Record Snowstorms Paralyze Transportation

Transportation Industry Through the Entire Central West Completely Tied Up; Methods Used by Signalmen to Move Traffic

THREE of the severest snowstorms in history have swept over the central west during the past month, paralyzing transportation for from 24 to 48 hours each time. The first storm was accompanied by a snowfall of nearly 15 in., which constitutes a record for Chicago and tributary territory and was confined largely to a zone within 100 miles of that city. It started west of the Mississippi River late in the evening of Saturday, January 5, and at Chicago the velocity of the wind was about 55 miles an hour. The railroads were forced to annul most of the passenger trains scheduled to leave Chicago on Sunday, January 6, and all incoming trains were late.

Hardly were the rails and yards cleaned of snow when the second storm passed over the same section of the country. It began on Friday evening, January 11. The snowfall was not so heavy, a maximum of about eight inches and in many localities not exceeding three inches, but the gale was as bad if not worse and of longer duration. Passenger trains throughout the storm area were stalled and passengers were forced to billet in warehouses, country stations and small rural hotels. The less fortunate had to remain in the trains, in some cases after the car-heating facilities gave out. Many important trains could not be moved for from 24 to 48 hours. Some, which left Chicago Friday evening, January 11, were recalled when it became apparent that they could not proceed, but the return trip in some instances took all day Saturday and Sunday.

Thousands of men were hired and others were drafted from all railroad departments which could spare men to clear the tracks. The Chicago, Burlington & Quincy employed all its freight handlers, freight clerks and draftsmen to shovel on January 14. Other roads took similar measures. Because of the difficulty of obtaining men for this work, some Chicago roads paid as high as $1 an hour for common labor. Rotary snowplows were put in work, but as long as the storm lasted these progressed with difficulty. On Sunday morning, January 13, a plow and a locomotive were derailed near Corliss, Wis., on the Chicago-Milkaukee line of the Chicago, Milwaukee & St. Paul.

Practically no trains were run on the 12th and 13th, but passenger service was resumed on something approaching normal schedules on January 14. Chicago suburban trains which attempted to fight the storm Friday night were stalled in snowdrifts, forcing commuters to spend the night in the cars except when rescued by farmers, who broke through the drifts with sleighs and bobsleds. Chicago offices, stores and factories were operated with depleted forces on January 12 because of the failure of all suburban trains, electric interurbans and street railways.

The first break in Chicago's isolation from the East came when the Twentieth Century Limited on the New York Central arrived at 10 a. m. Sunday, a little over 24 hours late. The New York-Chicago Limited on the Baltimore & Ohio, due at 9 a. m. on Sunday, the 13th, did not arrived until 1:30 p. m. on Monday. The Manhattan Limited and the Mercantile Express of the Pennsylvania, due in Chicago on Saturday afternoon, arrived Monday. These trains were held at Mansfield, Ohio.

No freight service except the movement of coal and perishables was attempted until Monday, January 14. The Illinois Central delivered coal at team tracks in Chicago on Sunday, although hardly a wheel of a passenger train moved. A small amount of milk in cans reached the city over the Chicago & North Western on Monday morning, the first to come in over that road since Friday. Milk deliveries in the city on the 14th were confined to families with babies and even some of those had to do without. Coal movements were greatly impeded everywhere. The Illinois State Fuel Administration commandeered for domestic purposes all coal in Chicago railroad yards. Even some of the railroads were seriously affected by the coal shortage. The Chicago Great Western and the St. Paul were not able to resume normal operation until they received additional coal. The former road operated only about 50 per cent of its passenger trains on Tuesday, January 15, and the latter line cancelled an unprecedented number of trains to conserve its fuel. Many large industrial plants in the Chicago districts were forced to close on January 14 because of the shortage of fuel and the difficulty of delivering that already in the terminals. Among them the steel mills in the Calumet region and three Chicago packing plants.

The second storm affected a larger area than the first one, extending as far south as Memphis, Tenn., west nearly to Omaha, Neb., and east beyond Cleveland, Ohio. In southern Illinois there was considerable sleet, which did much damage to railroad wires. The Chicago & Eastern Illinois had its telegraphic communication largely cut off. In the main path of the storm, however, the wind carried a fine, dry snow, which was especially hard to handle because it was blown back over the rails as fast as it was removed.

William G. McAdoo, director-general of railroads, telegraphed on Monday, January 14, to R. H. Aishton, chairman of the central department of the American Railway Association, expressing his distress at the inconvenience and suffering which the blizzard brought to the people in the west and central west and calling for the use of every possible means to overcome the situation and restore railroad service at the earliest possible moment. In reply, Mr. Aishton assured Mr. McAdoo that every possible means was being used to restore normal service, particularly the movement of coal. "All employees stuck to their tasks of keeping transportation moving as long as it was humanly possible to do so. Every available man was employed in the moving of snow. Through passenger service in the Chicago district resumed nearly normal operations this morning. Very good success obtained last night in placing coal in Chicago territory. Every man that can be spared from any other class of work is being used to remove snow from tracks in yards so that all transportation may be resumed at the earliest hour possible. You may feel assured that absolutely nothing is being left undone by officers and employees to restore full normal transportation."

The third blizzard invaded the central west on January 26, but, luckily for transportation, it disappeared on the following day. The storm was sufficiently severe, however, to delay the arrival of trains in Chicago on

Sunday evening of from one to six hours and to cause the annullment of a large number of passenger trains scheduled to leave the city that night. Conditions improved to such an extent on the following morning that tracks and yards were soon cleared of snow.

The flow of coal into the Chicago terminal district was uniformly heavy during the week ending January 26, as 9,933 cars of coal and 823 cars of coke were received therein.

Practically no traffic was delayed during these storms due to the failure of operation of automatic signals and interlockings. No attempt was made during any of the storms to keep other than the main line switches, or switches leading into yards that were being used, open at the various interlockings in or near Chicago. The snow was light and in most cases easily removed and as the signalmen were informed of the movement of trains, it was therefore not necessary to keep all switches and derails in operating condition. A number of section laborers were retained at each interlocking to shovel the snow from the movable apparatus and the keresone blow torch was found to be the most efficient means of keeping same in operating condition after the greater part of the snow had been removed. When traffic was suspended entirely, little outside work was done by the signalmen and the operating department informed them far enough

Ready for Emergencies
Shipping Snow
"Double Heading"
The Snow Melters at Work
Using Compressed Air
Clearing the Tracks
Opening Up the Line
Using the Kerosene Burners
After the Run

in advance of the movement of trains to allow them to get such functions as were necessary for immediate use in operating condition again. The Chicago & Eastern Illinois, in the territory between Chicago and Danville, and the Chicago, Indianapolis & Louisville, on its lines south of Monon, Ind., had line wires broken.

The Chicago & North Western, at their Lake street terminal, installed two flood lights on the Chicago & Oak Park elevated structure crossing overhead near the Lake street tower and also installed one headlight on the tower itself. The lights used were on 110-volt circuit from the power house and were equipped with 1,000-watt nitrogen lamps. It was found that these lights proved very helpful in connection with the removing of snow during the night. In addition to laborers cleaning the snow from the tracks at various points on the terminal, the signalmen made connections to a main air pipe line with a rubber hose and by use of a 4-ft. length of 3/8-in. pipe as a nozzle with air at 100-lb. pressure, proceeded to blow the ice and snow from the switches, switch points and movable point frogs. At the Lake street terminal 29 switches, 23 double slip switches and 23 movable point frogs were cleared in this way in three hours' time. The snow melters installed at this place performed excellent service in disposing of the snow.

Heretofore it has been found necessary during cold or freezing weather when switches begin to throw harder than under ordinary conditions, to start up the generators for boosting the voltage on the storage batteries to care for the additional overload. This practice can be eliminated by the application of a mixture of five gallons of kerosene oil with three quarts of black oil to all movable parts of the switch points after the snow has been removed and the kerosene blow torch used.

The Baltimore & Ohio Southwestern and the Chicago, Burlington & Quincy fitted up some switch engines in various terminals with steam hose to clear the switches and derails around interlocking plants.

IMPEDANCE OF A TRACK RELAY TO OBTAIN MAXIMUM ENERGY

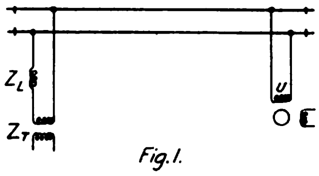
By C. F. Estwick

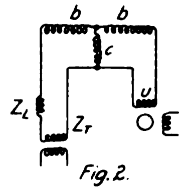
The determination of the most satisfactory value for the impedance of a track relay requires careful consideration of the various conditions met in service to produce positive and reliable operation and certainty as regards shunting of the relay. On account of the inefficiency of the track circuit as a means for transmitting energy from the transformer or other source to the relay it is advisable to take advantage, to the greatest extent possible, of the energy in the circuit and it is also desirable from an economical point of view to use the available energy efficiently. It is not the intention of this article to consider all conditions affecting the operation of the relay but to show how to determine what the impedance of the relay should be to obtain the greatest amount of energy for its operation.

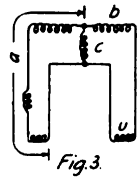
A general principal in regard to energy in an electric circuit may be stated thus:—To obtain the maximum energy in a portion of a circuit the internal impedance in that portion of the circuit should be equal to the external impedance, the latter containing the source of energy. The following proof is given to show how this principle can be applied to the track circuit and how the impedance of the circuit external to the relay should be measured.

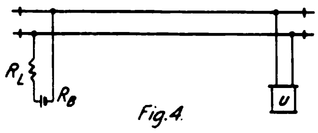
Figure 1 is a diagram of an alternating current track circuit used on steam roads in which Z_T is a limiting impedance or resistance, Z_L is the impedance of the secondary winding of the transformer and u represents the impedance of the track phase of the relay.

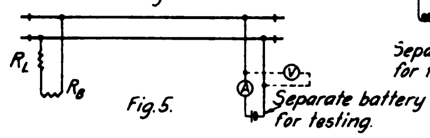
The track section in a complete circuit may be replaced, as far as terminal conditions at either end of the section are concerned, by an equivalent combination of

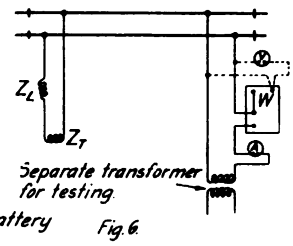












impedances. The circuit in Fig. 2 shows the section replaced by its equivalent "T" combination composed of impedances b, b and c. Fig. 3 is the same circuit simplified by combining the impedances b, Z_L and Z_T so that $a = b + Z_L + Z_T$. (These are vector values.)

Let E = the r. m. s. vector value of the potential developed within the secondary winding of the transformer at any instant.

I = the r. m. s. vector value of the current from the transformer at the same instant.

And i = the r. m. s. vector value of current in the relay also at the same instant.

Then by Ohm's law, applied to vector quantities,

$$I = \frac{E}{a + \dfrac{c\,(b+u)}{b+u+c}} = \frac{E\,(b+u+c)}{ab+cu+ac+bc+cu}$$

and

$$i = \frac{E\,(b+u+c)}{ab+au+ac+bc+cu} \times \frac{c}{b+u+c}$$

$$= \frac{\mathrm{Ec}}{ab+ac+bc+(a+c)\,u}$$

For simplicity, let $m = ab + ac + bc$ and $n = a + c$.

Then $i = \dfrac{Ec}{m + nu}$ or, if $k = \dfrac{m}{n}$

$$i = \frac{Ec}{n}\left[\frac{1}{k+u}\right]$$

The quantities expressed in italics are vectors which represent both phase and magnitude, whereas the corresponding values expressed in Roman characters represent the r. m. s. magnitudes as real quantities without considering the phase relation.

The magnitude of the current in the relay may be obtained by adding the terms in the denominator within the parenthesis trigonometrically and by representing the phase angle of k by α and of u by ϕ,

thus: $$\mathrm{i} = \frac{\mathrm{Ec}}{\mathrm{n}} \cdot \frac{1}{\sqrt{\mathrm{k}^2 + \mathrm{u}^2 + 2\mathrm{ku}\, cos\,(\phi \sim \alpha)}}$$