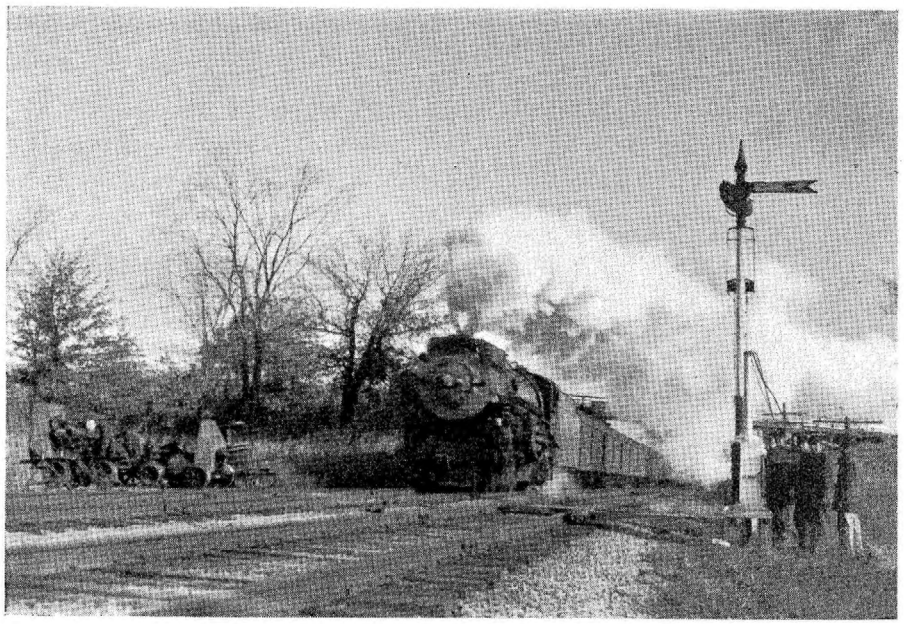

A two-position lower-quadrant distant signal being prepared for removal

Burlington Replaces Semaphores With Color-Lights

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Lower-quadrant, two-position, home and distant semaphores using two aspects replaced by searchlight signals using three aspects in 82-mile territory between Ottumwa, Iowa, and Osceola

A SIGNAL, like any other operating piece of mechanism, has an obsolescent date, which arrives when the signal has been worn to the extent that repairs cannot be made economically or at the time when it is no longer considered safe practice to keep it in service. This was the condition of the semaphore signals on the 82 miles of double-track line between Ottumwa, Iowa, and Osceola, on the Chicago, Burlington & Quincy. The semaphores were old Hall Type-K, and had been in service on heavily-operated territories for 25 years. These mechanisms were first installed on the terminal territory between Chicago and Aurora, Ill., in 1913, where they had been subject to extremely heavy service until 1925, when they were replaced by color-light signals, at which time the semaphores were re-installed between Ottumwa and Osceola, where they have been functioning on a heavy-traffic territory up to the present time. The Type-K was a good mechanism in its day, even though there were a few parts of the signal that were not as well developed as semaphore mechanisms of later types. However, there is no doubt but that these mechanisms fully paid for themselves several times up to the present when they are being retired.

The territory between Ottumwa and Osceola is part of the main line of the Burlington between Chicago and Denver, Colo. The traffic between Ottumwa and Albia consists of 14 passenger and 11 freight, or a total of 25 trains daily; the traffic between Albia and Osceola consists of 10 passenger and 11 freight, or a total of 21 trains daily. This difference is due to the Ottumwa-Des Moines trains leaving the main line at Albia. This is a high-speed territory, with permissible speeds of 50 m.p.h. for freight trains, 60 m.p.h. for steam-operated passenger trains, and 80 m.p.h. for the Denver Zephyrs. This section of double track is constructed and maintained to a high point of efficiency, and is in a condition which would permit of further increases in speed if deemed advisable. Consequently, it is apparent that modern signals, properly spaced to give correct braking distances, are a logical adjunct to a first class piece of railroad carrying high-class traffic.

Changes Made in Recent Years

The semaphore signals operated to two positions, horizontal and 60-deg. in the lower quadrant. Each home signal had a square-end blade painted red, and the night aspects were red or green, depending on the position of the blade. As originally installed, a distant signal was located braking distance from each home signal. Each distant signal had a fish-tail blade painted yellow, and the night aspects were yellow or green. As train speeds have been gradually increased, the original braking distances were found in some cases, to be too short. In such instances, changes were made in 1936, consisting of removing the distant signal mechanism from its mast and attaching the mechanism to the mast of the home signal in the rear, thus forming a two-arm signal, the lower arm being the distant signal for the next home signal in advance. As train speeds were further increased following 1936, there were instances in which the block length was not sufficient for braking distance between signals. Consequently, as a temporary measure in such cases, the double-distant principle was employed to pro-

View made before mast at left was cut off

vide adequate train-stopping distance.

As is usually the case with two-indication signals, the best possible arrangement is not always satisfactory, either from the standpoint of indications or braking distances provided. These problems, in addition to the fact that the old signals had rendered long life and were obsolete, led to the decision that the signaling on this territory should be modernized.

Light Signals Adopted

As the Burlington's standard for a number of years has been the color-light, three-aspect type of signal, it was decided that this territory should be so equipped, thus providing signaling adaptable for modern requirements of train operation, with longer range of vision as well as more conspicuous indications under adverse weather conditions. Because of the advantages obtained by the use of the searchlight type of signal, even over the color-light type, and following the past practice of the last few years, it was decided to make use of this type of signal. Those now being installed are of the SA searchlight General Railway Signal Company type, which will provide two-block, three-aspect signaling, each signal carrying three indications, red, yellow and green. The entire territory, when completed, will have a minimum braking distance of 8,000 ft. to a maximum distance of 15,000 ft., depending upon the lengths of blocks.

This territory includes five interlocking plants, namely, Lawler, Maxon, Albia, Halpin, and Shannon. All signals at these plants on the lines of the Burlington are also being changed to the searchlight, three-position type, and as all of these plants are modern plants, the addition of the searchlight signals brings them up to date.

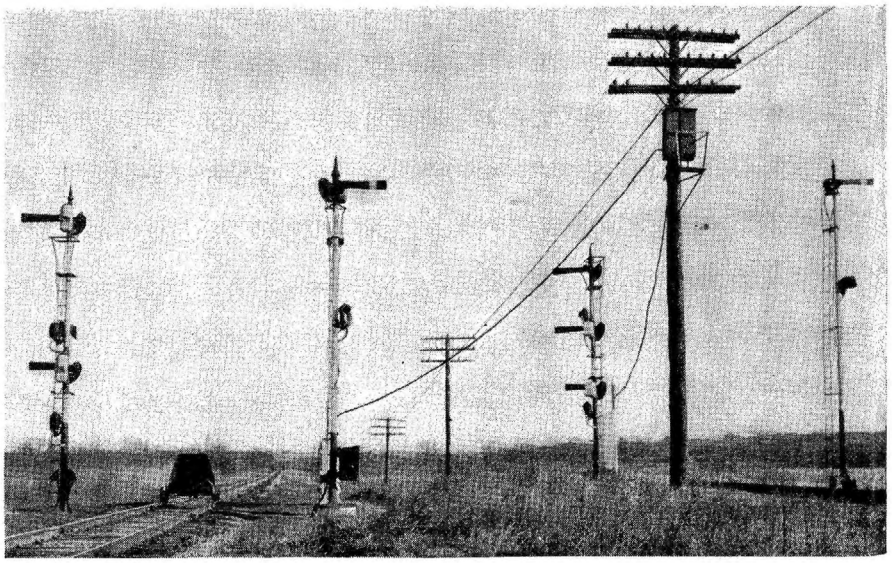
Program of Reconstruction

The modernization was started on October 9, with one gang of 11 men, and on December 14 an additional gang of 6 men were assigned. The work is progressing satisfactorily and is now approximately 50 per cent complete. The signal gangs are housed in the standard outfit equipment of the signal department, and, as required on this type of work, an adequate number of motor cars and trailer cars were provided to facilitate the movement of the men and materials to and from their work as between component parts of the project.

In planning this work, it was so arranged that all of the material was on the ground before the construction work started, which has eliminated any cause for delays. The work was started from the Ottumwa end, and sections of from 12 to 15 signals were changed over from one type of operation to the other at predetermined times. The work was done under traffic. When a section was ready to change, a train order was issued stating that the signaling on that section was out of service. Only a few hours were required to make each changeover, and periods were chosen during which the traffic was the lightest. Consequently, very few, if any, trains were in the territory where the actual change was being made.

The existing signal foundations in this territory are of the Burlington standard sectional type, which can be taken apart and moved readily from point to point in instances where signals had to be relocated. This feature facilitated moving the signals without the necessity for a work train or a derrick, and also consumed the minimum amount of time in making such moves. The old signal masts were of the standard height of 25 ft. for single-arm signals and of 31 ft. for the double-arm signals. In installing the new searchlight signals, the unit was placed on the pole at the standard distance of 14 ft. above the track, completely wired and prepared for service, while the semaphore signal above it was still in service. On the day of the changeover, the searchlight signal was cut into service and the blade and light of the semaphore signal removed.

The 1-½-in. holes for bringing the wires out of the mast to the searchlight signal were cut into the signal pole by using a Black & Decker circular saw, which is a tool especially



The searchlight signals were applied before the semaphores were removed

adapted for this purpose because no clamps need be applied around the pole as would be the case if regular drills were used. This tool has proved to be very satisfactory and has permitted holes to be cut in the poles much more rapidly than by the old method.

New wires required between the relay cases and the searchlight signals are being run up the mast and out through flexible metal conduit to the mechanism. In instances where signals are to be installed at new locations, the insulated rail joints, signals, instrument cases, batteries, etc., are all installed complete and the control circuits temporarily disconnected. Also temporary jumpers are placed around the rail joints. When all the preliminary work is completed on a certain territory of 10 to 15 signals, men are distributed over the territory during a predetermined period and the searchlight signals are turned on the masts so as to face the railroad traffic, and are corrected for proper alinement, the backgrounds applied, and the necessary connections made in the instrument case, after which the signal is in service. Following this, the blades and castings of the old signals are removed. At new locations, the temporary jumpers are removed and necessary connections made in the control circuits so as to cut these signals into the proper track circuit controls. A very thorough operating check is then made and the new signals are left in service.

Circuit Changes

The circuit arrangement being installed consists of revamping the old circuits to take care of the locations changed and also arrange for the three-indication signals instead of the two-indication signals. This necessitated circuit changes especially for the additional indication. Where single-arm, two-position semaphores were previously in service, the old signals had been controlled by the neutral track relay; where two-arms, home and distant, had been used, a line controlled "D" relay had also been provided. The new signaling, of course, required both the track relay and the "D" relay at each location, the polarized operating relay in the signal head being controlled in the standard manner through contacts on both of these relays. One of the illustrations shows an old semaphone signal mast with the new searchlight signal on, and before the mast has been cut off. It also shows an old signal pole after the mast has been cut off to the proper height and a pinnacle added.

Following each change-over, one of the signal gangs goes back over the territory placed in service, and cuts off the semaphore masts at the proper height above the new searchlight signal, so as to produce a mast of standard height for this type of signal. After removing the old mechanism and pinnacle and the upper sections of the ladders, the point at which the mast is to be cut is ringed with a diamond-head chisel, and then the section is sawed off with a hack saw.

The iron ladders are then reconstructed with the platforms at the new positions required. The mast and signals are then all painted aluminum, in accordance with Burlington standard, thus producing an installation with the appearance of a new project. In a few instances, such as at interlocking plants, due to the spacing of the two- and three-arm mechanism previously in service on a mast or bridge, it was necessary, of course, to remove the mechanisms before applying and mounting the new searchlight signals.

Installing cable at point where semaphore distant is being removed

System of Power Supply

The a-c. floating storage battery system of power supply was in service previously in this territory, and with the new change it is being continued in service. The line feed is 220-volts, 60-cycle. At each signal location there is a set of 5 cells of DMGO-7, 80-a.h. Exide cells, which are used to feed line circuits and as standby for the signal lamps. Under the previous arrangement, the semaphore lamps were lighted continuously both with the a-c. power on, as well as from the battery when the a-c. power was off. In the new arrangement, the signal lamps are lighted with the a-c. current, but in case of an a-c. power failure, the lamps are controlled on approach-lighting feed from storage battery. Each track circuit is powered by one DMGO-7 Exide storage cell on floating charge.

As a major portion of the material required for this change consisted of the searchlight signal heads, there was a very small amount of additional material ordered. This additional material consisted of the necessary relays, storage batteries, rectiers, and similar apparatus, required to handle a change in type of signal operation and produce the three indications instead of the one indication as previously used. The additional neutral relays are of the Burlington manufacture and assembly, having been made in the signal shop at Aurora.

When the work is completed over this entire 82 miles of double track, the signal installation will be practically a new one, as any necessary maintenance work in the territory has been taken care of by the signal construction gangs while the signals are being changed. This program modernizes another stretch of the Burlington's main line signaling as a means of facilitating train movements in a safe and economical way, for years to come.

The engineering and circuit work required for this rehabilitation program was done in the signal engineer's office, and the field construction work is progressing under the direction of the signal engineer. Even though this work is under way during the winter months, the construction costs will be very little, if any, higher than if it had been done in summer. This is due to proper planning and programming of the work before the construction was started.