

Above—Looking east on lower deck of bridge at South approach connection. Right—View on West approach at Signals 49 and 50. Gratiot Street tower in background.



St. Louis Municipal Bridge Signaling

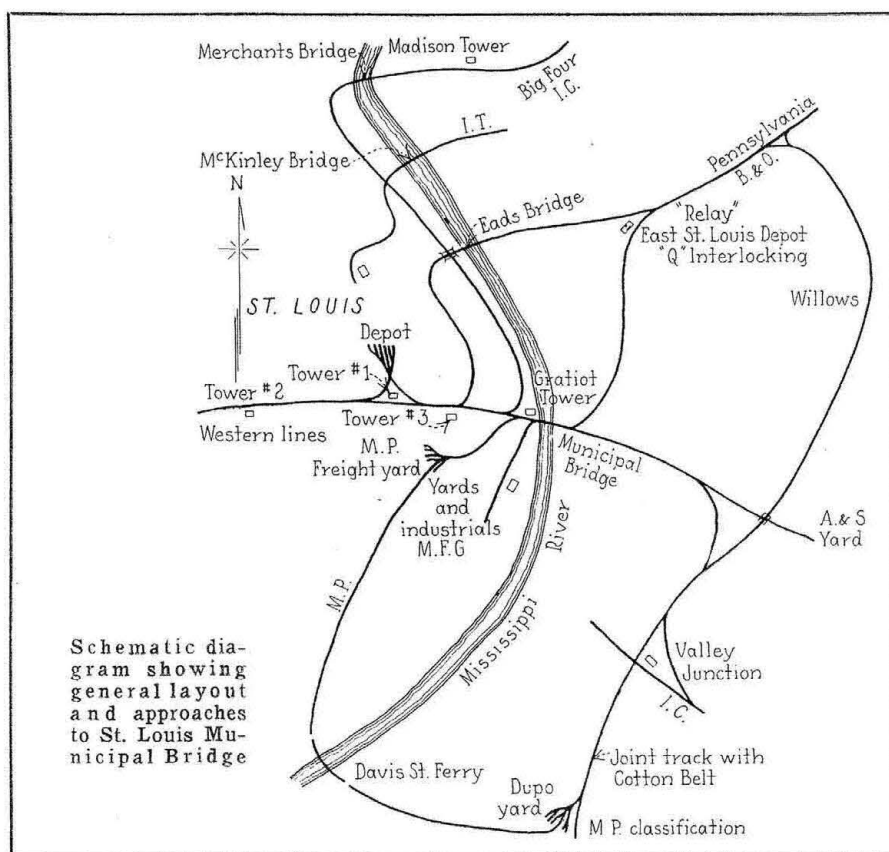
Board of Public Service equips complicated bridge layout between East St. Louis, Ill., and St. Louis, Mo., completely with searchlight signals of the dwarf type. All-relay interlocking control train movements from six approaches to main span

machines. The locations of signals and cross-overs were designed for the Board of Public Service, City of St. Louis, by A. P. Hix, signal engineer

of the Terminal Railroad Association of St. Louis. The circuits and control systems were designed by the General Railway Signal Company, Mr. Hix

AN extensive signaling project, involving the application of automatic signals to six double-track approaches and to the double-track main structure of the St. Louis Municipal Bridge over the Mississippi river in St. Louis, Mo., and the provision of two all-relay interlockings to control the movement of trains over the bridge has been completed recently under the direction of the Board of Public Service of the City of St. Louis.

The entire installation, including both automatic and home signals, involves 131 Type SA searchlight signals, and 47 Model 5C electric switch



and P. M. Gault, signal engineer of the Missouri Pacific, acting as signal engineering advisors.

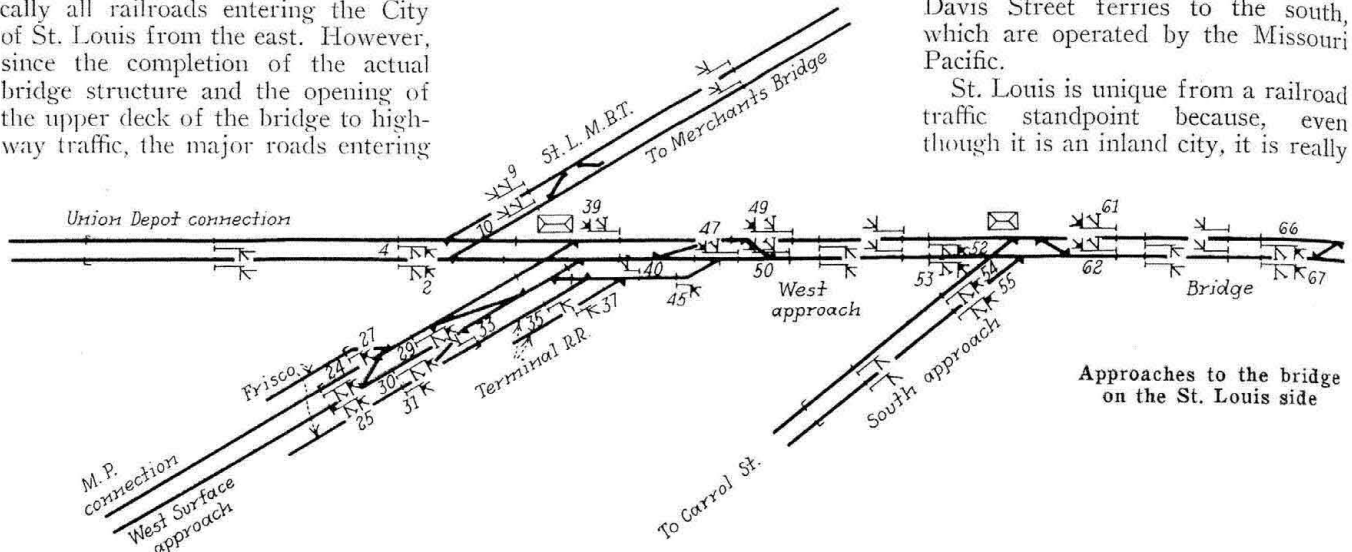
St. Louis Municipal Bridge

Construction of the St. Louis Municipal Bridge was initiated in 1908, the original plans calling for the utilization of the lower deck by practically all railroads entering the City of St. Louis from the east. However, since the completion of the actual bridge structure and the opening of the upper deck of the bridge to highway traffic, the major roads entering

and 21st Street approaches which form connections for Alton & Southern freight trains and for Missouri Pacific, Illinois Central, St. Louis-Southwestern and Terminal Railroad Association freight trains at a junction layout in East St. Louis, known as Valley Junction. The second step in the program involved the applica-

certain proportion of their freight and passenger traffic, under full automatic and interlocking signal protection. It is hoped that ultimately all passenger traffic entering the city from the east will come in over the bridge. At present such traffic is handled over the McKinley, Eads and Merchants bridges, which are north of the St. Louis Municipal Bridge, and over the Davis Street ferries to the south, which are operated by the Missouri Pacific.

St. Louis is unique from a railroad traffic standpoint because, even though it is an inland city, it is really



Approaches to the bridge on the St. Louis side

St. Louis have utilized their own lines to their respective terminals and freight yards. Since 1929, two roads handling freight traffic exclusively, the Alton & Southern and the Manufacturers R.R., have operated over the bridge, one approach on each side of the river only being involved, and operation being conducted on a straight manual block basis, no signals having previously been in service.

Early in 1938, the City of St. Louis decided to prepare for use of the bridge by other railroads. The first step in this program was the preparation of the approaches through rehabilitation for heavy traffic, G. E. O. track construction being utilized, and the installation of signals on the East

tion of automatic signaling and interlocking to the remainder of the approaches and to the main bridge structure. The signaling on the East and 21st Street approaches and the new controls at Valley Junction interlocking plant were placed in service on October 26, 1938. Work on the second step in the program was started on April 3, 1939, and was completed, with the exception of testing, on October 1, 1939.

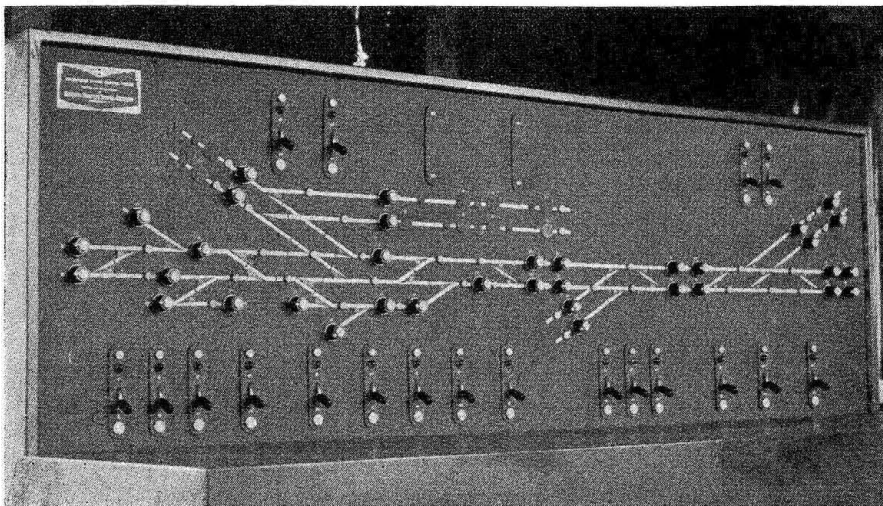
Purpose Behind Installation

The purpose of this extensive installation is to provide facilities which will allow all roads entering St. Louis from the east to use the bridge for a

an absolute terminal point. There are no such things as through trains; all trains originate or terminate at St. Louis. It is expected that the new bridge and the complete signaling installation will allow for the operation, by any railroad so desiring, of both passenger and freight trains at comparatively high rates of speed, particularly traffic to and from the east and switching moves into and out of East St. Louis. The signaling system has been installed with sufficient capacity to handle approximately 5,000 cars daily. Such traffic would constitute approximately one-third of the peak traffic experienced between St. Louis and points east at any time in past history.

Ferry and Tunnel Problems

The elimination of the Davis Street car ferry is considered desirable because during certain periods of the year, low water experienced in the

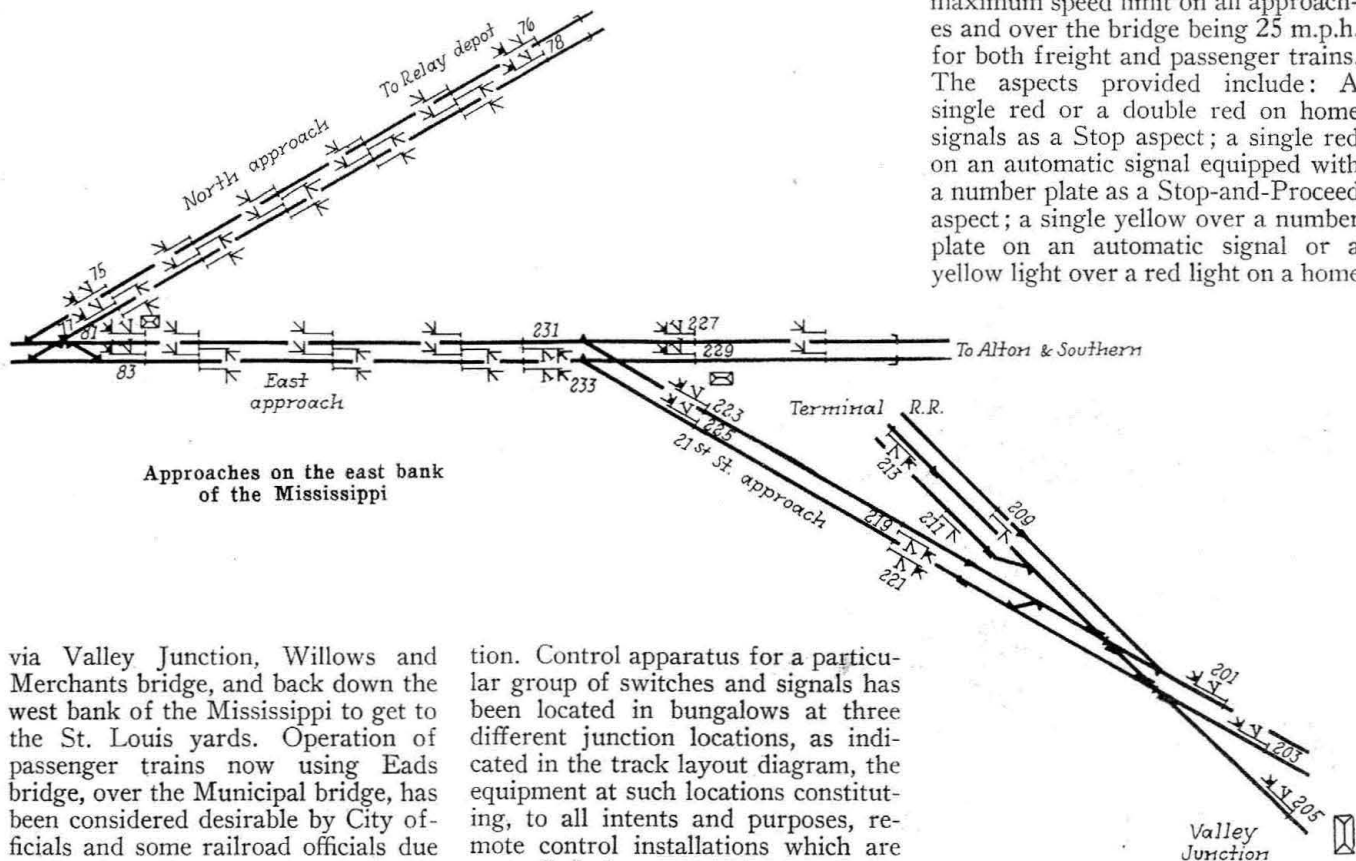


The Gratiot Street control machine is the nerve-center of operations

Mississippi river necessitates discontinuance of the ferry service, and at other periods ice conditions in the river make it necessary to route freight trains over an extensive detour

the various home signals, switch machines, and derails located at the junction points of the various approaches, excluding the junction switches and signals at the Valley Junction connec-

are employed primarily because of clearance problems. None of the home signals are route signals; rather, all are known as speed signals. A total of five different signal aspects are utilized to control train operation, the maximum speed limit on all approaches and over the bridge being 25 m.p.h. for both freight and passenger trains. The aspects provided include: A single red or a double red on home signals as a Stop aspect; a single red on an automatic signal equipped with a number plate as a Stop-and-Proceed aspect; a single yellow over a number plate on an automatic signal or a yellow light over a red light on a home



via Valley Junction, Willows and Merchants bridge, and back down the west bank of the Mississippi to get to the St. Louis yards. Operation of passenger trains now using Eads bridge, over the Municipal bridge, has been considered desirable by City officials and some railroad officials due to the fact that operation over the Eads bridge and operation through the narrow Eads tunnel, built in 1876 and 0.84 miles in length, with sharp curves at either end, might thereby be eliminated.

General Signal Layout

In addition to the Valley Junction interlocking, which forms a connection for the Missouri Pacific and is hoped ultimately to be used as an Illinois Central, St. Louis-Southwestern and Terminal Railroad Association connection, an extensive all-relay plant, known as Gratiot street, has been installed on the west side of the river. Gratiot street is really the nerve center of the installation, controlling

tion. Control apparatus for a particular group of switches and signals has been located in bungalows at three different junction locations, as indicated in the track layout diagram, the equipment at such locations constituting, to all intents and purposes, remote control installations which are controlled from the Gratiot Street tower. The bungalows were used in an effort to get the control equipment for a particular group located at one central point.

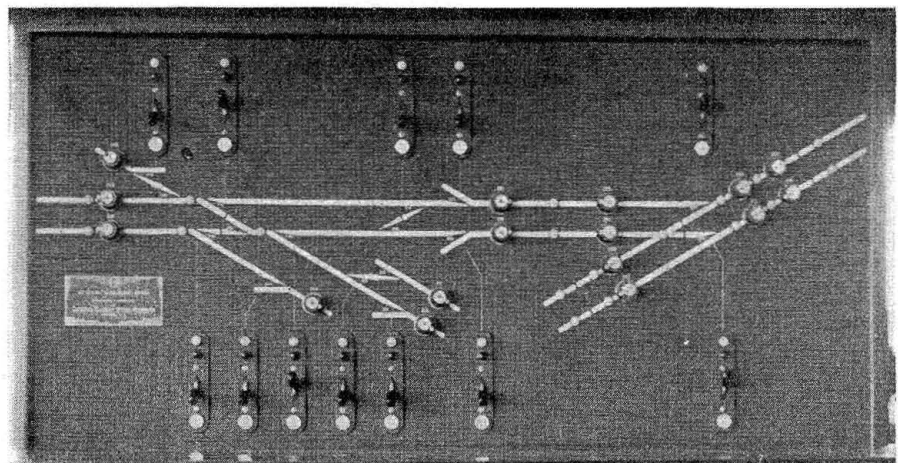
All signals are of the SA search-light type, 100 signal heads being of the dwarf type, with 1 high two-arm signal. In general, the top arm displays red, yellow or green, and the bottom arm displays yellow or red. Automatic signals are distinguished from home signals by number plates. Although dwarf signals are used, they function the same as high signals and

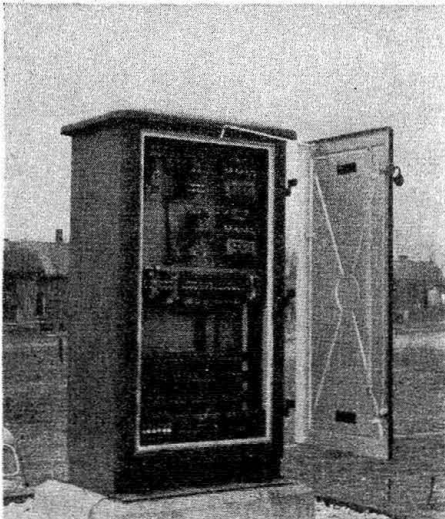
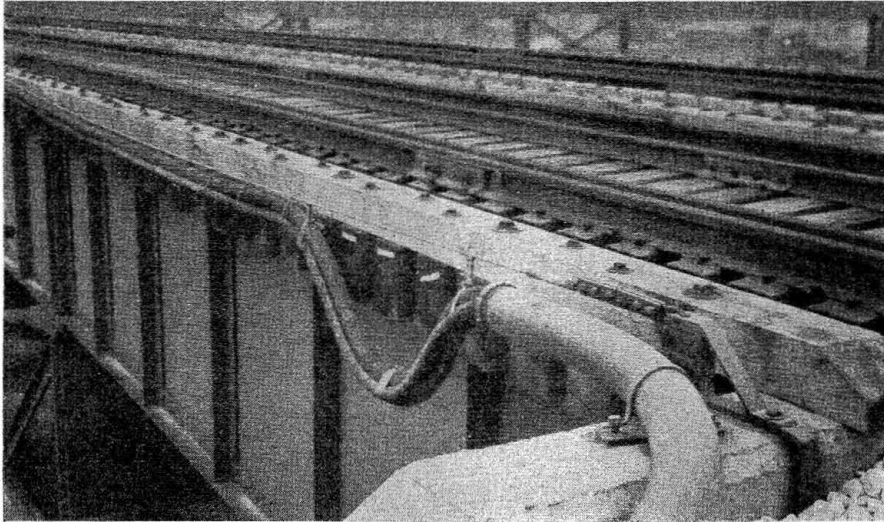
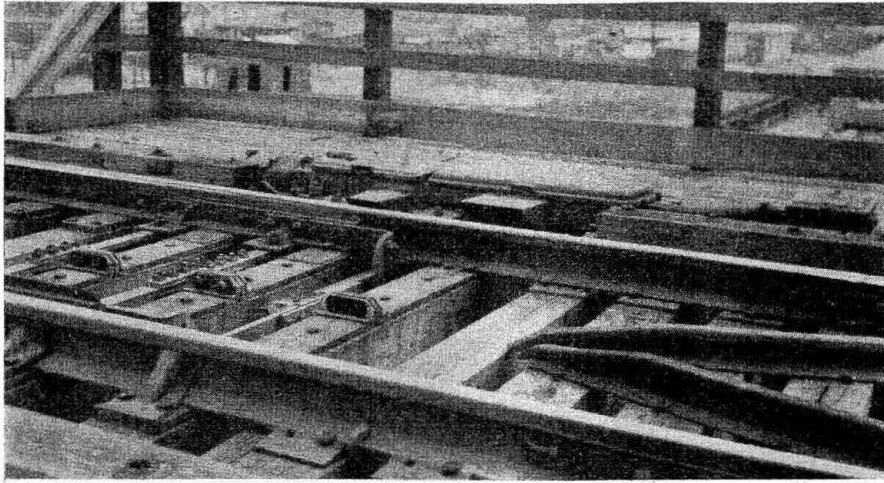
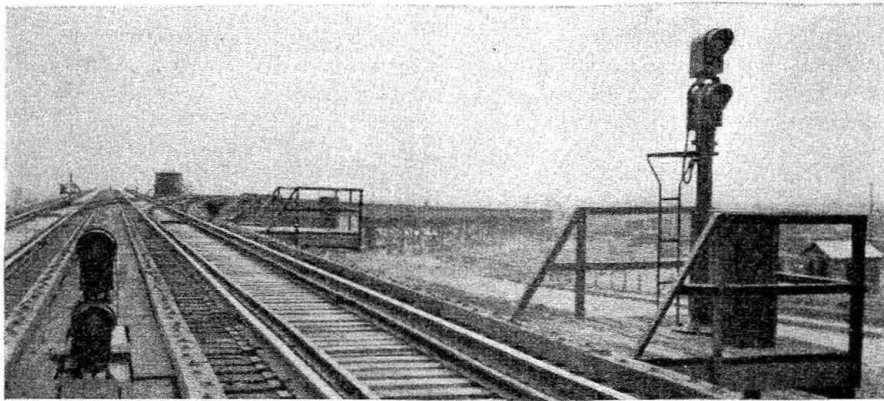
signal for the Approach aspect; a green light over a red light on a home signal or a single green light for the Clear aspect; and a yellow light under a red light on the home signal for the Restricting or call-on aspect.

Locking

At Gratiot Street tower, time locking has been applied to all signals which are not equipped with distant signals, the time locking becoming

The Valley Junction machine controls 21st Street approach and connection as well as crossing layout





Top—Signals 231 and 233 on East approach. Next—Typical switch machine layout. Above Cable support on structure. Left—Instrument case at Signal 221.

effective when the signal is cleared. All home signals having approach sections are equipped with approach locking. Traffic locking is now provided between signals 223, 225, 227 and 229 at Valley Junction, and signals 66 and 67 at Gratiot tower. On the North approach, the section between signals 76 and 67 is, to all intents and purposes, absolute permissive blocking. Signals 76 and 78 have been made semi-automatic stick signals rather than automatic signals, and are controlled from Gratiot tower, because of proposed plans to establish a Union passenger station in East St. Louis. The cable on the north approach in this vicinity has been installed with sufficient conductors to take care of any ultimate signaling which may be installed for this purpose in the vicinity of Relay depot.

Control Machines

The control machines at both Valley Junction and Gratiot contain on their face white lines representing the track layouts at the particular locations involved. Switches are represented by movable portions behind cut-out sections in the main panel, the movable sections being operated to indicate the position of the switches by magnets mounted behind the panel. Knobs are provided at each controlled signal location on the panel. With the knob turned up, the signal is cleared to display either a Clear or an Approach aspect, depending upon the conditions of track occupancy. When the track section immediately in advance of the signal is occupied, the knob is operated to a downward position and a Restricting aspect or call-on signal is displayed. Each switch is controlled by an individual lever mounted in the panel below or above the track diagram. Immediately over each switch lever are two lights, one red and one white; the red light is a lock light and indicates that the switch should not and cannot be operated; if the lever is operated with the red lamp illuminated, the lever must be restored and again operated before actual switch operation will be obtained; the white lamp is illuminated when the switch on the ground and the lever in the panel are not in correspondence.

Continuous track indications are provided between control points. All signal levers are on the track diagram at points corresponding to signal locations; an indication lamp in the lever knob, carrying a black arrow, is illuminated when the signal is cleared, the arrow giving the direction in which the signal governs. Traffic locking levers, consisting of knobs similar to the signal levers, are pro-

vided in the white lines representing the tracks where such locking is provided, arrows in lenses in the faces of the knobs turning to indicate the direction in which traffic rights are established.

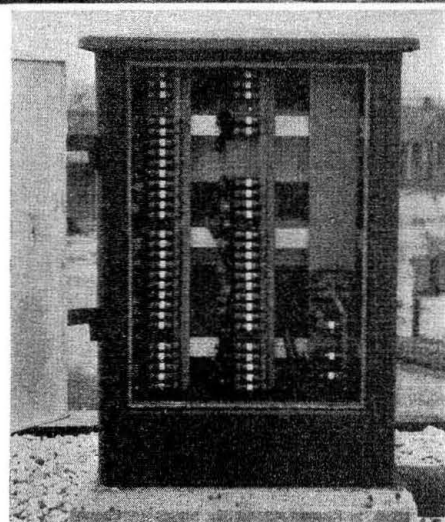
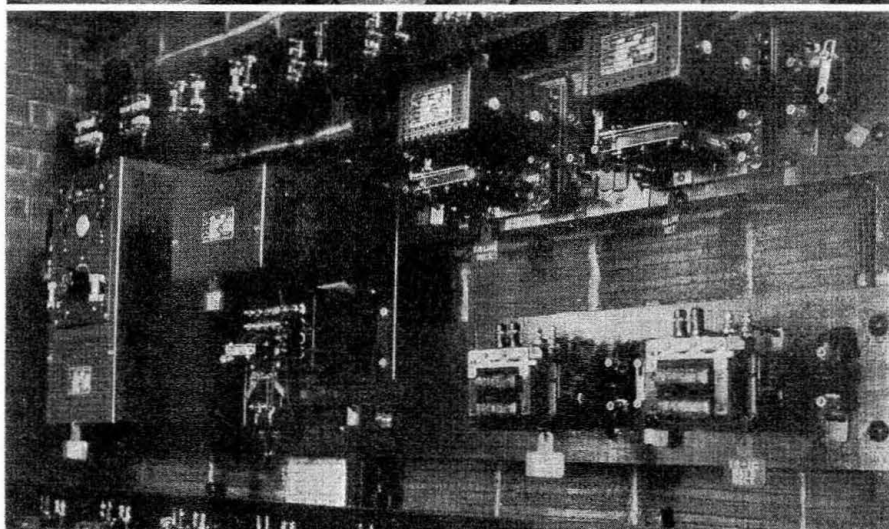
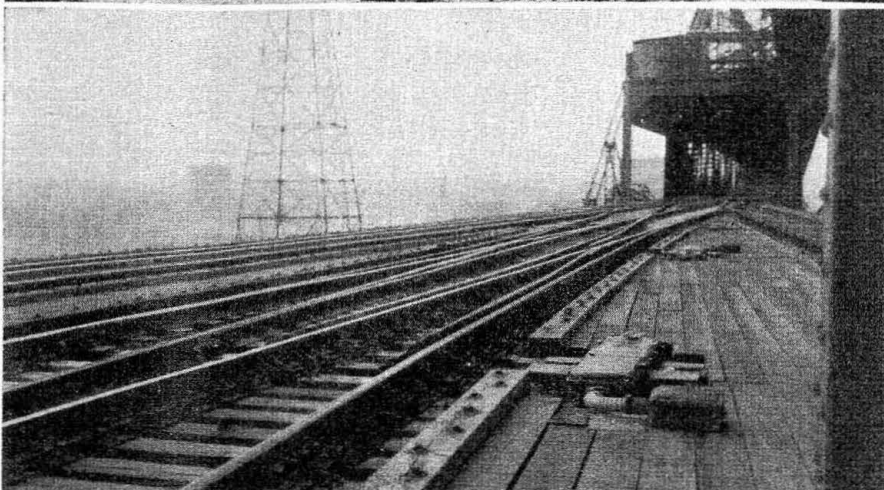
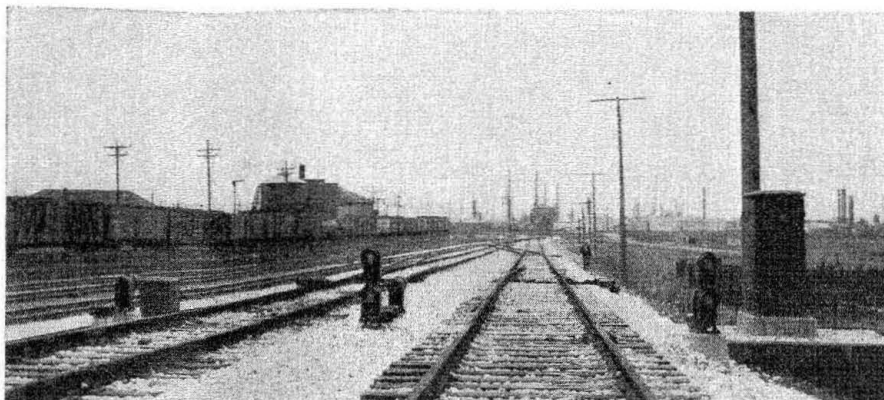
Relays, Batteries, and Cables

The control machines at Gratiot and Valley Junction are on the second floor of two-story towers at each of these locations, the tower relays and batteries being housed on the ground floors. All relays in the towers and bungalows are the new Type B manufactured by the General Railway Signal Company. At such points all of the control relays for the particular group of switches and controlled signals involved are housed in the adjacent tower or bungalow, control wires being run out in cable to the signal heads and switch machines. Relays in welded-steel cases, as at automatic signal locations, are Type K, wall mounted with shock absorbers.

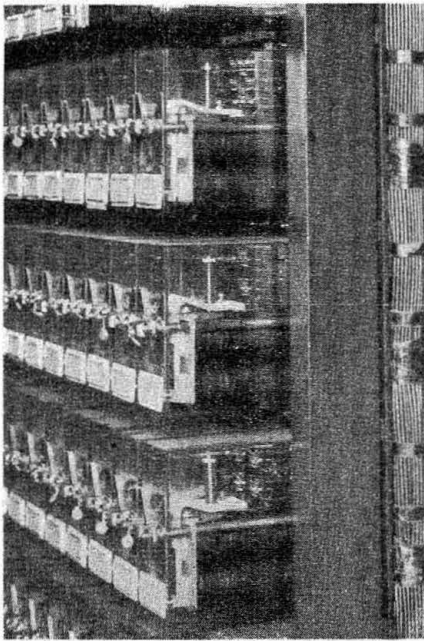
Trenchlay cable was used for all underground runs such as in the approaches. On the steel structure sections of the approaches and on the main spans, circuits were run in aerial cable supported on messengers mounted on strap-iron supports on the ends of the guard rail through ties. The aerial cable varies in size up to 37 conductors of No. 14 wire. One of the through runs carries a twisted pair utilized for telephone circuits, plug-in jacks being provided at each home signal location. Underground cable without armor varies in size up to 27 conductors. Where the bungalows are located on the bridge structures, the cables are carried under the tracks in 4-in. galvanized iron conduit.

Power is obtained from commercial sources at Gratiot Street interlocking, and at both the north approach and the south approach. This power is supplied at either 220 or 110 volts, 60 cycle. The 220-volt power distribution circuits are carried in aerial cable consisting of 3 conductors, No. 10, the 110 volts d-c. used for switch machines being carried in 3-conductor No. 4; where 110 d-c. is taken to the switch machines on the embankments on the approaches, 3-conductor No. 6 underground cable is used. One spare conductor is thus provided in each power cable.

The municipal bridge installation is equipped with standby battery, the Valley Junction installation requiring 51 Exide DMGO-7, 60-a.h. track batteries floated on BT 116 rectifiers, one 10-volt local relay and panel lighting battery, one 110-volt DMGO-9, 80-a.h., switch machine battery, and 4 10-volt line batteries. The Gratiot Street plant, the main span, and the



Top—Signals 219 and 221 at Valley junction. Next—North approach connection. Above—Transformers and rectifiers at Gratiot Street tower. Right—Cable terminal box.



Type B relays in bungalow at 21st Street approach connection

other approaches recently completed required 64 track batteries of the DMGO-7, 60 a.h. type, 42 DMGO-9, 80-a.h., 10-volt line batteries floated on BT rectifiers of various capacities,



Storage cells in bungalow at North approach connection

and two 110-volt batteries for switch machine operation floated on two BP type rectifiers.

The track circuits are equipped with American Steel & Wire Company Style S-1 bonds with $\frac{3}{8}$ -in. plug terminals. Western Railroad Supply Company Type-1170 bootleg outlets were provided for track connections on the ground, connections between

track leads and seven-strand connectors being used on the structures, stapled to the sides of the ties.

This installation was made by the City of St. Louis through the Board of Public Service, under the direction of Baxter Brown, president, and A. R. Ross, associate to the president.

The work was installed by Longwill-Scott, Contractors, O. B. Webster, of the G. R. S. Co., serving as engineer of construction, and Charles Lattimer, formerly of the G. R. S. Co., as superintendent. The major items of signaling equipment were supplied by the General Railway Signal Company.

Rock Slide Gives False-Clear

On July 3, 1939 a derailment occurred on the Cincinnati division of the Louisville & Nashville, near Sinks, Ky., on a section of double-track line over which trains are operated by time-table, train orders, and an automatic block signal system. The principal features of this accident as revealed in the report of the Bureau of Safety, Interstate Commerce Commission are abstracted herewith.

The derailment occurred on the northward track at a point 1,302 ft. south of Sinks interlocking. In the vicinity of the point of accident the tracks are laid along a hillside paralleling and about 50 ft. above the west bank of Roundstone Creek. Immediately south of the point of accident the pit of an abandoned rock quarry extends westward into the cliff a distance of 300 ft. The northward route through Sinks interlocking is governed by home signal 1372, located 477 ft. south of the tower and 855 ft. north of the point of accident. Automatic signal 1374, located approximately 3,356 ft. south of signal 1372 and 2,501 ft. south of the point of accident, governs the approach to signal 1372 and is of the one-arm, three-position, upper-quadrant, semaphore type, approach lighted. When signal 1372 displays a Stop indication, signal 1374 displays an Approach indication except that it displays a Stop-and-Proceed indication when there is a train, obstruction, or broken rail in the block ahead. Signal 1374 is controlled by a polarized line relay identified as 1374HD and energized by a control wire designated as wire 1374HD. Signal control is affected by a three line-wire polarized system having two control wires and a common wire. Of these, wire 1374HD controls the indication of signal 1374, and wire 1513HD5 controls the indication of southward home signal 1513; the common wire is used to carry energy to both circuits. These three wires extend from signal 1374 to the northward home

signal at Sinks interlocking. Paralleling these three wires and located on the same cross-arms are four other signal wires, one of which is a track repeater wire, normally energized, and which causes a light to burn and an annunciating buzzer to sound in the tower when a train is approaching on the northward track a distance of over two miles. The current from this wire returns to negative battery through the common wire that is used in connection with wires 1374HD and 1513HD5, making three circuits using this common wire.

According to the evidence, the train involved was approaching the point where the accident occurred at a speed of about 30 m.p.h. when the brakes became applied in emergency, following which the train stopped within about one car length. After the accident it was found that a mass of rock approximately 150 ft. long, 80 ft. wide, and from 18 to 35 ft. thick, had fallen from the cliff to the tracks. No slides or falling rocks had previously disturbed the tracks at this point. Subsequent examination disclosed that fissures in the cliff had weakened the formation and caused a portion of the wall to break away, and no doubt this condition was accentuated by recent rains.

After the accident, while the rear of the train was occupying the block north of signal 1374, this signal displayed a proceed indication. Tests made subsequent to the accident established the fact that a false-clear indication could be displayed by this signal if the signal line wires were crossed. No doubt the wires became crossed when they were entangled by the rock-fall. Since a section of about 200 ft. of the northward track was destroyed, it follows that if the wires had not become crossed signal 1374 no doubt would have displayed a Stop-and-Proceed indication, which in turn would have given the crew a warning of danger in time to avert the accident.