from the station the battery is charged rather uniformly from the line. When a heavy draft of current occurs, instead of an excessive drop in the line the battery furnishes most of the large current, and thus the drop is only the natural drop of the battery between charge and discharge. In one case the installation of a $10,000 battery was stated by the engineer to have saved $30,000 worth of copper. Although the depreciation in copper is less than that of the battery, it is not enough less to offset this saving. Still other uses of the battery

might be mentioned, but most of these follow as a consequence of the advantages described.

BATTERY OPERATION

The beneficial effects of a storage battery are largely dependent upon the treatment which the battery receives. The battery has two purposes; first, regulation, and second, preparation for emergency. In the first case the battery can be handled for economy much more easily than in the second. In anticipation of an emergency, such as a heavy peak in the load curve, or the possibility of a "shut-down," the engineer will naturally over-charge his battery in order to be sure that it contains the maximum possible quantity of energy. Overcharging necessarily involves a waste of energy, so that the battery will appear less efficient.

In regulating work the battery is most economical when it is about three-quarters fully charged. This is true for the following reasons:

In charging and discharging there are two main sources of loss of energy; first, the loss in ampere-hours due to overcharging, and second, to the loss in pressure, both in charging and discharging, and local action caused by the resistance of the battery and connections, and by local chemical action. The second loss is much greater when the battery is nearly fully charged; hence the desirability of keeping the charge below this amount. Three-quarters full is found to be about the best amount. These losses can be made a minimum by careful handling, as will be brought out in the illustration from the Buffalo plant.

THE BUFFALO PLANT

In order to illustrate the principles described in the first part of this paper, a well known and representative plant will be discussed in some detail, with a description of elaborate tests made upon it by students of Sibley College, Cornell University, during the past spring. The stations of the Buffalo Railway Company have been fully described in the "Engineering Literature," in which additional details can be found. The tests were made at the Niagara Street station, where power is obtained from a steam plant and from Niagara Falls. This station is now shut down and undergoing extensive alterations in order to utilize still more completely the Niagara Falls power, the experience with rotaries having been so eminently satisfactory.

The boiler equipment consisted of four 250-hp Babcock and Wilcox water-tube boilers, twelve 300-hp same make, and two 300-hp marine boilers. The supply of fuel was as nearly automatic as possible, as an electrically operated elevator took coal from the dump near the railway to a coal pocket of 2500 tons capacity immediately behind the station. A second conveyor, electrically operated, raised the coal to the top of the boiler room, where a horizontal conveyor carried it to a 5-ton hopper. A second movable hopper, of 1-ton capacity, distributed the coal to the Roney over-fed automatic mechanical stokers.

This portable hopper enables a very complete record of coal consumption to be kept, by recording the number of times which the hopper is emptied.

Removal of ashes was accomplished by running a hand-car in a tunnel below the hopper-shaped ash-pits and emptying the ash-pits about twice a day.

Feed-water is supplied either from the Niagara River, which is the normal arrangement, or from the city supply in emergencies. The water for the boilers is drawn from storage tanks of about 3400 gals. capacity each, through feed-water heaters. These tanks are supplied from the hot well of about 310-cu. ft. capacity. The water in the storage reservoirs is kept at about 50-lbs. pressure.

The engine equipment consisted of eleven engines, all two-cylinder cross-compounds, as follows: Two horizontal automatic Ball engines of 250 hp each. Nine vertical marine Lake Erie engines, three of 1000 hp each, and six of 500 hp each. To each of the three 1000-hp engines a ten-pole, 800-kw General Electric generator was directly coupled. To one of the Ball engines a 200-kw Edison bipolar machine was belted. Two generators of the same type were belted to three of the Lake Erie engines and 200-kw four-pole General Electric generators were belted to each of the other three engines.

A notable feature of the engine room was the rotary equipment. Four six-pole three-phase, 500-kw rotary convertors took alternating current from the secondaries of transformers at 350-volt pressure, three-phase. The primaries of these transformers are fed at 10,000-volt pressure from the Niagara Falls power plant. The rotaries convert the alternating current at 350 volts into a direct current at a pressure of about 550 volts.

The storage battery equipment of this station was a very large and complete one, having a capacity of 3000 amps. for one hour, and consisting of 272 cells of the "Chloride" type. As auxiliary to the battery a 70-volt booster, capable of passing 3000 amps. or more, was connected between the positive side of the circuit and the ground. The purpose of the booster was to force the battery to discharge when the load was heavy, and to force it to accept current when the load was light. This was accomplished by raising the battery voltage in the former case and lowering it in the latter.

The station was supplied with all necessary modern auxiliaries which go to increase the economy of operation of such plants.

RECORDS AND TESTS AT THE BUFFALO RAILWAY COMPANY'S PLANT

In the station just described very careful records of station performance were kept. These included readings at ten-minute intervals of voltage, total current output and generator-current output. Also, the daily coal consumption, number of boilers in use, wattmeter readings and weather conditions were recorded.

The conditions under which the plant operated were peculiar. A certain amount of power was purchased from the Niagara Falls Power Company to be used continuously. Also, the large number of cars constantly in operation made the load on the station remarkably uniform. These facts should be kept in mind in analyzing the results.

The charts plotted for the electrical readings, for the month of March, 1900, have been carefully studied for the purpose of this paper. On these charts a dotted line shows the total station output, and a solid line the generator output. The difference in the positions is due to the presence of the storage battery, which causes the dotted line to be above the solid at times and at other times below it. When the dotted is higher the battery is discharging, and vice versa. The area inclosed between the lines shows the amount of battery action, either charge or discharge, the inclosed area being exactly proportional to the energy transferred.

The charts show the following points very clearly:

1. The effect of the battery in straightening the generator load line is evident from a casual glance, the peaks being practically entirely carried by the battery.

2. The storage of energy for emergency use during light loads is shown by the large "charging areas" at these times. At night when the engines are all shut down and the load did not equal the capacity of the rotaries, the battery took up the surplus power. Similarly for the morning hours between the early peak and the noon hour.

3. The great assistance of the battery is adjusting the engines and generators to the changing load is brought out in a very interesting manner. As the load decreased the battery accepted more and more current from the generators, as shown by the battery ammeter. When the current had reached a point, fixed by previous experience, a generator was cut out. This reduced the generator capacity for the time below that required for the load. The battery then discharged until the load had fallen below the capacity of the generators. This continued until all of the generators had been cut out, and yet none had been run at inefficient loads.

By integration of the charge and discharge areas on the chart by means of a planimeter, the input and output of the battery in ampere-hours was obtained. From these measurements it was determined that during thirty-one days the battery received 189,369 ampere-hours, and gave out 164,036 ampere-hours, or a proportion of discharge to charge of 86.6 per cent. This is independent of some minor slight fluctuations too small to be noticed on the chart, but which affect the battery efficiency slightly. Assuming that the difference in pressure at the battery terminals varies by about 12 per cent between average charge and discharge, the efficiency of the battery for the work demanded of it in this case is about 75 per cent. This is lower than would be obtained for regulating work only, the peak or emergency work requiring overcharging with consequent loss of efficiency. In a case where the battery was used largely for regulating purposes with very small variation in voltage, over 90 per cent watt efficiency has been obtained.

4. From the coal records, the fact is deduced that less than 4 lbs. of coal are required for each hp-hour of electrical energy given to the line.

This record system is admirable, and gives data from which not only the performance of the station can be ascertained, but by studying which desirable improvements in equipment and methods of operation can be decided upon.

SIBLEY COLLEGE TESTS

Additional data for studying the operation of the plant under consideration can be obtained from a set of elaborate tests made during several days of March of this year.

The purpose of the tests was to determine:

1. The station economy as a whole.

2. To discover the effectiveness of the storage battery.

3. To determine the relative economy of the power from the engines and from the rotaries.

Incidentally the efficiencies of the various parts of the equipment were necessarily determined.

The standard methods were used throughout and no loss of any moment was allowed to go unmeasured. All instruments were carefully calibrated, and all readings were made continuously for twenty-four hours at very minute intervals. The error in the electrical measurements, as far as the instruments were concerned, was not more than one-half of one per cent, probably less. Particular interest in connection with the subject under discussion attaches to the battery measurements. A large Weston ammeter with plus and minus scale was used for the battery current readings. These were made at twenty second intervals for seventy-two consecutive hours without interruption.

The data resulting from the tests comprises the following:

Complete sets of data relating to all individual parts of the station under three conditions:

1. Normal, that is with generators, rotaries and batteries operating as usual.

2. Without rotaries, that is without Niagara power.

3. Without battery.

The information under these conditions is:

Complete boiler tests, including every detail and computation of boiler and grate efficiency.

Engine indicator diagrams and other measurements for determining engine output and efficiency.

Generator readings of current and pressure.

Battery readings of current and pressure at twenty second intervals.

The tests involved the employment of over eighty observers, and the computations required the labor of a number of men for several months.

The results of the tests are given in the following tables, taken from the thesis of Messrs. Burt and Macomber, and already printed in the *Sibley Journal of Engineering* for June, 1900, in connection with a paper by Profs. R. C. Carpenter and H. J. Ryan.

PARTIAL SUMMARY OF RESULTS OF TESTS

	Run 2	Run 3	Run 3
Pounds of steam per i. h. p. per hour auxiliaries included..	24.88	24.38	25.79
Water from and at 212 degs. in lbs. per e. h. p. hr.....	34.1	33.5	342.
Coal per i. h. p. per hour lbs.	3.53	3.31	3.64
Dry coal per e. h. p. hr. lbs..	4.23	4.04	4.17
Ave. mech. efficiency.....	84.1%	83.7%	84.2%
Engine i. h. p. hrs.....	69,900.	107,700.	53,250.
Generator output, hp-hours..	61,300.	92,600.	46,600.
Battery hp-hours—			
Charge	5,350.	6,100.	....
Discharge	1,950.	1,500.	....
Rotary output hp-hours.....	37,500.	....	31,100.
Total output e. h. p. without rotaries	59,900.	88,000.	46,000.

DISCUSSION OF RESULTS OF TESTS

The data resulting from the tests shows that more steam and more coal are consumed per indicated engine horse-power when the battery is not in operation than when it is. This is due to the increased efficiencies of the moving machinery. The summary shows that the efficiency is slightly less under normal conditions than when operating without the battery, but this is the average efficiency for the whole plant, some parts of which operated for a comparatively small number of hours per day.

The apparent battery efficiency is very low, due to a prolonged over-charging. It has been previously shown that the efficiency of the battery is not far from 75 per cent under normal conditions, and over-charged only to an amount necessary to secure a reserve for emergencies. Unfortunately the cells had been heavily over-charged just previous to the test, on account of some cells which had been short-circuited. Also, at the time of the tests a very heavy snow fall drew so heavily upon the resources of the station that the engineer evidently heavily over-charged in order to be ready for any possible emergency. This accounts for the low efficiency of the battery. The accompanying table shows a history of this over-charge during the days of the tests.

OVERCHARGE OF BATTERY, MARCH 1, 2 AND 3, 1900

Horse-power hours.		
In	Out	Gain
1,160.7	....	....
....	35.9	1,124.8
6.	....	1,130.
....	996.	134.8
2,155.7	....	2,290.5
....	.2	2,290.3
48.4	....	2,338.7
....	81.4	2,257.3
4.1	....	2,261.4
....	4.	2,257.4
12.2	....	2,269.6
....	3.2	2,266.4
9.6	....	2,276.
....	25.6	2,250.4
185.	....	2,335.4
....	361.1	1,968.3
4,984.2	....	6,952.5
....	1,093.5	5,859.
43.2	....	5,893.2
....	7.	5,886.2
32.6	....	5,918.8
....	26.6	5,892.2
208.8	....	6,101.
....	73.1	6,027.
1,624.1	....	7,652.
....	24.7	7,627.3
2.5	....	7,629.8
....	26.6	7,603.2
21.9	....	7,625.1
....	616.7	7,008.4
13.1	....	7,021.5
....	11.6	7,009.9
3,452.7	....	10,462.6
....	411.9	10,050.7
52.	....	10,102.7
....	34.2	10,068.5
2,146.3	....	12,214.8
....	340.9	11,873.9
395.4	....	12,269.5

The storage battery is not yet perfect, for there are disadvantages connected with its use. There is considerable variation in voltage; its first cost is high; some power must be wasted in the battery. To offset these facts, there is a decided advantage in steadying the load on generators, in keeping up the voltage when the battery is installed away from the station, in enabling the generators to be economically adjusted to the load-line, in wear and tear at the generator commutators on account of the steady load, and, most important of all, in the preparation for emergencies such as peaks in the load-line and possible temporary shut-downs. The remarkably rapid installation of storage batteries in railway stations, which has occurred within the last two or three years shows that the advantages enumerated are generally believed to more than compensate for the disadvantages.

Rochester & Sodus Bay Railway Company*

BY T. J. NICHOLL

At the risk of being called a bore, having a full knowledge of the many descriptions of new electric lines that have appeared from time to time in our railway journals (and which have almost become tiresome), I am going to venture upon your patience with a short description of a new line that has just been completed between the city of Rochester and Sodus Bay, N. Y. I do not know that there is anything particularly unique in its construction, nor that there are any details that may be valuable or even interesting to the convention; at the same time it may be that some points of good can be obtained that will be worthy of your consideration. At all events, the facts are given for what they are worth, and are a record of practical experience.

In 1898 my attention was first called to the necessity of an electric road connecting Rochester with Sodus Bay, between which is located probably the most prosperous country in the State of New York, devoted to agricultural and horticultural pursuits of great variety, the entire distance being 41 miles, and containing a population, including the city of Rochester, of nearly 200,000. This road reaches the famous Glen Haven resort, on Irondequoit Bay, and great Sodus Bay, which has long been noted for its beauty and popularity as a resort.

After many little meetings of a few gentlemen in our city, it was decided to incorporate, and accordingly we obtained a charter

*Paper read before the New York State Street Railway Association. Sept. 18-19, 1900.

on Aug. 13, 1898, after which we had to appear a number of times before the Railroad Commission of the State, and on the 24th of January, 1899, received from the Commission the required certificate, allowing us to proceed with the work. Then came the question of arranging for the money with which to build the road, which occupied our time until about July 1, 1899, when financial matters had been arranged and the real work of getting right of way, making permanent surveys, estimates, etc., began. The first sod was turned on Sept. 11, 1899, and the road was completed Aug. 22, 1900.

ALIGNMENT AND GRADIENTS

The line of the road begins at an intersection with East Main Street in the city of Rochester, 1 9/10 miles east of the center of the city, called the "Four Corners"; thence to Glen Haven, in a northeasterly direction; thence around the end of Irondequoit Bay, crossing the inlets to the same upon what is known as the Float Bridge, and up the Dugway Hill to the west end of the noted Ridge Road; thence along the Ridge Road to the town of Sodus; thence, paralleling the Rome, Watertown & Ogdensburg Railroad, to Wallington, where it passes under the Rome, Watertown & Ogdensburg Railroad in the ravine of Salmon Creek; thence, paralleling the Northern Central Railroad, to the village of Sodus Point on Sodus Bay, being a distance of 39 1/10 miles from the East Main Street station.

The heaviest grade is on the Dugway Hill, where it reaches, in one or two places for short distances, 5 per cent, compensated for curves. There are many other places along the line where the grades are as high as 3 per cent and 4 per cent for short distances, and the shortest curves are of 100-ft. radius. There is level about 70 per cent of the line, and tangents about the same per cent. All of the worst curvatures and gradients are made at the crossing of the Irondequoit Bay, in getting down to and out of the same.

RIGHT OF WAY

About 13 miles of the 39 miles is through private right of way, obtained by purchase and condemnation. The balance is along highways, where we first obtained the consent of the municipalities and afterward of the abutting property owners, and in this respect it may be proper to say that we had any quantity of trouble. The people, feeling that we were compelled to use the roadway, put up all sorts of obstructions and claims for damages, in the way of spoiling trees, crossings, appearance, etc., but I am glad to say that such people were much in the minority. There were sufficient of them, however, to make it very interesting at times. A whole chapter could be written upon this subject alone.

TRACK CONSTRUCTION

Track was built of 60-lb. T rail in the country, and 60-lb. girder rail through the villages, all in 60-ft. lengths; angle plates 24 ins. long, with four bolts 3¾ ins. x ¾ in., and of such a shape as to permit of electric bonding under the same. The rails were laid on oak, chestnut and cedar ties, using the cedar ties, as much as possible, on straight track and oak on curves. At the time the road was built it was quite difficult to get a sufficient number of standard ties, but generally we used ties 6 ins. x 8 ins. x 8 ft. long, and always placed 2-ft. centers. The electrical bonding used was generally a 0000 copper bond about 8 ins. in length, bent and flexible so as to provide for the movement of joint and expansion. In addition to this the track is cross-bonded once in every rail with a 0000 copper wire bond, using a brass clip that is threaded into the web of the rail. The track was ballasted, in many cases, with the local material and filled up well to the top of the rail, but generally with gravel, which had to be hauled some considerable distance from the various points along the line, for which we had to pay all the way from 8 cents to 16 cents per load. On the hills, and where private right of way was purchased, a regular roadway was formed, 12 ft. wide, with banks 12 ft. wide on top and cuttings 16 ft. in the bottom, with ditches, and on such work the track was ballasted with the ordinary material, which was generally sand, and filled only to about 2 ins. above the center of the tie. Along the roadway the general plan was to plow and scrape out to a depth of from 6 ins. to 18 ins., as occasion might require, so as to bring the top of the rail about even with the adjoining highway, and of course in every instance of this kind the track is filled in solid with gravel or equally good material. The bridging is generally of the standard steam railroad, trestle and pile bent style, using both wooden guard rails on the outside of the rails, and rail guard rails on the inside of same, bent inward at the end of the bridges in case of derailment. Along the highways we simply extended the kind of structure used on the highway, as it was needed, which was either of vitrified pipe, brick or stone arches, as the case might be.

The crossing under the Rome, Watertown & Ogdensburg Railroad at Wallington is made through a high embankment, which is now being made by that company, held in position by heavy retaining walls, the Rome, Watertown & Ogdensburg Railroad crossing the same on a solid floor of steel I-beams. The cost of this structure was in the neighborhood of $7,500, and of course was paid for entirely by the electric line, and upon the consent of the Railroad Commission.

In the country the track is generally laid, where not on private right of way, on the side of the road, crossing the same from one side to the other wherever it seemed best and easiest to get the consent of the abutting property owners. Through the villages of West Webster, Webster, Union Hill, Ontario Center, Ontario, Williamson, East Williamson, Sodus and Sodus Point, where girder rail is used, the track is generally in the center of the street.

The road is single-tracked throughout, except that in every mile a turnout is provided, about 300 ft. between frogs, one or two being lengthened out a distance of nearly half a mile. Spring frogs and split switches are used, the switches being kept locked to the straight track, except at the regular meeting points of trains, where they are kept locked so as to pass to the right. The sidings are all numbered with signs easily seen by trainmen, and the approach to a switch is indicated by stripes of white and black painted upon the trolley poles, beginning six poles from the switch, which has three white and two black stripes. The fourth pole from the switch has two white and one black stripe, and the second pole from the switch has one white stripe. These stripes are made 8 ins. broad and 1 ft. long around the pole, showing toward the approaching car.

Road and farm crossings were all planked with 3-in. oak plank, except in some cases, where rails were laid inside, and the space filled in between with cinders or gravel, and we find this practice particularly good where we cross the highway, as the inside rail forms a guard rail. All curves of less than 500-ft. radius have guard rails on the inside of curve.

OVERHEAD CONSTRUCTION

Eight-inch top, properly weathered and painted, 30-ft. to 40-ft. poles were used, set 6 ft. in the ground. Generally the bracket form of construction was used, composed of steel pipe and heavy wire bacing from the top, upon which is hung, on a separate cable, the trolley ears holding the trolley wire. There are two 00 figure-8 trolley wires running the entire length of the road, with no switches thereon except two car houses. Curve poles are all stayed back with cables or knee braces, and all poles are numbered. The trolley poles carry feed and telephone wires, in addition to the trolley wire, and are placed 110 ft. apart. The high potential line, whereon is carried the 10,000-volt current, runs across the country, as much as possible along the highways, separate and entirely distinct from the trolley system, and runs only from the generating station to the sub-stations. This line is built with 8-in. top, 30-ft. to 40-ft. poles, as the case may require, placed 6 ft. in the ground. One high potential wire is carried on the top and the two others on 3-ft. cross-arms, placed 2 ft. below the top, so as to make the three wires not nearer than 18 ins. from each other. The insulators used are porcelain, triple petticoated, placed on iron pins surrounded by a porcelain tube, all angles being double cross-armed, with strain insulators inclosed in suitable housing to protect them from the wire. The strain insulators are provided with turnbuckles for tightening or loosening the line. These poles are also numbered, and the line patrolled daily, trouble, if any, being reported so that it may be remedied at nighttime.

POWER

The main generating station is located on Irondequoit Bay, 5 miles from the western terminus of the road, so located on account of fuel and water and the heaviest grades. The steam plant is composed of two 500-hp horizontal Corliss engines, cross-compound, supplied with steam by four 250-hp Taylor & Altman water-tube boilers. The electrical generating equipment is contained in the main power house and two sub-stations. At the Irondequoit Bay power house there are two direct-connected, three-phase, alternating current generators, of 300-kw capacity each, generating current at 380 volts, 25 cycles frequency, which is transformed by six 100 kw static transformers that step-up the current from 380 volts to 10,000 volts. There is also in the main station one 250-kw rotary converter, that converts the 380-volt alternating current into 600-volt direct current, for immediate distribution to the trolley feeders supplying the western section of the road. The static transformers are grouped into two banks of three transformers each, deriving their current from the main bus-bars at 380 volts and supplying the current to the high potential bus-bars at 10,000 volts.

The switchboard arrangements do not differ materially from the ordinary arrangement. The high potential distributing devices,

however, are of vastly different construction. The switches, circuit breakers and lightning arresters are all located on a balcony above the main switchboard, to obviate any possibility of contact with the current while operating the switchboard. All of the 10,000-volt current switches are inclosed in fireproof cases filled with oil, so that they may be operated while "alive" without danger. The circuit breakers are of a special type, arranged to break the current through a fusible shunt inclosed in explosion tubes located behind the switchboard. The manipulation of all these devices is done by a system of levers from below the balcony, excepting the tripping mechanism of the circuit breakers, which is operated by primary batteries. The tripping mechanism of the breakers does not operate by direct influence of the high potential current, but is controlled by limit relays, that derive their current from transformers connected to main transmission line, the object being to protect the transforming and generating units from injury caused by prolonged or excessive overload or short circuit in the transmission line. The retarding of the tripping device is accomplished by a clockwork mechanism that trips the breakers should the excessive rush of current extend beyond the time limit to which the relays are set.

A ground detector is also used on the high potential line, which indicates not only the ground, but also the particular wire on which the trouble has occurred. As stated before, the transmission line consists of three No. 1 bare copper wires, placed 18 ins. from each other, and forming an equilateral triangle, the object being to minimize the inductive effect of the line so far as possible, as well as the mechanical balance.

In each of the two sub-stations, which are practically 12 miles and 24 miles respectively from the main power station, there is a single bank of three step-down transformers, provided with a special high potential switchboard, and one 250-kw rotary converter, with its accompanying panel, essentially the same as the one used in the main power house.

The transformers, both in the main power house and at the sub-stations, are located over a waterproof pit, so as to afford an air space for ventilating purposes, and are supplied with air by a fan, driven by an electric motor, serving, also, to keep the transformers clear from dust.

The direct distributing current to the trolley is cut into six divisions, two divisions being supplied by the main power station and four by the sub-stations. Circuit breakers are placed midway between the power station and the first sub-station; also between first and second sub-stations, so that any one of the six divisions of the line may be operated independently of the others. The feeder used in all cases is 0000, running for a distance of about 3 miles in either direction from the main power house and sub-stations, except at the extreme east and west ends, where the feed wire is continued to a distance of 5 miles, leaving 17 miles which is fed directly through the double trolley.

BUILDINGS

The power house is built of brick, with slate roof, in the most economical form, with space provided for increasing the power equipment 100 per cent. The sub-stations are built of stone, and at one end of the car house of the same material, with roofs covered with gravel. Each of these outside car houses are large enough to take care of four 45-ft. cars. There is also a car house at the Rochester end of the line, built of brick with gravel roof, with all necessary pits, machinery, etc., for repairs. This house will accommodate sixteen of the 45-ft. cars. There will be, although not erected yet, suitable hand-car and tool houses along the line, for the accommodation of trackmen, inspectors, etc., which will be built of wood.

EQUIPMENT

The rolling stock consists of eight combination cars, 45 ft. long, with 10-ft. baggage and express compartment at one end.

Six passenger cars, 45 ft. long, with smoking compartment at one end, entered directly from the vestibule.

Four 45-ft. combination cars, with 20-ft. baggage and express compartment.

All of the above are equipped with either four G. E.-57 motors or four G. E.-1000 motors, as the service seems to require, mounted on Taylor extra heavy, radial trucks, 33-in. wheels, ¾-in. flange and a 2½-in. tread. All of the G. E.-57 motor cars are provided with Sterling hand brakes and Providence fenders. In addition to the above we have four single truck, 26-ft. motor cars and six 26-ft. trailers, work car, two coal cars and two double-fanned Ruggles' snow plows, which we are at present building.

In round numbers the cost of the road and equipment has been about as follows:

Track, line, right of way, etc.	$453,000
Power and buildings	134,000
Car equipment	115,000
Organization expenses	20,000
Total	$722,000

OPERATION

The road is now operated with one train each hour each way, from 6 o'clock in the morning until 9 o'clock at night, and upon regular steam railroad rules and practice, orders being given by repeated telephonic messages, the telephone line being owned by the company.

For the purpose of collecting fares the line is divided into thirteen fare limits of 5 cents each, which is collected at one time, and the passenger is given a check to cover the length of his journey, but is rung up as each fare limit is reached on the register. We carry bicycles for an additional 10-cent fare any distance. We also carry baggage and express, under a properly arranged tariff. Our large combination cars are used for the carriage of the regular freight, which is operated upon practically the same principles as steam railroads, using the official classification, except that we limit the classification to four classes instead of six. All our freight trains start and stop at the intersection of East Main Street in Rochester. Other trains run, under a traffic arrangement with the Rochester Railway, to the Four Corners. The running time from the center of Rochester to Sodus Point is about two hours and fifty minutes, in which distance there is an average of fifty stops made. The stopping places are all—or will be—marked by properly enameled "Car-Stop-Here" signs, also fare limits, and in all these cases poles are painted white, so that the motorman may see them quickly, and are spaced from 1000 ft. to half a mile apart, at points where they will accommodate the most people, except in the villages, where we stop at all street crossings.

We have regular agents for the billing of freight and express at all of the villages along the line and in Rochester, who are under the supervision of a general agent, and are paid by commission. These agencies are designated by regular "agency signs," and at these points waiting-rooms are provided where necessary.

I trust that I have not wearied you with this description, which is necessarily much longer than I expected. I thank you for your attention.

Precision in Steam Power Making

BY A. S. MANN,
Of the Engineering Department, Metropolitan Street Railway Company

It is usually possible to make the steam machinery of a power station show a very high efficiency for a short time; so high indeed that the results, if not questioned, are at least given little attention because they are so far above average results that it is at once presumed that all the conditions then obtaining are so far from the usual state of things that it is impossible to operate machinery in that way. The following observations have been made to show the nature of the difference.

A large engine can run for an hour on 11 lbs. of steam per hp. Boilers of a good type can be made to evaporate 11 lbs. of water per pound of coal, actual conditions, when burning good coal. Then that makes 1 lb. of coal per hp-hour. The monthly record of a plant will show about 2 lbs. of coal per hp-hour. Where does the extra pound go?

Most running engineers know that a plant can not run on test conditions One engine can go that way for a few days, but that is all, and boilers will not keep up to the mark for more than four days; they fall off a good deal. Leaks will come in blow-off valves and brickwork will crack. A fire will not keep itself precisely 8 ins. thick forever, and surplus air will get through with the furnace gases. Then the load varies so. Thirty boilers must be kept ready for heavy loads and at times there is not a good load for ten. If attention is given to draft gages and flue thermometers, the heat in the gases when they pass away is known, but fire room men are not accustomed to hundredths of an inch while sixteenths give one result one day and a different one the next. The engineer runs his place in accordance with his judgment. He does what is most expedient. He takes indicator cards regularly every week, marks them and files them away; keeps his daily log and divides coal by kilowatts. Sometimes the results are low, sometimes they are a little high; but the average is fair, and of course the great thing is to keep running.

The great part of that pound of coal is lost in the fire room, and it can be recovered by making test conditions perpetual. The fire room is an enormous laboratory, manufacturing furnace for gas and ash, and the qualities of these products must be known always. The quality of the raw material, coal, must be known always. A fire making a gas with 15 per cent of oxygen looks fully as good as one with 5 per cent only. The excess oxygen carries a larger volume of excess nitrogen in with it, which is heated to flue gas temperature. The perfect product is nitrogen and carbonic acid gas, with a little sulphur dioxide, and a perfect fire makes a perfect product, and is of proper thickness. This fire thickness and the draft necessary to keep the boiler at its determined capacity will give a gas temperature which is most favorable; it may be high or it may be low. If the draft is kept at that point precisely, and the gas temperature goes up, the tubes are becoming dirty and should be cleaned, even if they are blown out every day. With the proper fire thickness and draft, the flue gas analysis will tell nothing about clean tubes.

The fireman who makes an ash with 30 per cent carbon in it, keeps steam just as well as does the man who makes 15 per cent carbon in his. The difference does not appear till the ash samples are burned down, and results weighed out on the analytical balance. When this is done and the fireman is told of it he will keep watch of the quality of the coal. He sights a bad lot ahead and speaks of the possible injury to his record. He stops talking about his judgment and what he did for the navy and hunts up a better way of making ash.

The coal man sends good coal when he finds his stuff is passing through analysis before he is paid. He can face an opinion with one of his own till he finds he is facing figures. British Thermal Units are what he has for sale, and are what he should be paid for.

The indicator measures pressure in a steam cylinder as it varies from point to point. That is all it is good for. If the right pressures are not there at the right time, steam is going somewhere; something is leaking; valves and piston are not tight when they should be. If the diagrams are measured this will be discovered. It will not be discovered if they are simply looked at and set down as good cards because the line is sharp and black. The eye will not detect leaks unless it is pretty well trained. Then compression can be taken off till the parts are just balanced. This requires more accurate measurement. If there is a knock in the engine somewhere, then it must be removed by local applications. Total horse-power and not indicated horse-power is what takes the steam, and things must be set by measurement. Leaky blown down valves and cylinder drips must be made tight, even if they are ground and scraped continually. The water passing a slightly leaky valve should be measured, and the amount charged out to leaks. The monthly total will tell whether it will pay to keep men fitting up valves. It is ten times what would be expected.

Measurements of precision are what will keep a plant running under test conditions. They reduce operation to mathematical certainty, and the errors of what is known as best judgment, and which varies 10 per cent, are removed from the problem. There is no room for guesses or about rights. They will enable an engineer to form a correct theory; a theory which takes account of all the facts; a theory with which perfect practice will agree. Every engineer of experience has a theory, but it is usually based on a lot of conflicting facts which he cannot reconcile, and so he has nothing to which he can fit the laws of practice. There is no guiding line for practice, everything is a compromise, sometimes fair, sometimes not. Precision is wanting, nothing is measured and accurately allowed for.

Every point in the travel of coal and furnace gas to the chimney; every point of steam and its travel to the condenser; every point of feed water and its travel to the boiler must be measured, located precisely. Then there is a working chart which tells of loss and gain, and which reduces the business of ash and furnace gas making to an exact science.

The Accountants' Convention at Kansas City

The programme of the convention at Kansas City of the Street Railway Accountants' Association of America has just been published, and shows that a most interesting meeting may be expected. In addition to the papers and reports to be presented a very important addition has been made to the collection of blanks, thus the interest aroused at Chicago will be continued this year. An examination of this exhibit gives an understanding of the part taken by blanks and forms in the construction and operation of the properties, an understanding necessary to the successful financial, operating or accounting officer.

As required by the by-laws, formal notice has been given that a change is proposed in Article VII. of the by-laws. This change will undoubtedly be the subject of earnest discussion.

Following the plan of the third annual convention, the programme provides for three half-day sessions allowing the whole fourth day for examination of the exhibits. This includes the exhibition of blanks which will be open the whole day.

The programme, in detail, is given below:

MONDAY, OCT. 15, 1900

7:30 p. m. Meeting of the Executive Committee at the Midland Hotel.

TUESDAY, OCT. 16, 1900

10 a. m. At the convention hall.
Address of Welcome.
Annual Address of the President.
Annual Report of the Executive Committee.
Annual Report of the Secretary and Treasurer.
Regular business routine.
Paper: What does the General Manager want to know from the Accounting Department? By C. D. Wyman, Boston, Mass. (lately general manager New Orleans City Railway Company.)
Report of Standing Committee: On a Standard System of Street Railway Accounting. Chairman C. N. Duffy, auditor Chicago City Railway Company, Chicago, Ill.

WEDNESDAY, OCT. 17, 1900

10 a. m. Convention Hall.
Paper: The Routine of a Street Railway, Electric and Gas Lighting Company. By C. O. Simpson, auditor Augusta Railway & Electric Company, Augusta, Ga.
Report of Committee: Is a Standard Unit of Comparison Practicable? Chairman H. C. Mackay, comptroller Milwaukee Electric Railway & Light Company, Milwaukee, Wis.
Paper: Departmental Accounts. By H. L. Wilson, auditor Boston Elevated Railway Company, Boston, Mass.

THURSDAY, OCT. 18, 1900

10 a. m. Convention Hall.
Paper: Material and Supply Accounts. By W. M. Barnaby, accountant Brooklyn Rapid Transit Company, Brooklyn, N. Y.
Informal Discussion upon any subject in Street Railway Accounting. (This is to be in every sense informal.)
Report of Convention Committees.
Election and Installation of Officers.
Adjournment.

The headquarters of this association will be at the Midland Hotel. Other hotels are the Savoy, Coates and Baltimore, all near the Convention building.

The usual one and one-third rates have been made by the railways upon the certificate plan.

Annual Meeting of the Union Traction of Philadelphia

The annual meeting of the stockholders of the Union Traction Company, of Philadelphia, was held Sept. 19. Nothing of very great importance transpired at the meeting. Directors were elected as follows: Thomas Dolan, William L. Elkins, Alexander M. Fox, John B. Parsons, William H. Shelmerdine, Alfred Smith, J. J. Sullivan, P. A. B. Widener, George D. Widener, George W. Elkins, Alexander Balfour and Charles O. Kruger, vice James McManes, deceased. The report set forth the assets of the company at $15,583,046, with liabilities at $15,583,046. The operating report as compared with last year shows:

	1900	1899
Gross receipts	$11,793,858	$12,996,291
Operating expenses	4,793,366	5,624,898
Earnings from operation	$7,000,492	$7,371,393
Receipts from other sources	242,409	253,528
Net income	$7,242,901	$7,624,921
Fixed charges	6,625,827	6,686,900
Net earnings	$617,074	$938,021

The increase in the operating expenses is accounted for in the report by "the advance in the cost of all supplies and by the increase in wages."

The balance sheet of the company, dated June 30, shows:

ASSETS

Cash	$216,582
Cash in agent's hands	20,000
Fire insurance fund	242,995
Advances to leased lines	5,556,839
Supplies	277,285
Construction and equipment	3,277,232
Real estate	398,586
Accounts receivable	36,518
Stocks and bonds	5,516,758
Franchise account	90,248
Total	$15,583,046

LIABILITIES

Capital stock	$10,499,912
Increase fire insurance fund	13,305
Mortgage account	.....
Accounts payable	140,701
Equipment leased lines	.....
Accrued maintenance account	274,255
Charges not due	1,331,693
Open accounts, leased lines	1,731,473
Due underlying companies	231,215
Due leased lines	.....
Accrued interest	.....
Trustees' accounts	176
Loans	.....
Profit and loss	1,360,313
Total	$15,583,046

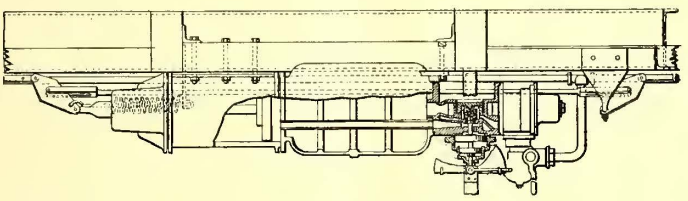
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, 177 Times Building, New York.]

STREET RAILWAY PATENTS ISSUED SEPT. 18, 1900

657,962. Car; C. Roehr, Bucyrus, Ohio. App. filed Nov. 1, 1899. Relates to means for changing a closed car into an open one, there being a series of side posts provided with parallel vertical grooves in which three panels are adapted to slide independently of each other, the middle section being composed largely of glass.

658,031. Railway Car; W. T. Van Dorn, Chicago, Ill. App. filed Nov. 4, 1899. The car axle is extended beyond the journal and carries an anti-friction roller, which slides in contact with the under surface of a rail arranged parallel with the track. The object is to prevent the derailing of the car.



PATENT NO. 658,256

658,131. Metallic Railroad Tie; S. F. Swanson, Pueblo, Col. App. filed March 23, 1900. Structural details.

658,227. Car Bolster; H. C. Williamson and H. Pries, Michigan City, Ind. App. filed Feb. 26, 1900. Comprises tension members and compression members extending parallel through their middle section and converging at their ends, and Z-shaped struts extending from end to end of the parallel portion of the first named members, and having their flanges secured thereto.

658,256. Regulator for Atmospheric Car Brakes; J. Georgoff, St. Petersburg, Russia. App. filed March 29, 1900. Consists in having in the passages from the three-way valve to the brake cylinder a check valve that can be acted upon by a pair of differential pistons, so that upon a certain maximum pressure being attained in the brake cylinder this valve will operate and restrict or close the passage to the brake cylinder and prevent any greater braking force from being exerted.

658,326. Car Brake; F. Theilengerdes, Memphis, Tenn. App. filed June 8, 1900. Comprises an annular friction clutch member fixed to the axle and a co-acting annual member supported by gimbal rings, whereby automatic universal adjustment of its frictional face is permitted, and devices for forcing the two members together.

PERSONAL MENTION

MR. OTTO A. STURZINGER has resigned as assistant superintendent of the Sandusky, Bellevue, Monroeville & Norwalk Electric Railway Company.

MR. THOMAS R. COLEIN, an attaché of the United Railways & Electric Company, of Baltimore, began his forty-first year of continuous service as a railway employee in Baltimore, on Sept. 16.

MR. J. D. PARKER has resigned as general manager of the Sandusky, Bellevue, Monroeville & Norwalk Electric Railway Company, of Norwalk, Ohio, and Mr. E. Adams, of Toledo, has been elected as his successor.

MR. MARTYN WELLS, resident manager of the Calcutta Tramways Company, Ltd., of Calcutta, India, is in this country for a short time inspecting the electric roads and studying American practice. Mr. Wells will return to London on Oct. 3 .

MR. WILLIAM A. HOUSE, manager of the United Railways & Electric Company, of Baltimore, Md., has just returned to that city, after a pleasant vacation trip. During his trip Mr. House inspected several of the Eastern street railway systems, including the New York system.

MR. JOHN NEVINS DODD, electrical engineer for the English Electrical Manufacturing Company, of London, England, was married to Miss Flora Melovidoff Elliot, of Lakewood, at Cleveland, Ohio, on Sept. 19. Mr. Dodd was for several years connected with the Walker Company.

MR. ISRAEL A. KELSEY, until recently general manager of the Winchester Avenue Railroad Company, of New Haven, Conn., and who was also interested in several electric railway companies in Massachusetts and Rhode Island, died at his home in West Haven, on Oct. 17, aged forty-one. He is survived by a widow and three children.

NEWS NOTES

BIRMINGHAM, ALA.—The Birmingham Railway & Electric Company, which now controls all the local street car lines, has secured a blanket franchise from the City Council. Heretofore each line has been operated under a distinct grant. In return for the new grant the company agrees to give universal transfers after two years. The company has placed its Fifteenth Street line in operation.

LOS ANGELES, CAL.—The Los Angeles Traction Company has withdrawn from the contest for street railway franchises here. This action was taken because it became apparent that the City Council would not recede from its position demanding an amendment to the State law before granting additional franchises.

NEW HAVEN, CONN.—It is stated that the United Gas Improvement Company, of New York and Philadelphia, will make application at next session of the Legislature for permission to establish an electric light plant in Bridgeport. It is said that the ultimate purpose of the company is to construct a dam on the Naugatuck River and build an electric plant at that point capable of operating electric roads and lighting cities and factories for 40 miles in any direction. Ultimately the whole of the Naugatuck Valley will be lighted and power furnished from one central power house.

LAPORTE, IND.—A special election will be held here Oct. 10, to vote on the proposition to appropriate $20,000 to aid in the construction of the projected electric railway to extend from Angolia, this State, across the Michigan line, with Coldwater as the terminal point.

INDIANAPOLIS, IND.—The new generator and 2500-hp engine of the Indianapolis Street Railway Company have been tested, and are now in operation. The company has built thirty new winter cars, repaired and remodeled sixty others, and will put 150 cars in service this winter.

BANGOR, MAINE.—The Railroad Commissioners have commenced their second annual examination of the railways in the State. They have examined the Bangor & Aroostook Railroad, and will examine the Portland & Cape Elizabeth portion of the Portland Railroad, Portland & Yarmouth Electric Railway, Brighton & Saco Railroad and the Grand Trunk Railroad.

WOBURN, MASS.—A car of the Woburn & Reading Street Railway jumped the switch at the turnout on Washington Street, Sept. 11, and, after running about 30 ft., it turned almost at right angles with the track and brought up against a guy wire post with considerable force. There were eight or nine passengers aboard, two of whom were injured.

WORCESTER, MASS.—The Worcester & Suburban Street Railway Company and the Worcester Consolidated Street Railway Company have reached an agreement, and will grant transfers between the two systems in the near future. They have also agreed upon the operation of cars over each other's tracks within the city.

BOSTON, MASS.—The Railroad Commissioners have an order approving the use of an electric system of motive power by the West End Street Railway on Cross Street, Malden. In doing this the board declines to assume juris-