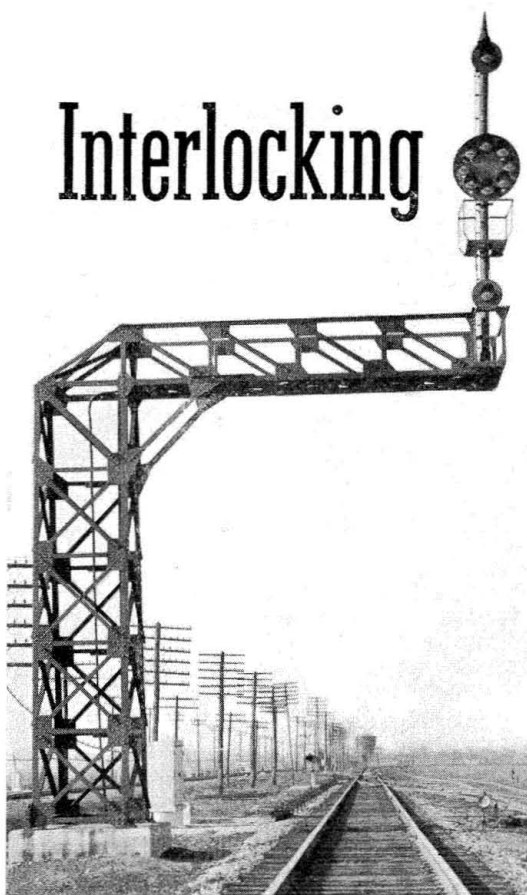


Interlocking and Automatic Signals on the Alton



Modern all-relay electric plant replaces a mechanical interlocking destroyed by fire. Semi-automatic signaling installed on eight-mile cut-off replaces old staff system

The northward home signal on the Big Four track at the new Wann interlocking

AT WANN, Ill., 22 miles north of St. Louis, Mo., on the main line to Chicago, the Alton had a 40-lever mechanical interlocking, the tower and the interlocking machine of which were destroyed by a fire. A replacement and modernization program was planned and completed in a short time. As a part of the project, a staff system for directing train movements on the eight miles of single track between Godfrey, Ill., and Wann, was replaced by semi-automatic block signaling as a means of increasing track capacity and reducing delays.

Between Bridge Junction, Ill., which is 2 miles from St. Louis, and Wann, which is 22 miles from St. Louis, the Alton and the Big Four operate jointly, the single track of the Alton being used as the southbound track for trains of both roads, and the single track of the Big Four is used for northbound trains. The track layout in the Wann interlocking, therefore, includes switches and crossovers for routing southbound Big Four trains to the Alton track, as well as for routing northbound Alton trains from the Big Four track to the Alton track.

When originally constructed, the main line of the Alton extended from Wann around through the City of Alton, Ill., and then northeast to Godfrey. This route involved numer-

ous train delays at street crossings in the congested parts of the city, and, therefore, a single-track direct cut-off was built years ago between Godfrey and Wann. A new passenger station for the City of Alton was constructed at College avenue on this cut-off. In the present operating arrangement, therefore, all passenger trains as well as through freight trains use the single-track cut-off between Godfrey and Wann, while the old line through the main part of the city is used only for making switching moves to various freight houses and industries in that area.

The daily traffic over the cut-off and through Wann interlocking includes 14 Alton passenger trains and approximately 14 freight trains. The Big Four operates 5 passenger trains and approximately 10 freight trains daily through the Wann interlocking. A yard, located in the area to the lower left of the diagram, is used to interchange freight cars between the two roads, and, therefore, the Alton switching trains make numerous moves through the Wann plant.

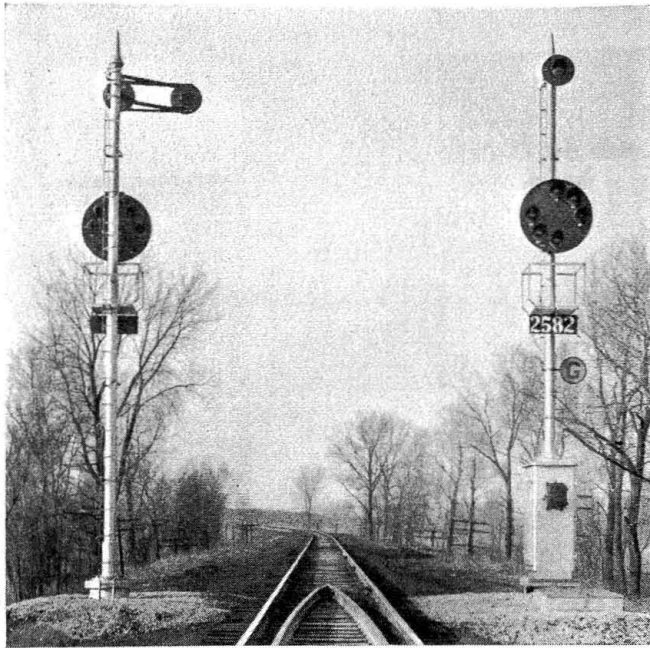
Replacement of the Wann Plant

The previous mechanical interlocking machine had 12 levers for controlling 12 signals, 8 levers for operating switches and 6 levers for

facing-point locks. In addition, 1 lever was used in the staff system, and 4 levers were for train-order signals, thus making a total of 31.

When fire destroyed the old tower, and demolished the mechanical interlocking machine, these facilities could have been replaced in short order, and thus the plant could have been restored to service in a comparatively brief period. The plant as a whole, however, was badly worn, and the old style mechanical semaphore signals were in need of replacement with signals of the power type. In view of the large number of train movements, and the desirability of making changes of lineups quickly the railroad management favored the installation of an electric interlocking, provided such a plant could be constructed at a cost which would not be a great deal more than the estimated expense for reconstruction of the previous mechanical plant, including replacement of the old signals. This desirable objective of providing a new electric plant, within the limits of funds available, was attained by utilizing various ingenious arrangements.

By adopting a plan to utilize an all-relay scheme with a small interlocking machine using miniature levers, it was practicable to obviate the replacement of the previous tower building, because a small frame building, formerly used as a yard office, was available for the new control office. The crossover No. 4 between the C. C. C. & St. L. main



An intermediate signal location on the single track Wann to Godfrey

line and the yard lead, at the lower left of the diagram, is used only when making switching moves. For this reason, a considerable saving was effected by installing an arrangement whereby this crossover is operated by a U. S. & S. Co. T-21

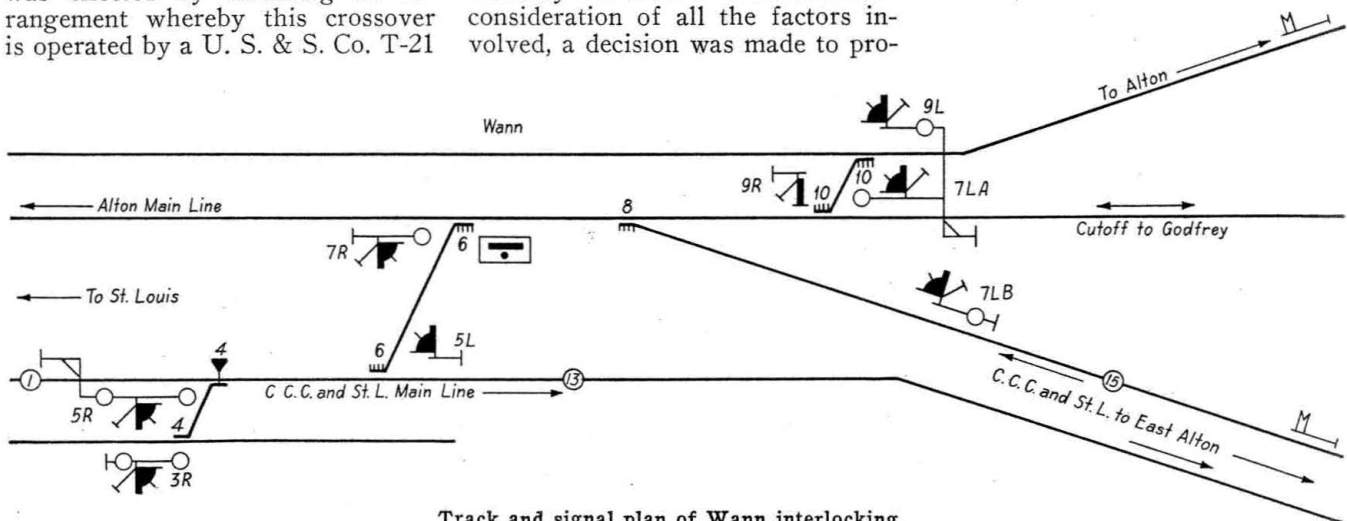
tween the Alton main line and the switching lead, at the upper right of the Wann diagram, is used only when switching moves are being made by the Alton. After extended consideration of all the factors involved, a decision was made to pro-

& S. Co. roller bearings. Normally these roller bearings support the switch points free from the plates, but, when a load is placed on the points, the plates under the bearings spring down and allow the points to rest on the plates.

New Signals and Aspects

As stated previously, the signals formerly in service at the old mechanical plant were in need of replacement, and therefore the expenditure for new signals would have been approximately the same regardless of whether the mechanical plant was rebuilt or replaced entirely by an electric plant.

The new signals at Wann are of the color-position-light type, and, as the name implies, provide aspects that are readable by color, by position or by a combination of color and position. The high and dwarf interlocking signals are distinguished from automatic signals by the absence of number plates. Doublet combination lenses are used in both forms of the signal, utilizing 30-deg.



Track and signal plan of Wann interlocking

vide an electric switch machine at the south end of this crossover, and to extend a pipe connection to a switch-and-lock movement for operation of the north end of this crossover, proper protection being provided by switch circuit controllers as well as controllers operated by the locking features. The electric switch machine on crossover 10, as well as the machines for crossover 6 and single switch 8, are the Model 5C, equipped for operation on 20 volts d-c. The standard arrangement of lock rods and point detectors are provided. In order that the switches can be operated easily with a minimum of friction between the points and tie plates, each switch is equipped with U. S.

hand-throw switch stand, including a facing-point lock, as well as an electric switch lock controlled by the interlocking. From this mechanism, a pipe connection extends to a mechanical switch-and-lock movement which operates the switch at the other end of this crossover, so that both switches are operated simultaneously by the hand-throw stand. At each end of this crossover, there is an electric switch target lamp with red lenses. When the crossover is normal, the lamps in these targets are extinguished, but, when the crossover is reversed, a red target and red light are displayed in each direction along the track.

Consideration was then given to the fact that crossover No. 10 be-

vide an electric switch machine at the south end of this crossover, and to extend a pipe connection to a switch-and-lock movement for operation of the north end of this crossover, proper protection being provided by switch circuit controllers as well as controllers operated by the locking features. The electric switch machine on crossover 10, as well as the machines for crossover 6 and single switch 8, are the Model 5C, equipped for operation on 20 volts d-c. The standard arrangement of lock rods and point detectors are provided. In order that the switches can be operated easily with a minimum of friction between the points and tie plates, each switch is equipped with U. S.

vertical spread light outer lenses on the dwarf signals, and the regular optical type hot-spot outer lens on the high signals. Each light unit is equipped with a precision 13½-volt, 17-watt lamp. The two lamps in each "pair," red, yellow, green or lunar white, are multiple connected, two in each circuit. The failure of one lamp in any pair results in the loss of position, but not of color, and trains are not required to stop unless the color is red. The failure of a marker light results in the display of a more restrictive indication than that intended.

The aspects and indications for the high and dwarf signals are the same, and each aspect has an individual meaning, there being no duplications

to create confusion or misunderstanding. The color-position aspects are the same as those which were developed on the Baltimore & Ohio and used extensively on that road. All of the Standard Code Signal Rules of the Association of American Railroads are covered, and, in addition, a few others are used to define both "route" and "speed." The position of the marker, above or below the main signal unit, provides certain information. For example, let it be assumed that a route is lined up for a southbound train off of the cut-off with crossover No. 10, switch No. 8 and crossover No. 6 in the normal position. Providing the next signal ahead is displaying Approach or Clear, signal 7LA will display a white marker over two vertical green lights, indicating Clear, this being a normal or main route. However, if the next signal is at Stop, signal 7LA will display a white marker over two diagonal yellow lights, indicating Approach, and to proceed at not exceeding medium speed prepared to stop at the next signal. If the block is occupied between signal 7LA and next signal in advance, a call-on signal may be displayed, consisting of a white marker over two diagonal lunar white lights, indicating restricted speed, and to proceed prepared to stop short of a train ahead. Signal 7LB will display aspects similar to those displayed by signal 7LA when a route is lined up for a southbound Big Four train to St. Louis, with crossover No. 6 in the normal position and switch No. 8 reversed, excepting that the white marker is located immediately below the main signal unit, thus designating a medium speed route.

The use of call-on signals in this layout greatly increases the track capacity in this vicinity, thus reducing delays of trains to a minimum.

Train movements can be made into occupied blocks for a following train movement, which, if a call-on signal was displayed, would permit a train to enter a block, where the direction of traffic is not necessarily fixed for the opposing direction. As mentioned previously, the call-on aspects consist of two diagonal lunar-white lights with a white light, either above or below the main unit. Two diagonal lunar-white lights without a marker light is used for diverging routes to yard tracks.

New Interlocking Machine

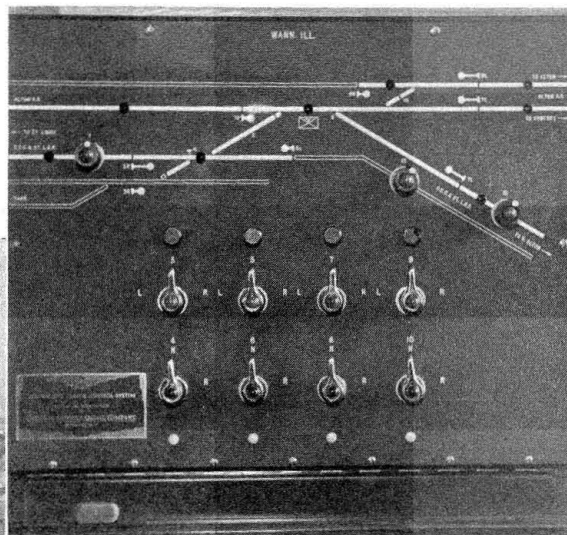
The new interlocking machine is of the General Railway Signal Company's miniature-lever type, with no mechanical locking between the levers, and is of the desk model type, consisting of a cabinet 18¾ in. by 16 in. by 8 in., the front of which is hinged. The machine includes an illuminated track model, four signal levers to control eight signals, three switch levers for controlling two crossovers and one switch, one lever for an electric switch lock, and three manual block exit levers. The switch levers, located below the signal levers, operate to two positions, either normal or reverse, and are equipped with an interior switch lock indication lamp which displays red when a switch is locked normal or reverse and a route is lined up and signals cleared for the movement. These levers are not to be thrown when such an indication is in effect. Be-

low each switch lever is a switch correspondence indication lamp which displays opal when a switch or crossover is either out of correspondence with the position of the lever or is in operation.

The signal levers are located above the switch levers, and operate to three positions, "N," "L" and "R," movement of which to the right clears northward signals, and movement of which to the left clears southward signals. An interior indication lamp in each of these levers displays a green light whenever a signal is cleared. Located directly above each signal lever is a call-on signal button, which, when depressed, will cause the display of a restricted speed or call-on signal when a route is set up, and the block is occupied.

On the track model, the track-occupancy lights are normally dark, and display red when any one of the respective track circuits is either open or occupied. Shortly in approach to the representations of signals 5R, 5L and 7L on the track model, are located manual block signal exit levers 1, 13 and 15, respectively. A Proceed indication may be displayed for a train entering manual block territory when the route is set up, by operating the signal lever and the exit lever. This may be illustrated by assuming the route for a train is lined up for a move between signal 5R and 5L, and thence to East Alton on the Big Four, with levers 4, 6 and 5 in the normal, normal and "R"

Right—The new control machine is of the non-interlocked miniature lever type



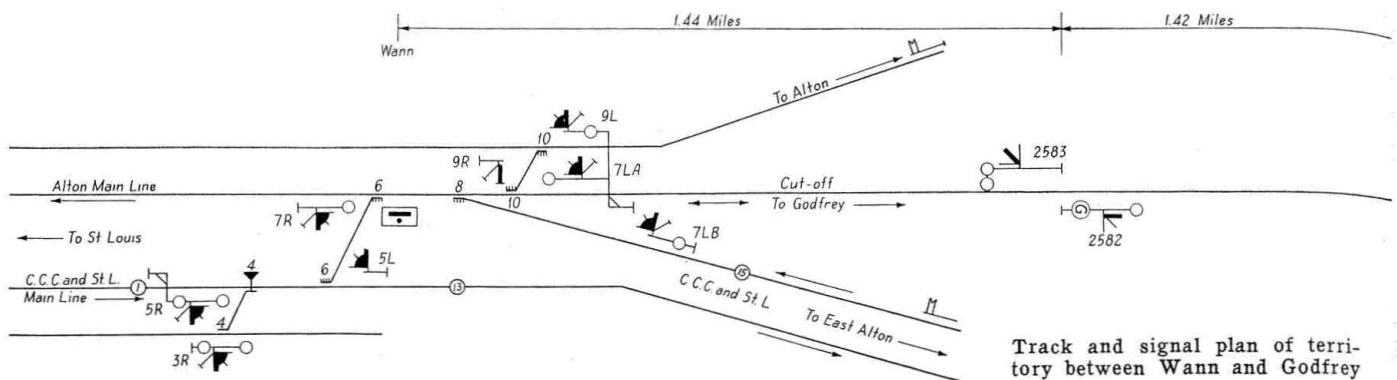
Left—Dwarf signal 9R and power switch No. 8 at Wann interlocking

positions, respectively. For such a move, signal 5R will not display a Proceed manual block indication unless lever 13 is turned to the right.

tribution, all lines that might have to be suspended across the right-of-way are obviated.

The majority of the control relays,

between Wann and Godfrey to replace the staff system. The main purpose of the new automatic signaling between these two points was

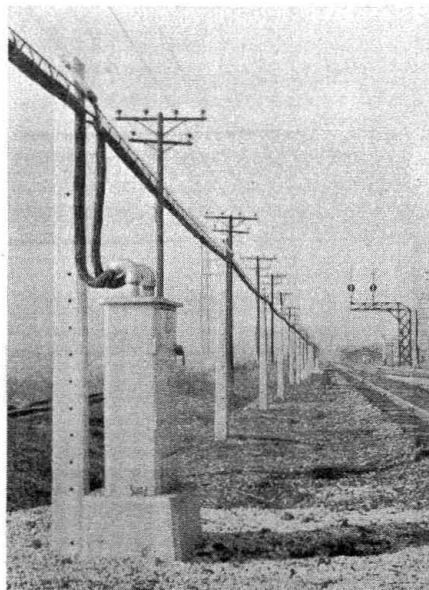


Track and signal plan of territory between Wann and Godfrey

Similarly, when a move is to be made in the reverse direction from 5L to 5R, etc., levers 4, 6 and 5 must be in the normal, normal and "L" positions, respectively, and lever 1 turned to the left before a clear manual block indication can be displayed by signal 5L. Before a Proceed manual block aspect can be displayed on signal 7R for a move to signal 7LB and north, levers 6, 8, 10 and 7 must be in the normal, reverse, normal and "R" positions, respectively, and lever 15 turned to the right. In all three cases, the exit switch must be restored to normal after each train movement.

Of interest on this installation at Wann is the use of concrete posts to support aerial cables on the west side of the Alton right-of-way, for carrying the various signal control circuits for different functions throughout the layout. These posts are spaced approximately 40 ft. apart and carry a $\frac{3}{8}$ -in. 30 per cent Copperweld stranded messenger wire with Copperweld cable rings to support the aerial cable, 9 ft. above the ground, and which is made up of insulated wires. Between the extremities of the post line, there are five terminal case locations in which the aerial cables drop down from the messenger to enter two goose necks on each welded sheet-steel case mounted on a concrete foundation. From each one of these terminal cases, underground parkway cables extend under the tracks to the signals and switch machines. Immediately east of the southbound Alton track is an open pole line which also carries some of the control circuits. From this line to other terminal cases on the same side, pole line wire drops are made, and other underground parkway cables extend to signals, switches and to the other terminal cases on the opposite side. With this arrangement of wire and cable dis-

transformers, rectifiers and storage battery are located in a sheet-metal instrument house adjacent to the tower, except for two instrument cases, at home signals. All the relays are of the Type K, wall-mounted. Each relay is supported



Cable on concrete posts

by a shock-absorbing sheet-metal hanger attached to boards, supported on channel columns attached to the relay house walls. The storage battery, located in the same house, includes 19 cells and 6 cells of Exide EMGS-7 cells for switch operation and relay controls, respectively. Each set of these batteries is on floating charge.

Automatic Signaling

At the same time that the new Wann interlocking layout was put into service, absolute-permissive color-position-light block signaling was placed in service on the cut-off

to expedite train movements, and at the same time to increase track capacity with the fullest assurance of safety, thus reducing delays of trains, a thing that was often incurred by the use of the staff system, which necessitated an absolute block for both following and opposing train movements. Under the new system of signaling on the cut-off, trains are governed by signal indication, which supersedes time-table superiority and the use of written train orders between these points.

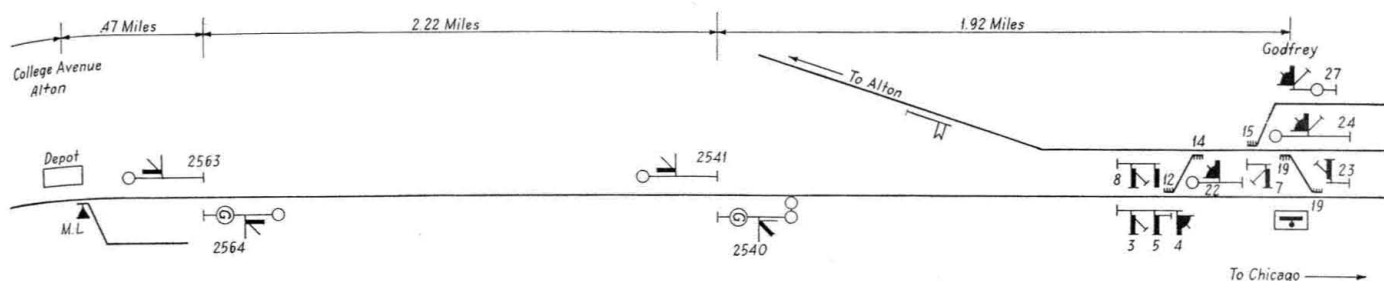
The cut-off is 8 miles long and there is no maximum ascending or descending grade either northward or southward, but there is a continuous ascending grade of 0.6 per cent between Wann and Godfrey. There are eight right and left curves between these points, varying from 0 deg. 40 min. to 2 deg. 18 min. The track is in good condition and consists of 112-lb. rail and rock ballast.

The signals are all of the color-position-light type like those at the Wann interlocking, and are identified as automatic signals by the presence of a black number plate on which are painted white digits. Because of the northward ascending grade, all of the northward automatic intermediate signals are equipped with a 16-in. yellow enameled disk, on which appears a letter "G" mounted to the right of the mast directly below the number plate. These "G" signs identify the signals as grade signals, which authorizes a train to pass the signal at restricted speed when indicating Stop-and-Proceed, the reason for which may be explained by the fact that if a train was stopped on this grade it might have difficulty in starting again, and thus decrease the efficiency of the signaling. All the automatic intermediate signals display normal route, that is, a white marker is located above the main signal unit to convey this informa-

tion. The signals display four indications, Stop, Stop-and-Proceed, Approach and Clear. Signals 2583 and 2540, which are the southward

ward interlocking signal at Wann cannot be cleared for an opposing movement, and vice versa at Godfrey. This is accomplished by using

On the line side of the track, each of the northward signals is provided with a Celotex-lined instrument case mounted on a circular, sectional and



and northward approach signals for Wann and Godfrey interlocking, respectively, are equipped to display a staggered white marker over two vertical green lights as an Approach-Medium aspect.

Signal Co-ordination

The northward semi-automatic high and dwarf signals at Wann interlocking, and the southward semi-automatic high and dwarf signals at Godfrey interlocking, governing movements to the cut-off, are co-ordinated with the new signal system between these two interlocking plants. The signaling is arranged to be absolute against opposing trains and permissive for following trains in either direction. When the towerman at Godfrey lines up a route for a movement over the cut-off to Wann, all the opposing intermediate automatic signals are automatically caused to display the most restrictive indication or Stop, and a north-

neutral track, double-wire, double-break polarized line A. P. B. circuits, with approach lighting.

A telephone was installed at each signal location between Wann and Godfrey, and is located in a small cast-iron box attached to the instrument case supporting the signal mast on the east side of the track. These phones connect the Godfrey and Wann towers, and are used mainly when a train encounters an absolute signal indicating Stop, so that a member of the train crew can call the operator at Godfrey or the operator at Wann for further instructions. Trains operating in this territory are only permitted to make reverse movements under signal indication or flag protection, and, therefore, to make a reverse movement a train must move to a point clear of the next opposing signal, call the operator at Wann or Godfrey, advising of a reverse move to be made, after which the movement will be directed by signal indication.

portable concrete foundation furnished by the Railroad Concrete Products Company. No shelving is provided, all of the relays and other allied apparatus being wall mounted, the relays on spring shock absorbers being fastened to a pine back-board. All the relays are of the Type K, manufactured by the General Railway Signal Company.

The line control circuits are terminated on Standard A. A. R. Signal Section terminals, and are protected by lightning arresters, which are mounted in the lower portions of the instrument cases as shown in one of the illustrations accompanying this article. The ground rods are Copperweld $\frac{3}{4}$ -in. by 15-ft., and the grounds are rated as good when reading under 25 ohms.

The connections to the track are in single-conductor No. 9 parkway cables, buried three feet underground in sand, using Western Railroad Supply Company bootleg outlets with American Steel & Wire Company Type S-2 stranded connections with $\frac{3}{8}$ -in. plugs. Each rail joint is bonded with Cadweld signal bonds.

Commercial power is received at College Ave., Alton, at 220-volts, 60-cycles, and is carried through the installation on two No. 8 S. C. DBWP line wires mounted on glass insulators on the two field pins on the bottom arm of the pole. Each track circuit, which averages about 4000 ft. in length, is fed from G. R. S. Company automatic rectifiers BB-3Y with two cells of Edison M 500-a.h. battery in series, which are located in a welded steel terminal case at each cut-section.

The new interlocking facilities at Wann, as well as the new automatic signaling on the cut-off between Godfrey and Wann were planned and installed by the regular signal department forces of the Alton under the jurisdiction of H. C. Sampson, Assistant Superintendent of Telegraph and Signal Engineer. The major items of signaling and interlocking equipment were supplied by the General Railway Signal Company.

View of interior in the new sheet-metal instrument house near tower

