

Left — Automatic telephone exchange equipment in the office at Markham Yards. Below — Telephones are provided at all offices and locations where needed



Illinois Central Uses

Automatic Telephone System

on Chicago Terminal Area

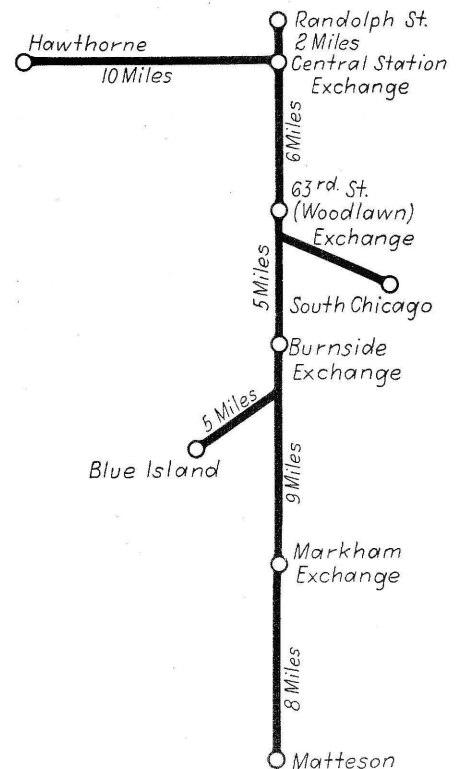
All railroad inter-communications handled on private system which, at a minimum operating expense, has capacity for normal operations as well as peaks

IN THE general offices of the Illinois Central at Chicago, as well as throughout the Chicago Terminal area, telephone communication, between parties within the Illinois Central organization, is all handled over a railroad-owned private automatic telephone exchange system. The area involved extends from the yards just south of the Chicago river, southward 34 miles to Monee, Ill., westward 15 miles to Broadview, Ill., and the South Chicago and Blue Island branches. This terminal division includes 54 miles of line, involving 253 miles of main track and 334 miles of yard and other track. A total of 200,000 train miles of scheduled suburban trains are operated in an average month, in addition to regular through trains, extra trains, transfer moves and switching operations. Approx-

mately 8,000 persons are regularly employed by the Illinois Central in this area.

A total of 1,369 telephones are connected in this inter-communication system. In so far as time and energy can be saved by telephone conversations, the basic objective of this system is to make telephone communication available between any two persons regardless of their locations in various offices or out on the line. A telephone, connected to the automatic system, is provided on the desk or in the office of every person who may have occasion to converse with any other railroad employee on the entire terminal area. Likewise, telephones are provided in all stations and on station platforms, as well as at many of the outlying hand-throw main-line switches and at each of the principal signal bridge locations. Loud-sounding bells or horns are provided on the telephones at outdoor locations, so that any employee working in the vicinity can be called.

In numerous instances cars are interchanged at frequent intervals be-



tween yards of the Illinois Central and yards of other connecting roads in the Chicago area. In order to facilitate communication concerning such matters, telephones connected to the Illinois Central automatic system are provided in the offices of certain yards on other roads.

Thus, in this railroad-owned automatic system, telephones can be justified at all locations where they may be used regularly or only in emergencies, this being true because the expense for maintenance and operation of the telephone service is economical and does not increase in direct proportion to the number of telephones provided. With plenty of telephones and automatic exchange equipment capable of handling all calls promptly, all phases of railroad operations are expedited. Men of supervisory capacity can keep in touch with their employees throughout the entire area, which is a decided aid in contributing to efficient and economical supervision, especially in cases of emergency.

"Inside" and "Outside" Telephones

The telephones connected to this private automatic system are for communication between persons "inside" the Illinois Central organization only. Other telephones connected through manually-operated boards are provided in the railroad offices for communication with parties "outside" the railroad organization. At first thought this might seem to be an unjustified duplication of telephone equipment, but such is not the case. Only 842 telephones, arranged for connections to outside parties, are required, as compared with 1,369 telephones in the railroad inter-communication system. In terms of conversations, about 15 per cent of the total number are with outside parties, as compared with 85 per cent between parties on the railroad.

Traffic department representatives as well as others who have business with the general public are provided with an "outside" telephone as well as a "railroad" telephone. When a shipper or prospective passenger requests information from a traffic representative, which requires a second conversation within the railroad organization, the outside party is requested to hold the line for a minute while the representative obtains the information over the railroad telephone system. The result is that the outside party gets his answer promptly, without breaking his connection or waiting for the traffic man to call him back.

In addition to the outside telephones in the traffic department, such tele-

phones are provided in the offices of various officers who communicate frequently with outside parties. The outside telephones are of the automatic type, and when a person wants to make a call he asks the operator at the Illinois Central manual board for an outside line, after which the person making the call dials the number wanted.

Another justification for the railroad inter-communication, separate from the outside telephones, is that the railroad system must be capable of handling peak volumes of calls without, in any way, interfering with the outside telephones used for handling conversations with the public.

Variations in Number of Calls

In an automatic telephone system of this character, maximum capacity is available at all times. Some of the telephones, such as in the car service bureau, may be busy a large percentage of the time, while telephones at outlying points, which were provided primarily for emergencies, are used only in such instances. For example, the calls per telephone for a month may average about 360 in the general offices, but this average is 739 in the Markham yard area. Telephones in some offices may be used only during regular office hours, whereas the telephones in yard offices and roundhouses are used at practically the same rate throughout every 24-hour period. The total number of calls handled by the system as a whole increases during a week to a maximum on Friday. On one occasion during a snow storm, 9,000 calls were handled by 150 telephones in a 24-hour period. On the system as a whole, during a peak demand of two hours duration, 1,800 calls were

handled in excess of the normal average for that period. An average of 430,000 calls are handled by the system in a normal month, but, if a few peak days are included, this total has exceeded 500,000 calls.

Thus the variations in demands for telephone communication can be met at any time by the automatic telephone system, without delays and without attention on the part of attendants or manual operators. Obviously if manually-operated exchanges were used, it would be impossible to call in a sufficient number of operators to handle unexpected peak requirements for telephone service brought about by an emergency or train congestion in a terminal such as that at Randolph street during peak periods when trains depart on 30-seconds headway.

Sudden peak demands for telephone communication as explained above are peculiar to railroad operating conditions, and the installation on the Illinois Central was designed and is maintained to meet such demands so that the only circumstance which prevents a party from being connected to the party being called is that the telephone being called is busy.

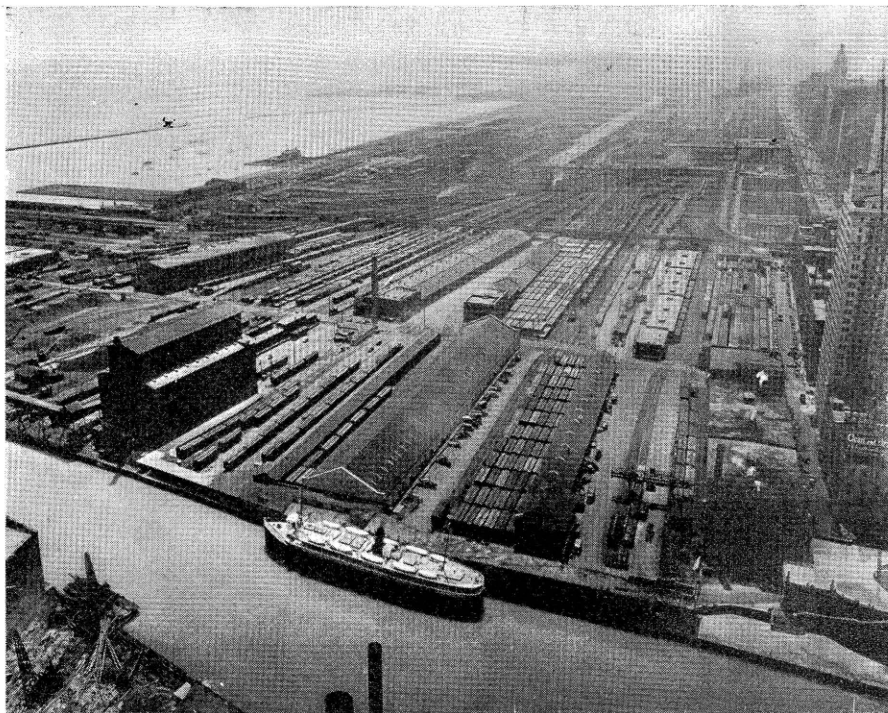
Four Automatic Exchanges

In the Chicago Terminal area the railroad inter-communication telephone system includes four automatic exchanges. The Central exchange in the general office building at 12th street serves 663 telephones, about 400 of which are in the general offices and passenger station building, the remaining 263 telephones being at various locations between the Chicago river on the north and 26th street on the south. A second automatic exchange in the Woodlawn Station building serves 308 telephones located in offices and the Illinois Central hospital in that vicinity, as well as at various points between 26th street and 75th street on the main line and on the South Chicago branch between 72nd street and 91st street in South Chicago. The Burnside exchange at 95th street serves 180 telephones in the shops and at various locations between 75th street and 130th street on the main line as well as on the branch



Outside telephones, at signal, bridges and outlying switches, are useful in cases of emergency, and also to keep touch with foremen at work on road

View from the Chicago river looking south and showing a portion of the busy Chicago Terminals division of the Illinois Central Railroad



line from 119th street to Blue Island, Ill. The fourth automatic exchange at Markham classification yards serves 218 telephones in these yards, as well as between 130th street on the north and Monee, Ill., on the south. The telephones and the automatic equipment in these four exchanges were manufactured by the Automatic Electric Company, Chicago, Ill.

Although the private automatic system includes four exchanges, the users of the telephones are not aware of this fact because the exchanges are interconnected as one composite system. Each telephone is assigned a number consisting of four digits. Regardless of whether the station being called is for a telephone in the same or a different exchange, the connections are completed by dialing only four digits.

Capacity Determined by Trunks

One factor in determining the capacity of this telephone system, as a whole, is the number of circuits, otherwise known as trunks, between the four exchanges. In a typical month when 239,219 calls were made from telephones in the Central exchange, only 22.6 per cent of these calls required the use of trunks to other exchanges, whereas of the 98,892 calls made through the Woodlawn exchange, 55.4 per cent were trunked, and of the 65,163 calls through the Burnside exchange, 61 per cent were trunked.

Each trunk consists of a pair of wires which can be used when establishing a call in either direction. Eleven such trunks extend between Central and Woodlawn, 9 between Central and Burnside, 8 between Central and Markham, 6 between Woodlawn and Burnside, 5 between Woodlawn and Markham, and 6 between Burnside and Markham. Automatic counters record the number of calls handled over these trunks. If the traffic increases such that calls cannot be completed because all the trunks between any two exchanges are busy, then additional trunks can be cut into service. If the demand for trunks ever increases beyond the number of

pairs of wires available in the cables, additional capacity can be obtained by using the existing quadded conductors for phantom service providing 50 per cent additional service; these trunks may be "composited," thus permitting three calls and conversations simultaneously over a total of two pairs of wires.

In the area north of 99th Street the circuits outside the buildings are in paper insulated lead-covered cables run in vitrified clay multiple duct lines. The wire sizes are such that the volume of transmission of speech is within practicable limits, regardless of whether the two telephones involved in a call are in the same building or at the two extreme ends of the entire terminal area.

In order to prevent interference between calls from telephones numbered in the same "hundred" within an exchange, a study is made frequently to determine the number of calls made on certain telephones, and those which handle many calls are grouped in the same hundred with those handling fewer calls. By constant study of changing conditions affecting use of the telephone, and making connection changes accordingly, the occasions for failure to complete a call due to inadequate capacity of the system are rare.

Maintenance to Render Reliable Service

As an important factor contributing to the reliability of the telephone service, this system is tested regularly and is well maintained so that the actual

failures of apparatus are relatively few. All the trunks between exchanges are given a service test before office hours each morning. By use of a test set in an exchange, the maintainer can determine whether a call can be completed through to any telephone, and tests of this nature are made frequently, especially to the outdoor telephones at outlying locations. No one has any hesitancy in reporting a failure to complete a call. In a recent month in which 429,235 calls were completed, there were only 112 instances in which failure to complete a call was reported. Two of the failures were the result of a receiver having been left off the hook. In 20 instances the connections were O.K. on the test, which points to the possibility that the party failed to dial properly. Fourteen of the 90 actual failures of equipment in the month were due to operation of protective devices such as arresters. This left only 76 failures which could properly be charged to faulty design or maintenance. Of this total, 18 of the failures were in cables outside the exchanges, 10 were in line and drop wires, 41 were in the telephone sets including cords, and only 7 failures were in the exchange apparatus.

In the Woodlawn exchange, serving 308 telephones, there were a total of 21 cases of trouble during the typical month. An average of 321 calls were made on each telephone, the cases of trouble per telephone were 0.068, and the calls made per each case of trouble were 4,709. For the system as a whole, the calls per each case of trouble were 3,882.