PAGES

MISSING

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OFFICIAL PROCEEDINGS

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PROCEEDINGS OF THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA MEETING.

PRINCE GEORGE HOTEL, TORONTO, *November 21st, 1911.*

The President, Mr. Baldwin, occupied the chair.

Chairman,—

Well, gentlemen, it is time for us to open the meeting; will you kindly be seated.

The first order of business is the reading of minutes of the previous meeting, and as everyone has had a copy of the proceedings mailed to him, it will be in order for someone to move that they be adopted as read.

Moved by Mr. Herriot, seconded by Mr. Wickens, that the minutes of the previous meeting be adopted as read. Carried.

Chairman,—

The next order of business is the remarks of the president. I am very pleased to see such a large turnout to-night. I suppose it is partly owing to the weather, and partly owing to the lecture, which we expect to get to-night.

One thing I am rather sorry about, is that the Executive and Reception Committee did not turn up at the appointed time to-night, so that we could close up the business in connection with the "Smoker." I am given to understand that those who are looking after the different items have attended to their part of the work, and that everything is going along splendidly, so that we may expect to have a rattling good time on the 1st of December at the St. Charles Restaurant, and we want you to come and bring your prospective members along.

I saw Mr. Taylor to-day, our esteemed 2nd vice-president, and he told me he would be unable to be present to-night, owing to sickness in his family.

The next order of business is the announcement of new members.

NEW MEMBERS.

G. McKenzie, Steamfitter, F. Armstrong & Co., Toronto.

A. M. Smith, Master Mechanic, T.Y. & R. Ry., Toronto.

H. Clay, Engineer, G.T.R., Stratford.

C. J. Poore, Travelling Salesman, B. M. Jones & Co., Inc., New York.

W. H. Norman Davis, Rep. The Garlock Packing Co., Toronto.

A. C. Pratt, Rep. Eadie Douglas Co., Toronto.
F. W. Donaldson, Boiler Inspector, Toronto.
L. H. Rummage, Sales Agent, Buffalo, N.Y.
E. W. Williams, Assistant Chief Clerk, Supt.'s Office, G.T.R., Toronto.
R. W. Bennett, Conductor, G.T.R., Hamilton, Ont.
E. A. Morrison, Supt. Moulding Dept., Canada Foundry Co., Toronto.
R. L. Coxon, Machinist, Gurney Foundry Co., Toronto.
W. Hebdon, Machinist, Gurney Foundry Co., Toronto.

Chairman,—

I might say in this connection, gentlemen, that these names have been passed on by the Executive, and these gentlemen have been duly elected as members of the Club.

I think it would be in order for the Secretary, when reading out the names of the new members to also read out the proposer's name, so as to give us an idea who is taking an interest in the Club's welfare by getting new members.

There is one member who attends practically every meeting of the Club, who deserves great credit for bringing in new members. I refer to Mr. Wright, of the Gurney Foundry.

MEMBERS PRESENT.

F. W. Salisburn
E. G. Southam
F. W. Naylor
T. J. Walsh
R. S. Magee
P. McClelland
A. M. Wickens
H. H. Wilson
F. Hardisty
C. A. Jefferis
J. Bannon
J. Shields
J. P. Law
A. C. Pratt
L. J. Mattice
W. Large
M. C. Schadel
C. F. Nield
M. A. Humber
E. A. Wilkinson
S. Wainwright
W. R. Gardner
W. E. David
J. M. Clements
C. L. Worth
E. Linstead
P. Jerreat
G. H. Davis
J. W. McLintock
W. Hebdon
J. O. B. Latour
E. Logan
H. E. Rowell
F. W. Donaldson
J. Adams
G. P. Beswick
W. W. Garton
J. T. Fellows
W. F. Donaldson
W. Demmett
T. J. Ward
A. Jacques
J. F. Nield
T. H. Barnes
G. M. Smith
E. B. Gilmour
G. McKenzie
R. Pearson
H. G. Fairlie
W. H. N. Davis
P. H. Fox
C. L. Wilson
D. Peddie
C. H. Dudley
H. G. Fletcher
J. Herriot
C. D. Scott
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T. B. Cole
J. H. Morrison
C. L. Gulley
J. Sim
J. Kelley
J. Scanlon
T. McKenzie
D. Cairns
G. S. Brown
G. F. Milne
D. Ross
J. Wright
L. S. Hyde

Chairman,—

In connection with the Social Evening, as the chairman of the Reception Committee, Mr. Fletcher, is here, I will ask him to give the members some idea of what has been done in connection with this.

Mr. Fletcher,—

The plan outlined for the entertainment of the members is similar to that carried our formerly. We are going to play cards, have a little refreshment, and a few songs. I have engaged the talent and I can assure you that as far as the entertainment part is concerned, there will be nothing wanting. We will have a good night.

Chairman,—

Do not forget, gentlemen, that you are invited to bring along prospective members.

Mr. Worth advises me that all arrangements have been made at the St. Charles so that I do not think that there will be anything left undone to insure our having a first-class time.

We will now pass on to the ninth order of business, the reading of papers or reports and discussion thereof.

We have with us to-night Mr. Howard Fairlie, who is taking the place of Mr. Dwight Smith, who intended to read this paper to us, but owing to a very urgent business engagement he was unable to be present. However, as Mr. Fairlie works in conjunction with Mr. Smith he is easily capable of handling this subject, and Mr. Fairlie, I understand, is a past master in the telephone business, and I am quite satisfied that you will listen to a very interesting lecture.

As Mr. Fairlie has some of his apparatus here he will no doubt make the lecture much more ineteresting.

I have much pleasure in introducing Mr. Fairlie.

Mr. Fairlie,—

As explained to you by the chairman, Mr. Smith is unable to be with you to-night, but he has asked me to read his paper for him.

Mr. Smith wishes me to state to you that he is indebted to Mr. G. K. Heyer, of New York, for certain of the data given in this paper, certain parts of which are the results of original investigation on his part.

TELEPHONE TRAIN DESPATCHING.

BY MR. A. DWIGHT SMITH, RAILWAY SALES ENGINEER, NORTHERN ELECTRIC & MFG. CO., LIMITED, MONTREAL.

(I am indebted to Mr. G. K. Heyer, of New York, for some of the data contained in this paper.)

From the wonderful development, which has taken place in the last few years in the designing of electrical appliances and the application of such equipment to everyday use, it is not at all strange that the field of the telephone has been extended to include the directing of train movements on steam roads. Prior to October, 1907, the telegraph was used exclusively for this service on the larger and more important of the trunk line railways. On the other hand, it is somewhat surprising that the value of the telephone for use in despatching trains was not generally acknowledged at an earlier date as several of the shorter roads have for a number of years used the telephone for handling traffic with very satisfactory results.

The New Orleans and Northwestern, as early as 1883, used the telephone for operating trains. This service was rendered over a grounded iron wire about one hundred miles long with the ordinary magneto telephones as used at that time, and without the aid of the selector, which mechanism has made possible selective calling on long and heavily-loaded railway telephone lines.

Some of the other roads, which used the telephone for controlling train movements, previous to 1907, are: Huntingdon and Broad Top Mountain Railroad & Coal Co. since 1883 over a line forty-five miles long; New York and Pennsylvania Railway since 1896 over a line fifty-six miles long; Lake Erie Alliance & Wheeling for some years have been operating by telephone a single track line about one hundred miles in length.

On the low grade division of the Pennsylvania Railroad between Columbia and Parkersburg, where the traffic was probably much heavier than any of the roads mentioned above, the telephone in connection with block signals has been used since 1906, the average number of trains per day being ninety-five, and consisting of 4,800 cars, carrying 280,000 tons.

The telephone equipment used in all of these installations was far inferior to that at present used. The great improvements which have been made in the last two or three years in the apparatus together with the new apparatus designed to

meet the special requirements of the service, indicates that the telephone for railway service has only begun.

Now, before taking up the reason why the railroads have adopted the telephone as a means of directing that portion of the business which is most important to railway operation, let us consider for a moment a few points in the history of train despatching, since the time the telegraph in 1850 was first used for this purpose on the Erie Railroad.

Previous to the time of the introduction of the telegraph, trains were run on what was called the "time interval system." With this system the ruling train had the right of one hour against an opposing train of the same class. Under this method of operation, a great deal of time was lost if trains were late. The trainmen were of course anxious to get through, and the following taken from Edward Harold Motts' history of the Erie Railroad and titled, "Between the ocean and the lake," describes the method of advancing trains under this method, and also describes in detail how the first train on the Erie Railroad was advanced by the use of the telegraph.

"Conductor Henry Ayres had lost his hour at Pond Eddy. He took the switch and after waiting ten minutes as was the rule and the opposing train not being in sight or hearing, he started a trainman with a red flag, and giving him twenty minutes' start, followed with his train. A little west of Schohola he caught the flag-man, who had stopped on enough straight line to make it safe. The exhausted man was taken aboard the train and a fresh man started on with the flag, which operation was repeated until the train expected was met at Callicoon, thirty-four miles from Pond Eddy. Captain Ayres used to say that he had flagged the entire length of the Delaware division more than once."

"Of course such a method of advancing trains was slow and unsatisfactory and the telegraph was first introduced by Superintendent Minot, of the Erie Railroad, when he happened to be going over the road on a west bound day express. The train, under the ruling then existing, was to wait for the east bound express to pass it at Turners, forty-seven miles from New York. That train had not arrived and the west bound train would be unable to proceed until an hour had expired unless the tardy east bound train arrived at Turners within that time. There was a telegraph office at Turners, and Superintendent Minot telegraphed to the operator at Goshen, fourteen miles further on, and asked him whether the east bound train had left the station. The reply was that the train had not yet arrived at Goshen, showing that it was much behind time. Then, according to the narrative, Superintendent Minot telegraphed as follows:

"To Agent and Operator at Goshen:
Hold the train for further orders.

Charles Minot, Superintendent.'

"He then wrote this order and handed it to the conductor:

"'To Conductor and Engineer Day Express:
Run to Goshen regardless of opposing train.

Charles Minot, Superintendent.'

"'I took the order,' said Mr. Stewart, in relating the incident, 'showed it to the engineer, Isaac Lewis, and told him to go ahead. The surprised engineer read the order and handed it back to me explaining:

"'Do you take me for a fool—I won't run by that thing.'

"'I reported to the Superintendent, who went forward and used his verbal authority on the engineer, but without effect. Minot then climbed into the engine and took charge of it himself. Engineer Lewis jumped off and got in the rear seat of the rear car. The Superintendent ran the train to Goshen. The east bound train had not yet arrived at that station; he telegraphed to Middletown; the train had not arrived there. The west bound train was run on a similar order to Middletown, and from there to Fort Jarvis, where it entered the yard from the east as the other train came in from the west. An hour and more had been saved by the west bound train and the question of running trains on the Erie Railroad by telegraph was at once and for ever settled.'"

The time was about ripe for an incident of this kind to demonstrate that not only did the needs of the railroads demand an entirely new and more efficient method of handling traffic than had been in use, but brought them face to face with the fact that they had been somewhat slow to realize that within easy reach was a system, the adoption of which would greatly improve traffic conditions.

With the energy and willingness to improve, which has always been characteristic of the railroads, they were not long in providing the necessary line construction along their right of way to arrange for telegraph operation.

The Erie, in 1851, marked the first systematic attempt to telegraph orders from a central point to trainmen and conductors. From that time until within the last few years, to one familiar with railway operation, the thought of train despatching carried with it the thought of telegraphy. How well the telegraph has performed, and how fruitful have been the results through all these years can better be told by some of the railway officials of the present day who started their career and received their early training as telegraph operators.

In 1875, twenty-five years after the introduction of the telegraph for train despatching, the telephone was invented by Alexander Graham Bell, at Brantford, and in spite of the many difficulties encountered in the early days, it very soon came to be generally used as a means of carrying on communication between distant points. The question was at once raised with regard to whether or not this new and improved method could be drafted into service for directing train movements.

The controlling minds of the railroads, who have expressed themselves by means of the Morse key, had come to consider the telegraph as much a part of the regular operation of the system as to believe it synonymous with clear, safe and efficient operation. They were disposed to let well enough alone, and could not feel themselves free to advocate the use of a system, which to them was comparatively new and untried. Another recommendation against the use of the telephone was the feeling among the operators that the passing of the telegraph would seriously affect their positions. This fear, however, has not been borne out by subsequent events, and the railroads have shown every disposition to retain operators in their old positions. On serious thought this could only be expected as the welfare of the railroads makes necessary the employment of men who know railroad business, and in few cases, if any, have operators lost their positions due to the use of the telephone, except as a result of some action of their own.

The following taken from an article written by Mr. C. H. Gaunt, formerly of the Santa Fe Railway, and printed in the Santa Fe Railway Employees' Magazine, expresses very clearly what has been the experience of many despatchers. "The telegraph is used by the train despatcher in the intricate operation of his trains for one purpose only, that of communicating with the operators scattered along the stretch of railroad, which use has developed the certainty of action in telegraph manipulation that commands the respect of all. But how often has a half-frantic despatcher loaded down with the complicated problems before him wished he could use his voice to the men with whom he must communicate and thus avail himself of the rapidity of action, the definiteness and security that would follow. There were many reasons advanced by those favoring the telephone to show why the telegraph should be superseded, but these recommendations could not convince the men of influence and experience in the field of railway operation. There was a feeling that in the improvement of the advantages which came by the new system, changes could not be made without risk. The fact that the use of the telephone had long been advocated did not prove anything, and the level-headed railroad men were justified in demanding absolute proof in

actual service conditions. These proofs were forthcoming as soon as the first few installations of telephone and selector equipment had been given a practical trial."

The New York Central was the first to install equipment of this nature, and in October, 1907, a section of the main line between Albany and Fonda, a distance of forty-four miles with sixteen way stations, was completed.

The installation on the New York Central was closely followed by a number of installations on the Chicago, Burlington & Quincy, where in December, 1907, the main line between Aurora and Mendola, Ill., a distance of forty-six miles with eleven stations was equipped. After this a section from Aurora and Galesburg, Ill., a distance of 125 miles with sixteen stations was equipped, and another section between Aurora and Clyde, the end of the Chicago Terminal, a distance of twenty-eight miles with fifteen stations. Closely following these installations, the Canadian Pacific Railway installed a circuit from Montreal to Newport with the despatcher located at Farnham. These installations produced the proof for which many had been waiting, and these railroads can justly be called the pioneers in telephone train despatching.

The proof was conclusive and the results obtained so satisfying that the subject became at once one of world-wide interest. The extent to which the telephone has been adopted by the roads in Canada is best shown by the following: A train can

FIG. 1—"DESPATCHER'S OFFICE."

start on the Canadian Pacific Railway at St. John, N.B., and travel through to Vancouver, and other than those sections of their line between Vancouver and Kamloops, and the double track between Winnipeg and Fort William, by means of a portable train telephone set, would never be out of communication with some despatcher. There are a total number of seventy-three roads with a mileage of 50,000 miles now using the telephone for train despatching in Canda and the United States out of a total of 285,000 miles of track.

Now in considering the reasons why the telephone is destined to replace the telegraph for train despatching, it will be well to compare the two systems, and this comparison will show the advantage of the former.

With the telephone the orders are issued verbally by the despatcher (Fig. 1), word for word, in place of being sent out in code and the speed which may be obtained is limited only by the ability of the operator to copy messages.

The forms used are the same as used with the telegraph and the operator repeats the order back to the despatcher for his O.K.

It is a well known fact that the rate of sending attained by the average railroad telegraph operator is about twenty-five words a minute, while with the telephone a speed of one hundred words or more may be obtained.

Experience has shown that fourteen to sixteen train orders may be put out in one hour with the telephone, while with the telegraph the despatcher was doing exceedingly well by doing half this number.

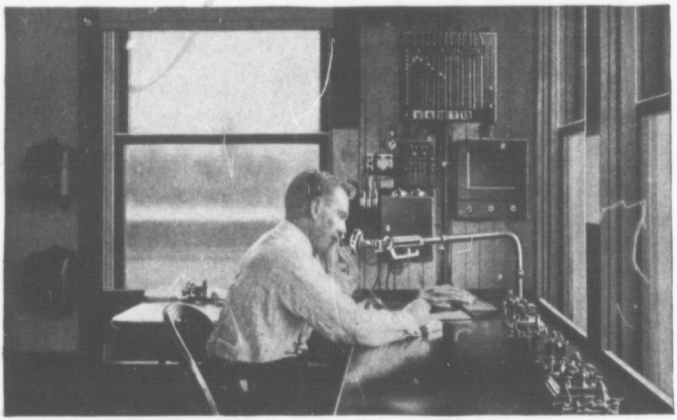

FIG. 2—OPERATOR AT WAY STATION.

The greatest speed possible with the telephone is also shown in the reporting of trains, that is, stating the time of passing, arrival or departure of trains at stations. The despatcher is of course always in on the line, and as is customary, the operator (Fig. 2), when wishing to report, merely removes the receiver from the hook, and after being assured that the line is not busy, calls his station. The despatcher instantly replies by saying, "Despatcher." The report is then given in in the fractional part of a minute. Probably the time saved in calling stations is greater than in the sending of orders or reporting trains. The despatcher is relieved of the aggravating operation of repeating a station call over and over again by sending the telegraph letter used for this purpose. It may be said here that the operator has been relieved of all calling of the despatcher.

Information regarding accidents, derailments, etc., is conveyed to the despatcher verbally by either the operator or the conductor, and the narration is at once so complete that the chances of misunderstanding and the necessity of additional messages are eliminated.

The use of poratble sets (Fig. 3), puts the conductor in immediate touch with the despatcher in case of a break-down

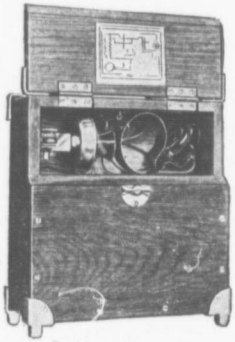

FIG. 3—PORTABLE TRAIN TELEPHONE SET

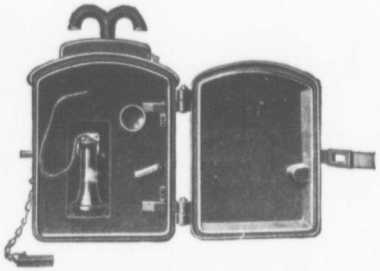

FIG. 4—METAL TELEPHONE SET FOR SIDINGS.

or other trouble, between stations, while with the telegraph it is necessary to reach the nearest telegraph office to send in a call for help. One of the largest Canadian roads has over 750 of these portable sets in use, having equipped the larger portion of their passenger and freight trains, and all of the wreck trains with them.

The use of siding sets (Fig. 4), placed at points wherever the operating officials desire is a great value in that they enable the

train crews to reach the despatcher and keep him advised of their movements.

The feature that has made telephone train despatching possible is the development of apparatus called the Selector (Fig. 5). This is an electro-mechanical device whereby the despatcher can call a way station individually, and have a bell ring in that station only, while all other stations on the line are silent. In conjunction with this apparatus, a feature is obtained whereby the despatcher is absolutely assured that he has rung the bell in the way station. This is called an "answer back," and takes the form of a distinctive buzz that is heard in his receiver.

It is quite an engineering problem to have a line say 300 miles long with forty or more way stations scattered along it and enable each way station to come in on the line and the farthest man away hear the despatcher's voice as clearly as the man nearest the despatcher, yet this is being done.

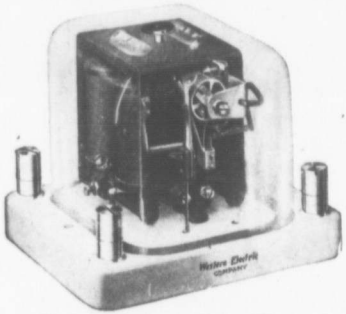

FIG. 5—STEP BY STEP TYPE SELECTOR.

FIG. 6—SPECIAL DESK STAND.

In order that you may realize the saving in time brought about by the telephone, it has been assumed by some of the roads that if from a wreck or in other cases traffic is held up, the additional expense incident thereto, amounts to approximately $1,000 per hour. On the average, with the telephone system wrecks are cleared up and traffic moving again in one-half to two-thirds of the time it is possible with the telegraph. A considerable saving, therefore, can be affected, and these features of railroading and approximate yearly figures can be arrived at by knowing the cost of suspending traffic and multiplying this together with one-third or one-half of the average time of clearing wrecks and the number of wrecks per year.

Mr. W. F. Williams, of the Seaboard Air line, has prepared information which shows that for each month on 150 miles

of single track on his road, and with a 14.4 per cent. greater density of traffic for 1910, when the telephone was used an average saving of one hour and twenty-six minutes in the running time of all through freights was affected over the same period for 1908 with the telegraph. This is a saving of time of 10.9 per cent. and will be seen instantly by computing the pay of the train crew, reduction of over-time charges, increased efficiency of the motive power, the reduction in fuel consumption, the increased safety of hauling perishable freight, etc., that on any road makes the telephone a good investment.

It is not possible to give a general figure representing in dollars and cents the value of the time saved on account of the conditions surrounding the various railroad systems. If, however, the items as given above are reduced to a monetary value on the individual system, the results obtained will be greatly surprising and in the case referred to, would represent approximately from $1,000 to $1,500 per month, or a yearly saving of at least $12,000.

Comparing the cost of the telephone equipment based on $100 per mile, which includes the cost of telephone and selector apparatus, line wire (No. 9 B. & S. copper) and installation, from the yearly saving in handling through freight traffic alone, it will be seen that the telephone will pay for itself the first year. In other terms, the yearly saving amounts to in the neighborhood of $100 per mile. Carrying this still further, we may say that for the 50,000 miles equipped on all of the railroads, there should be a difference in operating expense of approximately $5,000,000.

We have now covered the history of telephone train despatching and the adoption of the telephone, and it might be well to give you here a short description of how the calls are put through. In front of the despatcher is located what is known as a sending key cabinet (Fig. 1). In this

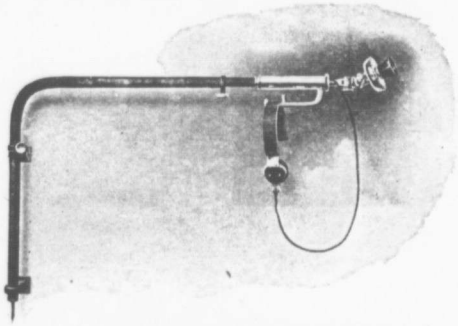

FIG. 7—SPECIAL NO. 1020A TRANSMITTER ARM.

cabinet are individual keys, one allotted to each station on the circuit. If the despatcher wishes to call a way station, he gives the key representing that station a quarter turn which sets a train of gears in motion by means of a spring motor. This sends out on the line a pre-determined number of impulses from a main line battery by means of a special telegraph relay. These impulses operate the desired selector at the way station called, its contact closes and the bell is rung. This bell can be kept ringing or stopped at the will of the despatcher. It takes from a fraction of a second to four seconds to complete any call.

There are a great many types of apparatus designed and used to meet the different conditions existing on each road, and for your information I will describe some of the different types.

First we take the standard desk stand (Fig. 6), equipped with a special switch hook to accommodate the head receiver, and place a special transmitter upon it, and when finished we have a very convenient way station set.

What is known as the No. 1020-A arm is another type (Fig. 7). This arm is being used by the Grand Trunk Railway as a standard on their circuits. It consists of a desk stand stem mounted on tubing and is generally installed so that it

FIG. 8—OPERATOR USING VAN AIKEN ARM.

swings over the desk, clearing all papers or other obstacles upon it.

A familiar type of transmitter arm to be met with on the Canadian Pacific Railway is the Van Aiken arm (Fig. 8), which derives its name from its inventor, Mr. S. L. Van Aiken, of the New York Central. The arm is arranged with an adjustable mouthpiece on the transmitter and an adjustable receiver to allow for the different sizes and shapes of faces. The switch connecting the set to the line is operated when the arm is moved to the position in which it is used by the operator. A foot switch is used to close the transmitter battery in place of a key switch is generally used on the previous mentioned arms.

There are still a great many different types of apparatus similar to these that could be described, but the space allowed on one paper will not permit of it. Each piece of apparatus has been designed to meet the special conditions which exist and change on each road, and they are so designed and arranged that they permit the operator to use both hands in order that he may write his orders and messages with perfect ease.

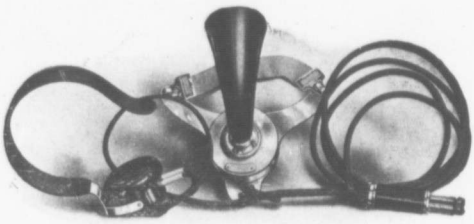

FIG. 9—DESPATCHER'S TELEPHONE EQUIPMENT.

The despatcher's equipment is practically the same on all railroads and consists of a chest transmitter supported by a band passing round the despatcher's neck, and a head receiver (Fig. 9). This apparatus is not unlike the telephone equipment worn by the operators in central exchanges, and it is connected to the circuit by means of a flexible cord terminating in a plug, which when inserted in a jack installed on the desk completes the line connection. This arrangement is provided the despatcher so that he may be able to move around at will and manipulate his train sheet. As the despatcher is listening in on the line continuously, apparatus light and easy to wear is provided for him.

When a standard telephone set is used at each end of the line, commercial transmission is said to be equal to thirty miles of No. 19 B. & S. cable, and translating this into open wire,

it is equal to approximately 900 miles of No. 8 B.W.G. copper, weighing 435 pounds to the mile.

The railroads have adopted as a standard for their despatch-

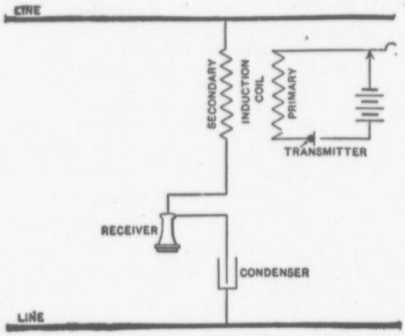

FIG. 10—FIRST FORM OF WAY STATION TALKING CIRCUIT.

ing circuits No. 9 B. & S. copper wire, firstly because of the economy derived; secondarily, it contains satisfactory tensile strength. It can now be seen by the above figures that with the use of this size wire, circuits 480 miles in length can be used before the so-called commercial transmission limit is reached.

As despatchers' circuits in Canada average approximately 135 miles and never over 350 miles, there is a considerable margin of surplus transmission available, which can be taken advantage of in arranging circuits to permit several operators listening in simultaneously. The loss sustained by the selector

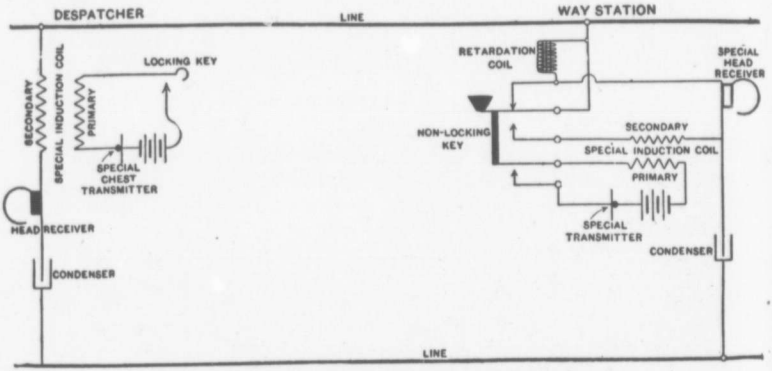

FIG. 11—HIGH EFFICIENCY TRANSMISSION SCHEME.

bridges is almost negligible, and when forty selectors are bridged across the line, it equals a loss of about one mile of cable.

The first form of talking circuit used (Fig. 10) on a despatcher's wire was the standard local battery circuit. The total impedence of this bridge to talking current is 600 ohms, 300 of which is active for receiving purposes. It is obvious when a number of these sets are bridged across the line, transmission is difficult between widely separated stations.

A great many schemes were tried to overcome this trouble such as using different types of induction coils, and raising the impedence in the receiver. It was, however, finally determined that the best results, both for receiving and transmitting were obtained by installing a switch arrangement at the way station, (Fig. 11), so that when the switch was in one position, the best possible results were gained for receiving, and when in the other, the best results for transmitting. The circuit developed is known as the "Northern Electric high efficiency transmission scheme."

On train wires equipped with this circuit, the despatcher is able to call in on the line, as many way stations as he desires and issue orders to them simultaneously, and the farthest man receives just as good transmission as the man nearest the despatcher.

There will undoubtedly arise in your minds a number of questions that we have overlooked in this paper, and I will be pleased to answer any of them.

Chairman,—

As Mr. Fairlie is ready to answer any questions I should be pleased if someone will start the discussion, without my having to call on anyone in particular.

Mr. Humber,—

One or two years ago on the electric line between Portland, Maine, and Old Orchard Beach they had in use a telephone system by which the conductor on the cars could call up and get his orders for the movement of the car, but, in one instance during an electrical storm a car stopped at one of the sidings and the conductor opened the box and put the receiver to his ear. At this moment a flash of lightning struck the wires, and he was instantly killed. Is there anything to overcome an accident of this kind so that when a conductor stops his car at a siding to phone he does not take the chance of being killed in this manner?

Mr. Fairlie,—

If an instrument is properly equipped with protectors, this danger is practically obviated. Care must be taken that proper grounds are obtained at each of these.

The pole line should be provided at suitable intervals with a means of lightning discharging to ground. Wires clipped to the pole and extending above the line wires are generally used, but care must be taken to see that a good ground is obtained by having the wire well wrapped around the butt of the pole before planting the same.

Drainage coils are also used to remove static charges from the line.

Where high tension lines are encountered the following precautions are usual.

1. Special instruments with all metal parts insulated.

2. Special protectors to cover every possible risk. These are of many forms, but should include fuses in the line that will let the telephone wires fall clear of any dangerous wires. A transformer insulated to withstand 25,000 volts is also used to prevent the instrument being directly connected to the line.

3. The telephone line should be on high tension insulators in dangerous locations and in every case be kept as far as possible from the power line. Special care should be taken with telephone lines in the vicinity of high voltage circuits, and I think it is generally understood that the telephone will not be used during severe lightning disturbances.

It should be understood that no protective apparatus can be guaranteed to absolutely protect against actual contact with high voltages. The railroad rule of "when in doubt take the safe course" will apply here.

Mr. Jefferis,—

I would ask Mr. Fairlie if there is any advantage to be gained by the use of the telephone system over the telegraph system, I mean that would prevent the train despatcher, the operator, or the crew misunderstanding the order, or the name of the station. For instance—we have a busy single track road, and we are going to make a meeting point for two trains, the train despatcher tells the operator that freight train No. 47 will meet passenger train No. 3 at such a station. Now I understand that the operator writes that down and gives the order to the conductor, if that is so, the telephone system is just as imperfect as the telegraph system. I will give you an illustration of what I mean. There were two stations, one named Somerset, and the other Summit, two fast passenger trains, one of which was on time, and the other late, were running on a single track road, the engineer of the northbound

train, which is late, stops his train for orders, and the conductor hurries into the telegraph office, signs for the order, and takes it to the engineer, and says, "Billy, we meet No. 1 at the Summit," the engineer reads the order as Somerset, and away they go at a fifty mile an hour clip, they meet the other passenger train and the result is a head-on collision. This happened just before the holidays when a large number of young people were travelling from the state colleges and universities to their homes to spend Christmas, the misunderstanding resulted in the loss of forty lives.

Now I want to know if there is any way in which the telephone system would prevent an occurrence of this kind. Would it not be better, seeing that any man can use the telephone, if, after the operator has written the message down, the conductor, who would be waiting to receive the order, repeated the message to the train despatcher, and thus check the opearator.

Mr. Fairlie,—

The telegraph superintendents of the United States and Canada have adopted a standard for the sending of messages for train despatching by telephone, whereby all numbers and names must be spelt after the number or name has been pronounced, for instance, take the following message—"Train number 98—n-i-n-e e-i-g-h-t will meet train number 27 t-w-o s-e-v-e-n at Somerset 'S-o-m-e-r-s-e-t." The standard rules state that where two letters or numbers have a similar sound the letters or numbers just previous must be called off. For instance if the first letter in the name of the station is "D," then the despatcher says, A-B-C—"D" or supposing the first letter is "O" then he would say "L-M-N—"O," etc. In that way the person receiving the message is able to locate the letter without any difficulty.

Practice shows that no difficulties of this kind have been encountered up to the present time, and there is no record of any accident having occurred through an operator when taking a message failing to correctly receive same.

After a very short period despatchers become so proficient in spelling out the words, that, to the ordinary man listening it sounds almost like jargon. An outsider listening on the line will have to pay very close attention to be able to catch the words as they are spelled out, so adept have the operators become in this method of sending messages.

Mr. Jefferis,—

I can fully appreciate the method you have described and the time that can be saved by the telephone system, also money for the company in delays, but, I was wondering if in your

experience in handling this apparatus, whether it did not occur to you that there might be a chance of a mistake occurring, a mistake that we know does happen with the telegraph system, and by having the third man read the message back it might have the tendency to prevent this mistake occurring. For instance, the message might be sent, "Passenger train No. 27 will meet freight train No. 145 at Hamilton," the operator writes that down and in place of the operator repeating the message the conductor repeats it back. What I am trying to get at is, that by having a third man there is less likelihood of any mistake occurring, as he will act as a check on the other two.

Mr. Fairlie,—

The point you mention in bringing in the third man would certainly be another check. However, the general practice of railroads, as far as we have had any experience on this continent, has been to confine the despatching to the operators. I do not know of any instance where they have felt the necessity of having a third person to act as a check on the other two. I grant you that the third person would undoubtedly be an additional check.

Mr. Jefferis,—

If we had had the third man in the case I spoke of we would probably have saved about forty lives.

There is no doubt but that the greater fault was in having two stations with similar names on the same division. I might say, that one of the names was changed soon after this accident.

Is there any difficulty where the despatcher has to make up his running time for the different classes of trains, which are not following each other closely on a single track, where he has to do some figuring, but, of course, that would apply to both systems.

Mr. Fairlie,—

He has the train sheet just the same as with the telegraph.

You will see a cut in the proceedings showing a despatcher at work with his train sheet right in front of him.

Mr. Baldwin,—

Up to two years ago this Club used to hold its picnic at Jackson's Point, and there is a gentleman here who used to take care of us. As we discontinued going there he asked a member of our Executive why we did not go back to Jackson's Point, and he told him that we got hung up a little too long on

the sidings. That gentleman is here, evidently to get some information as to a quicker method of handling his cars, so as to induce us to go to Jackson's Point next year over his road. We would like to hear from Mr. Wilson.

Mr. Wilson,—

Do you think I can say anything after that? I have been very much interested in listening to what has been said to-night in connection with telephone train despatching.

We have been using telephone train despatching over our fifty-three miles of road since 1905, giving about 500 orders a day, eighteen hours' operation.

We have met with a great many of the difficulties mentioned here to-night and are using the straight telephone, metallic circuit system. We have incoporated in that system several of our own home-made devices. We have eliminated many of the troubles incident to having too many instruments on the line by providing a cut-out key at each of the sidings that the crews use to take orders.

The despatcher calls up the station by giving a pre-determined number of rings. This is a somewhat antiquated method but we have not been satisfied until the present time that there is any better apparatus which will work, on account of the location of the telephone line in relation to our transmission wire. We have a 16,000 A.C. power line within 4 or 5 feet of the telephone line. This is the point I would like to get some information on.

I notice that you must have two dry cells to supply the current for ringing the bell in each station. Suppose, for instance, one of these cells ran down would not that prevent the ringing of the bell when desired. Would it not be possible to utilize, in case of an emergency or the running down of the dry cell, the line current to ring the bell?

Mr. Fairlie,—

We can give you a system for ringing the bell either directly from the despatcher or from the two dry cells in the way station.

Mr. Wilson,—

You have three or four stations on the line with the different operators all listening, and the despatcher is handing out orders which affect only one station. Take for example, stations five and seven drop off the line, is it going to interfere with the despatcher talking to the others, and if he wishes to call back five and seven, does he have to clear the line and begin all over again?

Mr. Fairlie,—

You can talk and ring at the same time without disturbing the conversation. The system makes it possible to accomplish this without any disturbance in the receivers of the listening operators.

Mr. Wilson,—

I watched the C.P.R. installation between Toronto and Montreal with a great deal of interest. They had considerable trouble with the first installation with selectors and as we were at that time ready to adopt something similar, I went to Chicago to look over some equipment exhibited there, and found quite a number of different types, but none of them had reached that stage of perfection where the railroad people were willing to adopt them. At the same time the selector is not a new proposition, as it has been adopted to telephone work, that is the ordinary city telephones, for some time.

In reference to the despatcher ringing up a station and listening for the buz on the wire which you spoke about as indicating that the bell had been rung, would it not be possible for an instrument placed at a way station to have become charged by lightning and the contacts carbonized so that the despatcher might hear the buz on the wire and think that he had rung the bell at the station and all the time the bell had not rung?

Mr. Fairlie,—

That would hardly be possible Mr. Wilson, because the contact is in the bell, and hence a separate circuit from the line. Unless the bell hammer is hitting the gong there is no possible way of getting the answering buzz.

Mr. Wilson,—

We have experimented quite a bit with portable transmitters and receivers, but we have adopted a system of boxes, these are old patrol boxes bought from the City of Toronto, which we have placed along our right of way. I might say we also have portable sets, which are carried on the cars. In the boxes we have done away with the hooks which necessitated the lifting down of the receiver and have placed in them stationary receivers which come immediately opposite the transmitter, and we find by this means that we have saved a lot of maintenance.

Mr. Fairlie,—

The iron box I spoke to you about seems to me to be the

one that would meet your case. It has a minimum of moving parts and double doors. The front door is locked with a switch lock, and the interior door has an ordinary screw lock.

Mr. Wilson,—

The point I was leading up to is that of maintenance. The question of maintenance is the one on which the installation of a new system is based. It is an easy matter to get money for the first installation, they do not care what it costs at the present time, but what is it going to cost to maintain after you have got it? Years ago it was the other way about, the question then was, "What was the initial cost?" That day is gone, and they do not ask what is the first cost, but what is the cost of maintenance, and I shall be pleased to have your opinion on this?

Mr. Fairlie,—

The majority of the installations are equipped to ring with the two dry cells at the way stations because it is always necessary to have the batteries for the telephone. The maintenance man can then renew the one set while attending to the other.

Mr. Wilson,—

We found that the dry cells were too expensive.

Mr. Fairlie,—

In connection also with maintenance, the selector has been given the most severe tests. As telephone train despatching has really only been in operation during the last three years, we were desirous of knowing how long the selector apparatus would stand up under actual operating conditions. Repeated calls were sent over a test line to see how many calls the selector would respond to before it would show any signs of wear. The selector was taken off after having answered a million and a quarter calls and had not developed any weakness. From statistics taken from different roads this would mean about twenty-nine years of trunk line service.

Chairman,—

Mr. Wilson, you can take it from me that we will go to Jackson's Point next year.

We would like to hear from Mr. McKenzie.

Mr. McKenzie,—

As it is getting rather late and this is a subject we could speak on all night, I think we had better make another night of it.

Chairman,—

We have with us Mr. Fox, Chief Despatcher of the Canadian Northern, perhaps he would like to say something.

Mr. Fox.—

My connection with train despatching has thus far been confined entirely to the use of the telegraph for this service, and I am, therefore, not in a position to speak from experience on the probable advantages of the telephone over the telegraph for despatching purposes. I have, however, frequently been allowed to listen on the C.P.R. and Grand Trunk circuits from Toronto and from the knowledge so obtained and information gathered from those using the system I have formed the opinion that the telephone has numerous advantages over its older and dutiful brother—the telegraph.

In allowing that one may fool some of the railways some of the time we must admit that not many of them can be hoodwinked much of the time and the fact of so great a number of the larger roads having recently supplanted the telegraph by the telephone as its despatching medium is surely one of the strongest arguments in its favor.

Here permit me to draw attention to your Mr. Jeffries' remarks in connection with the train wreck he mentioned. As I understand the occurrence the crew of one train are supposed to have mistaken verbal instructions received regarding their meeting point with another train, there being a similarity in the names of two stations close to each other. Under present operating rules verbal instructions are entirely removed from anything in connection with the handling of train orders; no train collisions are possible unless glaringly disgraceful violations of very important rules are indulged in. All regular trains are shown on a time table, a copy of which must be in the possession of every man in train service when on duty. On this time table is shown the time of trains at different stations and trains cannot leave these stations ahead of the time shown opposite. The time table also makes certain direction trains superior to others in the opposite direction. On Canadian railways and the majority of others, south and eastbound trains are superior to north and westbound, for instance, a first-class passenger train running from Detroit to Toronto is superior by direction to a train of the same class running from Toronto

to Detroit. A despatcher in issuing an order for two such trains or any others to meet is required to first send the order to the operator receiving it for the superior train. If an operator is located at the station where the trains are to meet the despatcher must next issue the order to the operator at that point and it is then lastly sent to the office receiving it for the inferior train. Every station at which an operator is employed is equipped with what is known as a "train order signal," which is displayed at right angles to the main track by the operator before he may accept an order for any train. When in this position no train may pass until it has received the order for which the signal was displayed—after a despatcher has transmitted an order those receiving it repeat it back to him word for word —he checking its correctness—in addition to this check each operator receiving the order should also check and if necessary correct the others repeating. It is thus seen that an order is checked by four different responsible persons before it is delivered to the trains affected. The conductor of the train to which the order is addressed must before he signs it read it aloud to the operator and also must have the engineer repeat it to him (the conductor). On arrival at the station where the meet is to take place another copy of the same order is delivered to the trains by the operator at that point who is required to ensure the fulfillment of the meet. These requirements are stringently enforced, no shadow of anything tending towards laxness in any shape is allowed and the entire method is most carefully supervised by efficient, experienced officials. Under these conditions we see the absolute impossiblity of the miscarriage of instructions unless as before mentioned some gross trangression of the rules which all employees in train service are required to write and also explain verbally their complete understanding of is committed. "Accidents will happen," but statistics show only a very small proportion indeed of them occasioned through a misunderstanding of train orders. I mention the method of handling merely to show that the manner of handling the instructions for the trains Mr. Jeffries mentioned was a flagrant violation of most important rules.

All must agree that in the responsible matter of train despatching reliability is without question by far the most important requirement and here I believe the telegraph measures up to, if indeed, does not surpass the telephone. Every letter in the Morse aphabet is composed of a certain number of different characters. In the word, "Hamilton," for instance, the "H" is made up of 4, the "A" 2, "M" 2, "I" 2, "L" 1, "T" 1, "O" 2, and the "N" 2; 16 in all as against only 8 on the telephone—the word "Winnipeg" has 20 Morse characters, "Vancouver" 25, and there is no word that is not built of more Morse than telephonic characters; none of the digits have less

than four distinct characters and while these facts might be advanced as an argument showing a reliability of the telegraph over the telephone I believe that if it is an advantage it is offset by, under regular conditions, the absolute distinctness of transmission over telephoning despatching circuits.

Mr. Fairlie,—

I would like to say that the points brought out by Mr. Fox are all good ones. He spoke of the different characters necessary to form each letter, he said that in transmitting the word "Hamilton" there were four characters for the "H," so many for the "A," and so on. Now with the telephone system there is very seldom any difficulty in hearing distinctly every letter or word that is said so that instead of having to use four characters for the letter "H" all you have to do is to just simply say "H."

Mr. Fox,—

Before having listened on telephone despatching circuits I must admit that I could not believe it possible to have obtained so perfect a speaking adjustment on it. I have distinctly heard the snap of a match struck about one foot from in front of a receiver nearly one hundred miles distant from the instrument at which I was stationed. Aside from this the telephone carries the very great advantage of offering direct verbal communication with a desired person, especially is this highly desirable in cases of derailments, washouts, etc., when it is possible to if necessary ascertain from any certain one there required information instead of as on the telegraph it being necessary to obtain this through an operator who cannot grasp the salient points of a despatcher's questioning; much time is lost in this and other ways and expensive train detention necessarily follows. "Time is money," and by the elimination of this waste I am convinced the telephone will soon pay for its installation and maintain its cost of operation.

Let us not, however, slander the telegraph's good reputation; nobly and well has and is it performing its duties; praise its past and pity its future for slowly, but surely it is retreating before the advanced of its modernized successor until I venture the prediction that in a few years hence its past almost incessant and even yet, in some sections, familiar chatter will no longer be heard as far as its relation to train despatching is concerned, except on those smaller roads who for financial or "let good enough alone" reasons, have not seen their way clear to follow in the wake of their more progressive competitors.

As I understand the matter of calling stations by telephone

it takes ten seconds to get each office in on the line. For instance if it was desired to have eight stations on the line at once it would take eighty seconds to get in communication with all. I should be glad to know if this is correct?

Mr. Fairlie,—

It is possible to call a station in from two to three seconds. This is an average time for divisions of ordinary length. Where a number of consecutive stations are to be called this time may be much reduced by using the strap key to call the different stations after the first station bell has rung. In this way only the calling key for the first station desired is operated by the despatcher.

Mr. Newman,—

I have listened with a great deal of pleasure to this discussion on a live subject, and while I am not a railroad man, I believe after listening to this excellent paper I could despatch a train myself. I have great pleasure in moving a hearty vote of thanks to Mr. Smith also Mr. Fairlie for his work to-night.

Seconded by Mr. Jefferis. Carried unanimously.

Chairman,—

As the election of officers for the year 1912 takes place next month it will be necessary to select a Nominating Committee to-night, who will nominate officers for 1912, between now and the next meeting, and present their names to you to be voted on.

The following committee was selected:

W. C. Sealy, General Foreman, G.T.R., Toronto.

E. Logan, Foreman, G.T.R., Toronto.

C. A. Jefferis, General Superintendent, Consumers' Gas Co., Toronto.

J. Wright, Foreman, Gurney Foundry Co., Toronto.

A. M. Wickens, Executive Special, Canadian Casualty and Boiler Insurance Co., Toronto.

J. Herriot, General Storekeeper, Canada Foundry Co., Toronto.

Moved by Mr. Fletcher, seconded by Mr. Herriot, that the meeting be adjourned. Carried.