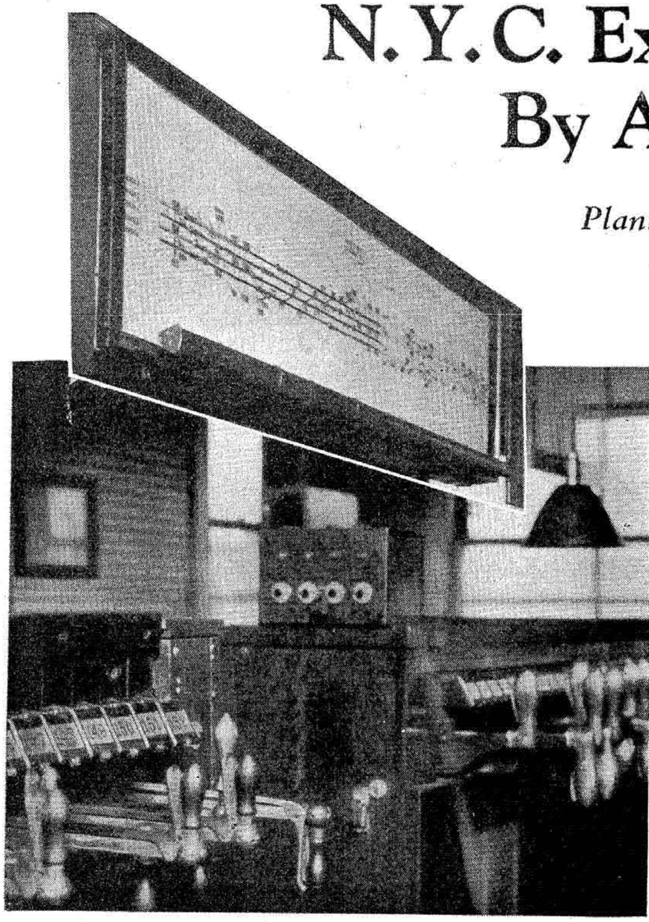
N. Y. C. Expands Electric Plant By Adding 48-Levers

Plant at 16th Street in Chicago is one of the earliest in the country—Heavy traffic on four-track line



The old machine at the left—New one at right

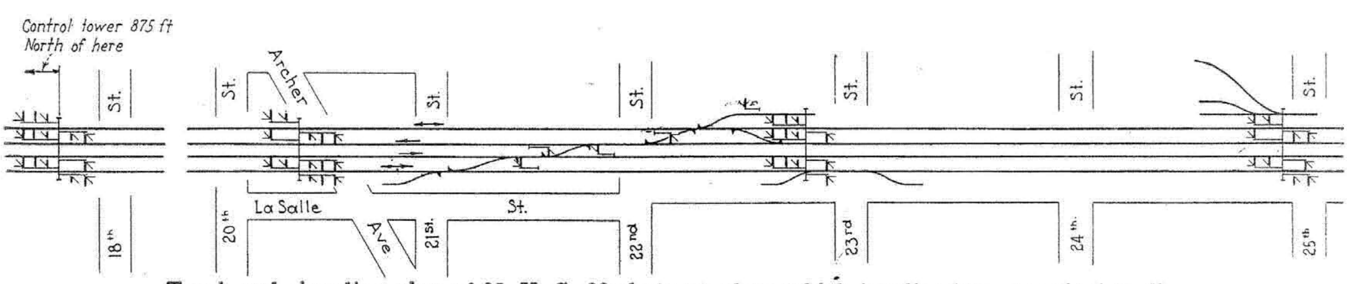
A RECENT extension of the 16th street electric interlocking plant of the New York Central at Chicago, to take care of crossovers located immediately south of the old plant limits, is of unusual significance because of the fact that the original installation is one of the first G-R-S electric installations using the principle of dynamic indication in the United States. The original G-R-S 152-lever Model-2 machine was placed in service at 16th street in June, 1901. To take care of the crossovers and industry switches in the vicinity of 22nd street, an additional interlocking plant has been installed with a 48-lever machine located in the same interlocking tower. In order to avoid confusion in this article, the new plant will referred to as the 22nd street interlocking plant.

This section of railroad is a very busy four-track line, the daily average of train movements running close to 600. The individual tracks in this four-track system are numbered *2, 3, 4* and *5*, beginning with the easterly track of this north and south line. Tracks Nos. 2 and 5, that is the two outside tracks, are fully equipped with signals for either-direction operation. Track No. 3 is signaled only for northbound movements into the LaSalle street station. Track No. 4 is signaled only for southbound movements out of the station. In addition, all of the Illinois Central passenger and freight movements on this railroad's western line, as well as all freight train movements on what is known as the St. Charles Air Line are also handled from the 16th street N. Y. C. interlocker. The I. C. and St. Charles Air Line tracks cross in an easterly-westerly direction immediately south of the interlocking tower. All switching movements on the Illinois Central tracks east of the New York Central right-of-way as far as Dearborn street, which is about 1,800 ft. east, are handled by the towerman at 16th street.

Tower Reconstruction

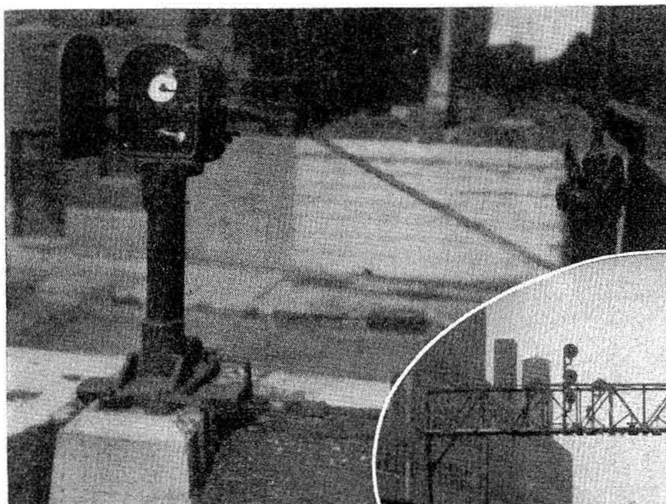
In order to provide room for the addition of a 48-lever G-R-S Model-2 unit lever type of electric interlocking machine, it was necessary to pull out the south wall of the tower and build an addition. The new 48-lever machine is located a few feet south of the old 152-lever machine and there is no mechanical or electrical connection between the two machines. In effect, they are operated as two distinct interlocking plants, the control levers in the new machine being operated by the levermen in addition to those in the 152-lever machine which comprised the original 16th street installation. The control levers in the new machine are numbered consecutively from 153 to 200, thus there can be no confusion in lever numbers between the two machines.

One of the noteworthy features of the new G-R-S machine is the type of cross-protection relay used. In contrast to the old practice of carrying the control for the main power circuit breaker of the interlocking plant through the individual contacts of the polarized relays installed on the switch and derail levers, the new machine is so arranged that the cross-protection relays, as they are called, break only the individual switch or derail machine circuit. Moreover, should one of the cross-protection relays open, the fact is

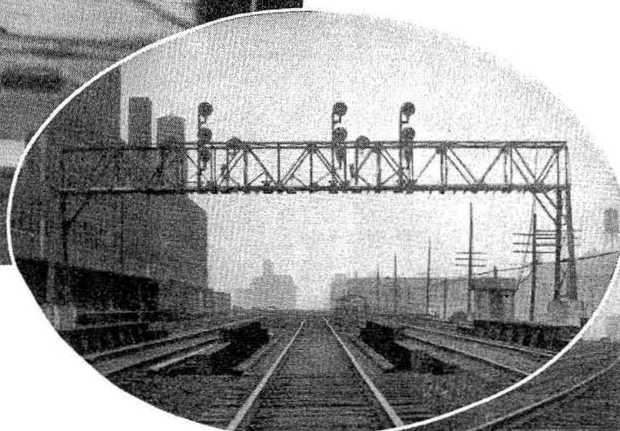


Track and signaling plan of N. Y. C. 22nd street plant which handles busy terminal traffic immediately indicated by a red lamp located above the corresponding detector lamp in front of the machine so that a maintainer can locate the relay which is open. This is considered a distinct improvement from a maintenance standpoint. Approach and sectional route locking is provided, the latter permitting a switch to be operated after a train has cleared the particular release section.

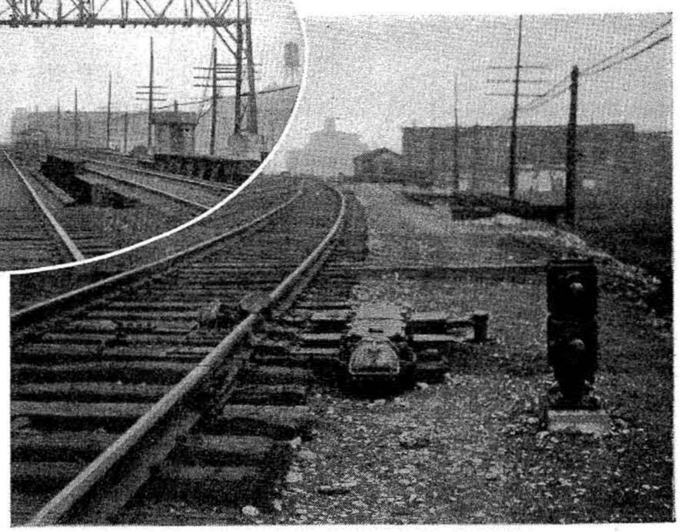
Above each lever in the machine, an illuminated number plate is provided, which, in the case of switch or derail levers, is lighted up whenever the switch or derail lever is locked. When the towerman has lined up a particular route, all of the switch levers affected will be indicated by the illumination of the numbers above the corresponding switch levers. As fast as any of the sectional release locking functions to release switch levers behind a passing train, the fact is immediately indicated by the number plates darkening. In the case of the signal levers, the illuminated numbers indicate when the signal is clear.



One of the electric switch locks on an outlying switch —This is under control of 16th street towerman



Oval—One new signal bridge was added



Below—G-R-S Model-5A power switch and dwarf signal

Illuminated Track Diagram

Suspended from the ceiling above the machine is an illuminated track diagram showing all of the switches, derails and signals involved in the 22nd street plant. The only indicator lights on this diagram are those that repeat the track circuits. The control is so arranged that the track sections are illuminated when the trains are on the particular sections. At night the track diagram can be illuminated by means of trough lighting installed along the lower edge of the diagram. The track diagram was constructed in the signal department shop at Elkhart, Ind. Two manipulation charts are provided, one on each side of the illuminated track diagram, the one on the left being for northbound movements and the one on the right for southbound movements.

It is significant that the 110-volt, 200-a.h. Gould storage battery in the 16th street interlocking tower, had ample capacity for the operation of the additional functions involved in the new 22nd street plant.

G-R-S Model-5A, 110-volt, d-c. switch machines are used on all main line switches, and the two Hays derails on industry tracks, which are not shown on the plan. What is known as the Type-"SS" control is employed in connection with the new switches. For this purpose, Hall motor-type polar relays are connected to the point detector contacts in the switch machines. These polar relays, together with other signal control relays, are located in special relay houses.

Outlying Switch Protection

A noteworthy feature of the 22nd street plant is the protection of outlying switches, both within the plant limits and south of the plant, using G-R-S Model-9A electric switch locks. There are two electric locks at 23rd street and one at 25th street, those at 23rd street being inside of the plant limits. These are all controlled by levers in the new machine. When the lock lever in the machine is placed normal, the outlying switch locks are energized and the track switch can be operated. The three outlying switches between 25th street and 27th street outside of the plant limits are similarly controlled, with the exception that in this case, two control levers in the machine are used, an individual lever being provided for one of the electric locks, the remaining lever taking care of two electric locks. The lock control levers in the interlocking machine are mechanically interlocked with other levers in the same machine as would be the case if a power switch were used. The normal, or de-energized, position of the electric lock at the track switch is indicated at the control lever of the interlocking machine. This control is arranged by means of a repeating relay, designated as a *WLP* relay and this repeating relay, which is located in the interlocking tower, is picked up through a contact located on the circuit controller of the electric lock, and the back contact of the lock relay which is an integral part of the electric lock. When the *WLP* lock repeating relay is energized, the indication magnet on the lock control lever in the machine is energized and the lever can be moved full reverse.

Existing automatic signal bridges, with but one exception, were utilized for all of the interlocking signals. The additional signal bridge at 23rd street is a seven-track structure, and is noteworthy for the concrete decking and the methods of mounting the signal poles outside of the structural steel members. A concrete decking is used because it is fireproof. With the signal units mounted outside of the bridge structure, enginemen obtain an unobstructed view of the signal units. The interlocking home signals, as may be noticed in the illustration, are three-unit color-light signals. The top unit is the G-R-S Model-G triangular type as is also the middle fixed unit, while the bottom unit, which is used as a call-on signal, is the G-R-S Type-D signal. This is the standard arrangement of interlocking signal aspects on the New York Central. The top signal unit takes care of through movements. Slow-speed diverging movements or slow-speed advancing movements on the main track are indicated by the call-on signal. These signal units are equipped with 8-volt, 18-watt lamps, burned at 7.5 volts. They are normally lighted by alternating current with a reserve source of energy furnished by Exide 120-a.h. cells, connected five in series through a variable resistance unit. These five storage cells for reserve lighting are of the Manchester positive plate type, commonly used in interlocking service.

Alternating current power for signal lighting and storage battery charging is transmitted throughout the extent of the plant at 440 volts single phase. A connection with the Commonwealth Edison Company is made just north of 22nd street, where the 220-volt a-c. energy is stepped up to 440 volts for transmission to the 16th street interlocking tower. The 440-volt power connections are carried into the relay houses at the signal bridges, where the energy is stepped down to 110 volts through a G. E. transformer. A Westinghouse snap switch is inserted in the primary circuit of the transformer to control the local charging circuit. General Railway Signal Company transformers, with 110-volt primaries, together with Balkite rectifiers, are employed for charging. All of the storage batteries for reserve signal lighting, track circuit operation and electric locking circuits are in concrete battery boxes obtained from the O. S. Flath Company. The Balkite rectifier cells are housed in the same box. The relay house contains all of the signal relays, switch indicating relays, (Hall motor-type), track relays and G-R-S Type-H power-off relays, for all of the signaling in the immediate vicinity. So many control relays were necessary because of the multiple-track installation that it was considered not only more economical, but much better from a maintenance standpoint, to house the relays in a shelter which a maintainer could enter, than to locate them in the standard N.Y.C. relay boxes.

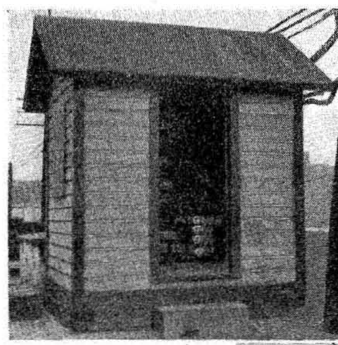
Telephone System

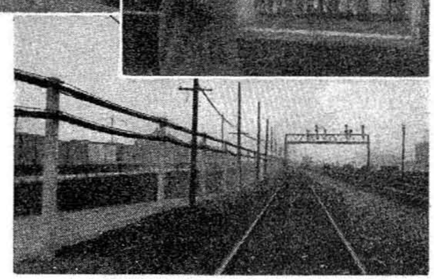
A feature of the 22nd street plant is the local telephone system, whereby the maintainer can get in communication with the towerman from any location in the plant. A Western Electric multiple telephone set with hand magneto for ringing the towerman is always carried by the maintainer. Telephone jacks are located in the relay boxes, relay houses and also in the maintainer's tool house. In all, there are six of these Western Electric jacks which are protected from the elements by being mounted in Crouse-Hinds condulets with a hinged strap at the bottom which must be removed before the telephone plug can be inserted. A motor-driven horn, located on the tool house, which is near the center of the 22nd street plant is used to signal the maintainer when the towerman wants to reach him on the telephone.

Wire and Cable Distribution

A combination of aerial cable line and parkway cable distribution system is employed. All control and operating wires are carried in parkway cable from the tower to a point about 600 ft. south where they come up out of the ground and enter a terminal box. From this point south, the wires are carried in an aerial cable line supported on concrete posts to a point just north of 22nd street where connection is again made to parkway cables carried over the present viaduct. South of the 22nd street viaduct, the cables come up through a terminal box and connection is again made to an aerial cable line which is carried on stub poles to the signal cases at the south end of the plant.

The use of parkway cable over the 22nd street viaduct is necessitated by the street widening program which is at present being carried out. The New York Central will soon replace the present via-





Above — Relay shelter at signal bridge

Right — Maintainer telephoning to towerman

Below — Aerial cable distribution system

duct with a much longer one to accommodate the increased street width. In order that the construction forces on this street widening project would not be handicapped, the control wires were carried in parkway cable on top of one of the steel girders of the viaduct, enough cable slack being allowed to permit the construction forces to move the cables around out of the way until permanently located on the new viaduct. At other viaduct crossings, the aerial cable wires are pulled through wooden pump logs, which are strapped to the top of the steel girder.

A 5/16 in. copperweld stranded steel messenger wire is used on the aerial cable line. The individual rubber-covered wires, constituting the cable, range in size from No. 12 copper to No. 6. To protect these wires against the destructive action of locomotive gases, the entire aerial cable was given a coating of No-ox-ide rustproof preservative, the application being made with a brush.

Parkway cable is employed for all connections leading from relay boxes and relay houses to operative functions and rail connections. A three-inch pipe is used to house the parkway cable as it comes up through the ground. The parkway cables needed for switch machine operation and indication are carried from this pipe a short distance to the switch machine. This short exposed length of parkway cables is also covered with No-ox-ide rustproof preservative.

At rail connections, a two-inch pipe is employed to bring the parkway out of the ground. The soldered connection to the copper-clad bond wire is made outside of the pipe and is painted with Vitrolac black insulating paint to protect it against the elements. A four-inch length of discarded air hose is slipped over the parkway cable and carried in a bridle ring bonded to the rail in order to relieve the soldered connection between the parkway cable wire and bond wire of all mechanical strain. Track circuits are operated with one cell of Exide KXHS 120-a. h. storage battery with an Everett adjustable resistance unit inserted in one of the track leads. The track relays are G-R-S Model-9 of 4-ohms resistance. Duplex copperweld bond wires (No. 6) supplied by the Railroad Accessories Corporation, New York, and secured to the rail with channel pins are employed for rail bonding.

This interlocking plant was installed by the signal construction forces under the direction of F. B. Wiegand signal engineer, New York Central, Lines West, and under the direct supervision of T. G. Inwood, signal supervisor.

Lightning Protection For Signal Circuits*

By Stanley C. Bryant

THE subject of protection of electrical circuits from lightning disturbances is one of vital interest, especially to those who have charge of the operation or maintenance of lines or circuits. Before entering directly upon the subject of protection it will be well worth while to study the generation of lightning and some of its more common characteristics. There are several slightly differing theories as to the cause of the formation of electrical energy in the clouds.

Each of the very small moisture particles of which the rain clouds are composed, collects a charge of electricity, due to the fact that there is always some electrification of the air. When a large number of such small moisture particles join into one large drop, the electricity of the numerous particles is collected in the large drop. This results in the large drop having a higher electrical pressure, because it contains the electricity of all the small drops of which it is composed.

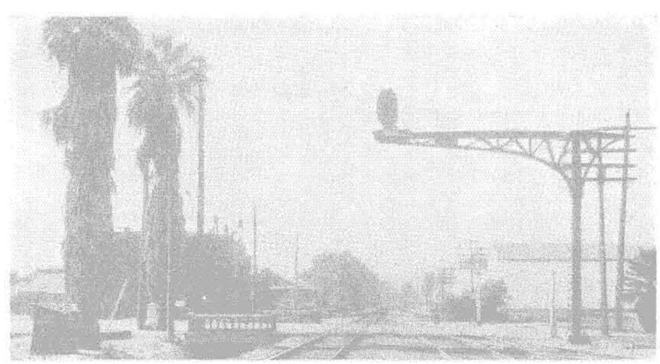
During thunderstorms a very light discharge from cloud to cloud or from cloud to earth is sometimes immediately followed by one of extremely greater force and volume. This without a doubt is due to the first discharge causing a surge which reacts on other clouds that are heavily charged, but are not in condition to cause an initial discharge themselves. They in turn very often flash to adjacent clouds or to earth with terrific intensity. During a thunderstorm it is often noticed, that when a flash occurrs, it is immediately followed by a succession of terrific detonations, rumblings and reverberations. These noises are caused by the echo effect against the clouds, and are also due to successive flashes or discharges which were caused by the first flash. When a lightning discharge occurs, its distance from the observer can be judged fairly correctly by counting the number of seconds from the instant one sees the flash until he hears the report because sound travels at a speed of about 1,130 ft. per sec. at 70 deg. F.

Methods of Lightning Protection

With the knowledge of conditions which must be met, arresters have been designed which will give the maximum protection for the class of service in which they are used. For the protection of signal systems using low-voltage apparatus, the ideal method is to use arresters which will operate or function at a low potential. Through the use of such low-voltage arresters, any disturbances which might effect the lines or apparatus are immediately carried to earth, without any potentials building up to an abnormal value before the arresters operate. If an arrester having an air gap is used, then protection in this case starts at the value at which the arrester will operate. In other words the apparatus is subjected to any abnormal strains up to the time that the arrester operates. This means that if the potential must build up to say 1,000 volts before the arrester functions, then the apparatus will have to stand the strain of this potential, and such a strain as this may and very often does cause trouble.

In order to keep the operating voltage of an air gap arrester at a low value it is necessary to have the adjacent parts of the spark gap close together. This distance must not be more than a few thousandths of an inch. The question of a possible ground must be considered in the air gap type of arrester, and for this reason it is not practical or desirable to have the adjacent parts extremely close at the gap. Where air gap arresters are used, the gaps must be as short as possible, so that they will function at a reasonably low voltage, and yet from the standpoint of the danger of accidental grounds it is not practical to have the gap extremely short.

The fundamental principle of the non-air gap arrester is the absence of an air gap. A certain grade of carborundum when placed between the line and ground will operate or function at an extremely low potential—about 500 volts. While the carborundum functions at a low potential and is extremely sensitive to all abnormal voltages, its high resistance, which measures several hundred thousand ohms, is practically an insulator to the signal current.



Cantilever mounting for signal at Riverside, Cal., on the Santa Fe (Coast Lines)

*Abstract of paper presented before the St. Louis Sectional Meeting, Signal Section A. R. A., some time ago, and is here presented as a non-technical explanation of lightning and its effects.