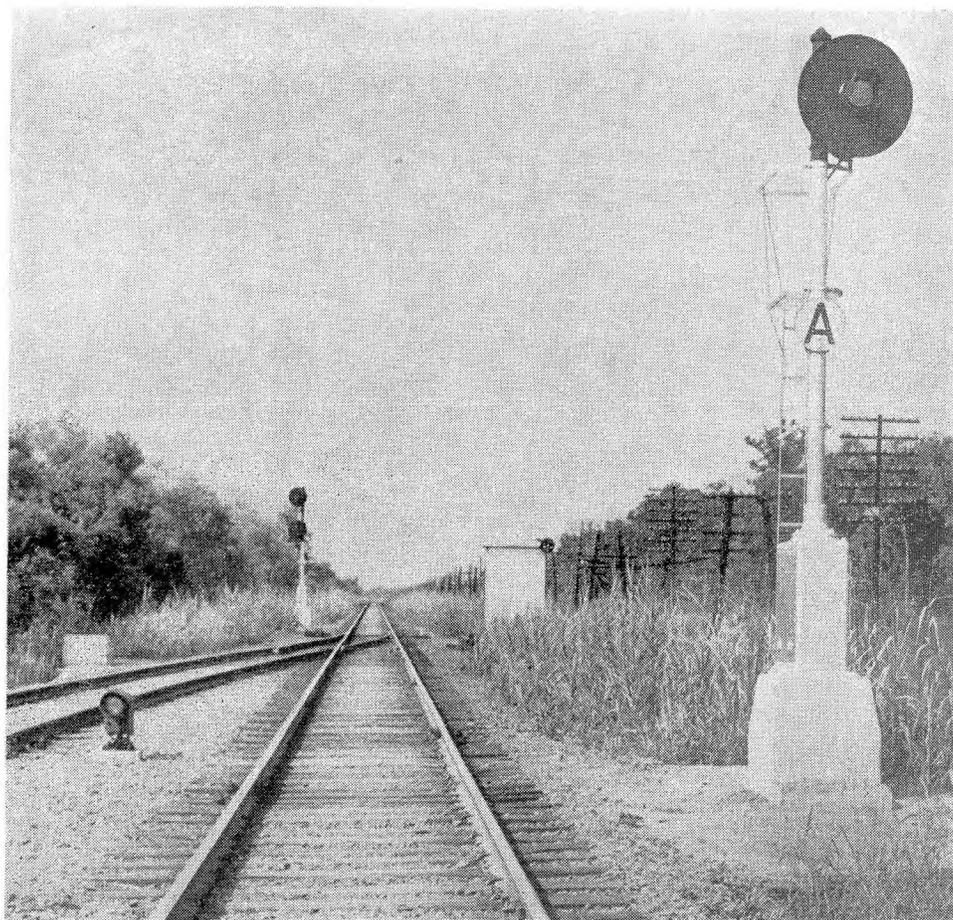


Power switch and signal layout at the south end of a siding at Akka



# L. & N. Installs C.T.C. On an Engine District

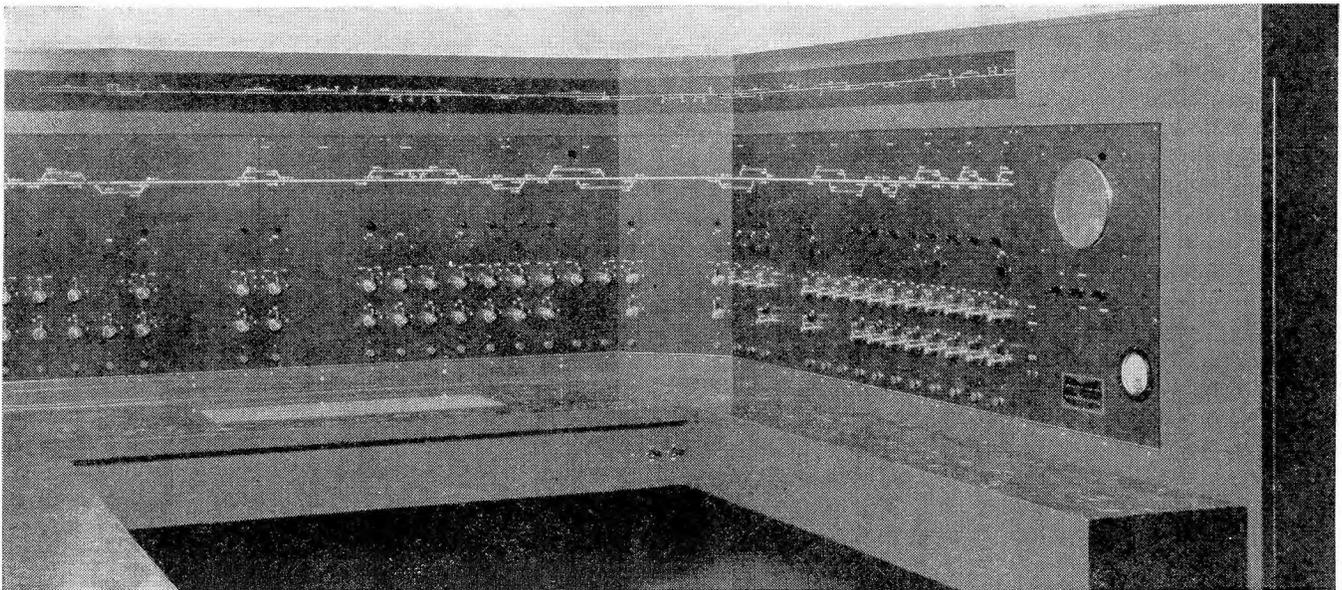
THE Louisville & Nashville will soon complete the final section of an installation of centralized traffic control on the engine district between Montgomery, Ala., and Mobile. Double track extends 4 miles south from Montgomery to Catoma, from which point the centralized traffic control extends on 110 miles of single-track main line to Welka, which is the north end of a six-mile section of double track through Flomaton, Ala. The south end of this double track is at Miles, from which point centralized traffic control extends on 55 miles of single-track main line to Sibert Yard which is about two miles north of the passenger station in Mobile.

The power switches and semi-automatic signals on the single track between Catoma and Welka, are con-

trolled from a C.T.C. machine in an office at Georgiana, which is approximately midway in this 110-mile territory. The 56-mile territory between Miles and Sibert Yard at Mobile is controlled from a C.T.C. machine in an office at Mobile. On these two sections of single track, all trains are governed by signals whose indications supersede the superiority of trains for both opposing and following movements on the same track. On the six miles of double track between Welka and Miles, trains are operated under automatic signal protection. Movements into and out of the passing tracks at Flomaton, as well as to and from the Myrtlewood branch line at Escambia Junction, are controlled remotely from a desk-type C.T.C. machine in the office at Flomaton.

**Project between Montgomery, Ala., and Mobile includes 172 miles of road — Three-wire local line circuit includes the motor-car indicators**

This 178-mile engine district between Montgomery and Mobile is a portion of the Louisville & Nashville through route between Cincinnati, Ohio, and New Orleans, La. Seven passenger trains are scheduled in each direction daily between Montgomery and Mobile, and during the last year, some of these trains have been running in two sections almost every day. The daily schedules include four through freight trains in each direction daily and a local freight each direction daily except Sunday. Extra freight trains are operated as required. On the average about 48 to 52 trains are operated daily.



Middle section and right wing of control machine at Georgiana, Ala.

Throughout most of this territory, the grade is slightly rolling with short sections ranging up to 0.8 per cent. The tonnage rating for the Class J3 locomotives is 2,080 tons, and for the Class J4 the rating is 2,400 tons. The curvature is comparatively light with 3 deg. as a maximum. In general, therefore, the conditions are favorable for handling trains at high sustained speeds, on the territory between Montgomery and Hurricane. The through passenger trains are scheduled to make this 110 miles between Catoma and Welka in about 2 hr. 20 min. The through freights cover this mileage in about 4 hr. 50 min.

Between Hurricane and Sibert, 15 miles, the railroad crosses five drawbridges, the maximum speed limit over these bridges being 15 m.p.h. As a result the average train speeds are low in this section, the time being about 30 min. for passenger trains and about 45 min. for freight trains.

#### Junctions and Branch Lines

From Georgiana, Ala., a single-track branch line known as the Alabama-Florida Branch extends southeast 100 miles to Graceland, Fla. The traffic on this line includes one local passenger train and a local freight each way daily except Sunday. From Flomaton, Ala., one branch line extends south 43.7 miles to Pensacola, Fla., where connection is made with a line extending 160.6 miles east to Chattahoochee, Fla. Three first-class trains and a freight train are operated daily each direction between Flomaton and Pensacola.

A second branch line extends north from Flomaton 112 miles to Selma, Ala. One passenger train is

operated each way daily and one freight train is operated each way daily except Sunday. The Foley Branch extends from Bay Minett 36 miles to Foley, on which one mixed train is operated each way daily.

#### Passing Track Layouts

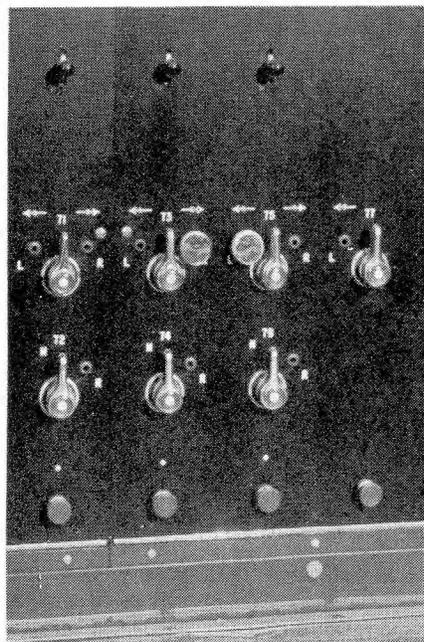
In the C.T.C. territory, single passing tracks with power switch machines at both switches are located at stations as indicated by the legend on the accompanying diagram. At Greenville all four switches of the two passing tracks are equipped with power machines so that trains in either direction can enter or depart at any switch. In the lap layouts at McGehees, Leto-

hatchie, Calhoun, Wilcox, Evergreen, Castleberry and Hurricane one passing track is used by northward trains and the other is used by southward trains. The trains enter their respective passing tracks at the outlying switches which are equipped with power switch machines, and the trains depart from the passing tracks at the lap switches which are equipped with spring mechanisms. Similar spring mechanisms are used at the ends of double track at Catoma, Welka and Miles, as well as at the yard lead switch connecting to the main line at Aladocks. Considering the C.T.C. territory as a whole, there are 50 electric switch machines and 18 spring switches.

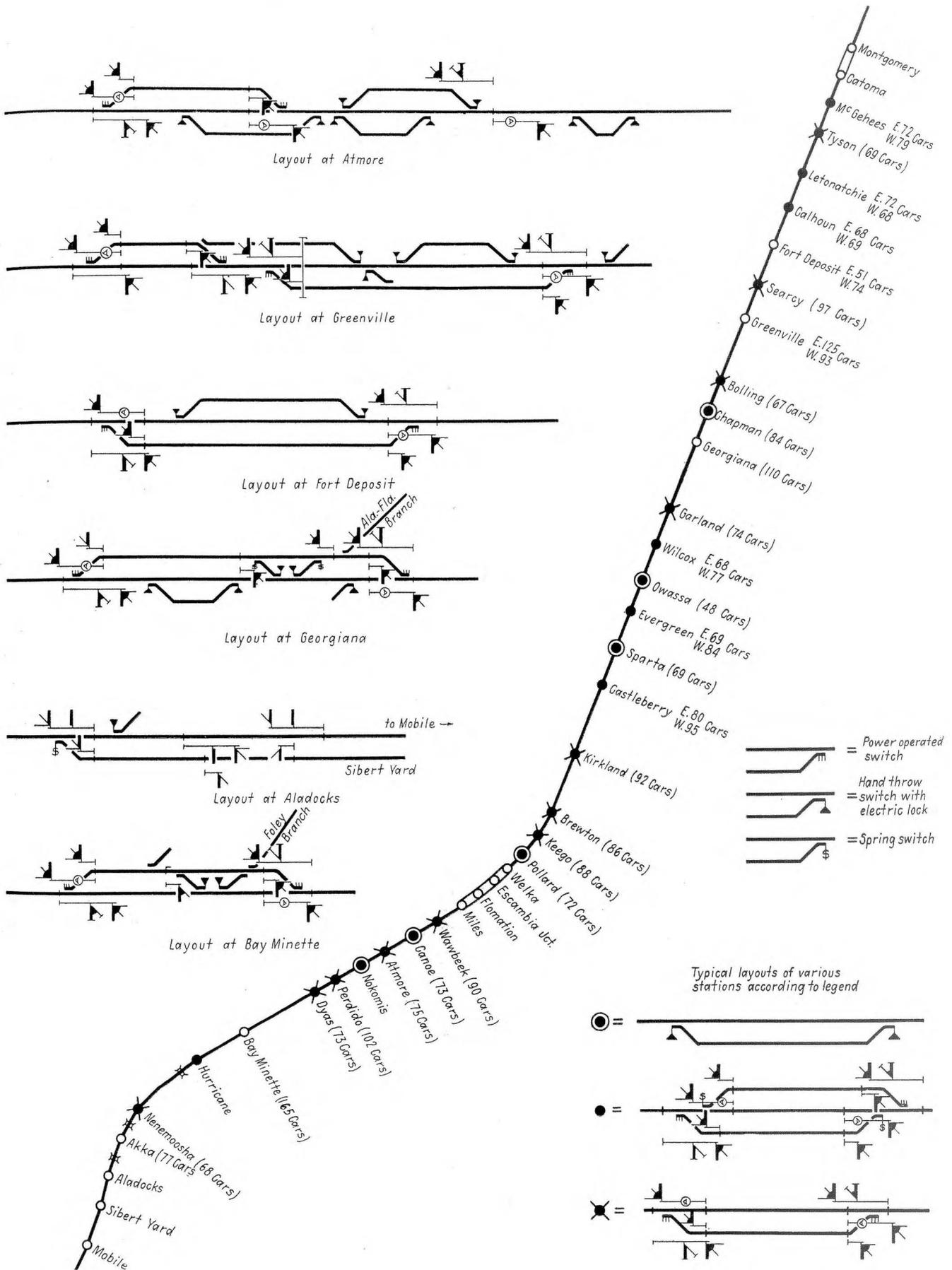
At 12 short sidings which are used only by work trains or by the local freight trains when setting out or picking up cars, the hand-throw switch stands were left in service, but electric locks were applied to these switches. Similarly electric locks were applied to 21 other main-line hand-throw switch stands on crossovers or spur tracks. Thus a total of 45 electric switch locks are included in the C.T.C. territory.

#### C.T.C. Control System

The control of the power switches and semi-automatic signals, as well as the return of indications to the control machines, is accomplished by the General Railway Signal Company's Type-K, Class-M shunt-type line code system using two line wires. One such circuit extends from the control office at Georgiana north to Catoma, and a second circuit extends south from Georgiana to Welka. A third circuit extends from the control office at Mobile to



Knobs inserted to prevent throwing lever 73 to right or lever 76 to left



Map and detail layouts of project as a whole

Miles. These three circuits are carried on new No. 6 AWG 40 per cent Copperweld bare wire put up for the C.T.C. code system. It is so arranged that these three circuits can be coupled together to provide a through circuit for a voice frequency telephone if found necessary or desirable.

### Arrangement of Control Machines

As shown in one of the views, the panels of the control machine at Georgiana are set at an angle to form a "U" shape, so that the man in charge can reach any of the levers without leaving his chair. The panel of the control machine at Mobile is in one straight section 100 in. long. Each of these two machines has an automatic train-graph which records the operations of trains when they pass the OS sections at the various power-operated switches.

The machine at Georgiana has 47 levers for controlling semi-automatic signals, and 34 levers for controlling power switches. Similarly the machine at Mobile has 22 levers for signals, and 16 levers for power switches. These machines are equipped with the conventional forms of indications to repeat the operations of switches and signals. In addition to indicating the occupancy of all portions of main track,

the illuminated track diagram also has tokens which can be used to indicate occupancy of the passing tracks.

### Switch Machines and Spring Switches

The power switch machines are the Model 5D dual-control, equipped with motors for operation on 24 volts d-c. The spring switch mechanisms are the Mechanical Switchman type made by the Pettibone-Mulliken Company.

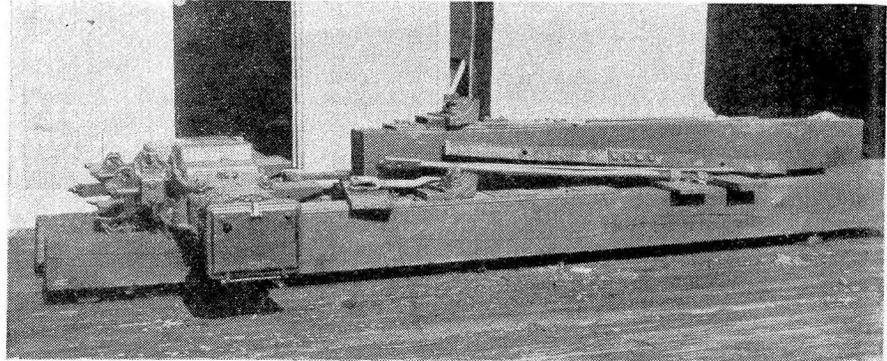
The switch layouts equipped with switch machines or with spring

bolted to the switch machine, thus preventing lost motion.

The electric locks on the hand-throw switches are the Model 9A, equipped with indicators and an emergency release device.

### Changes in Automatic Signaling

Prior to the installation of centralized traffic control, automatic block signaling had been in service on this division for years. Three-position upper-quadrant semaphores were in service between Montgomery and Carpenters, and color-light sig-



Switch machine and plates on ties at shop ready to install

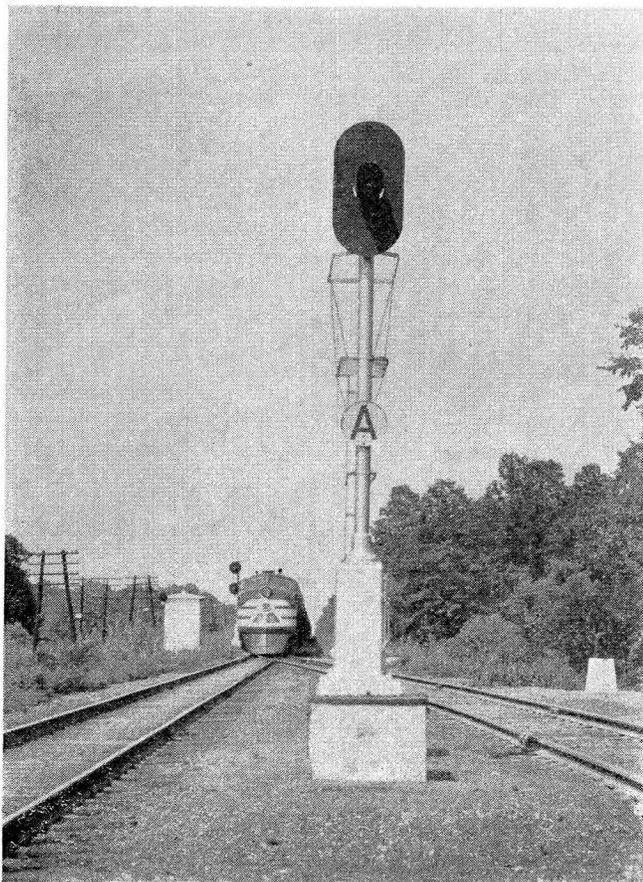
switches are reconstructed to provide good ties, heavy plates and adjustable rail braces on four ties. On two ties, the plates extend and are

nals were used between Carpenters and Mobile. As a part of the C.T.C. project, the semaphore signals were removed, Type-SA searchlight intermediate automatic signals being installed on the section Catoma to Welka at locations as were required according to present-day braking distances. On the section between Miles and Mobile, the existing color-light intermediate automatic signals were relocated as required. The semi-automatic signals at the various passing tracks are all new searchlight-type signals.

### Changes in Local Controls of Signals

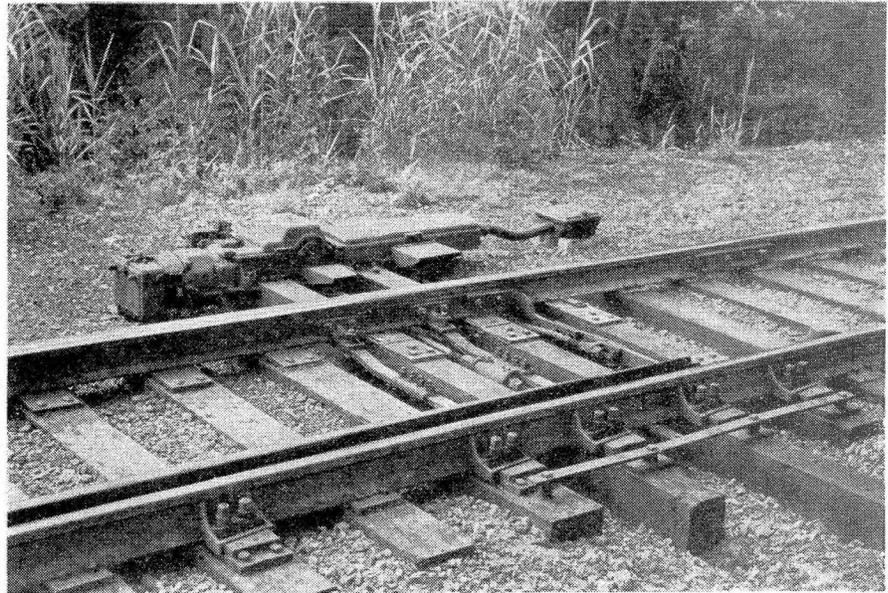
The previous automatic block signaling included conventional absolute-permissive-block controls, using one line wire for each direction in connection with a third wire which was common. Neutral d-c. track circuits were used throughout.

When changing over to C.T.C., coded track circuits were installed between stations, the objective being to utilize the increased lengths of coded circuits to eliminate cut sections, and also to use these coded track circuits to provide track-occupancy indications for each station-to-station block as a whole, without requiring any line wires for this purpose. A special feature was to provide means for warning men on motor cars concerning the approach



Train delays are minimized by the new signal system

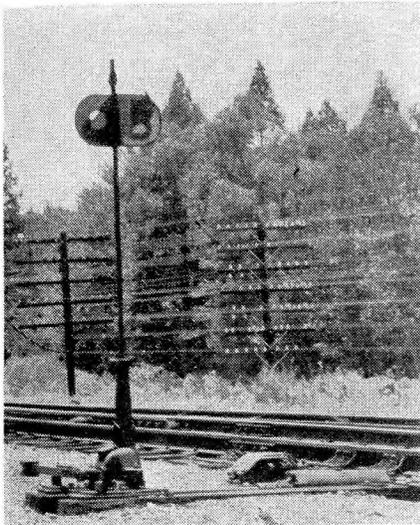
The switch machines are of the dual-control type. Note adjustable rail braces on five of the crossties.



of trains. This objective was accomplished in two ways: (1) By arranging that lights on all intermediate signals be normally extinguished, but when a line-up is made, these signals are lighted; proceed aspects, i.e., yellow or green being displayed on the signals for the direction of traffic established, and the red aspect being displayed on the signals for the opposite direction; (2) The head-block signals are normally lighted, therefore, these signals cannot be used as information to men on motor cars.

**Motor Car Indicators**

At the head-block locations special lamps with 8 3/8-in. lunar white lenses and 19 1/2 in. backgrounds are mount-



Spring switch at Hurricane

ed on the sheet-metal instrument house near the switch. These motor car indicator lamps are located so that they display an indication into the block toward the next passing siding and are lighted as long as no line up is in effect for a train to proceed from the adjacent stations to the station at which the said indicators are located.

With this system of information, a man on a motor car watches the signals when between stations. When departing from or approaching a passing track he observes the motor car indicators. With such an arrangement, the man in charge of the C.T.C. control machine is instructed not to line up for trains any sooner than necessary; otherwise the men

in the field could not figure closely on the time at which trains may be expected at the various locations.

**How the Three Line Wires Were Used**

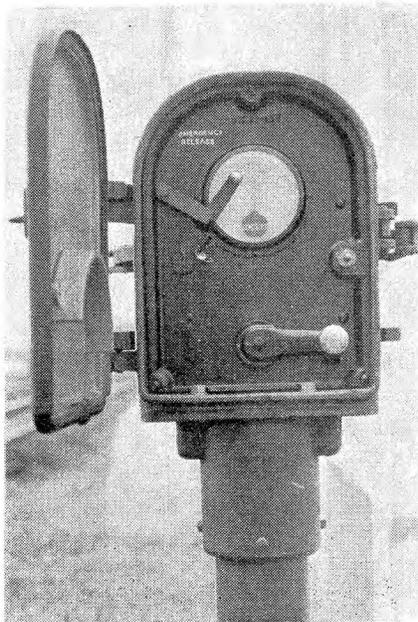
The three No. 10 bare copper line wires, formerly used for the A.P.B. line circuits of the automatic signaling, were utilized in a new and novel circuit scheme to do these three things: (1) As local line controls for the intermediate signals to clear in one direction or the other when the direction of traffic is established by C.T.C. control between any two sidings; (2) to cause the signal lamps in all intermediate signals between said two sidings to be lighted when a line up is being established for a train; (3) control the motor car

indicators at the passing track switches at the end of a station-to-station block.

In so far as clearing the signals for one direction or the other is concerned, this new circuit accomplishes nothing more than a circuit using two line wires, as has been installed on several roads including the Louisville & Nashville between Winchester and Irvine, Ky., as discussed on page 628 of the October, 1943, issue of *Railway Signaling*.

The important new objective attained by the new circuit, using three line wires, is to provide means for warning men on motor cars of the fact that the man in charge of the C.T.C. control machine has lined up the signals for a train. As considered from another standpoint, the new circuit scheme eliminates special relays and circuits to control approach lighting on intermediate signals. The lamps in intermediate signals are lighted when C.T.C. line code control from the office is effective in establishing control for a station-leaving signal. The semi-automatic C.T.C. controlled signals at the switches are constantly lighted.

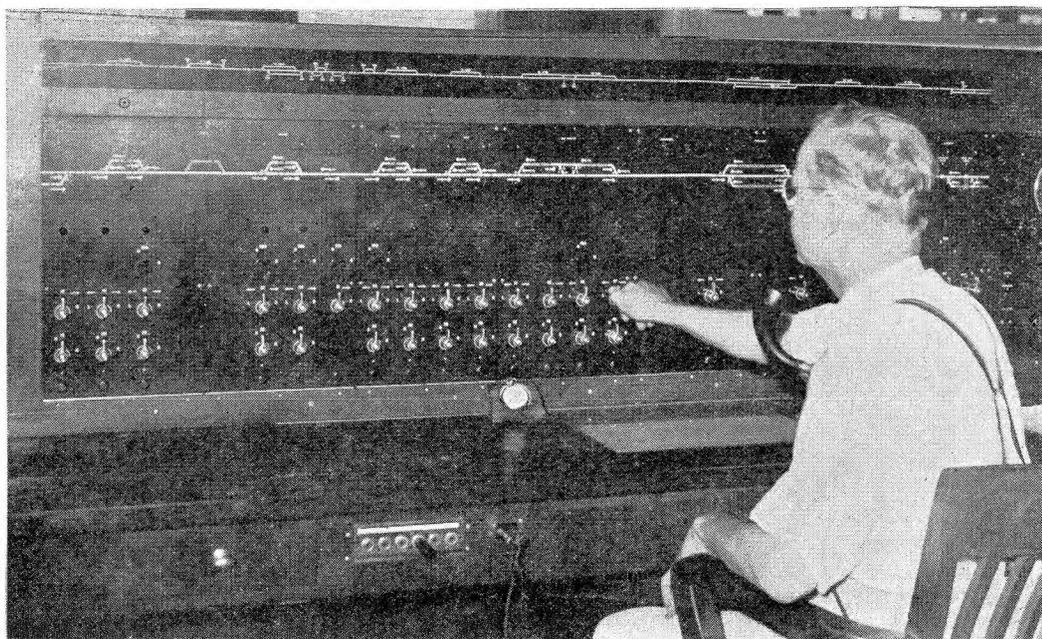
The new circuits use three line wires between any two locations of intermediate signals, or between a station-leaving head-block signal and the first intermediate location. The circuits remain energized for the direction used by the last previous train, as, for example, in the typical circuit, Fig. 1, the line relays 101HD and YHD and signals 111 and 121 are shown energized. With these relays energized, and with no C.T.C. code control in effect, a corresponding set of relays are energized, thus preventing the lamps in the intermediate signals from being illuminated. For this reason, at intermedi-



Electric lock with emergency release







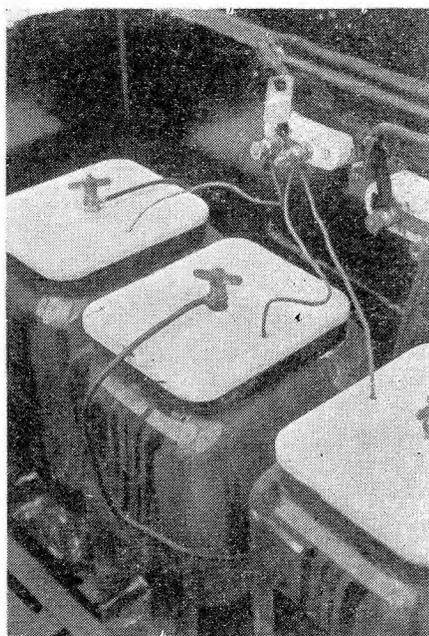
The C.T.C. machine at Mobile controls the section from there to Miles, Ala., 55 miles

cupied then 75 code is fed southward on B142T. Only when 180 code is received on B142T at signal 9R is the block occupancy relay 9LBP energized.

Similarly with track circuits B132T and 112T unoccupied, then relay 7RBP is energized. With both 9LBP and 7RBP energized and repeated in the C.T.C. office, a station-to-station track occupancy lamp is extinguished. Thus the track occupancy indication of each station-to-station block is obtained without requiring any local line wires.

#### Control of Outlying Switch Locks

Outlying switch locks were installed on hand-throw switches leading from the main line. The method



Primary battery on track circuit

of control for these locks, while varying depending on the particular location, followed a general pattern.

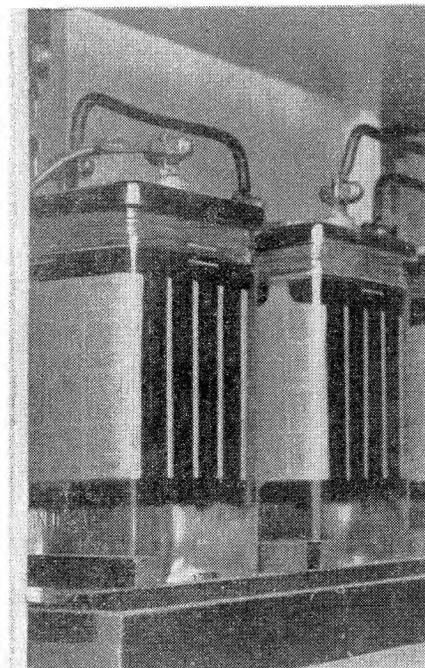
Typical circuits Fig. 1 shows a short siding, with the switches at both ends protected by switch locks, located between signals 111 and 132. Briefly stated the control for these two locks is as follows: (1) The door of the lock must be open to energize the lock. (2) For a train movement out of the siding a time element is provided to furnish a definite time interval before the lock can be energized. (3) For moves into the siding a short "release" track circuit is provided. The train pulls up to the switch and stops with the engine on this release track. A crew member opens the lock door and the lock may be operated at once. The opening of the lock door also drops the lock repeater relays 8ALP at locations 111 and 132. Assume a train movement out of the siding and the following conditions are set up when the 8ALP relays drop. B132TP at location 111 will be de-energized and in turn opens the line circuits to put the protecting signals to stop. Relay B132TPP down also causes a block occupied indication for this section to show on the control machine panel. The LP relays at both 111 and 132 locations control the respective stick relays also.

#### Power Supply

On most of this C.T.C. territory 550-volt a-c. single-phase power is distributed on a circuit of two No. 6 copper line wires. This power is fed about 10 to 15 miles in both directions from certain towns with a gap of one automatic block between the end of one feed and the end of the

next, thus saving line wire. The 550-110 volt transformers at the power switch locations are rated at 300 v.a., and at intermediate signal locations at 100 v.a.

At each power switch location there is a set of 12 cells of 80-a.h.



Storage battery at switch location

Exide storage battery for operation of the switch machine and for feeding the line coding apparatus. Another set of 5 cells of 60-a.h. battery is used to feed the local relays and signal line relays and a similar set of battery is provided at each intermediate signal location.

Each of the coded track circuits is fed by one cell of Edison-B4H type storage battery, and each of the conventional d-c. track circuits in sta-

tion limits is fed by three cells of 1,000-a.h. Edison primary battery.

When installing the centralized traffic control, the previous automatic signaling was changed to the extent that construction was required throughout. New signals at new locations were required at the switches, and practically all the intermediate signals were relocated and reconstructed. New underground cables were installed throughout, this cable being of Okonite manufacture. The construction methods and field organization on this project were about the same as used on previous Louisville & Nashville jobs, as were explained in detail in an article entitled "Signal Construction

Organization on the L. & N." on page 688 of the December, 1942, issue. A special feature is the mounting of the switch machines, plates, braces, etc., on ties, at construction headquarters, and the installation of these assemblies as units.

The first section of this C.T.C. project between Mobile and Bay Minette was placed in service on May 31, 1943, and various other sections were brought into service when completed. This C.T.C. was planned and installed by signal forces of the Louisville & Nashville under the direction of W. H. Stilwell, signal engineer, the major items of equipment being furnished by the General Railway Signal Company.

eastward main track, was 1,723 ft. west of the point of accident. This signal was of the two-unit, two-indication, searchlight type.

First 208, an eastbound first-class U.P. passenger train, was passing through Devore on the eastward track at a speed of about 25 m.p.h. when the eighth car was struck by Extra 3778 West at the fouling point of the crossover.

**Discussion**

Extra 3863 West, a westbound freight train, had stopped on the westward main track between the siding switches at Devore. Extra 3778 West entered the westward siding to pass Extra 3863 West, and stopped near the clearance point at the west siding-switch. The investigation disclosed that the fireman of Extra 3863 lined the west siding-switch for movement of Extra 3778 from the siding to the westward main track, and gave proceed signals, then lined the east crossover-switch immediately in front of engine 3778. He said he thought the first switch was for operating the derail only, and that the second switch was for operating the west siding-switch. He was not aware that a crossover was located in this vicinity. It was dark, 9:55 p.m., and he was carrying a lighted white lantern. His entire railroad experience covered only about 6 months. He had never been instructed regarding the manner in which derails operated in conjunction with siding switches.

If the switches of the crossover at Devore had been equipped with electric-locking, it would not have been possible to operate the switches to permit movement on the crossover when a train was moving on the eastward main track in the vicinity of the crossover, as in this case, and the accident would not have occurred.

It is found that this accident was caused by the unintentional throw-

## Accident at Crossover

ON November 26, 1943, there was a side collision between a Union Pacific passenger train and an Atchison, Topeka & Santa Fe engine on the line of the Atchison, Topeka & Santa Fe at Devore, Cal. An abstract of the report of the Interstate Commerce Commission concerning this accident is as follows:

**Location of Accident**

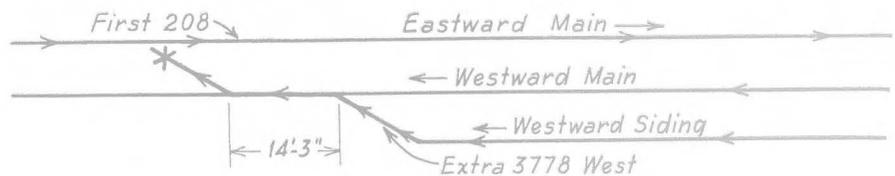
Trains of the Union Pacific were regularly operated over this portion of the railroad. This is a double-track line over which trains moving with the current of traffic are operated by an automatic block-signal system, the indications of which superseded timetable superiority. The current of traffic is to the left. At Devore the westward siding is south of the westward main track, and its west switch is 3,486 ft. west of the station. The east switch of a crossover 207.6 ft. long, which connected the main tracks, is 14.3 ft. west of the west switch of the westward siding, and is facing-point for movements from the westward main track to the eastward main track. The accident occurred at the fouling point of the eastward main track and the crossover.

From the west on the eastward main track there was a 3-deg. curve to the right 1,925 ft., which was followed by a tangent 182 ft. to the point of accident and 935 ft. beyond. From the east on the westward siding there were, in succession, a tangent 1,718 ft., a 3-deg. curve to the right 1,009 ft., a tangent 671 ft., a No. 10 turnout 200 ft. to the westward main track, a

tangent 14.3 ft., and a No. 10 turnout about 50 ft. to the point of accident and 157 ft. beyond. Throughout a distance of more than 1 mile immediately west of Devore the grade for eastbound trains varied between 2.06 per cent and 2.25 per cent ascending, and at the point of accident it was 2.2 per cent ascending.

A derail was located on the south rail of the siding about 200 ft. east of the west switch. This derail was connected to the west siding-switch and operated in conjunction with it. When the west siding-switch was lined for movement from the siding to the westward main track, the derail was in non-derailing position.

The switch-stand for the west siding-switch was on the south side of the westward main track and was of the low-stand, hand-throw type. The switch-stand for the east switch of the crossover was of the high-stand, hand-throw type and was located south of the westward main



Track layout in the vicinity of the accident

track. When the west siding-switch was lined for movement to the westward main track, and when the east crossover-switch was lined for movement to the eastward main track, the switch lamp of each switch displayed a red aspect.

Automatic signal 712, which governed eastward movements on the

ing of a switch immediately in front of an approaching train.

It is recommended that the Atchison, Topeka & Santa Fe install electric switch-locking at main-track hand-operated switches in automatic block-signal territory.

By the Commission, Chairman Patterson.