Spring Switches Used Extensively on Chicago & North Western

Seventeen installations on eight different kinds of layout with special signal protection, latest type buffers and rods used

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The use of spring switches on the Chicago & North Western is not new, such a device having been in service on a switch near Ironwood, Mich., for at least 27 years. However, the general adoption of spring switches did not receive much encouragement until the Atchison, Topeka & Santa Fe developed the oil buffer to prevent pounding and excessive wear of the switch points with the passing of each set of trucks when trailing through the switch. Starting in 1924, the C. & N. W. installed its first spring switch with an oil buffer at the west end of the yards at West Chicago, Ill., which eliminated the necessity for 24-hour switch tender service and resulted in a saving of $5,000 per year. The track layout and signaling is shown as Sketch B in Fig. 1. The successful operation of this installation brought to attention numerous other layouts where spring switches could be used to eliminate train stops or the requirement for operators or switchmen at junction points, ends of double track, etc., such that a total of 17 spring switches are now in service on eight different kinds of track layouts.

Signaling To Be Used with Spring Switches

When applying spring switches it soon became evident that the unusual features of the operation of trains over spring switches would require special provision for the signaling. To serve as a guide sketches of a series of layouts were prepared and approved for use on the C. & N. W., which with slight variations will probably cover all conditions. The idea back of this chart, which is shown as Fig. 1, is that of keeping trains in motion as far as practicable and yet not spend any more money than is absolutely necessary for safety.

Sketch-A shows a trailing switch installed in automatic signaled double track territory. The siding in this case is but a train length long and, therefore, in order to allow a train on the main track to pass, the train on the siding must of necessity be stopped. Therefore, there is no need of giving information by which the train can keep in motion through the spring switch. The trainmen can go to the switch indicator and observe its position and then give necessary information to the engineman to proceed. A dwarf signal is provided on the main track to protect reverse movements, for which purpose a color-light signal is generally used although a semaphore signal can be used if desired. This signal is normally in the stop position and is operated to "proceed" through an
trailing through the spring switch was limited to 10 m.p.h. when the spring switch was installed but later experience has led us to believe that this limit can be raised safely.

Specific Examples of Spring Switch Installations

The advisability of installing a spring switch depends primarily on the train operation involved. The first installations were at the leaving ends of yards where the train movements were made at reduced speeds. Advantage was also obtained by not having

Spring Switches Applied to Passing Tracks

With spring switches in successful operation at yard leads and ends of double track the next step was to apply them for passing track switches. On
this same freight line 13 miles south of Radnor, is a passing track 6,300 ft. long, which is used a great deal as it is the only siding for 12 miles on a piece of busy single track. In order to eliminate the stops required to handle the switches it was decided to install spring switches so connected as to, in effect, left-hand track on double-track lines. The switch indicator at the switch informs trainmen when the track is clear for the train to pull out. The existing automatic signal No. 110 provides protection for the train while pulling out and also indicates stop if the switch is not in the proper normal position at any

produce a short piece of double track by diverting all westbound trains through the passing track, the eastbound trains holding the main track. If no trains are to be met no stop is required, or if a good meet is made neither train stops, the trains trailing out through the spring switches without stopping. New leads with No. 20 frogs were installed to permit high-speed movements over the turnouts. Automatic signal protection is provided to stop trains if the switches are not in the correct position for the train movements as shown in Sketch-H, Fig. 1.

The use of spring switches for passing tracks on high-speed double-track territory were the next applications. At Cortland, Ill., there is a two-mile eastbound passing track which is used by many freight trains. In order to eliminate the necessity for these trains stopping to close this switch when pulling out, a spring switch was installed and additional signal protection provided, as shown in Sketch-A, of Fig. 1. The standard practice on the Chicago & North Western is to run trains normally on the shown in Fig. 3. With this arrangement trains switch on the westbound main and the eastbound main is used for a short distance as a piece of single track.

Unusual Applications at Yards and Junctions
At one of our new yards where a switching lead was not provided, considerable delay to main line trains was anticipated due to trains pulling out on the main track to switch the yard. In order to permit the use of a section of main track for this purpose and yet not hold up main line trains two sets of crossovers with spring switches at one end of each have been installed recently at Proviso, Ill., as

Spring switch layout showing buffer and special spring head rod—The longest rod to left is connected to switch stand
point, the switch of which is operated by means of a low voltage distant control switch machine, and a large terminal yard at which point the train dispatchers are located. (See Fig. 4.) Between these two points is a long passing track at the foot of a heavy grade. It is proposed to equip the two ends of the passing track with spring switches making it a short piece of double track and to connect the junction switch into and operate it from the dispatcher's office. The dispatcher will also have control of the leaving signals at both ends of this piece of track which must be used by the trains of two divisions. By this means the dispatcher, without additional

Cross-section of oil buffer showing positions of piston operators, will handle this layout and trains can operate to or from either of the divisions and, if a good meet is made, pass at the intermediate point without stopping.

Development of Buffer Spring Switch in Brief

On account of the scarcity of men during the world war, T. S. Stevens, signal engineer of the Atchison, Topeka & Santa Fe, installed a spring switch at a branch line junction, with automatic block signal protection and found not only that it worked successfully but that he also saved the expense of maintaining two switchmen and a switch shanty. This installation included an air buffer furnished by the Pettibone-Mulliken Company to provide the slow return motion of the switch points.

This air buffer type did not prove successful on account of the condensation of water in the air within the cylinder, which froze in the colder climates. However, the advantage of the buffer was quite evident and in 1922 an oil buffer was developed by the same manufacturer and installed on the Santa Fe.* The first oil buffers had a return pipe with a check valve across the top of the cylinder. In co-operation with the several roads now interested in spring switches the Pettibone-Mulliken Company has continued developments of this type of spring and the buffer.

An action to retard the closing of the switch point is desirable up to a certain predetermined point, beyond which the speed should be accelerated in order to reduce to a minimum the time and increase the force of closing the switchpoint, to insure a tightly closed point on the return movement to its normal set position. A suggestion of F. C. Stuart, signal engineer of the Elgin, Joliet & Eastern resulted in changes of design which accomplished this result in the latest type of buffers, as will be described.

As the switch is forced over by the first wheel of a train trailing through; the piston rod, piston and attached parts are forced to the left with a quick stroke, the force of the oil pouring through the large holes in the piston forcing the disk valve 31, open against the force of the coil spring 38.

The full movement of the switch point places the piston near the left end of the cylinder leaving the force of the spring in the head rod to pull the piston back against the oil pressure thus forcing oil through the small groove as shown above the dotted position of the piston. Each succeeding wheel tends to hold the piston to the left until the entire train passes through. In the meantime the movement of the switch point is hardly perceptible if the train is moving over 10 m.p.h.

After the train passes, the oil runs around the piston through this little groove until the piston is about half-way over, and then, as the larger groove covers the piston, the pressure is relieved and the force of the spring in the head rod is more effective, forcing the piston over faster and finishing the return stroke with force enough to bring the switch point tightly into its normal position. The idea of these grooves of different sizes was suggested by Mr. Stuart.

To hold the switch against the stock rail while the train is trailing through, it is necessary to maintain a full cylinder as any air in the cylinder would cause a rapid movement of the switch point away from the stock rail between two trucks of passing train. To avoid this difficulty an oil reservoir was adopted, which serves a further important purpose of taking care of the expansion of the oil. The physical characteristic of the oil should be such that the viscosity be approximately constant to temperatures between 125 degrees above and 40 degrees below. In order to obtain this result we change the oil in the spring and fall.

The parts of this oil buffer can be assembled for application on either side of the track, on the open

* See article in Railway Signaling of July, 1923, for description of early installation of spring switches on Santa Fe and details of first type of oil buffer.
or closed point side. In order to avoid making these changes in the field we specify the type of connection when ordering.

**Developments in Spring Head Rod**

In the earlier type of spring switches the spring formed a part of the switch stand connecting rod, the regular head rod being used. The improved type of head rod for spring switches now includes a set of double-coil springs enclosed in a cast-steel tube and mounted on the head rod. These springs are opposite winds, heat treated, and will withstand a fibre stress of 115,000 lb. per square inch and were adopted after considerable experimenting and testing under actual service. The head rod is also provided with a turn-buckle for adjusting the gage of the switch points. An extra sleeve is furnished which can be attached to the rod to provide spring movement one way only.

**Switch Must Be Well Constructed and Maintained**

Through actual service it has been found that the points should be heavily reinforced. The recommended practice is 1 3/4 in. thick reinforcing bars on the gage side for 16 ft. 6 in. switches and shorter, and for longer points a 3/4 in. bar on the gage side with a 3/4-in. bar on stock rail or back side. These bars are attached to the switch points with high tensile bolts as it has been found that rivets become loose due to the weaving motion produced. A loose bolt can always be tightened but a rivet cannot be satisfactorily corked. The reason for the additional reinforcement is to prevent a lateral bend on the switch points, caused by the side thrust of the first trucks of the locomotive as it trails through.

The switch points are also equipped with an extra heavy forged socket clip to which the spring head rod is attached, thereby insuring a positive connection at all times between the rod and point. A heel joint is used that consists of a cast heel filler, bent and planed angle bar and pipe thimble which is securely fastened to the stock rail with four long, high tensile bolts. This joint is desirable to prevent movements and creepage of the switch points. Both main and side tracks should be securely anchored.

We find it advisable to provide a solid foundation consisting of good ballast, first-class ties and proper drainage for each spring switch layout. Switches of various lengths up to and including 30 ft. have been installed. No difficulty has been experienced or undue wear found which could have been caused by the wheels pushing over the switch points or on account of their riding them when so doing. C. & N. W. standard main line switch stands are used.

**A Few Operating Considerations**

When trainmen need to operate one of these switches for switching cars, recognition must be made of the fact that due to the resistance of the oil and springs the switchman cannot throw it over quickly by hand but must keep a slow, steady pressure on the handle until it is all the way over. For this reason a “flying switch” should never be attempted. Trains trailing through and stopping on the switch must not take up slack until the points have been thrown, otherwise the switch will be straddled, resulting in a derailment. No trouble on this account has been experienced however.

**Economy**

The cost of installations has varied from $500 to $2,000 and the estimated savings from $400 to $5,000 per year, while the percentage of saving per year to the expenditure varies from 40 to 300 per cent.

**On the Louisville & Nashville at Worthville, Ky.**