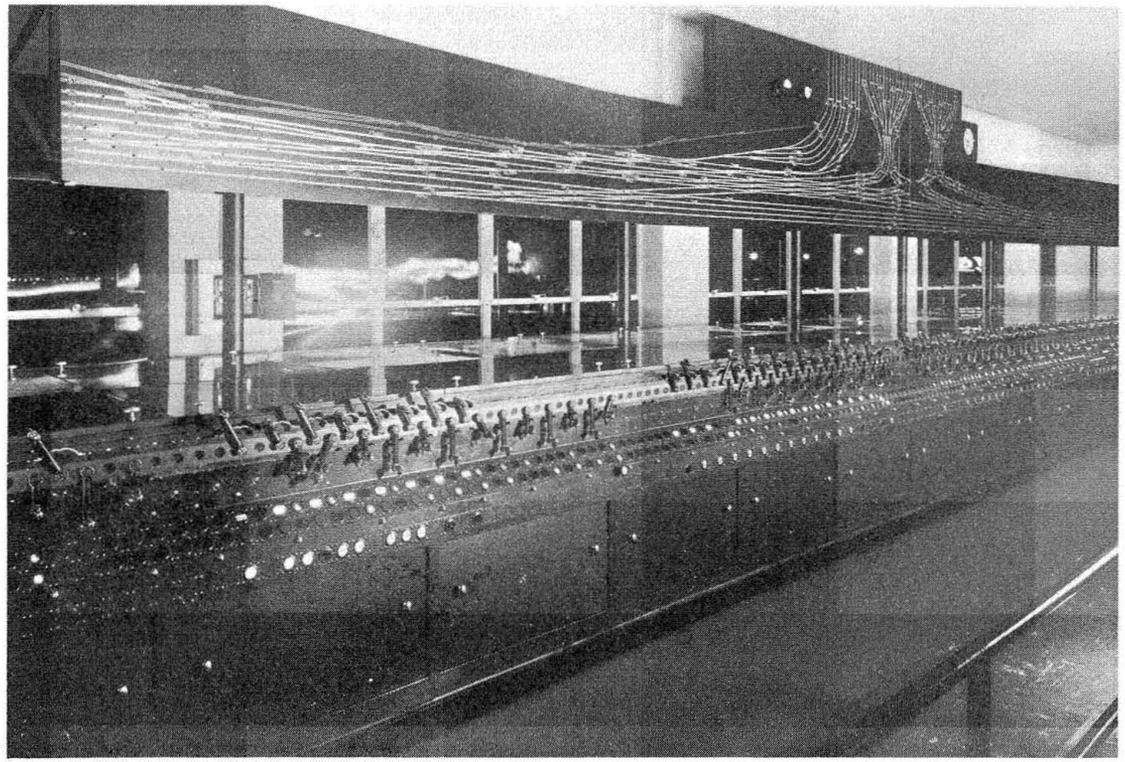


This 303-lever interlocking machine has 262 levers which control 96 single switches, 60 double-slip switches, 5 movable-point frogs and 296 signals. About 2,500 routes can be set up in this plant and an average of 1,700 lineups are made every 24 hours



# Interlocking Restored to Service

## At St. Louis Union Station

**New tower, interlocking machine, relays and wiring installed in record time to replace those destroyed by fire at large plant—Plug-in relays, and fire-proof construction are features of project**

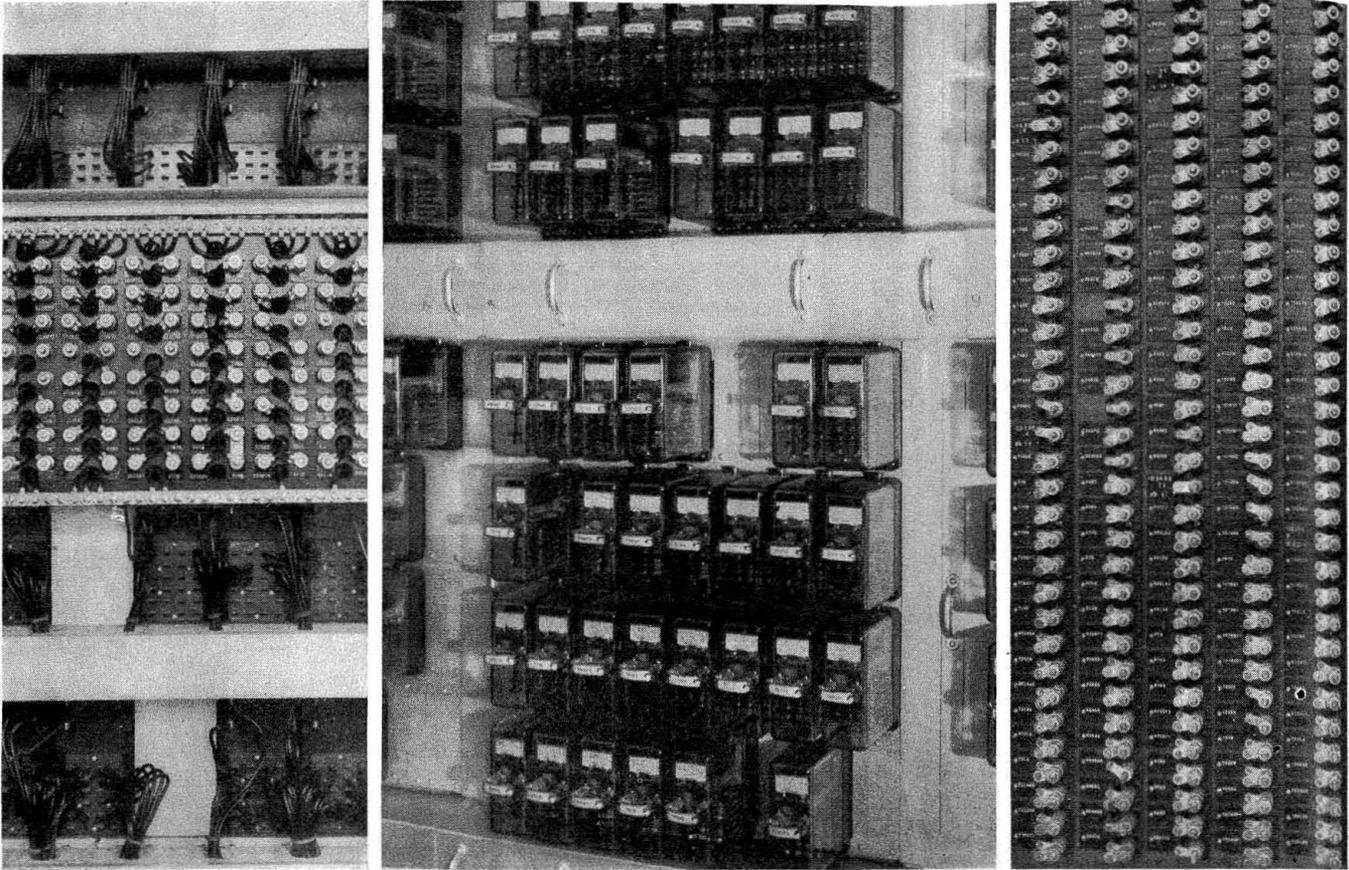
AS EXPLAINED in an article in the August, 1940 issue of *Railway Signaling*, a fire, on July 22, destroyed the tower, interlocking machine and other apparatus of a large electro-pneumatic plant at the Union Station in St. Louis, Mo., which is owned and operated by the Terminal Railroad Association of St. Louis. Before the flames were entirely extinguished, calls were sent to various persons concerned, and, at a conference the next morning, a decision was made to adopt a procedure of replacement which gave promise of restoring the interlocking to service in the shortest time possible, and at the same time to make the job per-

manent as well as to include as much modern equipment and construction practices as time would permit.

### **Trains Handled With Plant Out of Service**

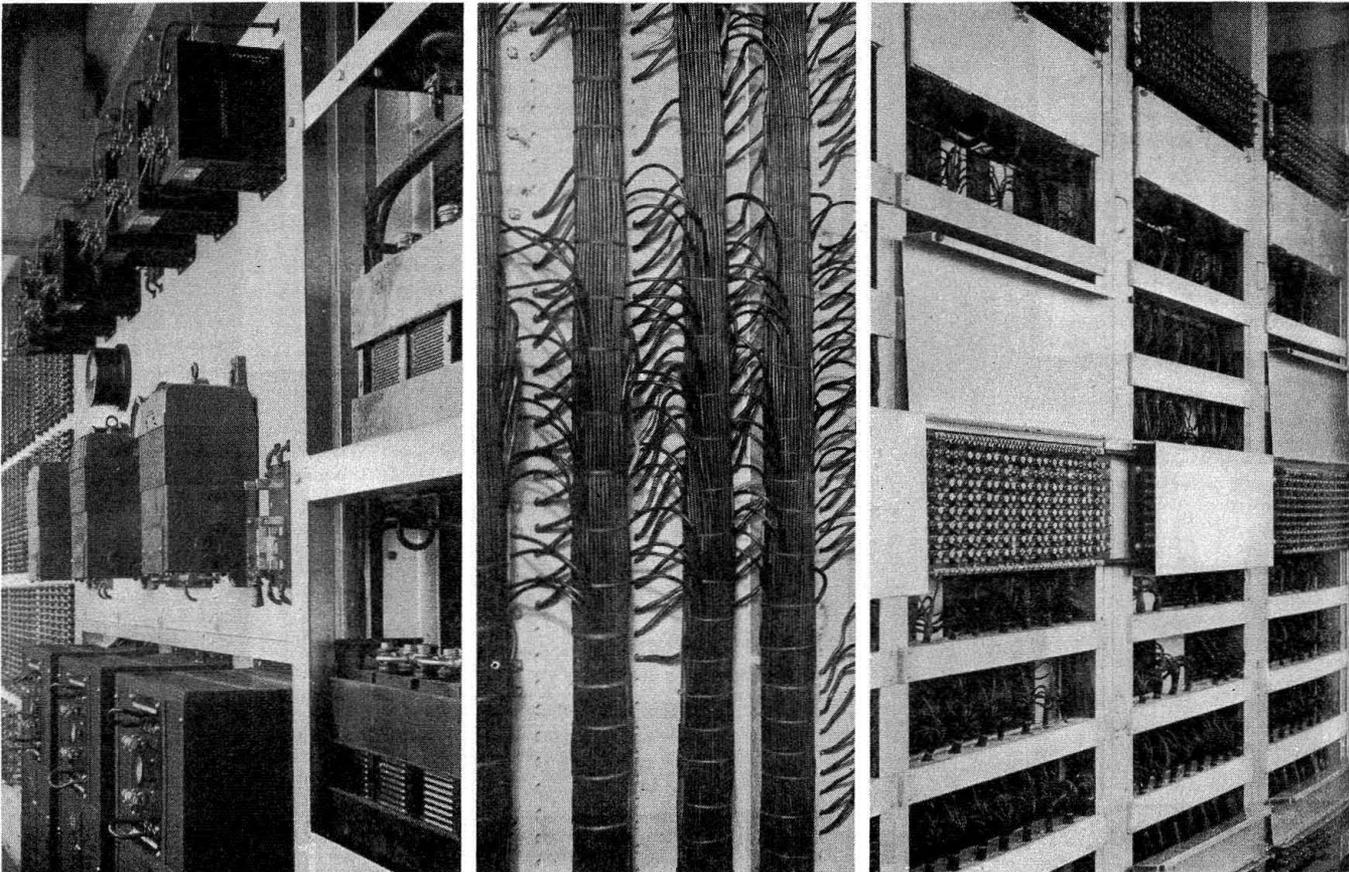
Within a very short period after the fire, methods were devised for the safe handling of trains with the interlocking out of service. Temporarily the electro-pneumatic switch machines were each controlled locally by "fingering" the valves, however, within a short time, a knife switch and indication lamps were installed at each switch to control the valves for operation of the switch. Train directors, each in charge of a certain area of plant, issued orders, by telephone or loudspeaker communication, to the men at the switches. When a track lineup was complete, train movements were directed by hand signals under the direction of the train director in charge. Within the course of a few days, this special form of handling trains improved

such that trains were coming and going without delays of any consequence. Switching moves were handled more quickly than previously because they were directed locally, without being required to run out beyond a fixed signal before reversing the direction. Due to good fortune, as well as to the eternal vigilance and efficiency of the men involved, no train accident or personal injury occurred in train service in the interlocking limits while the plant was out of service. This accomplishment is outstanding in view of the fact that there are 93 inbound and 94 outbound scheduled trains every 24 hours, and, in addition, hundreds of switching moves of empty equipment as well as light engine moves are required. The new 303-lever interlocking machine is the largest of its type, and has 262 levers to control 96 single switches, 60 double-slip switches, 5 movable-point frogs, and 296 signals. Approximately 2,500 routes can be set up in this plant, and an average of 1,700 lineups are made every 24 hours.



Above: Left—Rear of rack for plug-in, quick-detachable relays. Center—Face of rack showing quick-detachable relays. Right—Terminal board using squeeze-on connectors

Below: Left—Transformers, rectifiers and storage battery in the tower. Center—Rear of terminal board with fireproof wire. Right—Rear of relay rack showing cover for terminals in the raised position

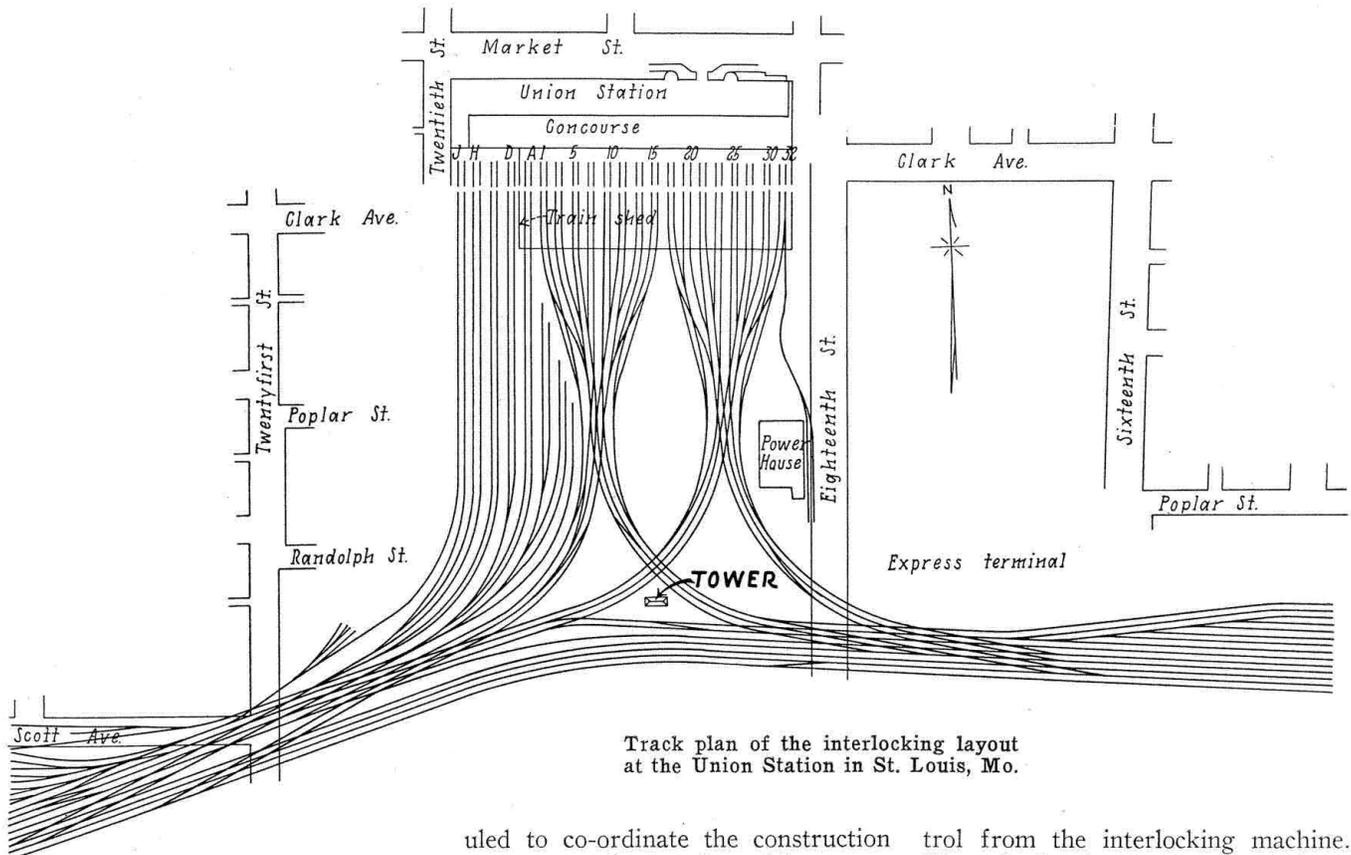


In addition to the interlocking machine, a train director's panel was provided in the operator's room. This panel is equipped with push buttons and lights for train communication westward to tower No. 2 and eastward to tower No. 3. The panel also includes push buttons and lights for a train-starting system, one light and one push button being provided for each station track. Six push buttons were provided for release of sectional route locking in certain instances where a switching train locks a large number of switches in advance while standing and still waiting for a back-signal. The buttons for operating

the Terminal Railroad Association of St. Louis had on hand a modern unused electro-pneumatic interlocking machine which was available. Arrangements were made with the Union Switch & Signal Company to use this machine as a part of the new machine, and to furnish relays and other accessories, as well as circuit diagrams. Orders were placed for insulated wires and cables, as well as other accessories. Most of the storage batteries which were in the tower basement during the fire were cleaned, painted, installed in new trays and restored to service. The delivery of all equipment was sched-

November 17, the signals and switches in the area east of the tower were cut into full interlocking service, and other areas were cut in on November 24, December 1, and December 15, thus completing the restoration of the interlocking operation and protection within 150 days after the fire. In the meantime, signal construction forces had been working 10 to 12 hours or more daily, including Sundays.

The changeover procedure was somewhat as follows. At an opportune time between trains, the new circuits were connected through to each switch, and were tested by con-



Track plan of the interlocking layout at the Union Station in St. Louis, Mo.

electro-pneumatic whistles, located at various points in the plant, are also on this panel.

**Basic Problems of Reconstruction**

The fire destroyed the tower and all its contents, as well as the wiring distribution leads for some distance from the building. The electro-pneumatic switch machines were not damaged, and the air pressure supply or piping distribution were not affected. The signal bridge near the tower was damaged by the fire, thus requiring extensive repair. The electro-pneumatic semaphore signals on this bridge were destroyed, and were replaced with searchlight type signals. One of the proprietary railroads of

uled to co-ordinate the construction program, and no serious delays were caused by not having material on hand when needed.

Other than repairing and replacing signals or installing new junction boxes and wiring, the signal construction forces could not start on the major program until the new tower building was practically completed. Beginning September 18, the installation of relay racks was started on the ground floor, terminal boards and main duct lines were placed, and the new incoming cables were installed and connected. The new illuminated track and signal diagram, 56 ft. long and 6 ft. 6 in. high at center, said to be one of the largest in the world, was installed in the operating room on the second floor. The interlocking machine was moved into the tower on October 6. On

trol from the interlocking machine. Then the local temporary control arrangement at the switch was restored. In the meantime, the circuits to the signals were connected and tested, but the lamps in the signals were not installed. When the scheduled time arrived for cutting an area into interlocking service, the switch circuits were connected as well as tested again, and the lamps were installed in the signals. The actual changeover was, therefore, accomplished within a very short period of time.

**The New Interlocking Machine**

In so far as the switches and signals controlled, and the lever numbering, are concerned, the new interlocking machine is identical with that which was destroyed by the fire. This ar-

agement made it possible to use the old dog-chart and locking sheets with slight changes and to permit the levermen to return to their duties without being required to learn new lever manipulations. The new machine is the Model-14 electro-pneumatic type and is enclosed in a sheet-metal case.

#### Time-Releases Inside Machine

A special feature of this installation is that the clock-work time releases are housed inside the interlocking machine case. Shafts from the releases extend to operating knobs exterior to the face of the machine case. A total of five releases were required.

Route locking, with sectional release, was provided. The signals are slotted, and time locking applies to all signal levers, to prevent changing of a route as a train is approaching, and when the head end of a train passes the signal, an indication is given on the machine. In the meantime, the route locking is placed in effect. Each signal lever has a signal indication magnet and a lever lock. Each switch lever has an independent detector lock as well as two indication locks. As soon as practicable, the present valve arrangements on the electro-pneumatic switch machines are to be replaced with Type-CP valves. Then the switch indication lever locks can be eliminated, and all the electric locking will be accomplished by the electric locks on the signal levers, except, of course, the detector locking on the switch levers. With these future changes, a switch lever can be operated full stroke without hesitating to wait for the switch machine to operate and for

the indication lock to be released. In these respects, this new machine is of the type installed last year on the Kansas City Terminal at Kansas City, Mo.

#### Facility for Inspecting the Machine

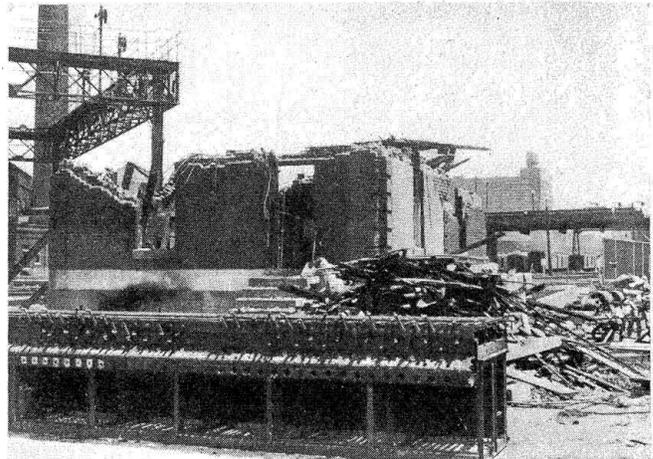
An opening in the concrete floor, extends centrally under the full length of the interlocking machine. An enclosed steel walk-way, at a level 48 in. below floor level, extends for the length of the opening under the machine. The cast-iron frame members of the machine were specially made in the form of an inverted "U". With this arrangement, a man, standing

walk-way is enclosed, with fireproof material, and a door is provided at each end. This enclosure prevents dust from rising up and into the machine, and also prevents any fire in the lower story from reaching the machine.

#### Plug-In Relays and Panels

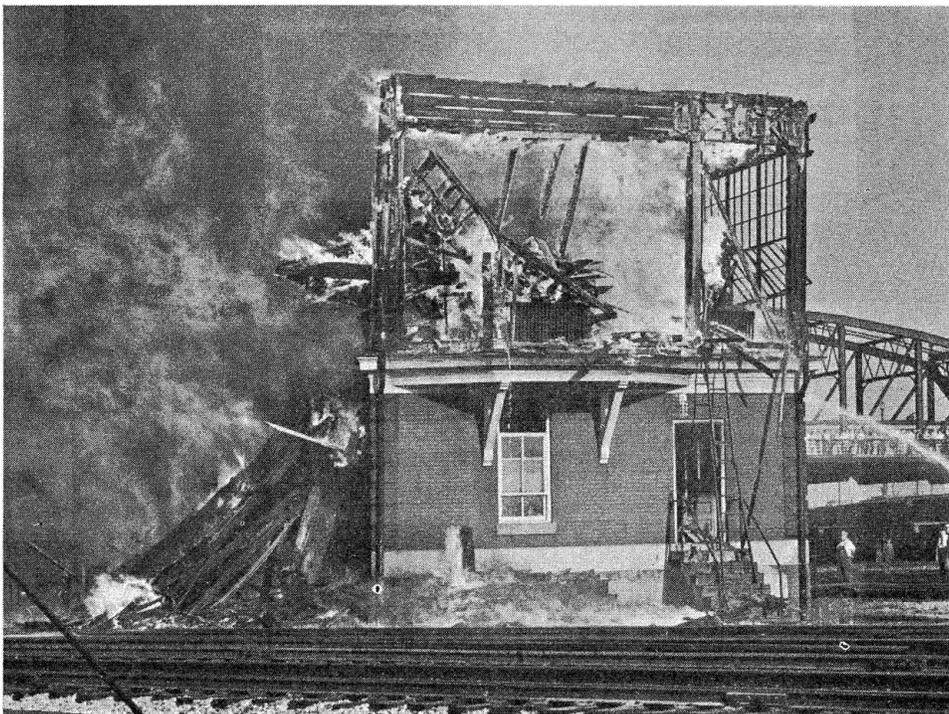
The relays are of the plug-in, quick-detachable type, designed to fit into receptacles which form a part of insulated boards which, in turn, make up vertical panels 31 in. wide. These panels are bolted to vertical steel upright members, the feet of which fit into and are bolted to steel channel keyway sec-

The interlocking machine as well as relays and other apparatus were totally destroyed by the fire

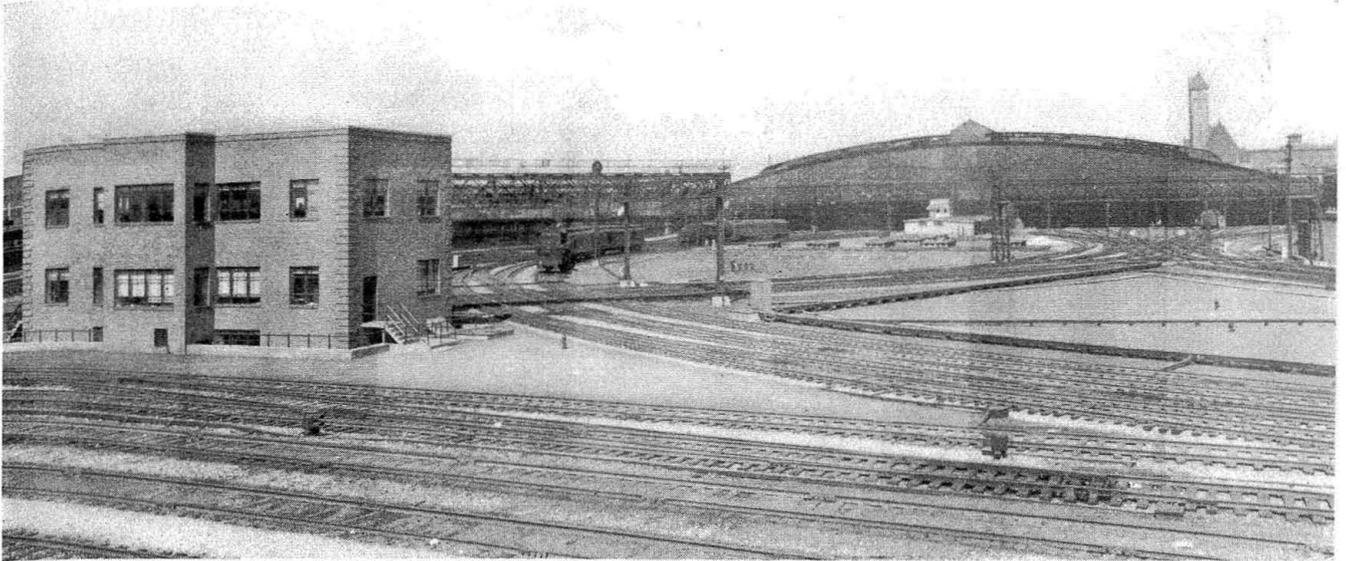


erect on the platform of the walk-way, can easily inspect, test, and adjust all the equipment included in the interior of the interlocking machine. Fixed electric lamps as well as lamps on extension cords are provided. The

tions which were placed flush with the floor surface when the concrete floors were laid. At the top, each vertical upright member is bolted to channels in the ceiling. A total of 22 such relay panels are located in one line. A total



This picture showing the tower in flames was made about 18 minutes after the fire started



General view with new tower at the left and tracks leading to the train shed in the distance

of approximately 1,575 relays are located on these racks in the new tower building. As a unit, each relay panel was wired complete in the factory, using flexible wire with fire resistant insulation, without braid.

Main terminal boards, as well as boards for mounting transformers, rectifiers and special relays, are all made of asbestos board bolted to angle iron uprights.

As the panels were already wired, the only wiring work after the panels were in place, was to connect the incoming cable wires to the terminals on the panels and extend connections between terminal boards of the different panels as well as to the interlocking machine and illuminated diagram. A total of 200,000 ft. of insulated flexible No. 16 insulated wire was required for interconnection inside the tower. About 400,000 conductor feet of solid wire as single conductor and in cables was required for replacement of cables from the relay racks to the new junction boxes located 50 to 100 ft. or more from the tower. Between the junction boxes and the terminal boards in the tower, all insulated wires and cables are run in pipe conduits, some of which are 10 in. in diameter. The duct line near the ceiling in the basement extends the entire length of the building, is 12 in. deep and 4 ft. wide, made of asbestos board bolted to angle iron. The braided covering on the cables from the tower to the outdoor junction boxes is non-inflammable.

### New Tower Building

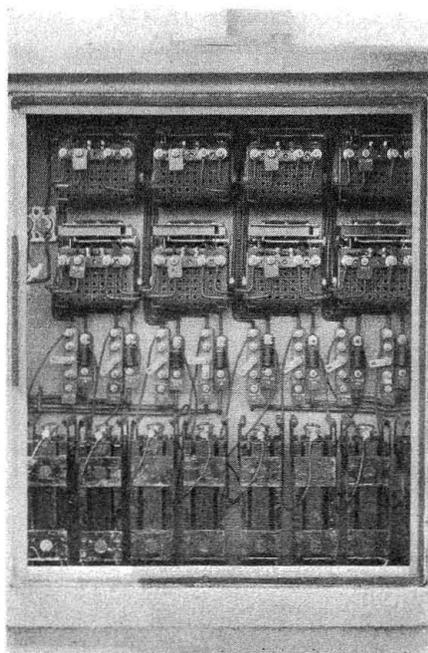
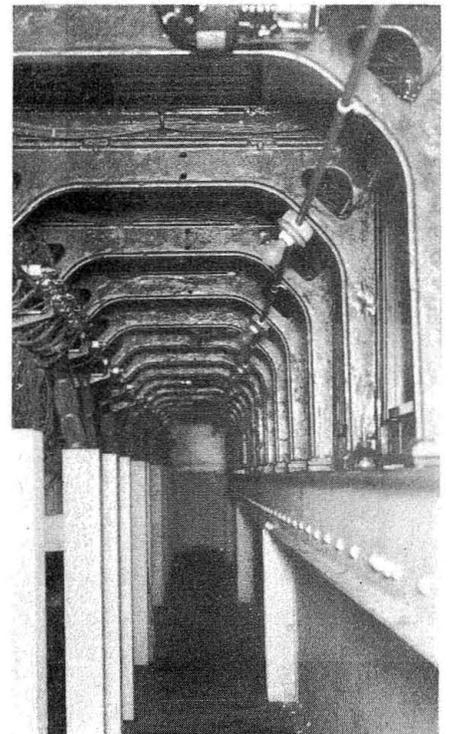
The new tower building, dedicated "Perry Tower," is of concrete and brick construction, 26 ft. wide and 75 ft. long, with two stories and a basement. This tower is of fireproof construction throughout, metal door

frames, doors, window frames and sash being used. The composition tile floor is non-inflammable, and the acoustic ceiling material is fireproof. Even the venetian blinds are made of metal with chain connections. All partitions are of asbestos board.

### Lighting and Heating

Fluorescent electric lighting is provided in the operating room, three 40-watt units being used in each of five fixtures. The building is heated

Right — An illuminated walk-way under the interlocking machine permits a man to stand full height while inspecting contacts and other equipment. Below — Each track circuit is fed by one cell of storage battery on floating charge



tains. Steel lockers, toilets and shower bath equipment are provided in the basement.

The replacement of the tower and the interlocking facilities were handled under the jurisdiction of H. J. Pfeifer (now deceased), then Chief Engineer of the Terminal Railroad Association of St. Louis, the interlocking work being handled by signal department forces of the T. R.R. A. of St. L. under the direction of A. P. Hix, Signal Engineer. The major items of interlocking apparatus were furnished by the Union Switch & Signal Company.