

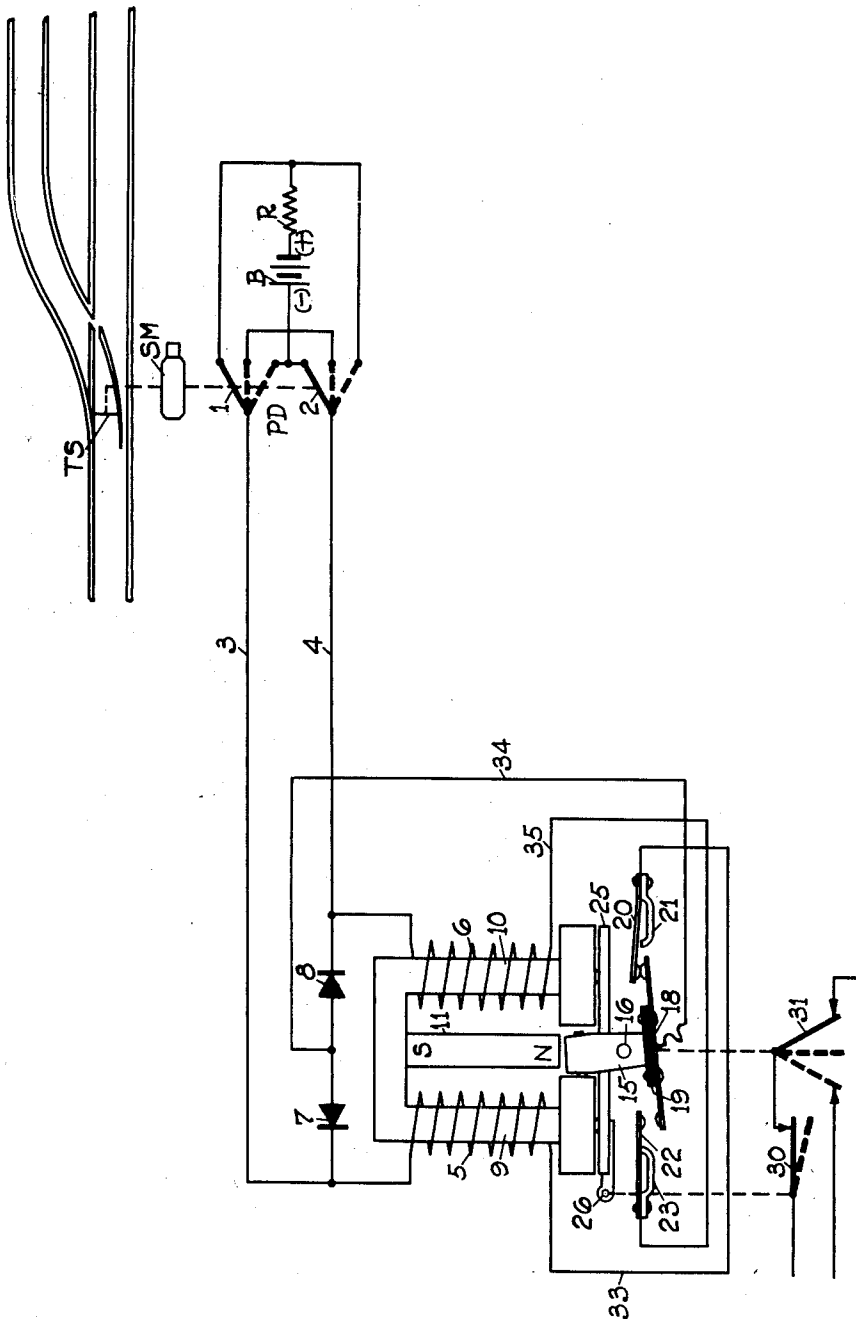
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RAILWAY TRAFFIC CONTROLLING SYSTEM

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RAILWAY TRAFFIC CONTROLLING SYSTEM

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This invention relates in general to traffic controlling systems for railroads, and more particularly to means for indicating the position of a railway traffic controlling device.

5 In railway signalling systems, it is often necessary to condition certain apparatus at a remote location in accordance with the prevailing condition of a traffic controlling device. A neutral-polar relay is often used for this purpose which is energized with one polarity or with the other 10 polarity in accordance with the normal or reverse extreme position of a track switch and which is deenergized when the switch is in an intermediate position. The clearing of signals over one route 15 or over another route may then be selected according to the position of the polar contacts of the neutral-polar relay, and arranged so that neither of these signals can be cleared unless the neutral contact is closed. However, in the event 20 some abnormal condition prevents the polar armature of the usual type of neutral-polar relay from properly responding to a change in polarity of energization, the neutral armature may still be attracted, thereby clearing the signals over a wrong and possibly an unsafe route. 25

In view of the above and other considerations, it is proposed in accordance with the present invention to provide a means for conditioning a neutral-polar relay in accordance with the position of a traffic controlling device whereby the 30 neutral armature can be attracted only when the position of the polar armature corresponds to the polarity of energization of the relay. It is further proposed to provide such a means for conditioning a neutral-polar relay which prevents attraction 35 of the neutral armature in the event of a failure of any of the apparatus employed to check the proper polar contact operation, and which allows the neutral armature to be attracted only when 40 the position of the polar armature corresponds to the polarity of energization regardless of the intensity of such energization.

Other objects, purposes and characteristic features of the present invention will be apparent 45 as the description thereof progresses, during which references will be made to the accompanying drawing which shows, in a diagrammatic and conventional manner, one specific embodiment of the present invention.

50 The accompanying drawing illustrates in a conventional manner a section of railway track including a track switch TS which is power operated by a switch machine SM of the type shown, for example, in Patent No. 1,466,903, granted to 55 W. K. Howe, on September 4, 1923. A suitable

point detector contact mechanism PD is associated with the switch machine SM and track switch TS which may be of any suitable type such as shown in Patent No. 1,517,236, granted to C. S. Bushnell, on November 25, 1924, which point 5 detector mechanism has herein been shown merely as two movable contacts 1 and 2 operable in unison to either of three positions. It is believed to be sufficient for an understanding of the present invention to know that the contacts 1 and 2 10 are in their present normal position when the track switch TS is in its normal position in accordance with the switch machine SM and is locked; that the contacts 1 and 2 are in their center position whenever the track switch TS is 15 unlocked or in operation; and that contacts 1 and 2 are in a reverse or lower extreme dotted position whenever the track switch TS is in its reverse position in correspondence with the switch machine SM and is locked. 20

The contacts 1 and 2 of the point detector mechanism selectively control the energization of a line circuit including wires 3 and 4 from a local source of energy such as a battery B, which line circuit is employed to energize windings 5 and 6 of a neutral-polar relay generally constructed as 25 shown for example in Patent No. 1,749,331 granted to O. S. Field, on March 4, 1930 with certain modifications as will be later pointed out. Such a relay has been illustrated in a simplified 30 manner in the present drawing as comprising two parallel electro-magnet cores 9 and 10 terminating at their lower ends in enlarged pole pieces and each joined at their upper ends to the upper end of a center permanent magnet 11 extending 35 parallel therewith. A polar armature 15 is mounted beneath the lower end of the permanent magnet 11 so as to be magnetically coupled therewith, and is operable about a pivot 16 into engagement with the inner vertical surface of the 40 pole piece of either core 9 or 10 in accordance with the polarity of energization of windings 5 and 6.

A suitable means is required to bias the polar armature 15 to a center position midway between 45 the two pole pieces of cores 9 and 10 when the present relay is deenergized, and in the present embodiment, this bias is provided by an opposed spring contact arrangement providing the usual 50 make-before-break contact operation. This contact arrangement is shown in a simplified manner as comprising a cross spring contact finger 18 attached to an insulating member 19 which is in turn carried in a suitable manner by the lower 55

end of the polar armature 15. The right hand end of this movable finger 18 is provided with a low resistance contact point which in the illustrated condition engages a similar contact point at the end of a stationary spring finger 20, whereby the spring finger 20 is forced upwardly from a stationary stop member 21 attached thereto. The left hand end of the movable finger 18 is arranged in a similar manner, or that is, a similar low resistance contact point on this end is in its present position disengaged from a contact point of a stationary spring finger 22 which engages its stop member 23 to prevent movement thereof in the direction of the movable contact finger 18.

It may now be seen that such a contact arrangement provides a biasing force tending to center the polar armature 15, or that is, with the polar armature 15 in its illustrated position, the stationary spring finger 20 tends to operate the armature 15 in a clock-wise direction but is overpowered by the magnetic attraction of armature 15 to its illustrated position. However, when the relay windings are deenergized, the biasing force of the stationary spring finger 20 is sufficient to operate the armature 15 to the center position wherein the biasing force in this direction is stopped by its engagement with the stop member 21. The movable finger 18 in this center position engages the stationary finger 22 as well as the stationary finger 20, so that a definite position of the polar armature 15 is assured and the movable finger 18 is electrically connected to both the stationary fingers 20 and 22. It will be obvious that the other or right hand position of the polar armature 15 in a similar manner disengages the movable finger 18 from the stationary contact 20, but retains its engagement with contact 22, and upon deenergization of the operation windings, the spring 22 acts to bias the armature 15 back to its center position in the same manner as spring finger 20.

A neutral armature 25 is operable in the usual manner into engagement with the lower surfaces of the pole pieces of cores 9 and 10 against a gravity biased by the energization of winding 5 or 6, and for simplicity the armature 25 is illustrated as operating about a pivot 26 located at its left hand end. The relay thus arranged is employed to operate suitable neutral and polar contacts such as the neutral contact 30 shown conventionally and indicated by a dotted line as operated directly by the neutral armature 25, and a polar contact 31 is also shown conventionally with a dotted line indicating that it is operated to either of three positions directly by the polar armature 15. These neutral and polar contacts represented by contacts 30 and 31 may be employed to select the control of various circuits such as the clearing of signals associated with routes over the track switch TS and for the selection of various locking and indicating circuits or the like in accordance with the usual practice.

Suitable asymmetric units or rectifiers 7 and 8 are required in connection with the present neutral-polar relay, which may be of any suitable type or the copper oxide type may be preferable as they may be conveniently mounted on the relay structure.

Having thus described the apparatus employed in the present invention, it is believed that the nature of the invention, its advantages and characteristic features can best be understood by further description being given from the standpoint of operation.

Operation

The track switch TS is shown in its normal position in the accompanying drawing which completes an energizing circuit for the neutral-polar relay from the (+) or right hand terminal of battery B, through resistor unit R, contact 1 of the point detector mechanism PD in its upper position, line wire 3, through the normal operating winding 5, wire 33, polar contacts 20—18, wire 34, rectifier unit 8, line wire 4, point detector contact 2 in its upper position to the (—) terminal of battery B. It will be clear from the drawing that the (+) potential of energy placed on wire 3 by the above circuit cannot cause current to flow through the rectifier unit 7, and also that current cannot flow through winding 6 due to open contacts 18—22. The current flowing in winding 5 however produces a south magnetic pole at the lower end of core 9, thus operating the upper end of polar armature 15 to the left into engagement with the side of the pole piece of core 9, this being due to the magnetism of armature 15 produced by the north pole of permanent magnet 11. The electro-magnetic flux produced by the energization of winding 5 also attracts the neutral armature 25 upwardly against the pole pieces of cores 9 and 10. Polar contact 31 and neutral contact 30 are thus operated to their illustrated positions to complete a readily apparent circuit therethrough.

Now assuming that the track switch TS is operated to its reverse position, the contacts 1 and 2 assume their center position during this operation thereby deenergizing the line wires 3 and 4 and shunting these wires over a readily apparent circuit. The winding 5 is consequently deenergized which releases the neutral armature 25 and allows the polar armature 15 to be operated by the spring finger 20 to a center position, thereby opening neutral front contact 30 and operating polar contact 31 to its center position.

When the track switch TS has completed its operation to its reverse position, the contacts 1 and 2 are operated to their lower dotted position whereby a circuit is completed from the (+) terminal of battery B, through resistor R, point detector contact 2 in its lower dotted position, line wire 4, through the reverse operating winding 6, wire 35, contact 22—18, wire 34, rectifier unit 7, line wire 3, point detector contact 1 in its lower dotted position to the (—) side of battery B. It will likewise be clear that this (+) potential of energy on wire 4 cannot flow through the rectifier unit 8, and as traced above, the majority of this current flows through rectifier unit 7 rather than winding 5 in multiple therewith. The current flowing through winding 6, however, produces a south magnetic pole at the lower end of core 10, thereby attracting the polar armature 15 to its right hand position due to its magnetization by the north pole of permanent magnet 11. The electro-magnetic flux produced by this energization of winding 6 likewise attracts armature 25, thereby closing the neutral front contact 30. The reverse position of polar armature 15 opens contacts 18—20 and places contact 31 in its extreme left hand dotted position.

Now considering that at the completion of the above reverse operation of the track switch, some abnormal condition prevented the proper operation of the polar armature 15 from its center position to its right hand position, it will be obvious that the polar contact 31 remains in its center position, whereby no circuit is completed

so that an unsafe condition cannot be produced by the picking up of the neutral armature 25 to close neutral front contact 30.

Also, considering that during the above operation of the track switch from its normal to its reverse position, some abnormal condition prevented the movement of the polar armature 15 from its illustrated left hand position upon deenergization of winding 5, it will be clear that the winding 6 cannot be subsequently energized upon the completion of the operation of the track switch to its reverse position. In other words, if the polar armature 15 has not operated from its left hand position to its center position upon the operation of contacts 1 and 2 to their reverse or lower positions, the (+) potential of energy applied to line wire 4 cannot energize winding 6 as its circuit is open at contacts 18—22, and obviously rectifier unit 8 prevents the application of such potential over line wire 34 to winding 5, which winding 5 is also shunted to this polarity by rectifier unit 7. In this manner, the windings of the relay cannot be energized under the above assumed condition to attract the neutral armature 25, thus retaining neutral front contact 30 open to prevent the completion of an unsafe circuit due to the improper position of polar contact 31.

In a similar manner, it will be apparent that an unsafe circuit cannot be completed during the reverse of the above assumed conditions, or that is, when an abnormal condition prevents the polar armature from operating from its reverse or right hand position to its center position during the operation of the track switch from its reverse to its normal position. In other words, with the armature 15 improperly retained in its reverse or right hand position, the application of (+) potential to line wire 3 cannot energize winding 5 due to open contacts 20—18, and this potential cannot energize winding 6 over wire 34 due to the rectifier unit 7, which winding 6 is further shunted to this polarity by rectifier unit 8.

It will be noticed in the above description of the manner in which an improper polar armature position prevents energization of the relay, that in each case the energization of one winding even though shunted by a rectifier unit was further prevented by the other rectifier unit. However, if either one or both of the rectifier units should become short-circuited to pass current in either direction, they are so arranged that a shunt across line wires 3 and 4 would exist when a polarity of energization was applied thereto which was ordinarily blocked by the defective rectifier.

Such a shunt across line wires 3 and 4 would obviously prevent energization of the relay to attract the neutral armature, thereby preventing an unsafe condition from obtaining due to a possible failure of a rectifier unit, and in order to prevent an unduly high current from obtaining if such a shunt occurs across wires 3 and 4, the resistor R has been provided in series with battery B. It is of course obvious however, that the neutral armature can be attracted by one polarity of energization of the control circuit even though the rectifier employed to block the opposite polarity is short-circuited, providing that the polar armature is not in an improper position, this being the normal and proper relay operation.

A means for conditioning a neutral-polar relay in accordance with the position of a traffic controlling device has thus been provided, wherein a biased-to-center polar armature is employed having a make-before-break contact arrange-

ment in combination with rectifier units arranged to select the energization of one or the other of two operating windings according to the polarity of energization of the control circuit to accordingly position the polar armature and attract the neutral armature, and the polar armature thus properly positioned opens the circuit for the coil which is not energized by the particular polarity of energization of the control circuit. Consequently if the polar armature sticks in an extreme operated position upon deenergization of the relay, the coil open circuited by the polar armature in this position cannot be subsequently energized and the rectifier arrangement prevents the other coil from being energized with a direction of current which does not correspond to this extreme polar armature position, thus preventing the neutral armature from being attracted by an energization of the control line circuit which is out of correspondence with the position of the polar armature.

An important feature of such an arrangement is the fact that the above operation does not depend on any definite limits in the degree of energization of the relay, or that is, the neutral armature cannot be attracted when the polar armature is in an extreme position out of correspondence with the polarity of energization even though the potential of such energization is raised to an abnormally high value. Another important feature resides in the rectifier arrangement whereby the neutral armature cannot be attracted in the event the rectifiers fail to block the opposed direction of current thereby preventing the possibility of an improper and dangerous condition of the relay contacts from obtaining due to such a rectifier failure.

The above rather specific description of one form of the present invention is given solely by the way of example, and is not intended, in any manner whatsoever, in a limiting sense. It is also to be understood that various modifications, adaptations and alterations may be applied to meet the requirement of practice, without in any manner departing from the spirit or scope of the present invention, except as limited by the appended claims.

What I claim is:—

1. In combination; a neutral-polar relay having a normal and a reverse operating winding, a neutral armature, and a polar armature operable to a normal and a reverse position; means for biasing said polar armature to a center position; oppositely arranged rectifiers; a normal contact closed only by the center and the normal positions of the polar armature; a reverse contact closed only by the center and the reverse positions of the polar armature; an energizing circuit for attracting the neutral armature and operating the polar armature to its normal position including the normal operating winding, the normal contact, and one of the rectifiers; and an energizing circuit for attracting the neutral armature and operating the polar armature to the reverse position including the reverse operating winding, the reverse contact, and the other of the rectifiers.

2. In combination; a neutral-polar relay having a polar armature operable to two energized positions; means for biasing said polar armature to a center position; contacts operated by the polar armature; two oppositely arranged rectifier units; a circuit for current flowing in one direction including one relay winding, a contact closed only by the center and one operated position of

the polar armature and one of the rectifier units; and a circuit for current flowing in the other direction including another relay winding, a contact closed only by the center and the other operated position of the polar armature and the other of the rectifier units.

3. In combination; a neutral-polar relay having two operating windings and a polar armature operable to either a normal or a reverse position; means for biasing said polar armature to a center position; contacts operated by the polar armature; two oppositely arranged rectifier units; a circuit for current flowing in one direction including one of the relay windings, a contact closed only by the center and the normal position of the polar armature and one of the rectifier units; and a circuit for current flowing in the other direction including another of the relay windings, a contact closed only by the center and the reverse position of the polar armature and the other of the rectifier units.

4. In combination, a neutral-polar relay having a three-position polar armature and a normal and a reverse operating winding, a rectifier preventing the flow of current in one direction through the normal operating winding, a rectifier preventing the flow of current in the other direction through the reverse operating winding, polar contact means preventing the flow of current in either direction through the reverse operating winding when the polar armature is in its normal operated position, and polar contact means preventing the flow of current in either direction through the normal operating winding when the polar armature is in its reverse operated position.

5. In combination, a neutral-polar relay having a three position polar armature, means permitting current to flow in one direction only through one winding of the relay and in the other direction only through another winding of the relay, and contact means for preventing energization of the one winding during one operated position of the polar armature and the other winding during the other operated position of the polar armature.

6. In combination, a neutral-polar relay having a three position polar armature, means permitting current to flow in one direction only through one winding of the relay and in the other direction only through another winding of the relay, and contact means for preventing energization of the one winding during one operated position of the polar armature and the other winding during the other operated position of the polar armature whereby to prevent energization of the relay except by a direction of current corresponding to the operated position of the polar armature.

7. In combination, a neutral-polar relay having a three position polar armature, means permitting current to flow in one direction only through one winding of the relay and in the other direction only through another winding of the relay, contact means for preventing energization of the one winding during one operated position of the polar armature and the other winding during the other operated position of the polar armature but permitting energization of either of the windings during a center position of the polar armature,

and means for biasing said polar armature to its center position.

8. In combination, a two-winding relay having a three position polar armature, means permitting current to flow in one direction only through one winding and in the other direction only through the other winding, and polar contact means for preventing energization of either winding during an operated position of the polar armature out of correspondence therewith.

9. In combination, a polarized relay having a normal and a reverse winding on the same core and a neutral and a polar armature, rectifier means for shunting current of reverse polarity from said normal winding, means including said rectifier means for supplying said normal winding with current of normal polarity and said reverse winding with current of reverse polarity to operate said polar armature to its normal or reverse position respectively, and means responsive to the operation of said polar armature to its normal or reverse position to open the circuit to said reverse winding or said normal winding respectively.

10. In combination, a polarized relay having a normal and a reverse winding on the same core and a neutral and a polar armature, means for supplying said normal winding with current of normal polarity and said reverse winding with current of reverse polarity to operate said polar armature to its normal or reverse position respectively, means responsive to the operation of said polar armature to its normal or reverse position to open the circuit to said reverse winding or said normal winding respectively, means for shunting current of normal polarity from said reverse winding and current of reverse polarity from said normal winding, and a circuit having its continuity dependent on the operation of said neutral and said polar armatures.

11. In combination, an electro-magnetic relay comprising an armature and two windings, a circuit for said relay windings, means for supplying current of normal or reverse polarity to said circuit, means including one of said windings and responsive to current of normal polarity supplied to said circuit for causing said armature to open the circuit for the other of said windings, and means for by-passing current of reverse polarity around said one winding.

12. In combination, an electro-magnetic relay comprising an armature and a pair of windings, a circuit over which current of normal or reverse polarity is supplied to said windings, a pair of oppositely poled rectifiers connected across said circuit, and means controlled by said armature for selectively connecting said rectifiers to said windings.

13. In combination, an electro-magnetic relay comprising an armature and a pair of windings, a circuit over which current of normal or reverse polarity is supplied to said windings, a pair of oppositely poled rectifiers connected across said circuit, means controlled by said armature for selectively connecting said rectifiers to said windings, and means controlled by said windings and said rectifiers in combination for selectively controlling said armature.

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