Replacing Semaphores With Position-Light Signals On the Norfolk & Western

ON EXTENSIVE sections of its main line, the Norfolk & Western is replacing semaphore automatic block signals with modern position-light signals. For example, between Roanoke, Va., and Walton, 40 miles, two-position, two-arm lower-quadrant semaphore automatic signals were installed in 1908. As the traffic on this line is heavy, involving about 16 passenger and 22 freight trains daily, these signals had been subjected to hard service and although they had been well maintained, replacements were desirable. Furthermore, on account of the gradual increase in train tonnage and train speeds during recent years, it was desirable that the spacing of the signals be revised to meet modern requirements and it was decided that, while making such changes, it would be advisable to replace the semaphores with position-light signals, thereby securing the advantage of simplified and effective aspects. The position-light type of signal has been standard for all new work and replacements on the Norfolk & Western since 1924.

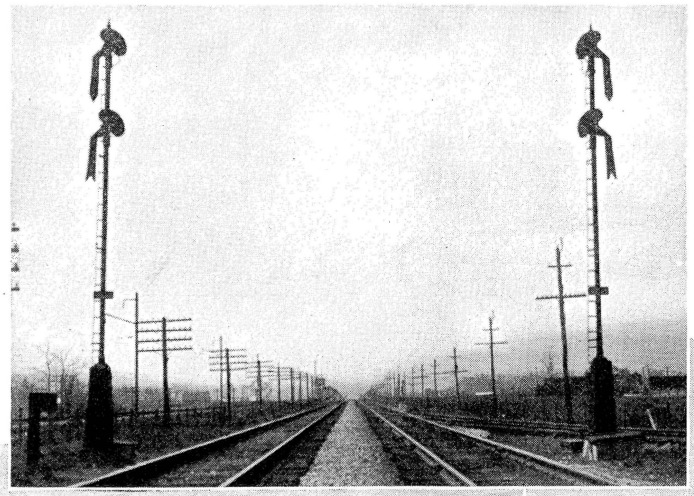
From Roanoke westward to Elliston, 19 miles, the line traverses a rolling territory and from Elliston to Christiansburg, 13 miles, there is a gradual ascending grade, climbing the eastern slope of the Allegheny mountains, the governing grade being 1.35 per cent. From Christiansburg, west to Walton, 8 miles, there is a descending grade.

Changeover Starts at Roanoke

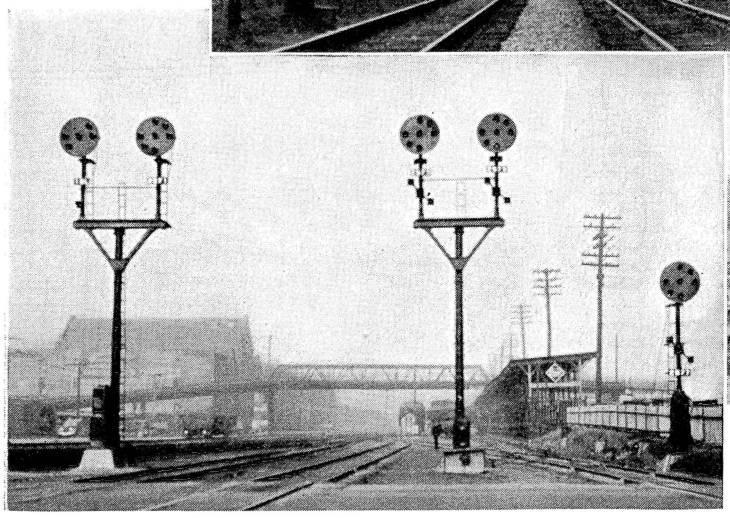
The first change from semaphores to position-light signals was begun at Jefferson street, just west of the passenger station at Roanoke. The main line is double track for about 19 miles from Roanoke westward to Elliston where there is a third middle running track or siding about 1.75 miles long, the switches at both ends as well as the crossovers at the middle being operated, together with the signals, by a 31-lever, electro-pneumatic interlocking installed in 1927; position-light signaling was used for all home and distant signals at the time this plant was installed.

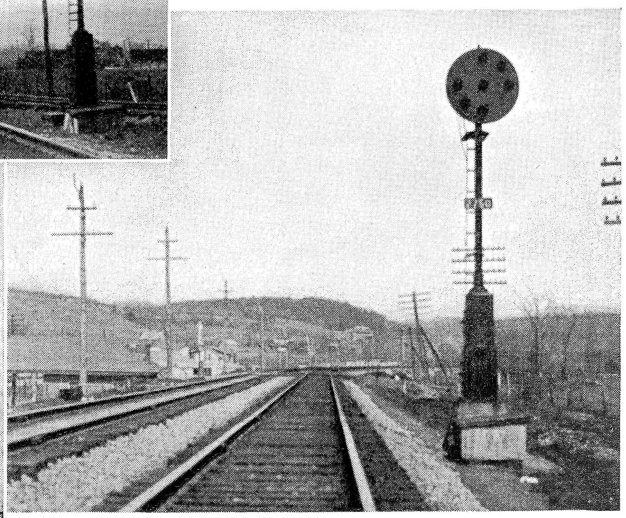
From the west end of Elliston, the line is double track for about 3 miles beyond which another center siding extends for 2.5 miles. This middle siding at Arthur is controlled by a

Right — Two-arm lower-quadrant semaphores were replaced with position-light signals



Below — View west from Roanoke station showing new position-light signals





The old cases and masts were used for the new signals many of which are at new locations

19-lever interlocking machine, which was installed in 1909. The upper-quadrant semaphores in this plant are also to be replaced by light signals at this time.

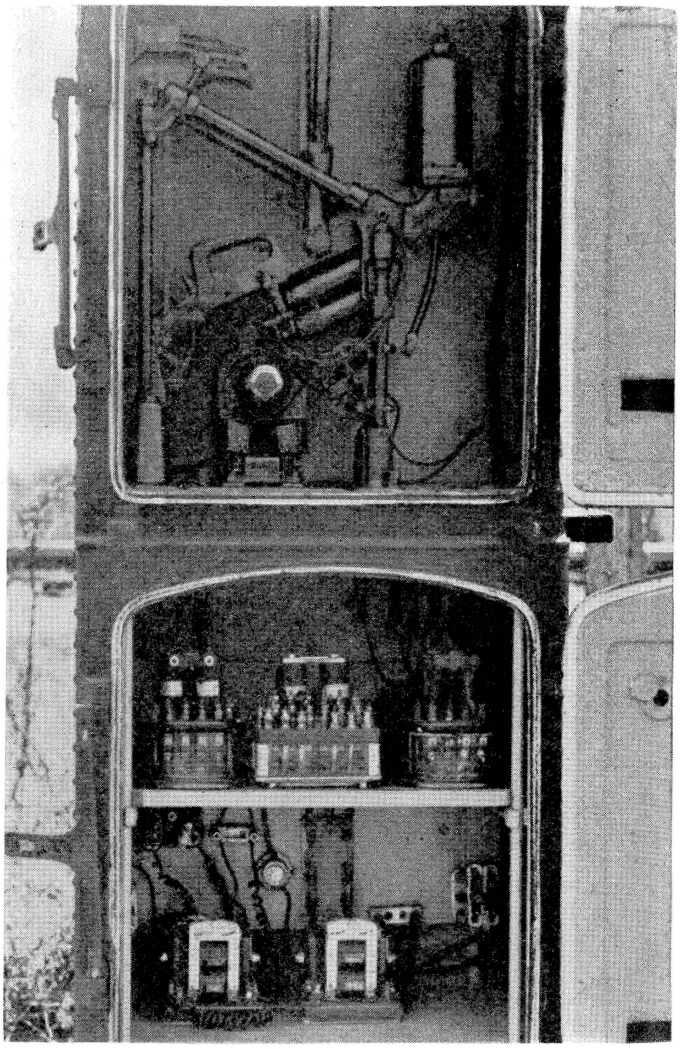
From the west end of Arthur, double track extends four miles to the east end of Christiansburg. The layout at this place includes a center siding one mile long, a section of double track ¾ mile long and a junction from double to three-track. This entire layout is operated by a 32-lever, electro-mechanical interlocking at Christiansburg, which includes upper-quadrant semaphores that are also to be changed now.

Three main tracks extend westward from Christiansburg, 7 miles to Walton, with a fourth main line for 1½ miles through Vicker, 2 miles east of Walton. In this three-track territory, the two outside tracks are equipped with automatic signaling for one direction; no automatic signaling is provided on the middle track, the usual practice being to use this center track for eastbound drag freight trains while climbing the grade. Manual block between interlocking towers at Walton and Christiansburg is used for the direction of such train movements.

The block spacing of the original automatic system ranged from 4,000 ft. to 6,000 ft., depending on over-all distances between interlockings and on the grades at various points. Of the 79 automatic block signals in this territory, the rearrangement program involves the elimination of 10 signals so as to lengthen the blocks, and the relocation of 7 other signals to adjust the block lengths in the sections where the signals were removed. At these 7 locations, as well as at the 62 remaining locations, the semaphore signals and mechanisms are being replaced with position-light signals. These new signals are of the latest design, known as the Style PL-2, which are equipped with lenses especially designed to provide long-range indication, using 12-volt, 5-watt lamps.

When the signaling is changed over from the semaphores to the light signals, each new light signal unit is mounted on the mast at a height such that the center light is 18 ft. above the level of the top of the rail, the purpose being to bring the signal more in line with the engineman in the cab of a locomotive. Of course, this result cannot be effected where the signals are mounted on bridges or bracket masts, in which instances the signals are adjusted so that the spread covers the track for an extended section in the approach to the signal. The old masts are, of course, cut off to the proper height, the old blades, spectacles, up-and-down rods and Style-B mechanisms being removed and scrapped.

At some locations where the track had been raised from time to time, the concrete signal foundations are now below the level of the rail although standard practice on this road is to have the top of the concrete foundation 12 in. above the top of the rail. At such locations, when replacing the semaphores with light signals, the instrument case, mast, etc., are raised up to the proper height by the use of ¾-in. by 3-in. iron bar brackets or stirrups, set over the anchor bolts and then bolted to the bottom of the casting on the base of the case. A form is then built up and a new foundation poured in around the old foundation and brackets.



The Style-B mechanisms have been in service for 28 years on a busy section of track—the instruments were housed in the lower case

Power Supply System

When the semaphore signaling was originally installed in 1908, the signals and control circuits were operated by storage batteries, using a 550-volt d-c. series-line charging circuit. The track circuits were operated by E7 lead-type batteries. Oil-burning semaphore lamps were used.

In 1928, the power supply for this signaling was changed over to the a-c. floating system. A new signal transmission pole line was constructed and a 4,400-volt, 60-cycle, 3-phase a-c. power line, using three No. 4 copper wires, was strung on a pole-top pin and on the top arm with a No. 5 Copperweld ground wire on the single bayonet arm extending up above the top of the pole. At appropriate signal locations there is a 4,400-110 volt line transformer rated at 750 v.a. A set of five Exide DMGO-5 lead storage cells was installed for the operation of each signal and to feed the line circuits, this battery being on floating charge from an RT-10 Union rectifier. Likewise, an EMGO-7 storage cell, charged by an RT-10 rectifier is used to feed each track circuit.

At that time the oil-burning semaphore lamps were replaced with electric lamps fed from the transformer, burning constantly. Therefore, the

same d-c. relays, signal mechanisms, etc., were continued in service as a d-c. system which was fed by the a-c. distribution line, enough reserve capacity being provided in the storage batteries to operate the signaling during an a-c. power outage of any reasonable duration.

Changing to Position-Light Signals

When the present change from semaphores to position-light signals was being planned, it was apparent that the existing signal storage batteries, as well as those for track circuits, were adequate for the new arrangement. However, it was also evident that the signal lighting load would be increased because each aspect of a position-light signal requires three 12-volt, 5-watt lamps. Therefore, a Union Style NL-15, 110 to 11.5-13.4 volt transformer was provided at each location.

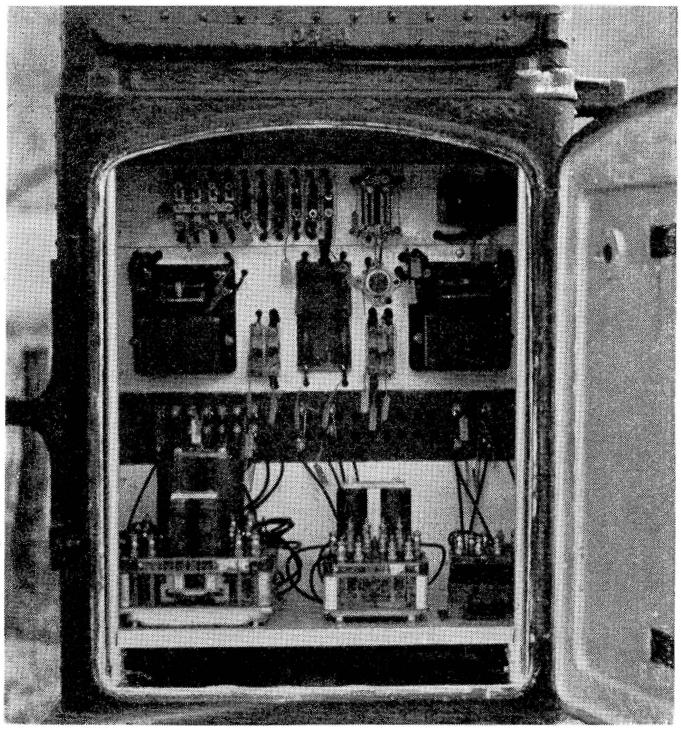
Likewise, in the control circuits, where the circuit breakers or pole-changers on the Style-B mechanisms had formerly been used to effect the 45-deg. to 90-deg. control, it was necessary, for the control of the position-light signal, to provide new Style DP-21 retained-neutral, slow pick-up polar track relays to effect the pole changing. One of the illustrations shows the interior of one of the newly-revised instrument cases, with a DP-21 retained-neutral polar track relay at the left, a new DN-11, 1,000-ohm line relay in the center and a 50-v.a. Type-NL lighting transformer at the right.

The dark colored terminal board shown just above the relays is made of hard wood and the brass terminal posts are set in this board, the incoming wires being brought out from the rear through individual ½-in. holes. This terminal board is treated with paraffin to make it moisture-proof and is not painted with aluminum, as the remainder of the panel is, because an aluminum surface is a conductor.

Low-voltage lightning arresters for all line circuits are mounted at the top of the panel, together with the 4.5-ohm adjustable resistance units, which are used to adjust the voltage on the signal lamps so as to secure the desired intensity, depending on local conditions.

At all places where the signals were moved to new locations, as well as at many of the old locations, the modernization program included the installation of new track wiring, No. 9 Kerite mummy finish underground cable being used in connection with Raco bootleg outlets at the rail. Thus the change-over, from semaphores to position-light signals, represents a complete reconstruction program practically equivalent to a new installation of automatic block signaling, in so far as the finished system is represented.

This modernization program was planned and executed by the signal department forces of the Norfolk & Western.



As a part of the changeover, new relays were installed and the cases were completely rewired

T. Geo. Stiles Rounds Out 60 Years of Signaling

On his eightieth birthday, June 15, T. Geo. Stiles, president of the T. Geo. Stiles Company, Arlington, N. J., received a pleasant surprise in the form of congratulations from numerous friends in the railway signaling field, complimenting him on the completion of his 60 years' service in the manufacture of signaling apparatus.

Mr. Stiles was born on June 15, 1856, at Stoke, Newton, London, England. He began his business career with Saxby & Farmer, London, in 1877, with which company he remained until 1882, when he joined the Johnson Compensator Company, Manchester, England. He traveled extensively in Europe for that company and also for Saxby & Farmer. He was with the Johnson Compensator Company until 1888, in which year he joined the Johnson Signal Company, Rahway, N. J. In 1890, he resigned on account of ill health and returned to England where he became associated with the Dutton Company of Worcester, England. He reorganized the plant of that company and then became superintendent of construction. In 1893, Mr. Stiles returned to the United States and again entered the employ of the Johnson Signal Company, where he remained until 1896, when he joined the Standard Signal Company of Arlington, N. J. In 1899, he became associated with the Thomas A. Edison Company plant ot Ogdensburg, N. J. In 1900, Mr. Stiles established the T. Geo. Stiles Company at Arlington, and has been head of that company since that time.

T. Geo. Stiles