This invention relates to railroad switches and control systems and more particularly to novel rail switches and control systems particularly adapted for use with model trains.

Various types of train actuated railroad switches have been known for many years. Among these may be listed the pressure switch, magnetic switch, resistance switch, impact switch, the frog switch, current switch and the rail switch. Each of these possesses certain advantages and disadvantages for use with model or toy trains. Perhaps the simplest and most reliable heretofore proposed has been the rail switch, which relies for its operation on the completion of a control circuit through a conductive element carried by the train.

The present invention relates to an improved rail switch particularly suited for double rail tracks which assures reliable and complete actuation of a control device such as a relay or the like. Additional features of the invention includes novel control systems incorporating the improved rail switch which may be operated from either an A.C. or D.C. track power supply or by a separate A.C. or D.C. power supply. An important feature of the present invention is the provision of a novel rail switch producing a pair or more of spaced pulses for actuating a control circuit.

It is therefore one object of the present invention to provide a novel rail switch.

Another object of the present invention is to provide a novel multiple pulse rail switch.

Another object of the present invention is to provide a rail switch particularly suited for use in conjunction with two rail tracks.

Another object of the present invention is to provide a novel control system for model trains.

These and further objects and advantages of the invention will be more apparent upon reference to the following specification, claims and appended drawings wherein:

FIGURE 1 is a perspective view of a portion of track incorporating the novel rail switch of the present invention:

FIGURE 2 shows a second embodiment of the rail switch of the present invention;

FIGURE 3 shows a reverse loop railroad control system constructed in accordance with this invention;

FIGURE 4 shows an automatic cross over safety system constructed in accordance with the present invention;

FIGURE 5 shows a passenger station control system constructed in accordance with the present invention;

FIGURE 6 shows a through train priority system constructed in accordance with this invention.

Referring to the drawings, FIGURE 1 shows a section of track generally indicated at 10 comprising a pair of conductive metal rails 12 and 14. While the rails 12 and 14 may comprise the track for any type of conveyor or full-size railroad operation, the novel switch of the present invention is particularly suited to structures where in the rails 12 and 14 constitute the two electrical power carrying rails of a railroad track such as an HO gauge model railroad track.

The locomotives and cars which pass over the track 10 are mounted on a plurality of trucks, one of which is indicated at 16. The truck 16 includes four wheels 18, 20, 22 and 24 mounted in pairs on two spaced axes 26 and 28. Wheels 18 and 20 are joined by a side frame 30 and wheels 22 and 24 are joined by a similar frame 32. The railroad car or locomotive is conventionally supported by the frames 30 and 32 in conjunction with the framework of one or more additional trucks.

In conventional D.C. model railroad construction and operation, of which HO gauge is illustrative, the D.C. voltage is applied across the rails as indicated in FIGURE 1 by the plus and minus signs adjacent rails 14 and 12 respectively. This D.C. potential from a suitable supply source provides track power for driving the engine of the train locomotive. In locomotive construction, two of the wheels, such as wheels 18 and 20 are made of electrically conductive metal while the remaining two wheels 22 and 24 of the truck 16 are formed of suitable dielectric material such as plastic. The metallic wheels 18 and 20 are electrically connected together by the conductive metallic material of the frame 30. D.C. current conventionally passes from this grounded rail 14 through the wheels 18 and 20 to the locomotive engine and then to the negative rail 12 through a similar pair of conductive wheels of a second truck of the locomotive located at a point on the locomotive remote from the track 16.

The novel rail switch of the present invention generally indicated at 34 comprises an electrically isolated section 36 of the track 14, to which is connected electrical terminal 38. Section 36 is spaced from the remaining portions of track 14 by small gaps 40 and 42. If desired, the gaps 40 and 42 may be filled with a suitable dielectric material to preserve the physical continuity of the track. At the same time, electrical continuity through the rail 14 is preserved by the jumper lead 44 connected to the rail 14 across the gaps 40 and 42. The plus terminal for the power supply to rail 14 is indicated at 46 while the negative terminal of the D.C. power supply indicated at 48 is connected to rail 12.

An important feature of the novel rail switch of the present invention is that it makes it possible to provide a switch which produces a pair of closely spaced pulses so as to assure reliable and complete operation of a control device such as a relay. This is made possible by constructing the switch so that the distance A between the center lines of the two axles 26 and 28 is at least equal to and preferably somewhat greater than the distance B between the outer edges of the two gaps 40 and 42. When the truck is in the position illustrated in FIGURE 1, a first pulse is produced by completion of a circuit between terminals 46 and 38. This circuit may be traced from positive terminal 46 through rail 14, wheel 18, frame 30, wheel 20, rail section 36, and back to terminal 38. Terminal 38 may be connected to a suitable control network which is actuated by the completion of this circuit. If the truck 16 in FIGURE 1 is moving towards the right in the drawing, a position will be reached where the wheels 18 and 20 completely span the two spaced gaps 40 and 42. This will occur because the distance A between the two axles 36 and 28 is preferably somewhat greater than the distance B between the outer edges of the two rail gaps. At this point, the circuit between terminals 46 and 38 is broken until such time as the rear wheel 18 spans gap 40. The circuit between terminal 46 and 38 is again completed and a second pulse supplied by way of terminal 38 to the control circuit. This second pulse terminates when rear wheel 18 moves to the right beyond gap 42.

FIGURE 2 shows a modified embodiment of the novel...
rail switch of the present invention wherein the lower rail 14 is provided with a pair of electrically isolated sections 50 and 52 defined by spaced gaps 54, 56 and 58 similar to gaps 40 and 42 previously described. As before, electrical continuity through rail 14 is preserved by the jumper wire 60. Track power to the rails 12 and 14 is supplied from D.C. terminals 62 and 64 by way of leads 65 and 66. The section of track 70 in FIGURE 2 differs from track section 10 in FIGURE 1 in that the control terminals 72 and 74 are completely isolated from and independent of the power supply terminals 62 and 64. As before, the distance C between the outer edges of the gaps is preferably somewhat less than the distance A between the axles of the railroad cars passing over track 70. As in FIGURE 1 the rail switch of FIGURE 2 will produce a double control pulse through terminals 72 and 74 which pulses occur at the instants when the front and rear wheels respectively of the car or locomotive track bridge the gap 56.

FIGURE 3 shows a pair of rail switches such as that indicated in either FIGURE 1 or FIGURE 2 used to automatically control a reverse loop system. In FIGURE 3 a pair of rail switches 80 and 82, labeled R5, are provided on each side of the reverse loops 84 and 86. Rail switches 80 and 82 are shown as of the type illustrated in FIGURE 1, but it is apparent that a switch of the type illustrated in FIGURE 2 may also be used for one or both of these switches 80 and 82. Loop 84 is formed by an isolated section of track 88 while lower loop 86 is formed by a similar isolated section of track 90. The two loops are joined by a common straight section of track 92. Track sections 88 and 90 are connected to the positive terminal 94 of the D.C. track power supply by leads 96 and 98 respectively. Leads 100 and 102 similarly connect the loop sections to the negative terminal 104 of the D.C. power supply.

Negative terminal 104 is connected by lead 106 to one terminal 108 of a control power supply which may be either A.C. or D.C. The other terminal 110 of the control power supply is connected by lead 120 to the isolated section of rail switch 80 while the other side of relay coil 116 is connected by lead 122 to the isolated section of rail switch 82.

Coils 114 and 116 form portions of a relay 130 indicated by the dashed line box in FIGURE 3. Relay 130 includes a pair of stationary contacts 132 and 134 connected to opposite sides of the center track section 92 and a pair of movable reversing contacts 136 and 138. When the movable contacts of the relay are in the solid line position shown in FIGURE 3, terminal 136 is connected to lead 106 and terminal 134 is connected to lead 108. When the contacts are reversed into the dotted line position shown in FIGURE 3, terminal 136 is connected to terminal 134 and terminal 138 is connected to terminal 132 so as to reverse the polarity of center track section 92.

In operation, assume a train is heading upwardly in FIGURE 3 along track section 92 toward the upper loop 84. After the last car of the train is completely on isolated track section 88 the locomotive nears switch 80. When each of the wheels of the locomotive make contact across switch 80, coil 114 is energized and latching or overcenter relay 130 (one which stays in the last energized position until tripped the other way) is actuated thus reversing the polarity of track section 92. The train continues on its way around the loop and downwardly along track section 92 and is able to pass because the polarity of the section 92 was changed by relay 130. The train passes downwardly onto track section 90 of loop 86 and when the last car is on this isolated track section the locomotive's wheels trip switch 82 to energize relay coil 116 so as to lock the relay 130 back into its initial position. This returns the initial polarity to track section 92 so that the train may pass around the lower loop and upwardly along the center track section thus completing a full trip over the entire track.

FIGURE 4 shows a plurality of rail switches constructed in accordance with the present invention incorporated in an automatically controlled cross-over safety system. FIGURE 4 illustrates a pair of criss-crossing tracks 140 and 142 incorporating an automatic control system so that the first train to arrive at the crossing continues safely while the same time automatically stopping any train that may be approaching the crossing on the other track.

Assuming that separate trains approach the intersection 144 along tracks 140 and 142 in the directions of the arrows indicated in FIGURE 4, track section 140 is provided with leads 160 and 162 insulated track 140 preceding the intersection while track 142 is similarly provided with isolated section 148. Track 140 is provided immediately in front of the intersection with a rail switch 150 and track 142 is similarly provided with rail switch 152. Beyond the intersection 144 track 140 is provided with a further rail switch 154 and track 142 similarly has a further rail switch 156.

The grounded terminal 158 of the D.C. power supply is connected to the upper rails of tracks 140 and 142 by way of leads 160 and 162. Track 140 is provided with isolated sections 146 and 148 from the other D.C. supply terminal 164 by way of lead 166, movable contacts 168 and 170 and stationary contacts 172 and 174 of a pair of relays indicated by the dashed line boxes 176 and 178. The movable contacts 168 and 170 are normally in the up position shown and supply power to the isolated track sections by way of leads 180 and 182. Relays 176 and 178 are again of the latching or overcenter type. Relay 176 includes a pair of coils 184 and 186 and relay 178 includes a similar pair of coils 198 and 190. One terminal 192 of either an A.C. or D.C. control power supply is connected by leads 194 and 196 to points intermediate the coils of relays 176 and 178. The other control power supply terminal 198 is connected by lead 200 to the grounded D.C. power supply terminal 158.

In operation, assume that two trains are approaching the intersection 144 at the same time, one on track 140 and the other on track 142 in the directions of the arrows indicated in FIGURE 4. If some sort of safety device were not provided, the train on track 142 would reach intersection 144 first, but while crossing the intersection would be struck by the train on track 140. With the system of FIGURE 4 this cannot happen because the train on track 142 hits relay switch 152 energizing coil 190 of relay 178 from control terminals 198 and 192. Energization of coil 190 causes movable contact 170 to move to the down position and is connected to terminal 192 of stationary contact 202. This movement breaks the D.C. circuit to isolated track section 146 previously established by lead 182, so as to cut off power to the train approaching on track 140. Therefore, the train on track 142 is able to continue on its way without fear of being struck by the train on track 140.

When the train on track 142 clears the intersection, it engages rail switch 156 thus completing the control circuit through coil 188 of relay 178. This moves movable contact 170 upwardly to again engage stationary contact 172 and relays 176 and 178 supplies power to the isolated section 146 of track 140 so that the train on track 140 is reenergized and may now pass through the intersection.

When the train on track 140 approaches first, coils 184 and 186 are actuated by rail switches 150 and 154 to detain and then re-energize any train approaching on track 142 in a manner similar to that described above.

FIGURE 5 illustrates a track 210 incorporating a control system for passenger-freight station control. In FIGURE 5, a passenger train with, for example, seven or more metal wheels on one side, will stop at station 212 for a few seconds, but a freight train with less than seven metal wheels will pass the station 212 without stopping. The track 210 is provided with a pair of rail switches.
station 212. The station is located adjacent an isolated section of track 218. Isolated track section 218 is connected by lead 220 through a thermal time delay relay 222 and lead 224 to the common power supply terminals 158 and 198. Relay 222 controls a pair of normally open contacts 226 and an energizing coil 228. One side of coil 228 is connected to the other control terminal 192. The other side of coil 228 is connected to the stationary contacts of a stepper switch indicated by the dashed box 230. Stepper switch 230 includes the usual rotatable wiper 232, a switch which weighs 234, and a recycle winding 236. The seven stationary contacts 238 of the stepper switch are electrically connected together as are the last seven stationary contacts 240.

In operation, it is assumed that a freight train passes over rail switch 214 moving in the direction of the arrow in FIGURE 5. The locomotive has two metal wheels on each side and therefore produces two pulses in stepper winding 234 which causes the stepper switch to step two contacts. Only two pulses are produced because the switch 214 is on only one side of the track. The conventional tenders also have two metal wheels on each side providing two more pulses and two more steps of the stepper switch 230. After the tender may be one or more freight cars, but these are conventionally provided with all plastic wheels so that the stepper switch is stepped only four times. In this case, the wiper 232 is connected to the contacts 238 and track power is supplied through the wiper arm and lead 220 to the isolated section of track 218. This allows the freight train to pass through the station without stopping.

If the train is a passenger train, with seven or more metal wheels on one side, stepper switch 232 is stepped more than enough times to bring the wiper arm 232 into engagement with commonly connected stationary contacts 240. Power is no longer supplied through lead 220 to isolated section 218 and the passenger train stops at station 212. However, at the same time that power is cut off to track section 218, wiper 232 supplies control power through contacts 240 to the coil 228 of relays 222. This coil energizes the relay after a time delay determined by the thermal heat-up time of the normally open contacts 226. When the contacts 226 become sufficiently heated to close, track power is again supplied to the track section through contacts 238, and the passenger train starts up and continues on its way.

Whether the train is a passenger on a freight train, when it clears track section 218 past station 212, the train contacts rail switch 216 thus energizing recycle winding 236 so as to swing the wiper 232 back to the zero position illustrated in FIGURE 5.

FIGURE 6 shows a train priority system for side-tracking a slow freight train to permit a faster passenger train to pass it instead of being held up. In FIGURE 6, the track 224 is provided with a siding 246 which siding is joined to the track 244 at each end by switches shown as dashed line boxes 248 and 250. Siding 246 is provided with an isolated short section of track 252 and with a rail switch 254.

Track 244 includes rail switches 256 and 258 preceding the siding and a third rail switch 260 beyond the siding. In the explanation, it is assumed that the trains travel on the main track 244 and the siding 246 in the direction of the arrows illustrated in FIGURE 6.

Terminal 198 of the control source is connected to the track 244 by way of lead 262. Rail switch 256 is connected to the stepper winding 234 of stepper switch 230 by way of lead 264. Similarly, lead 266 connects the recycle winding 236 of the stepper switch to rail switch 260 beyond the right hand end of the siding.

Switch 248 for the siding is provided with a pair of coils 266 and 270. The former acts to throw the switch so that a train approaching on track 244 passes onto the siding while the latter coil 270 acts as a straight-through coil and returns the switch 248 to its initial position so that a train approaching on track 244 passes the siding and continues along the track. Siding coil 268 is connected to rail 258 in the main track while the straight-through coil 270 is connected to rail switch 254 in the siding. Switch 250 may be set for the desired construction and may be manually manipulated.

In operation, it is assumed that there is a slow freight followed by a faster passenger train approaching rail switch 256. The passenger train is being detained by the slow speed of the freight and since passenger trains normally have priority over freight, the freight must be sidetracked and the passenger train allowed to proceed.

When the metal wheels of the freight train locomotive and tender pass over the rail switch 256 each metal wheel steps the stepper switch once and if as assumed in FIGURE 5 the freight is provided with four metal wheels on one side, the stepper switch steps to position 4 with the wiper connected to the common terminals 238. This indicates that the approaching train is a freight train.

Slightly more than one train length beyond rail switch 256 is a second rail switch 258. When the locomotive of the freight passes over switch 258 the coil 232 in position 4, coil 268 is energized and switch 248 moves to direct the freight onto the siding 246. The freight proceeds onto the siding slightly further than one train length and then engages rail switch 254 actuating coil 270 from control terminal 192 so as to return switch 248 to its original position. The freight train then passes on until its locomotive engages isolated track section 252. Since no power is applied to this isolated section, the freight train stops on the siding.

Since switch 248 has been returned to its initial position by coil 270 the passenger train now approaching passes by the siding and continues onto track 244. The metal wheels of the passenger train add their count to the count of the freight train so as to rotate wiper 232 into engagement with one of the common contacts 240, and the passenger train does not activate the switch 248. When the passenger train reaches rail switch 260 beyond the siding, after its last car has cleared switch 250, rail switch 260 acts to pulse recycle winding 236 so as to return the stepper switch to its zero position.

Release of the freight train from the siding may be either manual or automatic and switch 250 may be either a normal or spring return type switch. D.C. track power supplied to the track elements is conventional and is not illustrated in FIGURE 6.

It is apparent from the above that the present invention provides a novel simplified rail switch and improved control systems for railroad trains, particularly suited to D.C. track power. The novel control system of the present invention may be energized by either A.C. or D.C. having a common terminal with the D.C. track power supply and if desired the control circuit may be energized directly from the D.C. track power supply. The simplified rail switch of the present invention may be used to control the control circuit in parallel with the track so that the control equipment may be energized by track power.

An important feature of the simplified rail switch of the present invention involves the generation of two or more impulses to insure accurate and reliable operation of the energizing relays and switches, while at the same time providing power to the locomotive control system and car lights at all times. Although the various systems of FIGURES 3-6 illustrate a rail switch constructed in accordance with FIGURE 1, it is apparent that the rail switches of these systems may, if desired, be constructed in accordance with the embodiment of FIGURE 2. While particularly suited for use in two track systems, the rail switch of this invention may be used in systems involving more than two tracks.

The invention may be embodied in other specific forms without departing from the spirit or essential character-
istics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A rail switch for model railroads comprising a section of two rail track, means for applying track power to said rails, an intermediate section in one of said rails electrically insulated from the remainder of said one rail, said intermediate section including a pair of spaced sections of rail, the length of said intermediate section being less than the distance between the centerlines of the axles of a railway truck passing over said rail, electrically conductive means shunting said intermediate section for preserving electrical continuity along said one rail, and a separate control terminal coupled to each of said intermediate spaced sections of rail whereby said switch may be connected to a control circuit which is independent of said means for applying track power.

2. A rail switch according to claim 1 wherein said two rail track section is HO gauge.

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