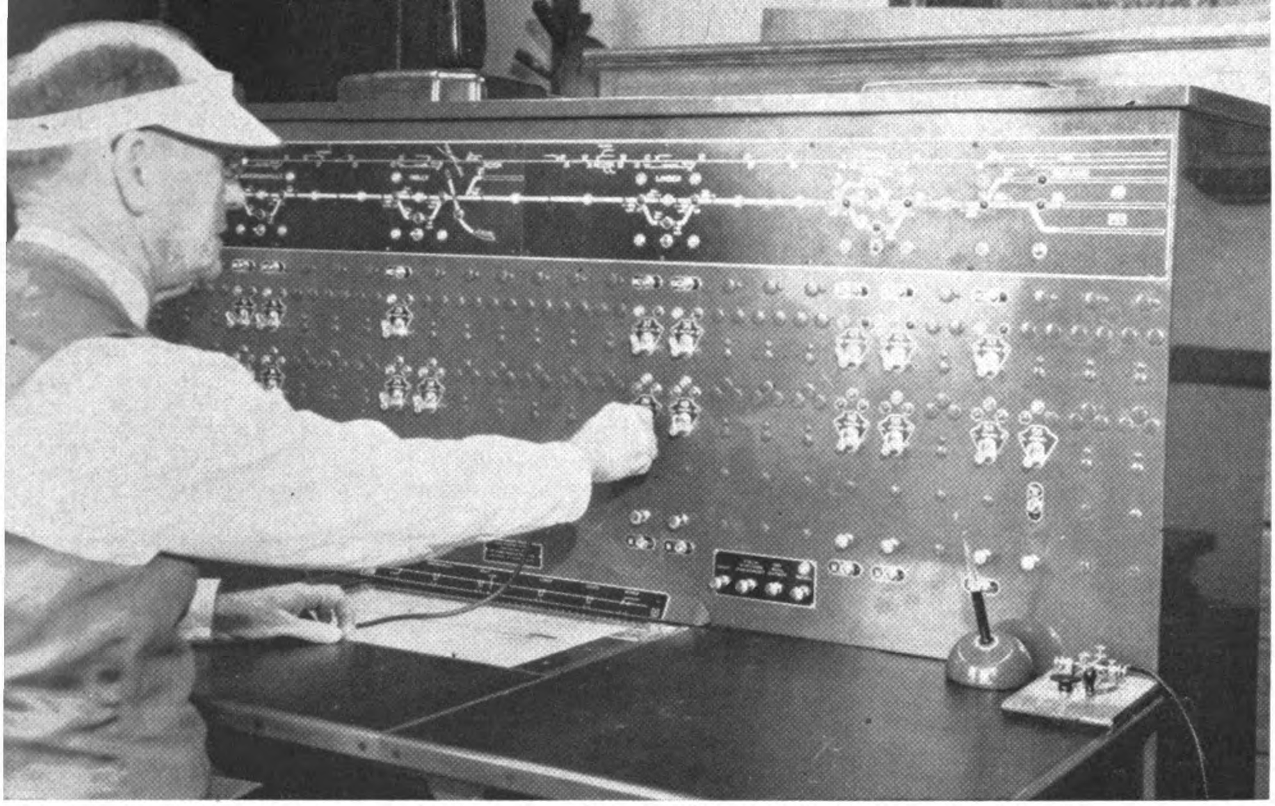


The CTC control machine is in the dispatcher's office at Durand

Grand Trunk Installs C. T. C. on 37 Miles of Busy Single Track

New signaling system saves an average of 42 seconds per mile for freight trains, and permits passenger trains to make up lost time without delaying other trains. Flashing-yellow aspect on leave-siding dwarf saves time

AS A MEANS of saving train time, increasing track capacity, and improving safety, the Grand Trunk Western has installed centralized traffic control, on an important section of single track, 37 miles long, between Pontiac, Mich., and Durand, Mich. As shown in the map, the G.T.W. has a main line from Detroit west through Pontiac and Durand to Grand Rapids, Grand Haven and Muskegon. In addition to ordinary traffic, this line handles cars to and from Muskegon for car ferry connections across Lake Michigan to and from Milwaukee.

At Durand, this line crosses the double-track main line between Chicago and Port Huron, where connections are made with the Canadian National. Through sleeping cars are operated between Detroit and Chicago via Durand, and freight traffic follows this route between these cities. A subdivision branch extends north from Durand to Bay City and also to Greenville. For these reasons, the traffic is heavier on the single-track section between Pontiac and Durand, than it is on other sections of single track on this line. Therefore, C.T.C. was installed on this section.

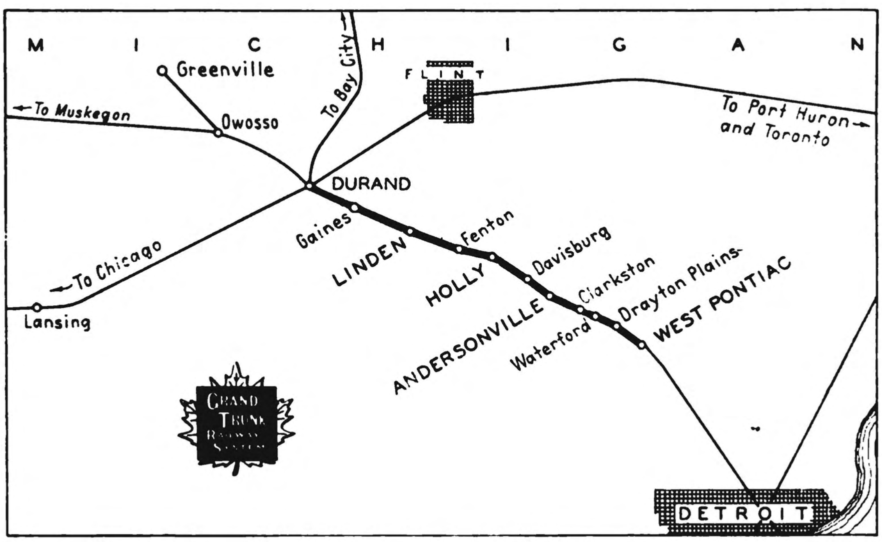


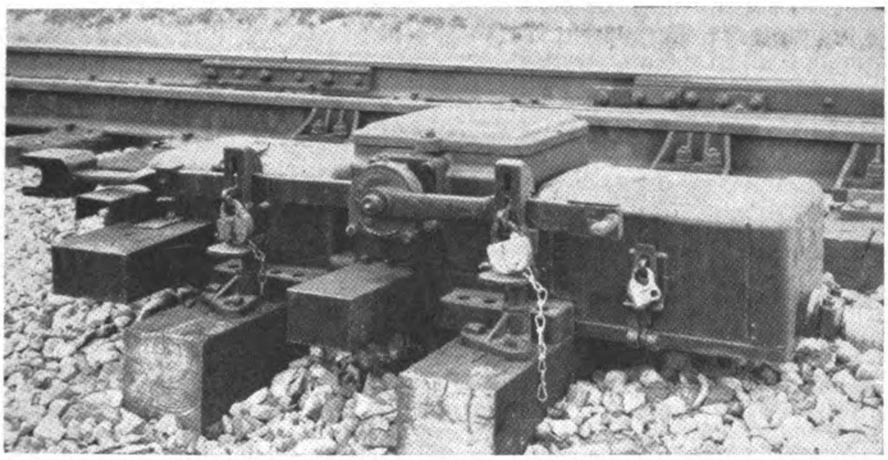
Fig. 1—Map showing the new centralized traffic control territory

The traffic includes 8 passenger trains and 12 to 16 freight trains daily. The grade is level-to-rolling with short sections of 0.8 per cent grade. The curvature is light, with a maximum of 2 deg. The maximum permissable speed is 75 m.p.h. for passenger trains and 50 m.p.h. for freights.

C.T.C. Saves Train Time

Previously, no signaling was in service on this section, and train movements were authorized by timetable and train order. If a train did not depart from West Pontiac or Durand when expected, the other trains lost time waiting on sidings, because the dispatcher had no means for quickly changing orders. The dispatcher states that he is now using the C.T.C. to save 75 per cent of previous delays. In some instances, the freight trains save 1 hour to 1 hour 30 minutes, compared with delays that would have occurred if train orders had still been in use. The dispatcher stated that on numerous days he saves 1 hour and 15 minutes on No. 513 which is an important westward freight train. The average time saving for freight trains is 25.9 minutes, which is about 42 seconds per mile each train is operated.

The signals are of the search light type and located at immediate right of track governed



The power switch machines are the latest type with dual control — A pair of roller bearings on the switch points is aid to operation

When passenger trains are behind schedule, the dispatcher uses the C.T.C. to make up some of the lost time, without delaying other trains. Previously the passenger trains were required to approach the block offices at speeds such that they could stop within range of vision of the train order signals at such stations. Now with C.T.C., no such speed reductions are necessary.

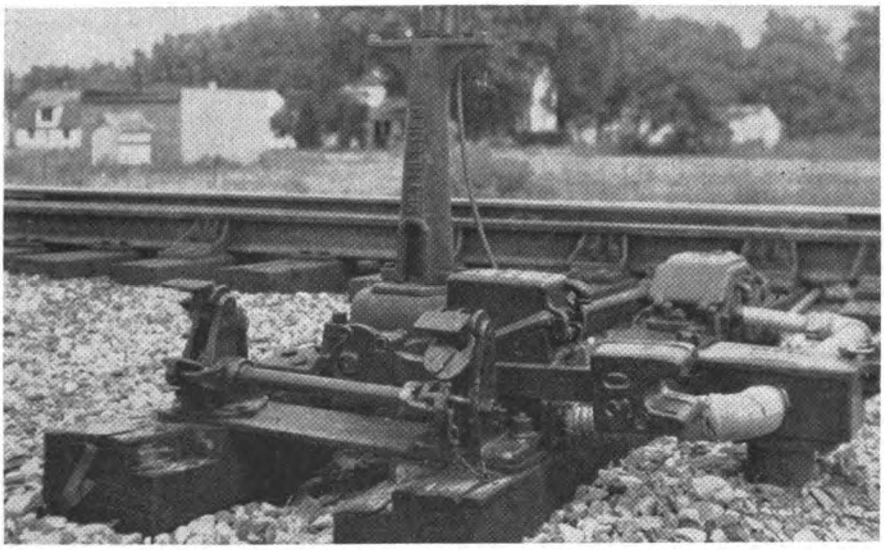
Fewer Sidings

Experience has shown that, with C.T.C., fewer sidings are needed. Therefore, when planning the Pontiac-Durand installation, the sidings were revised. About half of a siding at Drayton Plains was removed, the remainder being left in place as a house track. At Waterford, a siding on the south side was removed, and the west end of the north siding was removed, the remainder being converted to a house track. At Davisburg, the east end of the siding was removed, leaving a house track. The east end of the siding at Fenton was removed, leaving a double-end house track. At Andersonville, Holly, Linden and Gaines, the sidings were lengthened and equipped with power switches and C.T.C. controlled signaling. Thus, of a total of 9 sidings, previously available for trains to pass, one was removed, six were changed to house tracks, and only four were equipped for power operation and C.T.C. signaling for passing trains. The project also includes power switches and C.T.C.-controlled signals at the end of double track at West Pontiac and at the east end of the siding at Durand. These nine power switch and signaling layouts are controlled from a C.T.C. machine in the dispatcher's office at Durand.

The power switch machines are the latest Union type M-23-B dual control, as shown in the picture. Insulated gage plates, 1 in. thick and 8 in. wide, are used on two ties. Ramapo Ajax adjustable rail braces are used on five ties. Plates, ¾ in. thick by 6 in. wide, connect the switch machine to the ends of the tie plates, thus maintaining the relative position of the machine and the stock rail. A pair of roller bearings, on each set of switch points, aids in the operation.

Signaling Arrangements

The signals are the searchlight type. All signals are at the immediate right of the track governed. At one end of each siding, as for example at the west end of Gaines, the siding was thrown over to 18-ft. centers to allow clearance space for the westward main line signal. Referring to Fig. 2, a westward freight train, for example, is waiting on the siding at Linden for a westbound passenger train to pass. As soon as the rear of the passenger train is west of intermediate signal 57.7, the dispatcher can send out a control to reverse switch 39 and to cause a flashing-yellow aspect to be displayed on the leave-siding dwarf signal 40RC. This special restrictive aspect gives the engineer of the freight train the opportunity to get his train started and to pull out into the main track. This saves time



Lever of hand-throw stand is locked in both normal and reverse

compared with conventional practice in which the dwarf could not be cleared to allow the freight train to pull out until the rear of the passenger train goes beyond intermediate signal 57.7.

Block Signaling

The automatic block from the west end of the siding at Linden to intermediate signal 57.7 is 8,900 ft. long, and the automatic block from the east end of Gaines siding to intermediate signal 60.9 is 9,150 ft., thus leaving an intermediate block 17,150 ft. long between the two double intermediate signal locations. This arrangement of automatic blocks saves time. For example, if an eastbound freight train is entering the siding at Linden, just ahead of an approaching passenger train of the same direction, the short block between the approach signal 57.7 and the station entering signal 38R at the west end of Linden, gives the maximum time for the freight to get in the clear without stopping the passenger train. Also, if a westbound freight is waiting on the siding at Linden, the short block out to intermediate signal 57.7 aids in getting the freight underway sooner. Because the distance between main track signals at the ends of Linden is less than train stopping distance, the approach-medium aspect yellow-over-green, is displayed on approach signal 57.6 when signal 38L is displaying the Stop aspect and signal 40L the Approach aspect.

All the signals on this project are continuously lighted, so that the information given thereby, concerning the approach of trains, will be an aid to maintainers, track crews, agents, and train crews on sidings.

Locks on Hand-Throw Switches

Each of the hand-throw switch stands leading to house tracks is equipped with an electric lock. Ordinarily, the electric lock locks the hand-throw lever in the normal position but not in the reverse position.

However, the hand-throw switch at Gaines is within the switch detector "OS" track circuit limits. Therefore, a special arrangement, as shown in the picture, was installed so that the electric lock locks the hand-throw lever in both the normal and the reverse positions. A special dwarf signal is in service at the fouling point to authorize train or engine moves from the house track to the main track.

The electric locks on the hand-throw switches are released under automatic controls. For example, when a local freight train is to enter a spur, that train must stop, or must reduce speed to 15 m.p.h. (average), in the track circuit which includes the location of the switch. If a local freight, that has cleared the main track, is ready to depart, the conductor telephones to the dispatcher to learn whether the main line is clear for the move he wants to make. If the main track between sidings is unoccupied, and if no signal is clear to enter the siding-to-siding block, then the electric lock will release when the conductor removes the padlock.

Long Track Circuits with New Type Relays

The recently developed type DN22B direct-current biased-neutral relays are being used successfully on this project on track circuits ranging from 8,000 ft. to a maximum of 10,000 ft., thus extending the entire length of some of the automatic blocks without cut sections. This type relay is rated at 0.5 ohms, picks up at 0.16 volts, 0.32 amp., and the working values are the same as the pickup. The dropaway valves are 0.128 volts, 0.256 amp. The ballast in this territory is clean crushed rock. These new DN22BH relays give good shunting characteristics and, after a few weeks of adjustments of the battery feeds, these track circuits have operated through rain without failures due to wet track. The relays on the track circuits, 4,000 ft. or less, are the DN22- and DN11- types, rated at 4 ohms.

The line relays are the DP21 type retained neutral, polar type, rated at 400 ohms, together with the conventional type DN-11-500 ohm relays for control and repeater circuits. The power-off relays are the DN-22-P type with two sets of 75-ohm coils. This relay picks up at 7.0 volts and releases at 9.0 volts, the purpose of this special operation being to provide a full voltage standby source. If the a.c. drops to 70 per cent of the rated normal voltage, the relay will release, and will not pick up on less than 90 per cent of normal voltage. The armature will not float between contacts. The switch repeater, relays are type

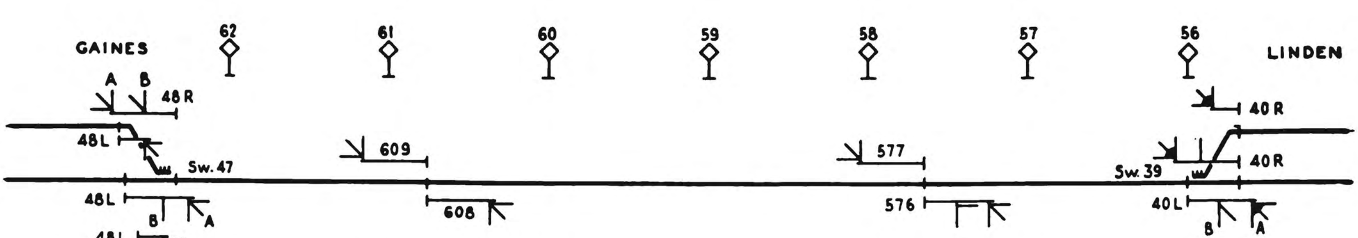
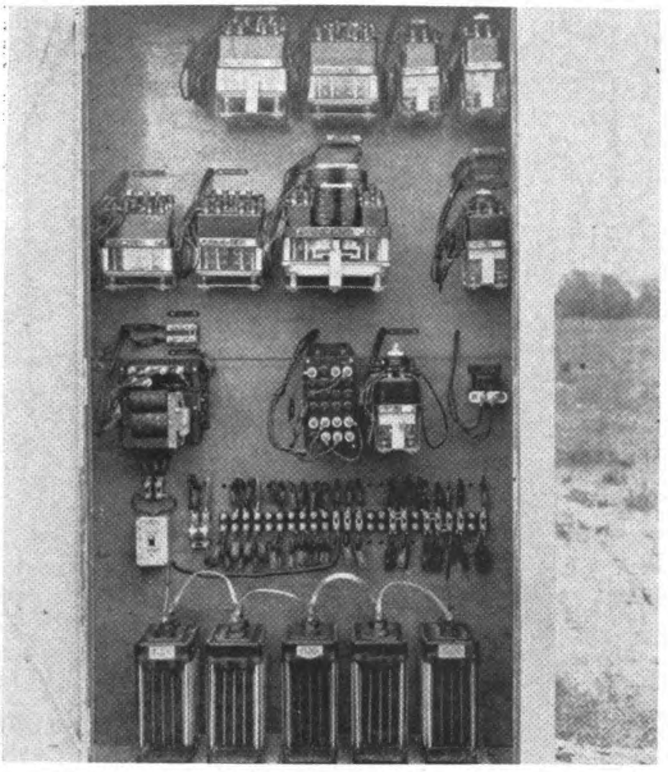
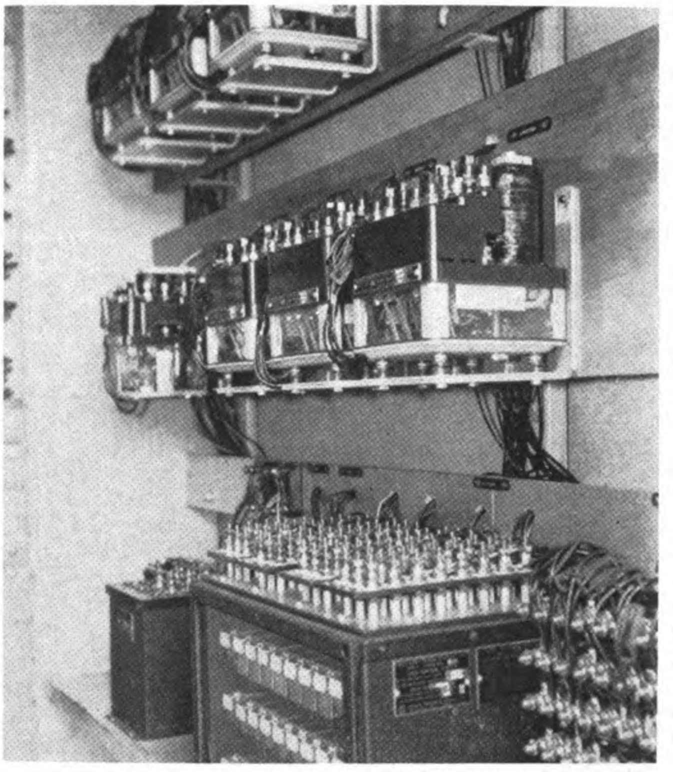


Fig. 2—Track and signal plan of the territory between Gaines and Linden



Relays and batteries in case at intermediate signal



The relays are equipped with plug couplers

DN11 rated at 500 ohms, with six contacts.

At power switch locations, the relays, code equipment and batteries are in 5-ft. by 7-ft. sheet metal houses, set on cast iron piers, 3 ft. high. At intermediate signals, the relays and battery are in sheet metal cases set on cast iron piers. The relays are equipped with plug couplers, by means of which relays can be replaced without changing wire connections to the plug couplers. Insulated nuts are used on the terminal posts on the plug couplers. Solderless terminals, made by Aircraft-Marine, are used on wire connections in the houses and cases. These wires extend direct from terminals on the relays to terminals on other relays or to terminals or arresters on the main board at the rear wall of the house, as shown in one of the views. This wire, about 3,000 ft. in each house, is No. 16 flexible with General Electric, Flamenol insulation.

The cables from the instrument house to each switch machine include a seven-conductor No. 6 motor circuit and a ten-conductor No. 14 for control circuits. Cables from the house to signals include a five-conductor No. 14 and a ten-conductor No. 14. The wires from the house or cases to track are single-conductor No. 9. A 19-conductor No. 14, manufactured aerial cable, self supporting, extends from house to pole line.

Westinghouse type RVS arresters are used on the code line and on the 110-volt a.c. power circuit. An unusual practice is that no arresters are used on other line circuits. The incoming 110-volt a.c. power circuit feeds in through a small G.E. circuit breaker equipped with thermal heater, which kicks out at 10 amp., closes it. Fusestats, set to pull open at 6¼ amp., are connected in the feed to the code line, and in the 24 volt d.c. feed to the switch machine motor. These Fusestats have a spring that pulls the circuit open when the fuse blows.

Power Supply

Power at 110-volt single-phase a.c. is fed both ways from various stations, on two-line wires. This a.c. feeds through rectifiers to charge storage batteries. At each power switch, 12 Exide 80-a.h. cells feed the switch motor. Eight of these cells also feed the coding equipment. A separate battery of five cells of the same type feeds the line circuits and serve as stand-by for signal lamps. One storage cell of the same type feeds each of the longer track circuits. Each short track circuit is fed by two cells of 500-a.h. Edison primary battery.

The two line wires for the C.T.C. code line are No. 8 Copperweld, 40-per cent conductivity, with braided weatherproof covering. The same kind of line wire is used for the 110-volt a.c. power. The local signal line controls are on No. 10 Copperweld, 30-per cent conductivity with synthetic weatherproof covering. The signal masts are set on sectional-type precast concrete foundations, made by the Permacrete Company, Columbus, Ohio.

The ten sheet-metal instrument houses at ends of sidings and ends of double track were hauled out in a work train and set in place at the field locations by a derrick. All other materials were hauled in highway trucks to the field locations. If trucks could not drive to the field locations, track push cars were used from the nearest road crossing. Two 1½-ton trucks with stake-type bodies were used to haul these materials and to transport the construction forces to and from field work.

The major items of signaling equipment for this C.T.C. were furnished by the Union Switch & Signal, division of the Westinghouse Air Brake Company. The C.T.C. project was installed by signal forces of the Grand Trunk Western under the direct supervision of Harry E. Smith, then supervisor of signals. W. L. Dayton, then signal engineer, was responsible for the planning and general supervision of installation, under the direction of A. N. Laird, chief engineer. Mr. Dayton retired on August 1, 1952, after the C.T.C. was placed in service, and was succeeded by Mr. Smith as signal engineer.