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Sheppard

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[54] EMERGENCY TRIP APPARATUS FOR A BRAKING SYSTEM

[72] Inventor: Charles W. Sheppard, Trafford, Pa.

[73] Assignee: Westinghouse Air Brake Company, Wilmerding, Pa.

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317/154 R; 200/61.19; 246/192, 200 R

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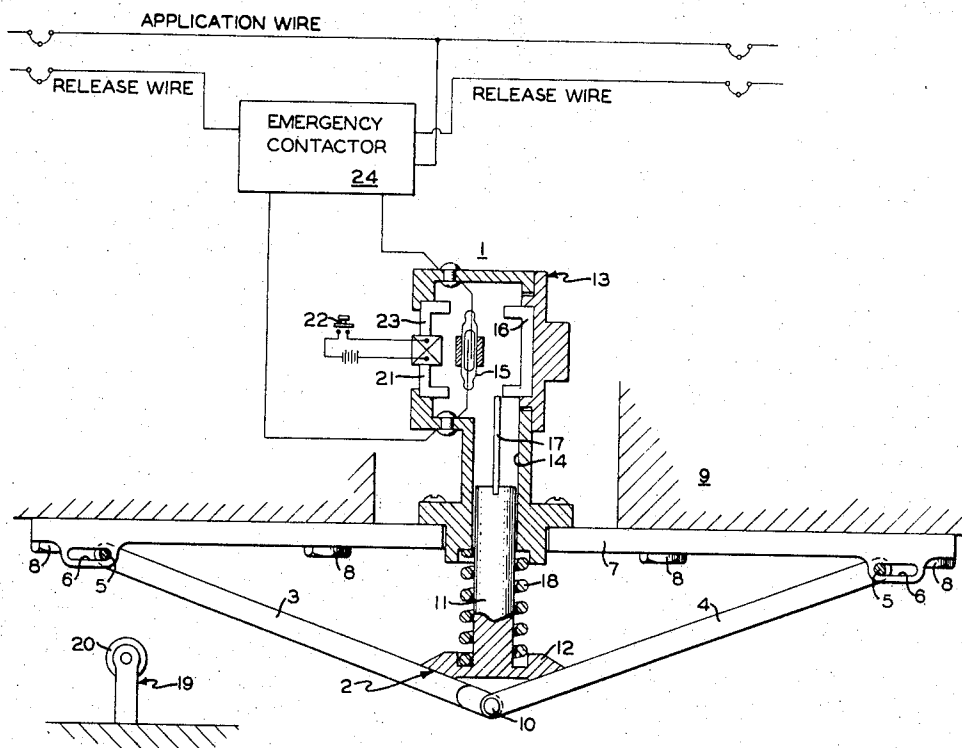
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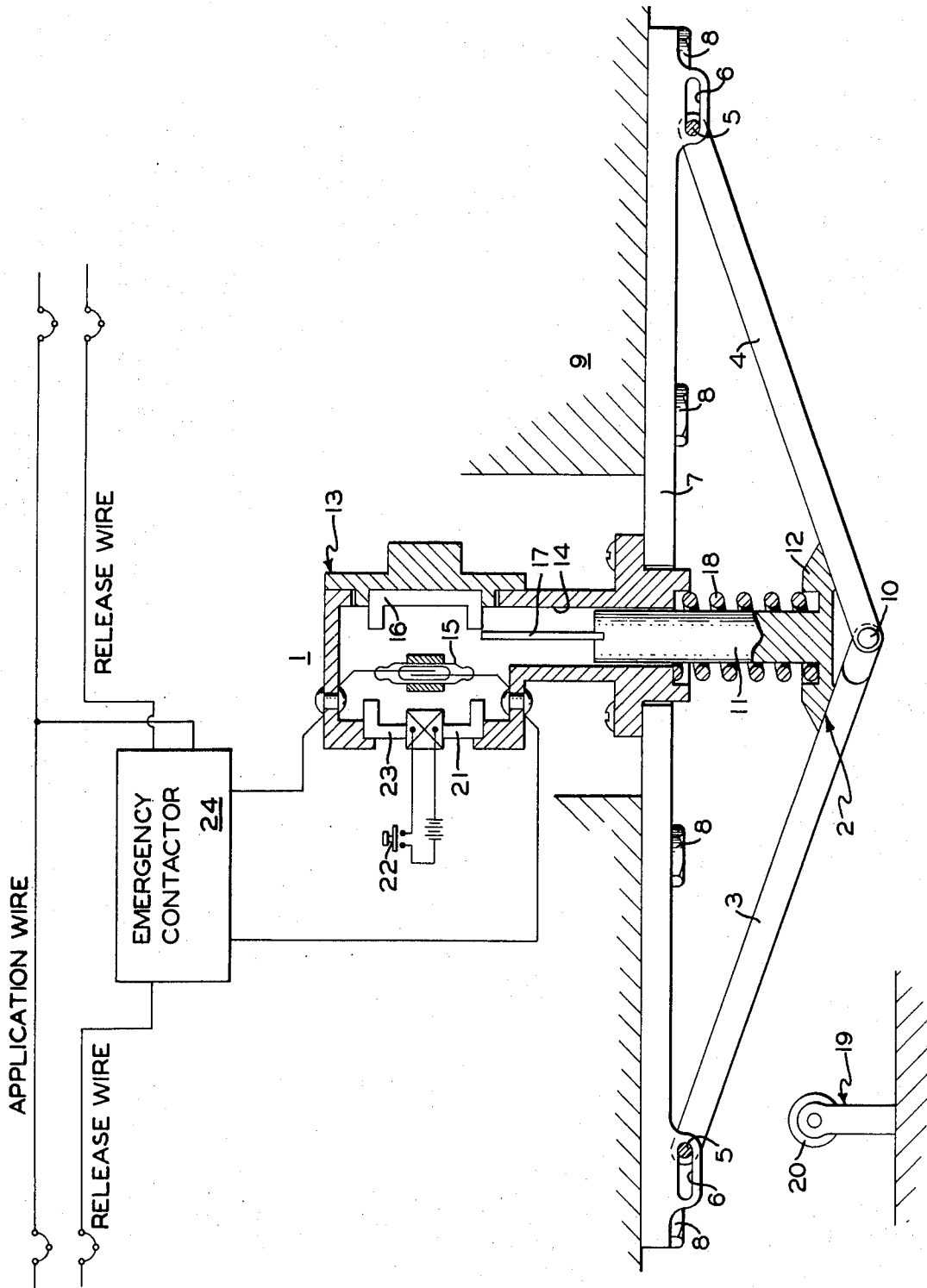
Primary Examiner—Gerald M. Forlenza
Assistant Examiner—George H. Libman
Attorney—Ralph W. McIntire, Jr.

[57] ABSTRACT

An electric trip switch device for railroad service utilizing a magnetic reed switch in proximity with a permanent magnet, which acts upon the reed switch. A magnetic conductor is adapted to move between the permanent magnet and reed switch in accordance with the actuating mechanism of the trip switch being engaged by a trackside detector to control the reed switch operation. An interlock circuit responsive to the electric signal provided by the reed switch may be employed to control application and release train line wires to produce a trip switch initiated brake application. Reset means comprising an electro-magnet is provided to momentarily reinforce the magnetic field produced by the permanent magnet to initially close the reed switch contacts following a trip switch actuation, after which the contact closure is maintained by the permanent magnet.

6 Claims, 1 Drawing Figure





INVENTOR
 CHARLES W. SHEPPARD
 BY *Ralph W. Mc Intire Jr.*
 ATTORNEY

EMERGENCY TRIP APPARATUS FOR A BRAKING SYSTEM

BACKGROUND OF INVENTION

Emergency trip devices may be either pneumatic or electrical and are typically employed in railway transit service for automatically initiating a brake application on a vehicle passing over a trackside detector device, which may be selectively set up to contact the emergency trip actuating mechanism. The invention relates particularly to electric type trip switch devices which have the advantage over pneumatic trip devices in that direct interfacing with a conventional emergency contactor is possible, the emergency contactor being an electrical interlock device arranged to control the application and release train wires, in addition to such other desirable emergency related functions as sanding, horn sounding, etc.

Being mounted on the unsprung portion of the railway vehicle so as to remain properly aligned for engagement with the detector device irrespective of the vehicle load condition, however, the trip device is continuously subject to vibration and shock forces transmitted from the rails during service. Conventional type electrical contacts, which are normally utilized in electric trip switch devices, are therefore susceptible to rapid wear by reason of their experiencing a high incidence of arcing encouraged by the vibration tending to open the contacts. Periodic maintenance is consequently required to maintain electric trip switches in an operative condition.

SUMMARY OF INVENTION

It is therefore the object of the invention to provide a simple, low-cost, yet reliable electric trip switch device which utilizes a magnetic reed switch, the contacts of which are substantially unaffected by car vibration and other environmental conditions normally associated with railroad operation.

According to the present invention, there is provided a trip switch device having a toggle type trip arm supported at its ends by a member mounted to the car truck and engageable at its hinged midpoint with means through which a ferromagnetic shield is movable within the space provided between a permanent magnet and a magnetic reed switch. When the trip arm is contacted by a trackside detector, the midpoint of the toggle is deflected upward, moving the shield between the permanent magnet and reed switch. The magnetic field flux provided by the permanent magnet which normally holds the reed switch contacts closed is consequently shunted away from the reed switch by the highly conductive shield. In the absence of a magnetic field at the reed switch, its contacts assume their normally open condition in which an emergency interlock circuit controlled by the reed switch is interrupted.

An electro-magnet is provided to reset the reed switch contacts. Momentary energization of the electro-magnet, after the trip arm resets, establishes a flux field which reinforces the permanent magnet flux field so that the combined flux density influencing the reed switch is sufficient to produce closure of the reed switch contacts and thereby complete the previously interrupted emergency interlock circuit. Once the contact closure is accomplished, the electro-magnet may be deenergized and the permanent magnet alone will

hold in the reed contacts to maintain circuit continuity until the trip switch is subsequently actuated.

Other objects, features and attendant advantages will become more readily apparent from the following detailed description when considered in conjunction with the accompanying single FIGURE drawing of an illustrative embodiment of the invention in which the disclosed trip switch device is shown diagrammatically, partly in outline and partly in elevation section.

Referring now to the drawing, a trip switch device 1 comprises a trip mechanism 2 which includes a pair of relatively wide cooperating arm segments 3 and 4, the outer ends of which are each provided with a pin 5. Elongated slots 6 are formed in a mounting bracket 7 to receive pins 5 and thereby support the outer ends of arm segments 3 and 4. The slots 6 accommodate longitudinal movement of the arm ends relative to bracket 7, which is secured by bolts 8 to the truck frame 9 or other suitable unsprung portion of a railway vehicle with which the trip switch device 1 is associated. The inner end of one of the arm segments 3 or 4 is arranged with a clevis and is joined by a wristpin 10 to the adjoining arm segment to provide a hinged joint connection at the midpoint of trip mechanism 2.

Also included in trip mechanism 2 is a follower stem 11 having a spring seat 12 formed integral, or otherwise secured therewith, and adapted to engage arm segments 3 and 4 near their hinged midpoint.

Further comprising trip switch device 1, in addition to trip mechanism 2 is a magnetic switch assembly 13, the body of which is formed of a magnetic insulator material. Assembly 13 is clamped or bolted to the mounting bracket 7 so that a bore 14 therein, in which stem 11 operates, is aligned vertically above the midpoint of arms 3 and 4.

Carried in assembly 13 is a conventional magnetic reed type switch 15 arranged in spaced-apart relation with a permanent magnet 16, the poles of which are located so as to polarize the normally open reed switch contacts and thereby establish a magnetic force of attraction therebetween. The reed switch is mounted with its contacts disposed so as to operate in a horizontal plane contrary to the direction of vibration forces, the effects of which are thereby minimized. A magnetically conductive shield 17 formed of a ferromagnetic material is suitably attached to the end of stem 11 opposite the end with which the hinged joint connection of trip mechanism 2 is engaged. Disposed about stem 11 is a spring 18 caged between spring seat member 12 and an annular recess formed in the bottom of unit 13. Trip mechanism 2 is urged downward at the hinged joint connection of arms 3 and 4 by spring 18 acting through seat 12 so as to be disposed in a depending position. As shown in the drawing, stem 11 is positioned in bore 14 such that shield 17 is removed from the space between the reed switch 15 and permanent magnet 16. The normal depending position of the trip mechanism 2 including location of stem 11 in bore 14 is defined by reason of the pin 5 in each arm segment 3 and 4 engaging the one extreme end of the respective elongated slots 6. A trackbed mounted detector device 19 of conventional construction may be selectively set up in a vertical position in order to encounter the depending trip mechanism 2, as a means of automatically producing an emergency stop signal in consequence of

a railway vehicle, on which the trip switch 1 is mounted, passing over the detector. A wheel 20 is preferably provided with the detector 19 to effect friction free engagement thereof with arm segment 3 or 4 of the trip mechanism 2, depending upon the direction of vehicle travel.

Also carried in assembly 13 is an electro-magnet 21, energization of which is controlled by a spring-loaded reset switch 22. A pole piece 23, forming the core of the electromagnet, is located relative to the poles of permanent magnet 16 so that their magnetic flux fields interact in a reinforcing manner. The combined flux density of the interacting fields produces sufficient magnetic attraction between the reed switch contacts to overcome the contact tension and thereby establish contact closure. The strength of permanent magnet 16 and its proximity with reed switch 15 are selected so that the effective magnetic energy is insufficient to close the reed switch contacts, but is sufficient to maintain the contacts in a closed condition subsequent to their being initially closed by the supplemental effect produced by the electro-magnet.

A conventional emergency contactor device, as represented by block 24, is shown as illustrative of means responsive to the signal provided by the reed switch operation for producing a brake application. Typically, the emergency contactor is utilized as an electrical interlock providing control of the application and release train wires in accordance with the condition of the reed switch, as hereinafter explained.

In describing the operation of trip switch device 1, let it be assumed that the contacts of the reed switch 15 are maintained in a closed condition by the effects of permanent magnet 16 to complete a circuit to the emergency contactor device 24. Being normally arranged in a fail-safe configuration, interlock circuitry provided by the emergency contactor establishes normal control of the application and release train wires by the operator. The field strength of the permanent magnet produces sufficient magnetic attraction between the reed switch contacts to maintain the contacts in a closed state during service against the effective contact tension and vibration forces tending to separate the contacts.

When it is desired to automatically stop an approaching railway vehicle or train on which the trip switch 1 is mounted, in the event the operator should fail, for example, to heed a warning signal to stop the vehicle or train, or for any reason is delinquent in bringing the vehicle or train to a halt at a prescribed location, it is simply necessary to set up an appropriately located detector device, such as detector 19 to strike the trip mechanism 2 of the trip switch 1, as the vehicle or train passes the detector.

In passing the detector 19, one of the arm segments 3 or 4 of trip lever 2 is carried over the detector wheel 20, thereby resulting in the midpoint of trip mechanism 2 being deflected upward against spring 18, which is compressed between the body of assembly 13 and spring seat member 12. Slots 6 in bracket 7 accommodate outward movement of the ends of arm segments 3 and 4, as the midpoint is shifted upward. In being deflected upward, the hinged midpoint of arms 3 and 4 act through seat member 12, forcing stem 11 upward in bore 14 a distance sufficient to locate shield 17

in the space between the reed switch 15 and permanent magnet 16. Being of a ferromagnetic material, shield 17 serves the purpose of readily conducting the permanent magnet field flux under the influence of which the reed switch contacts are normally maintained closed. This is accomplished by reason of the magnetic field flux produced by the permanent magnet having a propensity for the ferromagnetic material of which the shield 17 is formed so that the field tends to be shunted away from reed switch 15 via shield 17, substantially reducing formation of a field at the reed switch. As a result insufficient energy is available to maintain the reed switch contacts closed against the contact tension and the contacts consequently drop out to break the circuit to the emergency contactor 24.

The length of the arm segments 3 and 4 is chosen in accordance with the response time of the reed switch and anticipated maximum speed at which a vehicle can be expected to pass over the detector device 19, in order to assure that the shield 17 remains effective to shunt the permanent magnet field away from reed switch 15 for a duration sufficient to permit contact dropout to occur before the trip lever is reset. Once the reed switch contacts are open, shield 17 is withdrawn from the space separating the reed switch and permanent magnet by reason of the hinged midpoint of arms 3 and 4 passing over the detector wheel 19 so that spring 18 is effective to return the trip lever to its normal depending position. With shield 17 withdrawn, the magnetic field is able to expand sufficiently to encompass the magnetic reed switch. Since the energy of the field produced by the permanent magnet without the field effect of electro-magnet 21 is insufficient to effect contact closure, the circuit to the emergency contact 25 will remain open, even after the trip mechanism resets.

In consequence of the reed switch being open, emergency contactor 24 is caused to establish circuitry whereby the application train wire is energized to produce a brake application and the release train wire is interrupted to prevent brake release until such time as the reed switch 15 is reset to its closed condition.

After the vehicle or train is stopped following the trip switch initiated brake application, switch 22, which may be conveniently located in the operator's cab, is operated to energize the electro-magnet 21. With shield 17 removed from the space between the permanent magnet and reed switch, and with electro-magnet 21 energized, sufficient magnetic energy is effective to reset the reed switch contacts to a closed condition. This reestablishes circuit continuity to the emergency contactor to restore the interlock circuitry thereof to a condition in which control of the brakes is provided through the train wires in the normal manner.

Reliable operation of the trip switch is thus assured by its simplicity of structure and its unique operating feature utilizing the magnetic reed switch principle which permits a long service-free life to be realized at low cost under such adverse operating conditions as are normally experienced in railway operation.

Having now described the invention what I claim as new and desire to secure by Letters Patent, is:

1. Emergency trip switch apparatus mountable on a railway vehicle for engagement with a trackway detector device to provide an indication of the vehicle passing the detector, said apparatus comprising:

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- a. magnetically responsive switch means for providing said indication when operated from a closed condition to a normally open condition,
 - b. a permanent magnet spaced from said switch means a distance sufficient to prevent the magnetic faces of said permanent magnet from operating said switch means to said closed condition and to permit the magnetic forces of said permanent magnet to maintain said switch means in said closed condition following operation thereto,
 - c. a selectively operable electro-magnet arranged in reinforcing relationship with said permanent magnet to effect in cooperation therewith actuation of said switch means to said closed position, and
 - d. actuator means including a magnetically conductive shield member operative in response to engagement of said actuator means with said detector for movement into the space separating said switch means from said permanent magnet, thereby to direct the magnetic forces thereof away from said switch means to allow said switch means to assume said normally open condition.
2. The apparatus, as recited in claim 1, wherein said electro-magnet is effective to maintain said switch means in said closed condition only so long as the magnetic force provided by said permanent magnet is effective to act upon said switch means.
3. The apparatus, as recited in claim 1, wherein said switch means is a reed relay disposed in such an at-

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titude that the reed contacts thereof operate in a horizontal direction to effect said open and closed conditions.

4. The apparatus, as recited in claim 1, wherein said actuator means further includes a trip lever having a hinged midpoint formed by the adjoining ends of outwardly extending arm segments, the opposite ends of which are pivotally carried by a support member attached to said vehicle to permit displacement of the hinged midpoint from a normal depending position to an actuated position responsive to engagement with said detector device, said shield member being engageable with the hinged midpoint for movement therewith into the space separating said switch means from said permanent magnet.

5. The apparatus, as recited in claim 4, wherein said actuator means further comprises:

- a. a follower engageably disposed between the midpoint of said trip lever and said magnetically conductive shield member, and
- b. spring means disposed between said support member and said follower for urging said hinged midpoint toward said normal depending position.

6. The apparatus, as recited in claim 4, wherein said support member is provided with elongated slots in which the ends of said arm segments opposite said hinged midpoint are supported for limited movement to define said depending position thereof.

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