

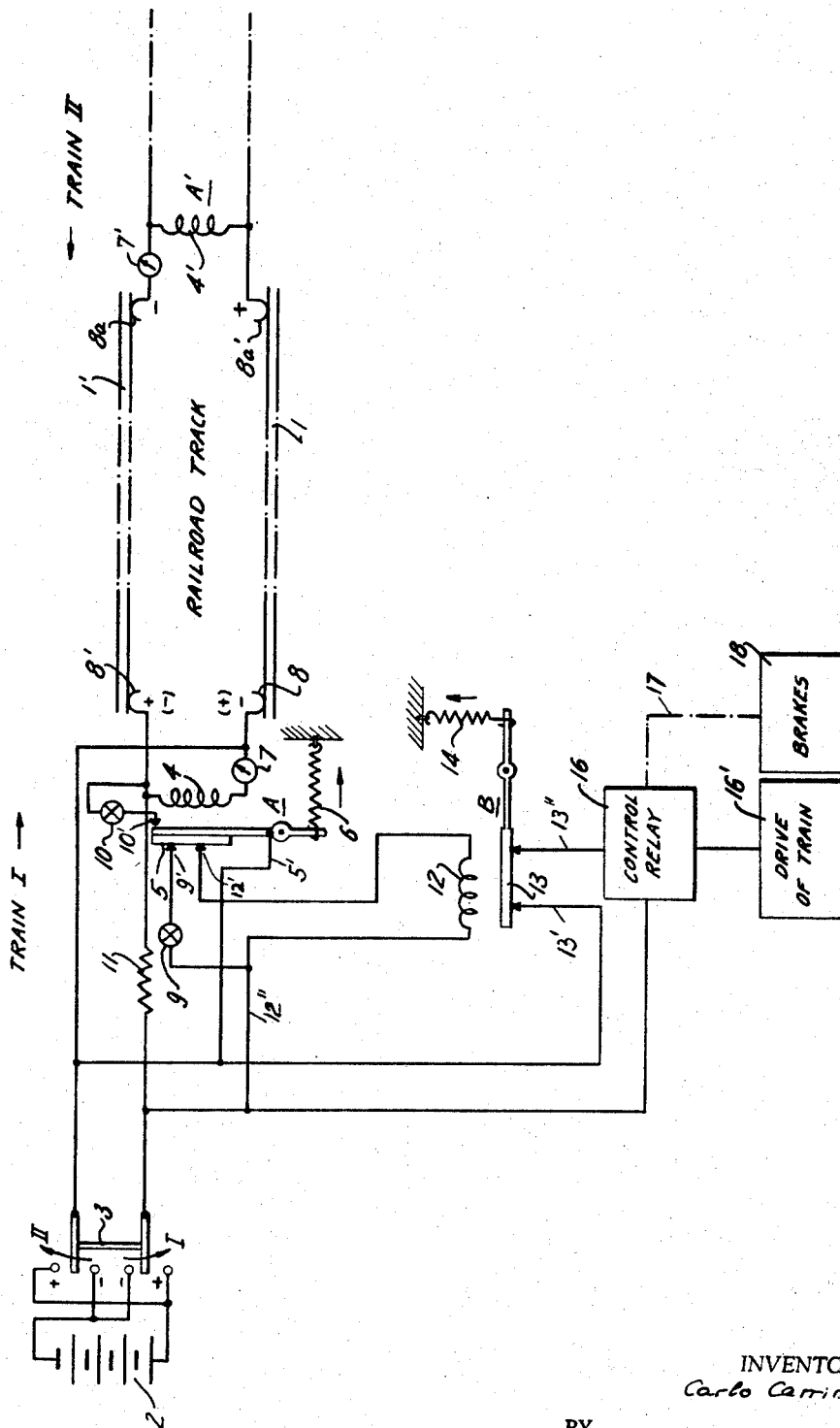
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ARRANGEMENT FOR PREVENTING COLLISION OF TRAINS

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ARRANGEMENT FOR PREVENTING COLLISION OF TRAINS

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7 Claims. (Cl. 246—65)

ABSTRACT OF THE DISCLOSURE

A device for preventing the collision of railway trains on a single track. Trains using a common track are each equipped with the device. When any one train approaches another train within a proximity regarded as unsafe, a signal is transmitted and/or brakes are applied for the purpose of holding the train. The device is operative regardless of whether the trains are moving in the same or opposite directions. An electromagnetic relay remains energized under normal conditions, and when no collisions are apparent. When, on the other hand, two trains get too close to each other from either the front or the rear, the relay is released, and a signal is transmitted whereby the trains may be stopped.

This is a continuation-in-part of my copending application Ser. No. 309,620, filed Sept. 18, 1963, now abandoned.

Background of the invention

It is one object of this invention to provide for an arrangement of the type set forth by which at least one of two trains using one common railroad track will be automatically stopped at a predetermined distance from another train no matter whether that other train is approaching the first train in opposite direction or from the rear while moving in the same direction as the first train.

It is another object of the invention to provide for such an arrangement which works in the same manner even if one of the trains is standing still.

It is still another object of this invention to provide for an arrangement as set forth which is in itself comparatively simple and entirely reliable in operation.

With above objects in view the invention includes an arrangement for collision protection of at least two trains using one common railroad track formed by two rails, comprising, in combination, on each train a supply of direct current electric energy; circuit means including at least two contact members in conductive engagement with the two rails, respectively, for normally applying voltage from said supply with positive polarity to a selected one of said two rails and with negative polarity to the other one of said rails, said selected one of said two rails being in the case of each train the rail so located on one particular side of said track that each rail is supplied with positive potential from one of the trains and with negative potential from the other one of the trains, respectively; and on each train relay means operatively connected with the motion control means of the particular

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train for causing discontinuation of movement of said particular train upon operation of said relay means, the latter being operatively connected with said circuit means for being operated when the direct current potential appearing at any time between said contact members drops below a predetermined threshold value, so that if the distance between two trains decreases below a predetermined amount the counteraction between the direct current potentials of opposite polarities applied to said rails from one train and from the other train, respectively, will reduce the potential appearing at said contact members below said predetermined amount whereby said relay means are operated and the movement of the trains is automatically discontinued.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

Brief description of the drawing

Referring to the drawing it is to be understood that it illustrates a portion of a railroad track formed by two rails 1 and 1', and in relation to this portion of the railroad track two trains, namely a train I which carries, e.g. on its locomotive, the illustrated installation according to the invention, while the other train II carries the same installation of which however only a small portion is illustrated in detail.

An electrical schematic circuit diagram showing the electrical components and their interconnection, in accordance with the present invention.

Description of the preferred embodiments

The drawing illustrates the basic example in which train I moves along the rails 1, 1' in one direction as indicated by an arrow, while the train II moves on the same track in opposite direction as also indicated by an arrow.

On each train the arrangement according to the invention comprises, according to the illustrated example, the following components. A supply of direct current is provided e.g. in the form of a storage battery 2. It is evidently not necessary to illustrate also means for recharging this battery from time to time. For reasons set forth further below a double-pole change-over switch 3 is provided instead of a plain single-pole or double-pole switch, for connecting the battery 2 with the remainder of the illustrated circuit arrangement. It is to be assumed that normally the switch 3 is in the position I. This position of switch 3 places the entire arrangement in operative condition in which the positive terminal of battery 2 is connected e.g. across a resistor 11 which might be useful for adjustment purposes, with a contact member 8' which is in conductive engagement with the rail 1', while the negative terminal of battery 2 is connected directly with a similar contact member 8 which is in conductive engagement with the rail 1. It is to be understood that the engagement of the contact members 8, 8' with the rails 1, 1' does not result in a short-circuit

because it is to be assumed that the rails 1 and 1' are insulated from each other.

The arrangement further comprises a first relay A which is sensitive to the direct current potential existing at any time between the contact members 8 and 8'. For this purpose the relay winding 4 (if desired in series with an ammeter 7) is connected in parallel with the contact members 8,8' as illustrated. The movable armature 5 of the relay A is continuously urged e.g. by spring 6 into the illustrated position in which the conductive portion of the armature 5 engages stationary contacts 9' and 12'. However, when the coil or winding 4 is energized the armature 5 is moved against the action of spring 6 out of engagement with the contacts 9' and 12', but into engagement with a contact 10'. In the position I of the switch 3 the negative terminal of the battery 2 is connected via line 5' with the conductive portion of the armature 5 while the positive terminal of battery 2 is connected via branch line 12'' with the coil 12 of a second relay B. The other terminal of coil 12 is connected with the above-mentioned contact 12' and a tell-tale bulb or similar signal 9 is connected between line 12'' and the contact 9'. A second tell-tale bulb, maybe of a different color 10 is connected between the stationary contact 10' and the contact number 8'.

It can be seen therefore that as long as the relay coil 4 is energized the relay coil 12 is de-energized while the tell-tale lamp 10 is supplied with energy so as to indicate that the relay coil 4 is energized.

The relay B has an armature 13 which is continuously urged by a spring 14 into the illustrated position in which the conductive portion of armature 13 is in engagement with two stationary contacts in circuit between the battery 2 and a control relay 16 forming part of the motion control of the train I. This control relay may be of any conventional design and so constructed that when it is de-energized it controls the drive means 16' of the train in such a manner that the motion of the train is discontinued. The control relay 16 may also be connected by a line 17 with the control 18 of the brakes of the train so that simultaneously with the discontinuation of the driving action of the drive means also an application of the brakes is effected.

It will be understood that as long as there is no train II on the common railroad track or if at least train II is at a very great distance from train I, the railroad track will constitute in relation to the contact members 8 and 8' an open circuit so that the potential available between the contact members 8 and 8' is substantially the voltage supplied by the battery 2, or in view of the resistor 11 a predetermined fixed fraction thereof. This potential is applied across the relay coil 4 and is calculated to be sufficient to energize the latter so as to move the armature 5 to its second position. Under these circumstances the tell-tale light 10 shows e.g. to the engineer that the relay A is energized which means at the same time that the second relay B is de-energized and in the illustrated position. Consequently the control relay 16 is energized and the motion control means of the train I can be operated by the engineer in a normal manner.

If now for any reason whatsoever, and possibly without being noticed by either one of the engineers of trains I and II, the two trains should approach each other in directions opposite to each other on the common railroad track, the fact that train II is equipped with exactly the same type of arrangement as described above for train I, will result in the application of positive potential to the rail 1 through the contact member 8a', of train II, and of negative potential to the rail 1' through the contact member 8a of train II. As the distance between the trains I and II decreases, the effect of the application of voltage with opposite polarities to each of the rails 1 and 1' will take increasingly effect so that when the distance between the trains has decreased to a

predetermined value, the available potential between the contact members 8 and 8' as well as that between the contact members 8a and 8a' will decrease below a predetermined value necessary for holding through energization of the relay coil 4 or 4', respectively, the pertaining armature in deflected position. Consequently under such circumstances the relay A and A', respectively, will become de-energized with the effect that the respectively cooperating relay B is energized whereby the motion of the both trains is automatically discontinued. At the same time, the light of the signal lamp 10 is discontinued and the tell-tale lamp 9 is switched on so as to indicate the changed condition of the arrangement.

It is quite impossible to give exact figures for the voltage of the source 2, the dimensions of the relay coils 4 and 12 and of the springs 6 and 14, but it will be well within the capacity of those skilled in the art to calculate the proper dimensions and data particularly in view of known or measured information about the resistivity of the rails 1 and 1'. Accordingly, the distance between trains at which the latter are to be stopped can be well predetermined.

In order to assure proper operation of the present invention, it is essential that the wheels and axles of the railway cars, do not short circuit the relay coils 4 and 4'. Accordingly, the wheels and axles are constructed so as not to form a low-resistance path or direct short circuit with respect to relay coils 4 and 4'. Thus, the wheels and axle may be constructed of a high-resistance alloy which has considerably higher ohmic resistance than the relay coils 4 and 4'. Furthermore, the fact that the wheels are in line contact with the tracks, also contributes toward increasing the resistance of the path through the axle and wheel. Although some current will flow through the axle provided the latter forms a conductive path, most of the current will flow through the relay coils, and maintain these energized, if the resistance of the relay coils is properly sealed or selected in relation to the resistance of the path through the wheels and axles. For example, assume that, as a result of the alloy material used in the construction of the wheels and axle, the combined equivalent resistance of the wheel and axle paths in parallel with coils 4 and 4', is 10 ohms. If, then, the resistance of the coil 4 or 4' is made 1 ohm, the current through coil 4 or 4' will be 10 times that through the wheel and axle paths. Thus, if the battery 2 is of the common 12 volt type, then the current through coil 4 or 4' will be 12 amperes. The current through the wheel and axle paths, on the other hand, is 1.2 amperes. The wheel and axle paths, therefore, do not form a short circuit with respect to the relay coils. It is also not a severe requirement for the battery to provide this amount of current, since while the train is in motion, the current is supplied by the train generator which is connected to the battery and maintains the latter continuously charged.

Short-circuiting of the relay coils 4 and 4' may also be directly prevented by electrically insulating the wheels from the axle. This may be accomplished by providing suitable insulating washers within the mounting of the wheels, so that the mounting surfaces of the wheels do not contact the axle directly. In one such design, the wheels are rigidly secured to the axle, with a layer or bushing of insulating material interposed between each wheel and axle so that they are not in electrical contact with each other. The axle is then rotatable within bearings mounted on the underside of the railway car. In this manner no current can flow through the wheels and axle.

In another design of the wheels and axle, for preventing short circuiting of the relay coils 4 and 4', the axle may be constructed as a two-part assembly wherein the two parts are appropriately insulated from each other. Thus, the axle may be made of two halves, with each half separately and rigidly secured to the underside of the railway car. The two halves of the axle are sufficiently

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separated from each other, so as not to form a continuous electrical path. The wheels, on the other hand, are mounted on the axle so that they are freely rotatable thereon. Thus a roller bearing may be mounted between each fixed half of the axle and the wheel supported thereon. In this manner, the wheels are in electrical contact with the axle parts, but the latter are separated from each other to inhibit current flow between wheels associated with opposite voltage polarities.

It is easy to understand that if one of the trains I and II is standing still under the control of the engineer while the other train is approaching, the operation of the arrangement according to the invention would be analogous to that described above and upon sufficient reduction of the distance between the trains the moving train will be stopped automatically.

It may occur in operation of a train that the engineer has to stop the train, maybe against regular schedule. In that case it may be of importance to protect the train standing still against a collision with a train following on the same railroad track. If this situation should occur, all the engineer has to do is to move the change-over switch 3 to position II. By doing this the polarity of the voltage supply from the source 2 to the remainder of the circuit arrangement is reversed. Consequently in train I the contact member 8 will now carry positive potential while the contact member 8' will now carry negative potential. A train III, not illustrated, following train I on the same railroad track would apply to its contact member 8 negative potential and to its contact member 8' positive potential. Thus, the same condition between trains I and III exists which have been described above in relation to train I and II. Consequently, as the following train III approaches the standing train I (or only slowed down train I) and the distance therebetween is sufficiently reduced, the arrangement according to the invention in trains I and III will function as above and either both trains or at least the moving one train III will be automatically stopped.

It can be seen from the above that by using the arrangement according to the invention collisions under all circumstances between trains using a common railroad track can be safely avoided with comparatively very simple and reliable means.

Evidently, the circuit arrangement described above by way of example and illustrated in the drawing can be modified in various ways without departing from the basic concept of the invention. For instance if the conventional control relay 16 requires energization in order to cause discontinuation of the action of the drive means 16' of the train then the relay B would be modified in such a manner that it does not normally connect by its armature 13 the lines 13' and 13'', but instead normally interrupts the connection between the lines 13', 13'' so that upon energization of the relay coil 12 this circuit is closed and the control relay 16 is energized. In this last mentioned case the arrangement could be further simplified by entirely omitting the relay B including the lines 13' and 13'' so that instead the relay coil 12 may be considered as a component part of the control relay 16. Thus, when the relay A is in its de-energized or inoperative position as illustrated the control relay 16 would be energized. Moreover, the stationary contact 12' could also be arranged on the other side of the armature 5 in the same manner as the contact 10' so that the line 5' is connected with contact 12' and thereby with the relay coil 12 only as long as the relay A is energized. Thus the armature 13 would be held out of engagement with the lines 13', 13'' as long as the relay A is energized and only when the latter is operated so as to release the armature 5 the armature 13 would be permitted to drop back into the position illustrated so as to energize the relay 16.

Also, the change-over switch means 3 need not be

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arranged in the manner illustrated for cooperation with a single source of direct current 2. Instead two separate sources of direct current could be provided for which may be alternatively connected by suitable switch means with the circuit arrangement. On the other hand, for instance the change-over switch means 3 could be connected in a suitable manner well-known to the art between the relay coil 4 and the contact members 8, 8' for reversing the polarity of the voltage applied to these contact members, respectively.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of an arrangement for collision protection of at least two trains using one common railroad track differing from the types described above.

While the invention has been illustrated and described as embodied in an arrangement for collision protection of at least two trains using one common railroad track by means of application of direct current of opposite polarities to the rails of the railroad track, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. An arrangement for collision protection of at least two trains using one common railroad track formed by two rails, comprising, in combination, on each train a supply of direct current electric energy; circuit means including at least two contact members in conductive engagement with the two rails, respectively, for normally applying voltage from said supply with positive polarity to a selected one of said two rails and with negative polarity to the other one of said rails, said selected one of said two rails being in the case of each train the rail so located on one particular side of said track that each rail is supplied with positive potential from one of the trains and with negative potential from the other one of the trains, respectively, the axles of the trains being adapted so as not to short-circuit said contact members; and on each train relay means operatively connected with the motion control means of the particular train for causing discontinuation of movement of said particular train upon deenergization of said relay means, the latter being operatively connected with said circuit means for being deenergized when the direct current potential appearing at any time between said contact members drops below a predetermined threshold value, so that if the distance between two trains decreases below a predetermined amount the counteraction between the direct current potentials of opposite polarities applied to said rails from one train and from the other train, respectively, will reduce the potential appearing at said contact members below said predetermined amount whereby said relay means are deenergized and released and the movement of the trains is automatically discontinued.

2. The arrangement defined in claim 1 including relay contact means and means urging said relay contact means from an inoperative position into an operative position in which said motion control means are caused to effect discontinuation of said train movement, and relay coil means connected in parallel with said contact members and dimensioned for being energized by said potential between said contact members sufficiently for moving said relay contact means into said inoperative position as long as said potential exceeds a predetermined threshold value, but permitting said relay contact means to be moved to said operative position.

3. The arrangement as defined in claim 2 including sensing relay means operatively connected with said relay means.

4. The arrangement as defined in claim 3 including

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indicator means for indicating whether said sensing relay means is energized or in the de-energized condition.

5. The arrangement as defined in claim 1 wherein said circuit means includes switching means for reversing the polarities of said direct current voltage applied to said one and to said other one of said rails. 5

6. The arrangement as defined in claim 2 including braking means operatively connected to said relay means and controlled thereby for braking said trains when the distance between two trains decreases below said pre-determined amount. 10

7. The arrangement as defined in claim 2 wherein said supply of direct current is a battery.

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