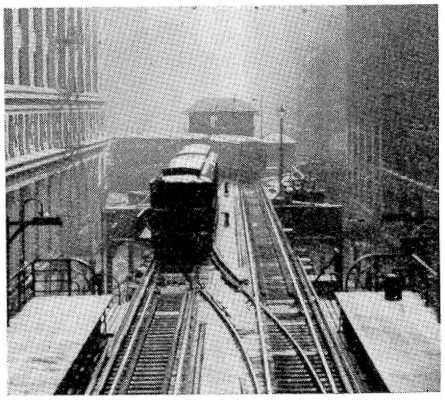
New and Unusual

Signal and Relay Repair Shop

on the Chicago Rapid Transit

All test circuits, controls, meter and related equipment operated from one panel using interlocked circuit selector—Includes test tables for pneumatic units



On the elevated loop

A SIGNAL repair shop with facilities for repairing, testing and reconditioning relays, interlocking equipment, electro-pneumatic switch and signal mechanisms, control valves, and other associated devices has been rendering efficient service since it was completed in January, 1934, by the Chicago Rapid Transit Company, at the Wilson Avenue shops in Chicago. The main test panel embodies certain features that are unusual if not unique.

The class of train service in which this company is engaged is such that, in certain localities at least, the maximum benefits that can be derived from a signaling and interlocking system are often closely approached. All traffic is comprised of passenger trains, some of which run locally within the city of Chicago, and others are in express service to outlying points, either suburban or within the city. Traffic density is relatively high, especially at junctions and at crossing points where interlockings are operated to expedite train operation.

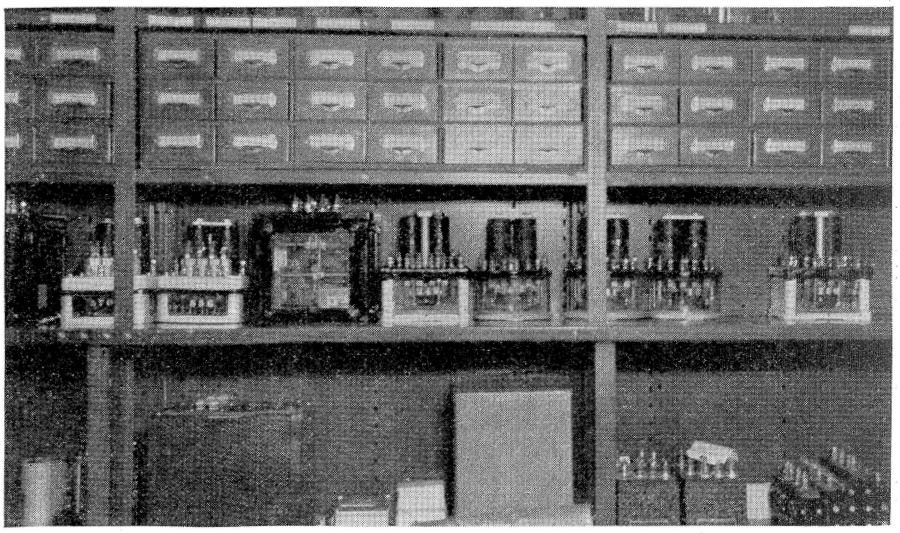
Such operating conditions demand close maintenance and careful servicing of equipment in order to forestall failures and serious tie-ups. This is especially true of the relay equipment, inasmuch as the total number of daily operations of such instruments as track relays often runs well into the hundreds, according to an actual count.

Relay Shopping Schedule Established

The new repair shop handles all relay repairs for the Rapid Transit and, in addition, the relays of the Chicago, North Shore & Milwaukee, an associated company, are serviced in this shop. During the past year, a field survey has been made and a list of all relays in service compiled, together with certain information as to the type of relay, class of service, serial number, date, location, etc. With this information readily available, a schedule of relay repairs has been undertaken, by which every relay will normally be serviced in the shop at least once in five years. Of course, those relays that are damaged or in need of repair previous to the expiration of five years will begin a new service period after being released from the shop. By following this procedure, it is intended that a higher standard of relay maintenance will be achieved than was formerly possible.

Every relay that is sent to the repair shop is assigned a number, which is stenciled with white lead on the glass case. This number is also assigned to a record card upon which is entered the previous location, date, serial number, model and type, date of last inspection, and its electrical characteristics as obtained from an initial test.

The relay is then dismantled, cleaned and completely overhauled and such contacts, leads, coils, or any other parts that may be defective are replaced. Terminal posts, nuts and washers are nickel-plated by a local jobber in large lots as they accumulate. The relay is then assembled and carefully adjusted and tested for



Section of shelving for relays and replacement parts—The drawers are indexed so that material can be quickly located when needed

proper performance, the data being entered on the record card; it is painted, a shop record tag is attached and the relay is sealed, after which it is ready for re-issue.

All materials used and labor expended are recorded in detail for each relay in order that proper accounting can be readily made. The record cards are conveniently located in a file box. This shop is normally operated by one signal repairman, C. C. Norton, and a helper. For this reason each repair job is completed separately once it is begun.

Test Panel

The most unusual feature of the test panel is the system of interlocked circuit selection. As may be seen in one of the illustrations, there is a series of single-throw, double-pole knife switches at the top of the board. Each of these switches is connected to the operating circuits in such a manner that test hook-ups of any kind, within the range of the switchboard, can be readily made with the proper combination of switches. For example, if a d-c. relay is to be tested, switches Nos. 1, 8 and 10 are engaged, and the testing circuit is thus set up, including the meters, control rheostat and a connection to the 20-volt d-c. bus.

However, these switches can not be engaged until a combination-selector knob has been set at position No. 1. This selector knob has eight positions and can, therefore, select an equal number of different combinations of the knife switches. The switch combinations are enforced by a sliding bar attached to the knob and actuated by it. The sliding bar has vertical notches properly spaced so as to permit only those switches to be closed that will complete the test circuit desired. In this manner a false circuit set-up is precluded as far as the test board is concerned, and the chances for damage resulting from mistakes in operation are greatly diminished. Also the celerity with which the various circuits can be selected is increased, for all fumbling with temporary wires is entirely eliminated.

Having selected the desired switch combination by means of the knob, and the proper circuits by closing the knife switches, the operator makes connections with the relay to be tested by means of plainly-identified leads, which are fitted with insulated spring-clips. These leads are run upward through holes in the test table, and are provided with plenty of slack, which is controlled by weighted loops under the table. A "manipulation chart" for use in operating the board is reproduced herewith. Like the operator of an interlocking machine, the relay repairman is sufficiently expert not to require continued reference to the chart.

In the center of the board a double-pole, double-throw switch serves as a d-c. polarity selector. Below this switch are two pushbuttons which are utilized to impose a standard train shunt upon the track-relay test circuit. Still lower on the board is a four-plug jack switch which is sometimes used to connect 110-volt power to a switch-machine testing table nearby.

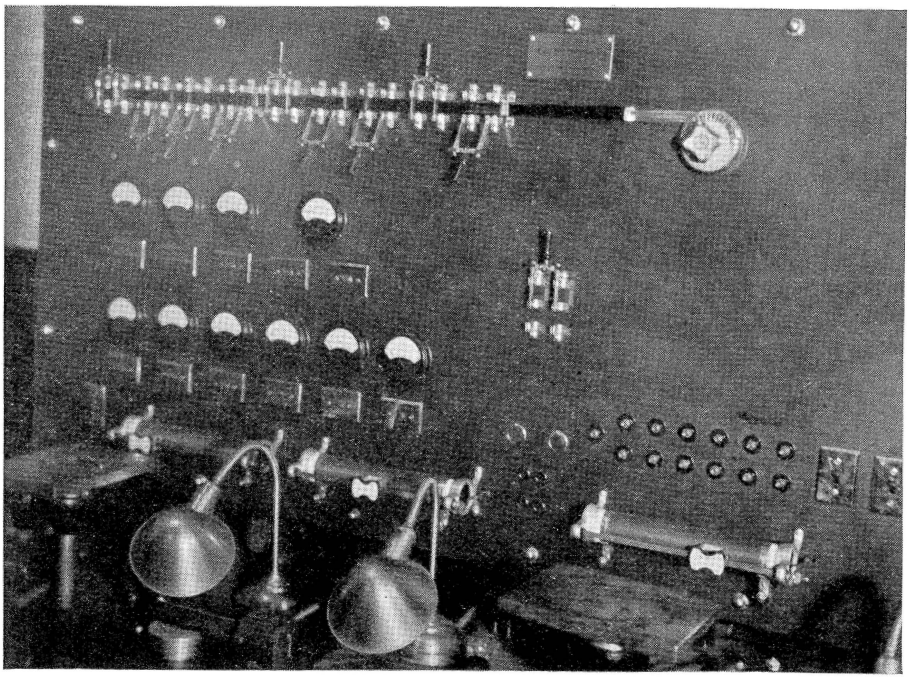
MANIPULATION CHART FOR OPERATING TEST PANEL

Apparatus	Locking Position	Switches	Voltage	Location of Apparatus
D-C. Relays	1	1, 8, 10	0-20 DC	DC Bus
D-C. Magnets	1	1, 5	0-20 DC	Test Bench
D-C. Valves	1	1, 5	0-20 DC	Test Bench
Model-15 Trk. Relay	2 & 3	2, 3, 7	0-110 AC	11[illegible] AC Bus
			0-11 AC	110 AC Bus
SLV-13 Line Relay	4	2, 7	0-110 AC	0-110 AC Bus
SLV-13 Trk. Relay	5	2, 4	0-6 AC	0-6 AC Bus
110-V. AC Magnets	6	2, 6, 7	0-110 AC	0-110 AC Bus

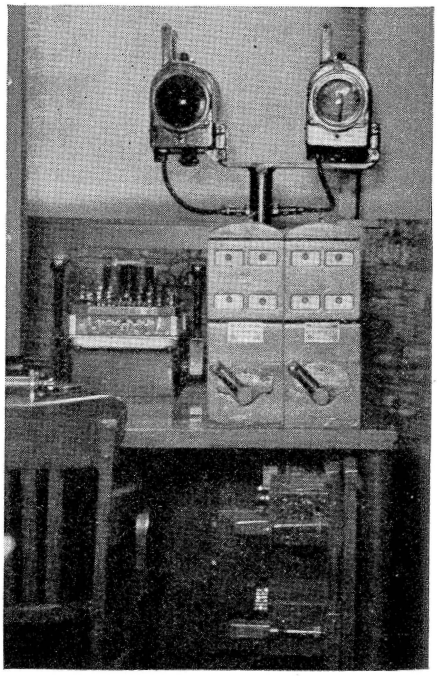
Contact Indicator Lights Built-In

On the lower right-hand side of the test panel are two rows of six switchboard lights. These repeat the operation of the front and back contacts of a relay being tested. This not only greatly facilitates adjustment of the individual contacts so that they function in unison, but also serves as a positive check of the pick-up and release of the relay. A pilot light and controlling toggle switches complete this part of the equipment.

Three 90-ohm sliding-contact rheostats are incorporated in the panel circuits and are conveniently mounted



All testing functions on the control board are built-in—Note the circuit-selector locking mechanism



Levers and WR relay for operating test of switch and signal apparatus

on the panel. The measuring instruments are of the switchboard type and were furnished by the Weston Electrical Instrument Corporation. Each meter is controlled by a toggle switch mounted directly below it. Three voltmeters are provided, two of which are for direct current. Of the four ammeters, three are for a-c. and of the three milliammeters two are for d-c. These meters have been selected so as to have suitable ranges for the work intended.

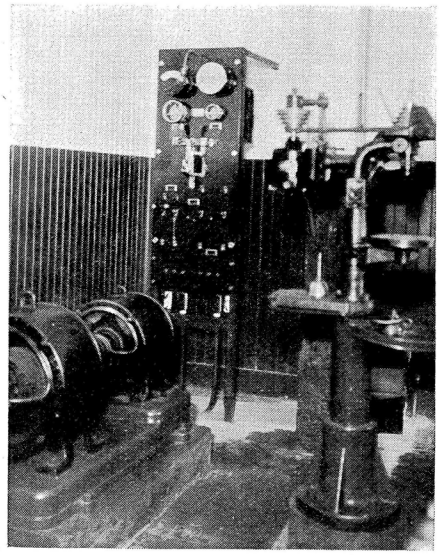
OFFICE TEST RECORD OF A. C. RELAYS

SERIAL NO._____ SPEC. NO._____

APPARATUS_____, TYPE_____ELEMENT, _____POSITION

NO. OF CONTACTS { 3 POSITION NORMAL_____REVERSE_____ DE-ENERGIZED_____
2 POSITION FRONT_____ BACK_____

PICK-UP				Work Current or Volt				DROP-AWAY				SERVICE			DATE OF INSPECTION	REPAIRS MADE	LOCATION AND DATE
Normal		Reversed		Normal		Reversed		Normal		Reversed		Control		Local			
Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts	Amps	Volts			
															ORIGINAL MARKING		



Drill press and 110-volt d-c. power supply

The test bench is provided with a small vise, adjustable bracket lamps, and two specially designed ball-and-socket relay platforms which can be adjusted to almost any position or height. Relays are clamped to these platforms while tests or work is being performed, thus assuring a secure and convenient support.

Repairs of E.P. Equipment

As most of the interlocking equipment of the C.R.T. is of the electro-pneumatic type, facilities for servicing the switch and lock movements, as well as E.P. signals are required. For this purpose an iron table, having properly spaced bolt holes for use in securing an E.P. switch machine or signal to the table, is located in the center of the room. As the relay shop is situated adjacent to the Wilson Avenue car shop, compressed air is piped from this building to the test table. Hose fittings and suitable valves have been attached to the table for convenient use.

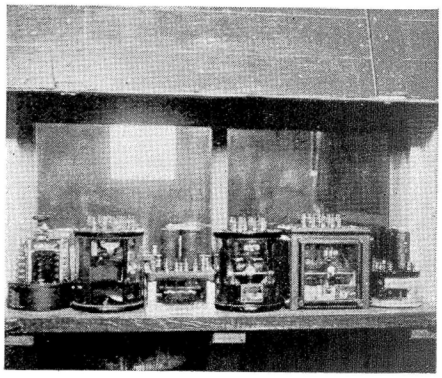
Two table-lever units, of the Union Switch & Signal Company Style-TC, have been mounted on the test bench for use in testing E.P. switch machines and signals that have been overhauled. The usual operating, locking and indication circuits have been run from these levers, through the main testing panel, and thence to the large work table. A five-conductor cable for switch valves and indications, and a seven-conductor cable for signal operation are terminated in receptacles on the table. The receptacles and the cable plugs used with them are the same as those used for interconnecting the passenger-car control circuits for multiple-unit trains. This method of connection is convenient and efficient.

After a repaired signal or switch has been set up on the work table and all connections made, the equivalent of an actual field test is carried out by operation of the table levers. Of course, the mechanical locking between the two levers has been omitted. Mounted above the two levers are two light-signal units which are utilized in making the timing adjustments on flasher relays. These also assist in simulating an actual service test.

Power is supplied to the shop from the commercial lines at 110 volts a-c. A Union W-10 transformer reduces this potential for test purposes and an RP-41 copper-oxide rectifier maintains a 10-cell Exide storage battery on floating charge for the d-c. circuits. A motor-generator set with a separate control and circuit-breaker board is used to supply 110-volt d-c. energy when such is required, these being of General Electric manufacture.

The machine tools of the shop include a small five-speed drill press with an individual motor drive, and a duplex electric grinder and buffer.

On one side of the shop a steel shelf and drawer arrangement is used for storing repaired instruments and spare parts of relays. A catalogue and index system has been devised whereby each replacement part is listed according to its function, specification number and kind. For example, if a trunion screw is needed for a Model-13 relay, a listing of the article may be found in the catalogue under Model-13 relays; the specification number is compared, cost noted, and the proper drawer is then selected by number so that no time is lost in searching for parts.



Relays in emergency-issue locker

In order to allow signal maintainers to obtain needed relay equipment in cases of emergency after working hours, special boxes having outside openings have been provided at central points on the system. These boxes are always locked from the outside and they contain the following equipment in first-class condition, ready for issue: One Model-15 relay, a Model-12 polar, Model DP-14, SLV-13 line, SLV-13 track, and one Model-13 relay: also two track-circuit resistors, two Style-W-10 transformers and one clockwork time release are included. When a maintainer takes out equipment, he signs a card receipt which is provided for the purpose in the cabinet. This method fixes the responsibility for all emergency issues of these devices.

This repair shop was designed and equipped under the direction of Matt Van Lennep, signal supervisor of the Chicago Rapid Transit Lines, under the jurisdiction of J. W. Stephenson, signal engineer, and R. N. Wade, engineer maintenance of way.