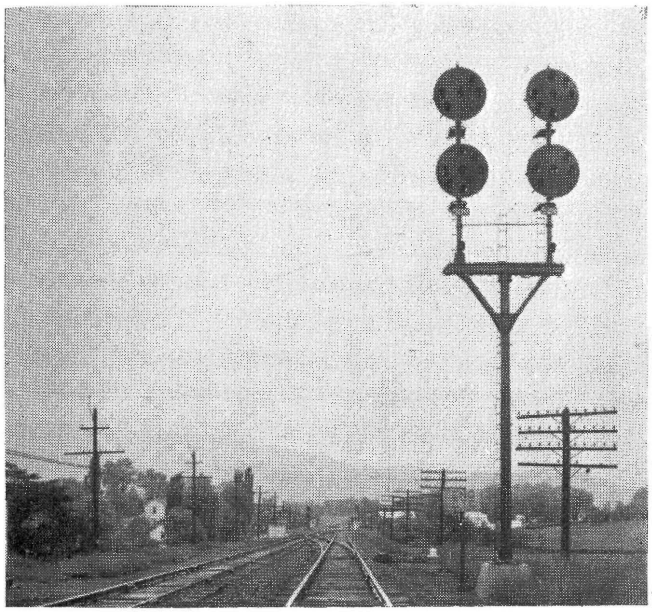
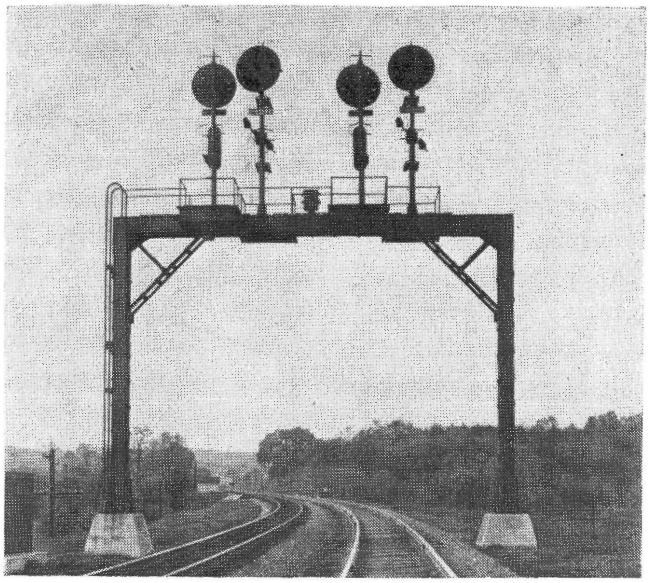
Below—View looking east at the eastward home signals at the Montvale crossover layouts at the foot of the 4.1-mi. ascending grade westward to Villamont





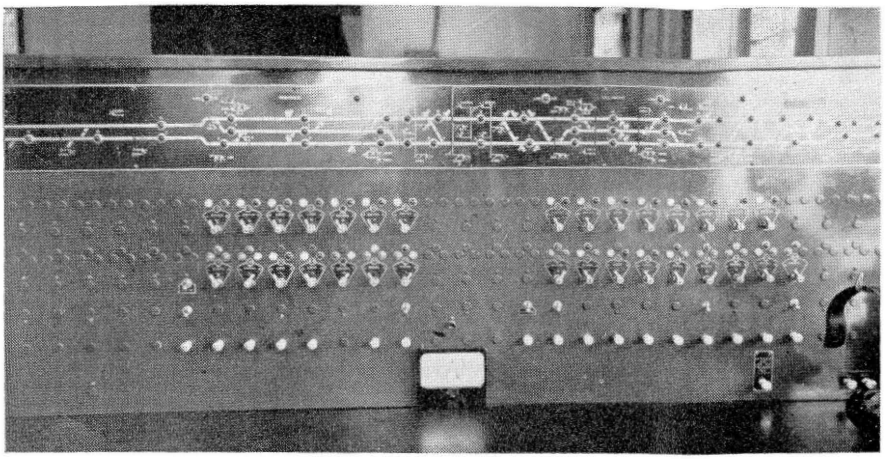
View of signal bridge 8,200 ft. east of Bonsack, with intermediate automatic block signals for both directions on both tracks—signals are position-light type

Either-Direction Running on Two-Tracks on the Norfolk and Western

Increased track capacity on two ascending grades up to the crest of the Blue Ridge Mountains of Virginia saves time by eliminating delay to freight trains

THE Norfolk and Western has reduced train delays and increased track capacity of a section of double track main line by installing power switches and signals which are included in centralized traffic control for the operation of trains in either direction on each of both main tracks on 11 mi. between Montvale, Va., and Bonsack. From Bonsack, which is the west end of the territory, the grade ascends eastward at approximately 1.0 per cent to 1.4 per cent for about 6 mi. to Villamont at the crest of the Blue Ridge Mountains. Then the grade descends eastward at about 1.3 to 1.4 per cent for 5 mi. to Montvale. This territory includes numerous curves ranging from 2 to 3 degrees, and a few ranging from 5 to 6 degrees.

Train speeds are slow when ascending these grades and, likewise, speeds are limited when descending, in order to insure safety. Thus, for the distance involved, the time of track occupancy by trains is longer than in the adjacent sections. A pusher locomotive is used to help eastbound time freights and coal trains up the grade between Bonsack and Villamont. Then the helper returns to wait on a special spur just west of Bonsack. A brick plant, stone quarries and other industries in this territory, receive and ship out about 60 to 70 cars daily. When serving these industries, the switch engine makes numerous moves over certain sections of the main track between the spurs leading to the industries. As a consequence of all these complications, the Bonsack-Montvale section was a bottleneck, which caused delays to through trains in both directions. In some instances, through freight trains lost as much as 30 min.



The centralized traffic control between Bonsack and Montvale is controlled by this one machine

waiting time. The average daily traffic on this territory includes 16 passenger trains, 26 freight trains and 14 light engine moves by the pusher locomotive. These freights include three fast merchandise freight trains each way, about nine loaded coal trains eastbound, and about the same number of empty coal trains westbound.

C.T.C. was the Solution

On account of this traffic and problems discussed above, the solution was the installation of centralized traffic control, including signaling to authorize train movements in both directions on each of the main tracks. With this arrangement, a tonnage eastbound coal train, for example, can be kept moving at normal speed on No. 2 track (formerly the eastward track), while, at the same time, a passenger train or fast freight train can be diverted at Bonsack to No. 1 track to run around the slower train, and then, either at Villamont or Montvale, the faster train is crossed over to the regular eastward track, ahead of the slower train. In order that these run-around moves could be made without slowing down the train speeds too much, No. 20 crossovers and turnouts were used at all points where diverting train movements are made. On account of curvature throughout this territory, the maximum permissible speeds are 50 m.p.h. for passenger trains and 35 m.p.h. for freights, between Montvale and Villamont, and 60 m.p.h. for passenger trains and 45 m.p.h. for freight trains between Villamont and Bonsack. Thus very little train time is lost by making a diverging move through a crossover.

Power switch machines are in service at turnouts and crossovers as indicated by standard symbols on the accompanying plan. The switch machines, and signals at these switches, are controlled from a C.T.C. machine in an office at Bonsack. The project also includes completely new intermediate automatic block signals for train movements in both directions on both tracks.

Advantages to Train Operation

With the new C.T.C. system, the track capacity has been increased to the extent that trains can be handled with minimum delay. For example, on a recent day, eastbound time freight train No. 84 left Roanoke, 6.1 mi. west of Bonsack, not much ahead of eastbound passenger train No. 24. With the C.T.C., the freight train was directed to keep going up the hill at normal speed on track No. 2 (previously the eastward track). At Bonsack, the passenger train was crossed over to track No. 1 to run around the freight, and was crossed back to track No. 2 at Villamont. This operation saved at least 30 min. for this important merchandise freight train. On the same day, No. 85, a west-bound time freight, was running not far ahead of westward mail train No. 9. At Montvale, the freight train continued up the grade on track No. 1, and the mail train was crossed over to track No. 2 to run around the freight. At Bonsack, the mail train returned to track No. 1. In another instance, a westbound train of empty coal cars was running ahead of a time freight, and the time freight was run around the train of empties.

Operation of Helper

Previously, after pushing an eastbound train up the hill, a helper locomotive would cut off at Villamont. A train order was required to authorize this helper to return on the eastward track to Bonsack. Now with C.T.C., the operator can control signals to authorize the helper to move promptly, on either track, thus obviating delays to the helper or to trains on account of the helper movement.

When large gangs are working on a track, it is important insofar as getting track work done, to keep the gang

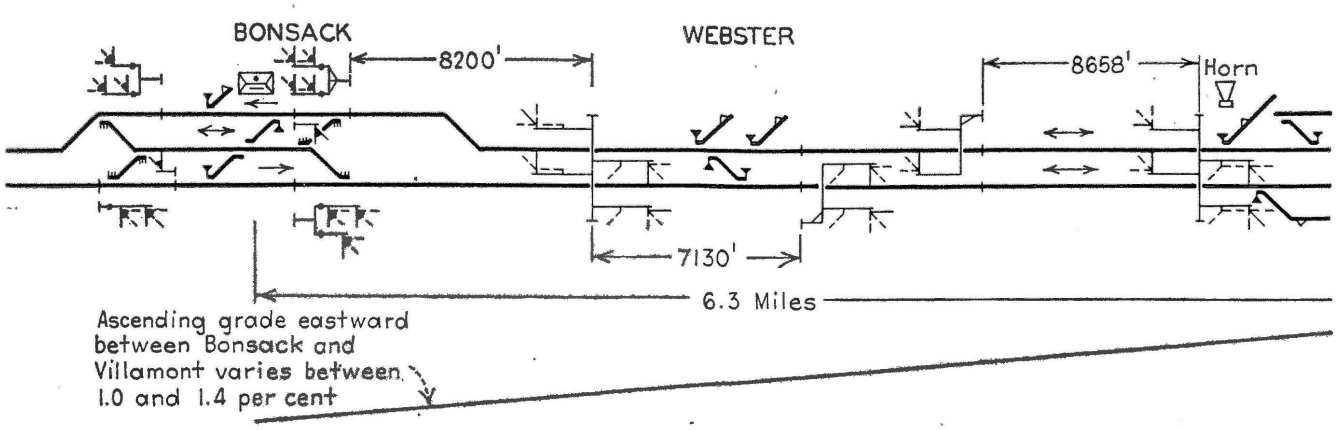
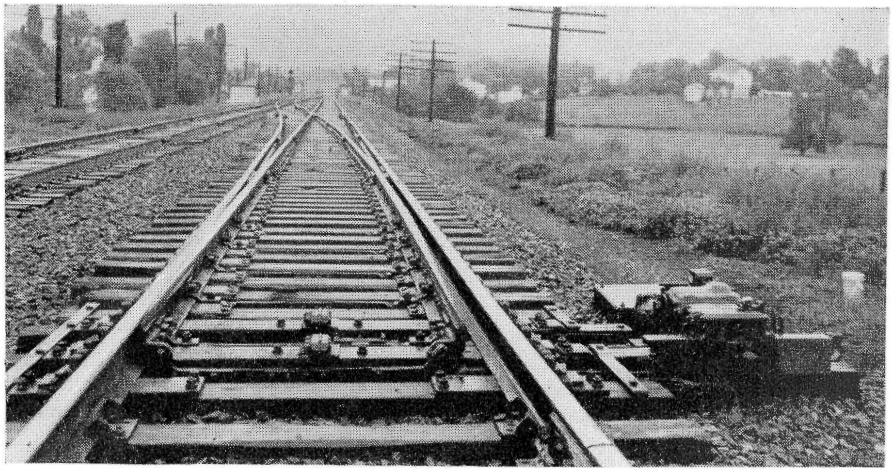


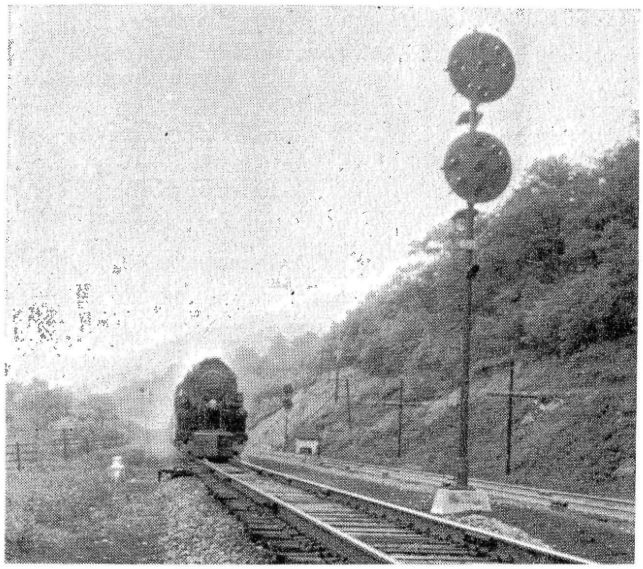
Fig. 1—Track and signal plan of the centralized traffic control territory between



The switch machines are the electro-pneumatic type with dual-control —This view at Montvale

busy, rather than waiting for trains to pass. Accordingly, with the C.T.C., when a large gang is to work on a section of track between Bonsack and Montvale, the trains are routed over the other track. This may cause delays to some trains, but is offset by the increased efficiency of the track gang.

Also the C.T.C. is an advantage in increasing safety and expediting the operations of the switch engine when making moves over the main track between the various spurs leading to industries. The hand-throw switches on these spurs are equipped with electric locks. Also on each of these turnouts there is a derail that is pipe connected to and operated by the switch. When the switch engine on an industry track is ready to occupy the main track, the conductor must telephone to the operator at Bonsack. The electric lock will be released if no train is approaching on that main track and if no signal has been cleared to authorize a train to enter that section of track, as for example between Villamont and Bonsack. If the switch engine is occupying the main while switching an industry track, and the operator wants them to clear the main track for a through train, he sends out a special control that sounds a horn near the location where the switch engine is working.

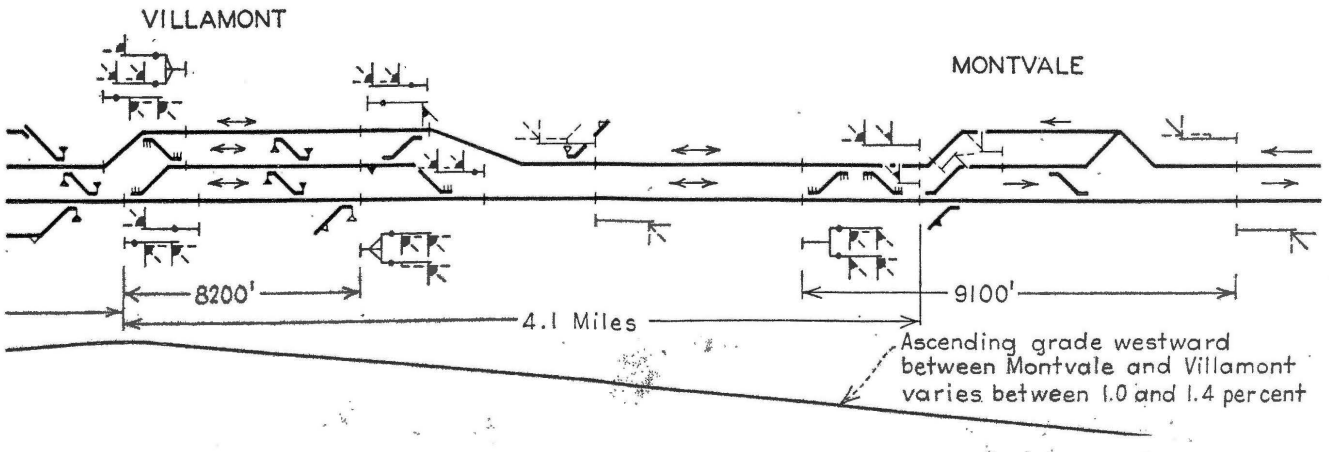


Eastbound train at east end of Villamont

Combined D.C.-A.C. Circuit

This project includes a clever arrangement in which two line wires handle two signal repeater circuits, one of which is d.c. and the other a.c. As shown in Fig. 2, both BP relays are normally energized and can be used to approach lock electric locks. The relay 4RBP is energized on d.c. from the rectifier, while at the same time, the relay 6LBP is energized by a.c. from the transformer. The condenser "D" is used to prevent d.c. from flowing through the transformer. The adjustable resistance "B" is used to limit the flow of a.c. current through the rectifier, and may be reduced as the length of the line in-

(*Continued on page* 437)



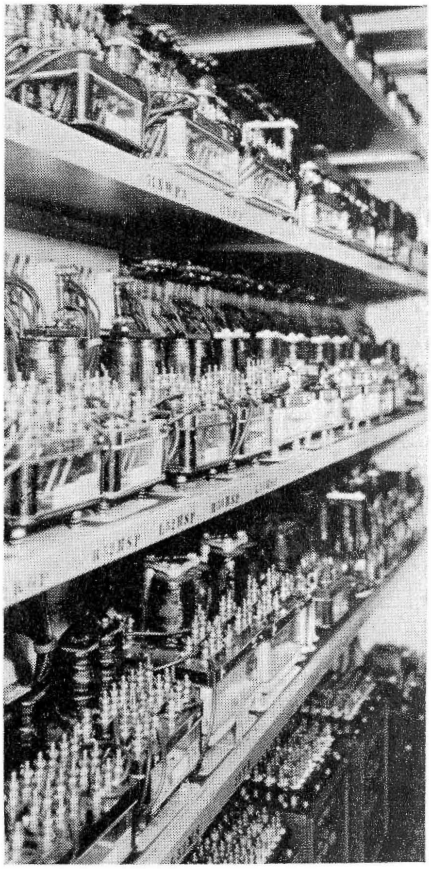
Bonsack and Montvale with line at the bottom indicating the approximate average ascending grades

Railroad Supply Co. No. 6 bootlegs. The same kind of cable extends from the houses to the switch machines. This buried cable is the Flamenol type made by General Electric.

Battery at Switch

At each power switch location, there is a set of 12 cells of 60-a.h. storage batteries which operate the switch and the wayside code equipment. Four cells of 60-a.h. feed the local line circuits and 5 cells feed the lamps. One 60-a.h. cell feeds each track circuit. At the control station, the C.T.C. code line are fed by Type BTMP-3 batteries, the control circuit by 100 cells and the indication circuit by 45 cells. These are lead batteries made by Exide.

This centralized traffic control between Algoa and Vanderbilt was planned and installed by railroad forces under the jurisdiction of L. S. Werthmuller, signal engineer, Missouri Pacific Lines, and H. L. Robertson, assistant signal engineer, Missouri Pacific Lines in Texas, deceased in September, 1948, and succeeded by P. H. Peters. The principal items of signaling equipment installed on the Algoa-Vanderbilt section were made by the General Railway Signal Co.



Interior of instrument house

Either-Direction Running on Two Tracks

(*Continued from page* 433)

creases. If battery is used in addition to the rectifier, resistance "A" and condenser 4MF at "C" may be omitted. When signal 4R is cleared, with switch 3 normal, the a.c. relay 6LBP is deenergized. When signal 6L is cleared, with switch 5 normal, the d.c. relay 4RBP is deenergized.

Coded Track Circuits

As a part of the new project, the previous track circuits were replaced by coded track circuits which, under C.T.C. lever control, are set up to feed either one direction or the other to be in the direction opposite to the train movement for which the signal is being cleared. The signals are controlled to different aspects by different codes —75 code for caution and 180 for clear. The 120 code controls the approach-medium aspect on signals in approach to interlocking home signals when displaying the medium-clear aspect governing a train movement over a long crossover or turnout.

Traffic-Direction Locking

The direction in which trains are to move over a section of track, as for example between Bonsack and Villamont, is determined by a two-wire traffic locking line circuit which checks the opposing signals in the stop aspect, and reverses the track circuits. These line wires are No. 10 and the two C.T.C. code line wires are No. 8. These four wires throughout the territory are covered with a plastic coating to prevent accidental shorts or crosses which might interfere with the reliability of the system. All line circuits are protected by point-type arresters, and track circuits by rare gas arresters. The signals on this project are the position-light type, all signals being high signals, on masts, bracket masts or over head signal bridges. The switch machines are the electro-pneumatic type with dual-control.

This signaling was planned and installed by Norfolk and Western forces under the jurisdiction of J. A. Beoddy, superintendent of telegraph and signals, the major items of equipment being furnished by the Union Switch & Signal Company

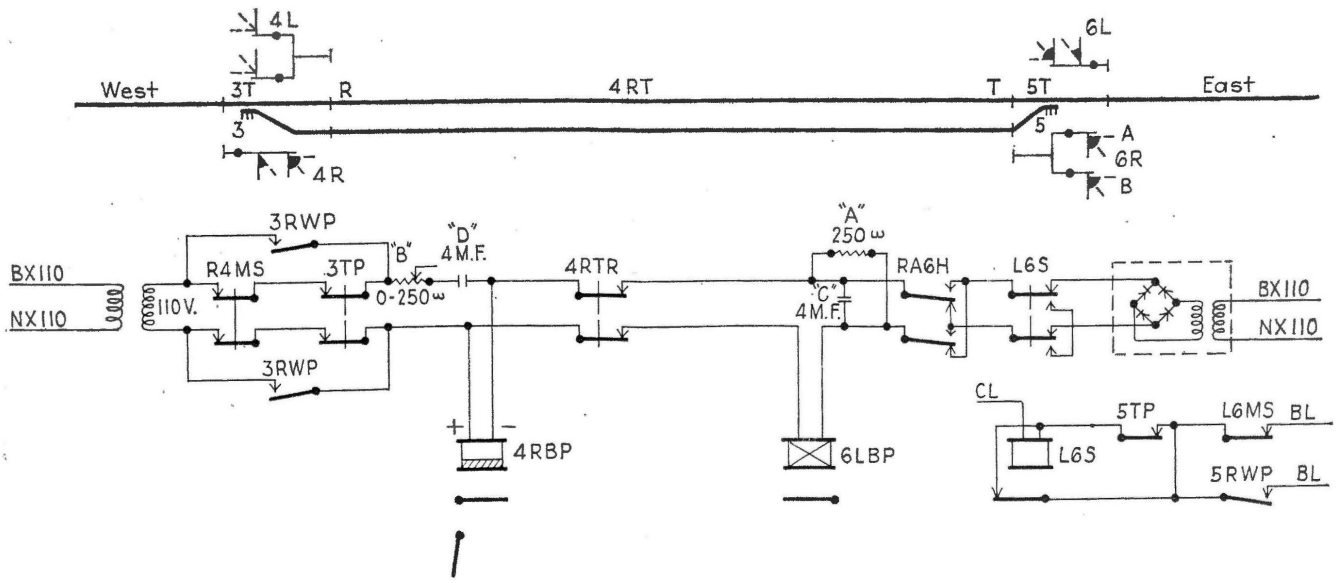


Fig. 2—Diagram of a.c. and d.c. circuits using the same two wires