the stick locking relay. This is in effect sectional route locking, as the signal lever under certain conditions can be moved full normal before the train has cleared the route, without operating the time release.

There is an electric switch-lock on the hand-operated junction switch leading to the roundhouse. The control circuits for the lock, also the normal indication circuits of the switch and the H relay control for the switch signal are shown herewith.

During the morning rush hours, there are three suburban trains that make up and load on the platform tracks at the same time. In order to signal the towerman, the conductor of the first train that is ready to go pushes an annunciator button mounted on one of the platform columns. As shown in the accompanying circuit, this picks up a stick relay in the tower, thereby operating a buzzer and lighting an indicating lamp. The buzzer continues to ring until the towerman drops the stick relay by pushing an acknowledging button. This train starting system is a great help to the towerman, as he knows immediately which train is ready to go.

In all three directions leaving the plant are "Stop and Stay" signals of the A. P. B. signal system. Located before the dispatchers, who are in the station building, are light indicators operated by push button circuits to indicate the position of starting signals so that necessary orders may be delivered at the station to permit passing these signals in accordance with the rules provided for such purposes.

This plant was engineered and installed by the signal department forces of the Burlington.

# Signaling of Paired Track Operation

## Low-Voltage Interlockers Operated by Primary Batteries, Both Lines Equipped with Automatic Signals

### By R. D. Moore

#### Assistant Signal Engineer, Southern Pacific Co., San Francisco, Cal.

A RATHER interesting joint operating arrangement on the main lines of the Southern Pacific and Western Pacific in Nevada was inaugurated effective August 1, 1924. The two roads virtually parallel each other for a distance of 183 miles through the Humboldt river valley, the route of the early emigrants who crossed the plains to California in the "covered wagon" before the days of the "iron trail." A glance at the accompanying map will show the relative position of the two roads in this territory. The tracks are 200 ft. apart at Weso (near Winnemucca), and 13 ft. at Alazon (near Wells), the west and east ends, respectively, of the joint track. At intermediate points the distance varies up to 6 miles.

Heretofore the two roads have been operated independently as single track lines between these two points, but under the new arrangement all eastward trains of both the Southern Pacific and Western Pacific will use the Western Pacific track and westward trains the Southern Pacific track, thus giving both roads the equivalent of 183 miles of double track railroad. Of the 777 miles of Southern Pacific main line between Oakland, Calif., and Ogden, Utah, 324 miles were already double tracked, therefore, with the introduction of the joint track facilities, 507 miles of this line are now double tracked, or 65 per cent of the total distance.

The combined business over the joint tracks averages about 40 trains per day, with the number running considerably higher during the heavy fruit season. Each road maintains its own tracks and other facilities and trains operate under the jurisdiction of the dispatchers and subject to the rules of the company over whose tracks they are running. The Southern Pacific line is equipped with Union Switch & Signal Co. Style-B, automatic block signals and the Western Pacific is now installing automatic signals of the same type on their line, so that both tracks



Track and Signal Plan of Plant at Alazon on East End of Paired Track



Track and Signal Plan of Plant at Weso on East End of Paired Track

will be completely protected by automatic block signals.

At Weso and Alazon, where the two lines join, the connecting crossover switches are equipped with Union Switch & Signal Co., Style-M, low-voltage switch machines, controlled through interlocked circuit controllers located in the telegraph offices. There are 7 interlocked switches and derails at Weso and 6 at Alazon. The signals in connection with the interlocking are Union Style-B.

As power was not available for the charging of storage batteries, Edison primary batteries were installed for the operation of all functions. A cellar was fitted up underneath each telegraph office to house the major portion of the batteries and relays. Although some of the switches and derails are located some distance from the office, the batteries for their operation are centralized in these cellars with two No. 6 copper battery wires running to each machine. Three multiple banks of 48 cells each are used to provide ample capacity for three or four machines operating simultaneously. The signals operate from independent 16-cell sets housed in battery boxes located at each signal. Type SS control is used for all switch machines and the signal control circuits select through switch circuit controllers on the facing point switches and derails as well as through the SS relay. Complete approach and route locking is provided.

#### Saving of \$3400 a Year on Each Plant

The cost of maintenance and operation, including interest and depreciation, for each of these plants will amount to about \$1800 per year. Had we not elected to





interlock these junction points, the only practical alternative would have been the employment of switch tenders, as we would not wish to require trainmen to handle the switches on account of the expense of stopping trains. Nor could the operators be required to handle hand throw switches, due to their heavy office duties and the remoteness of some of the switches.

Therefore, in considering the probable saving effected, it is apparent that this will be equal to the difference between switch-tender operation and the figure I have quoted for the interlocking maintenance cost, or in the neighborhood of \$3400 annually for each plant. In addition to the saving, greater safety of operation is afforded and train delays are reduced.

### Report on Great Northern Train Control Inspection

THE Interstate Commerce Commission has made public a letter from E. H. De Groot, Jr., director of the Bureau of Signals and Train Control Devices, to C. O. Jenks, vice-president of the Great Northern, offering criticisms and comments as the result of a preliminary inspection by the Commission's representatives of the installation of the intermittent magnetic train stop device of the Sprague Safety Control & Signal Corporation on the 23-mile single track section of the Great Northern between Minot, N. D., and Berthold. The substance of the letter, eliminating references to specifications, is as follows:

1. The track magnet may be displaced or removed without affecting the operation of the signal system, and, under these conditions a stop signal and an automatic brake application would not result at the signal and magnet in the rear. While the weight and form of these magnets, and the method of fastening employed make displacement unlikely, they should nevertheless be so connected as to overcome this criticism and we have been assured both by your representatives and those of the equipment company that this can and will be done.

company that this can and will be done. 2. A magnet should be provided at braking distance from the first westward signal governing entrance to train-control territory.

3. It is our understanding that the forestalling push-button without time-limit feature, which was installed on all but one of the locomotives inspected is to be replaced with a forestalling-switch having a time limit feature, similar to that installed on locomotive 2523.

This forestalling switch is new and while the principle appears to be correct, and its operation as observed on this one locomotive satisfactory, comment is reserved until it can be further inspected and tested under actual railroad operating conditions.

4. On two of the locomotives inspected, wooden spacers had been used in mounting the receiver under the pilot. It is suggested that the more substantial iron construction be used in all cases.

5. It is suggested that the type of fouling protection employed at sidings be considered with a view to possibly securing increased protection.

6. Cut-out cocks should be sealed.

7. If the oil reservoir is to be maintained separately from the brake-valve head, as now installed, it is essential that the integrity of the connecting pipe be insured, because excessive leakage might, and breakage of this pipe, or its connections, would result in a false-clear failure at a stop-indication point.

8. On one locomotive inspected it was found that in applying the train-control head to the engineer's brake-valve the assembly had been so made as to prevent the proper operation of the motor pistons. Care should be taken to see that this brake-valve head is properly applied.

9. As the magnetic receiver is the heart of the system in that it must respond to track impulses at all speeds up to the maximum possible, it is essential that there be a standard of adjustment insured by the equipment company, or by the railroad acting under its instructions, and that such receiver be maintained in a sealed condition.

The object of this and similar inspections is that of constructive criticism; the pointing out of such matters as may be helpful to the carrier in checking an installation against the specifications and requirements of the Commission, and comments concerning such other related points as our necessarily brief inspection may develop. The foregoing criticisms and comments are offered accordingly. They are not intended, nor are they to be taken, as a condemnation of this or any other device in connection with which similar criticisms may be offered.