Dec. 19, 1967 C. A. GALLAGHER 3,359,417

DIRECTIONAL RELAY

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Fig. 1.

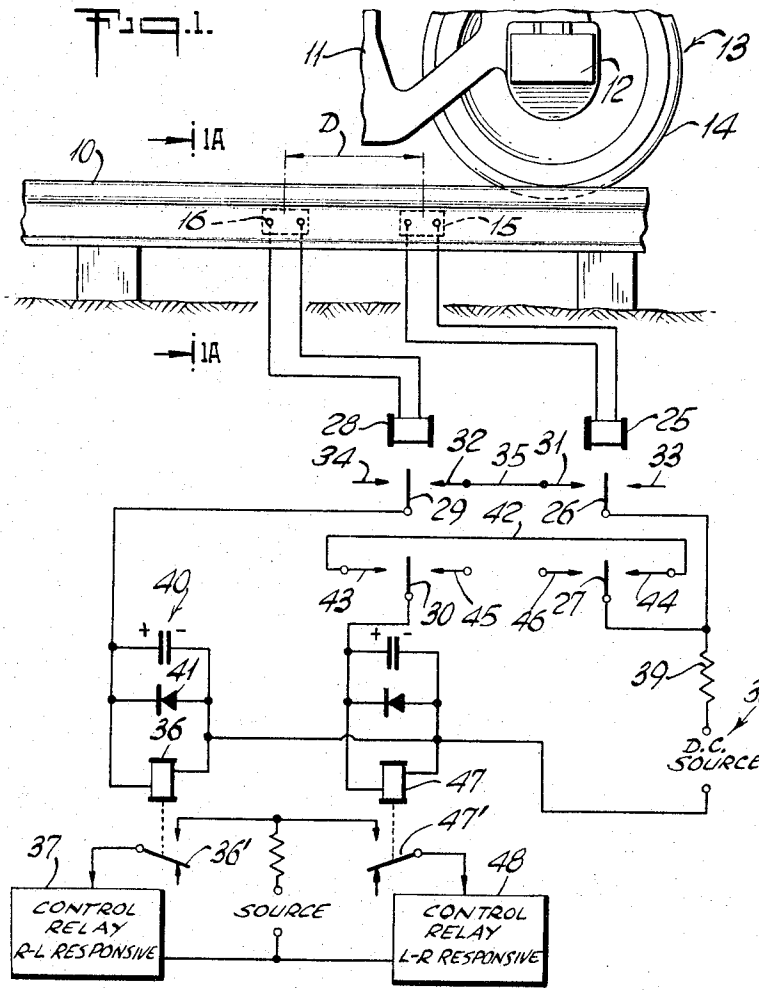
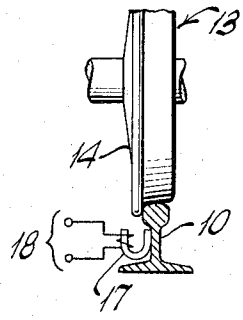


Fig. 1A.



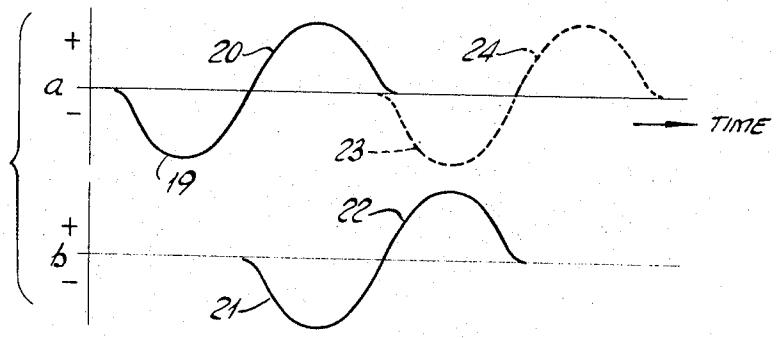


Fig. 2.

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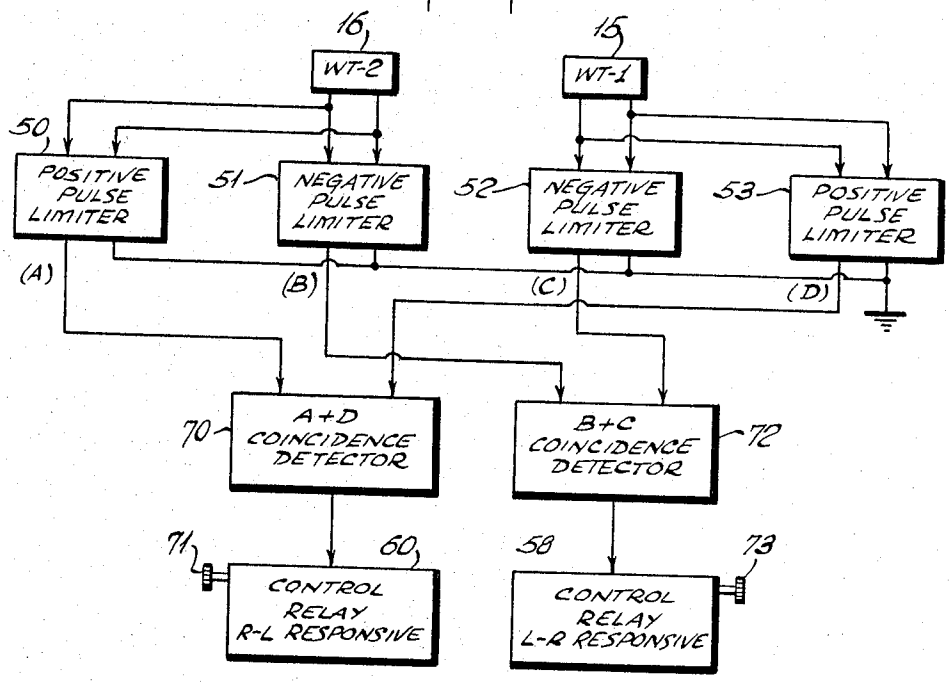
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DIRECTIONAL RELAY

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FIG. 3.



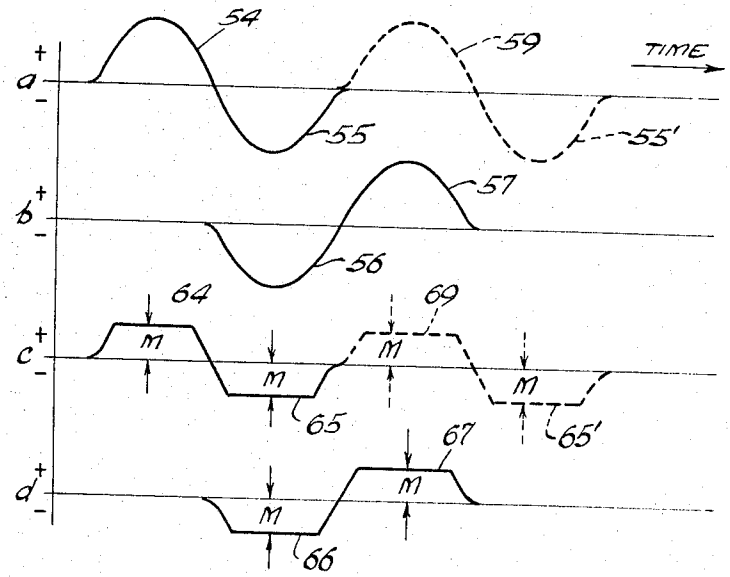


FIG. 4.

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DIRECTIONAL RELAY

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Fig. 5.

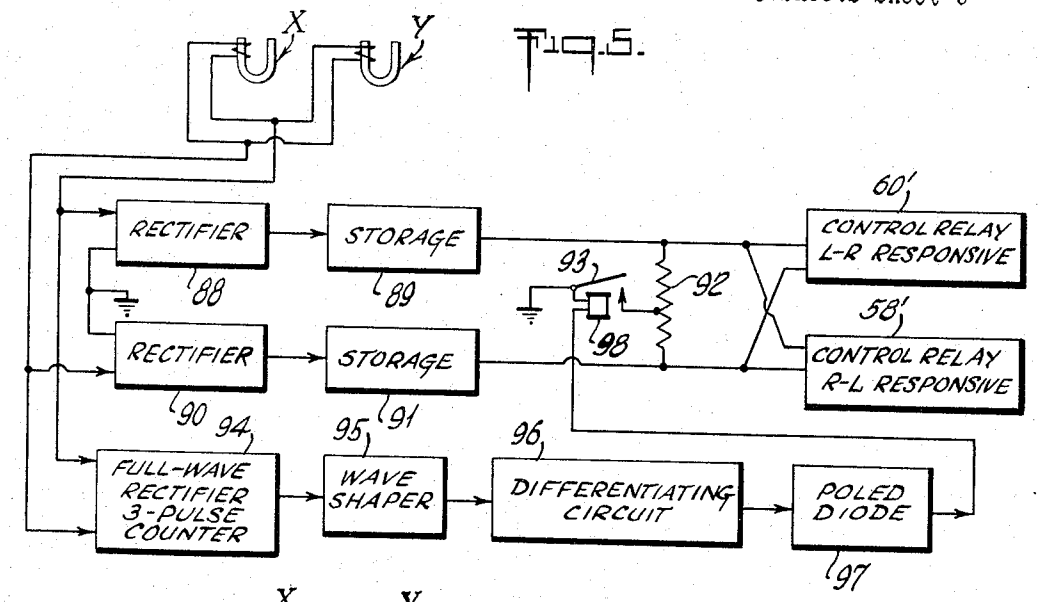


Fig. 5A.

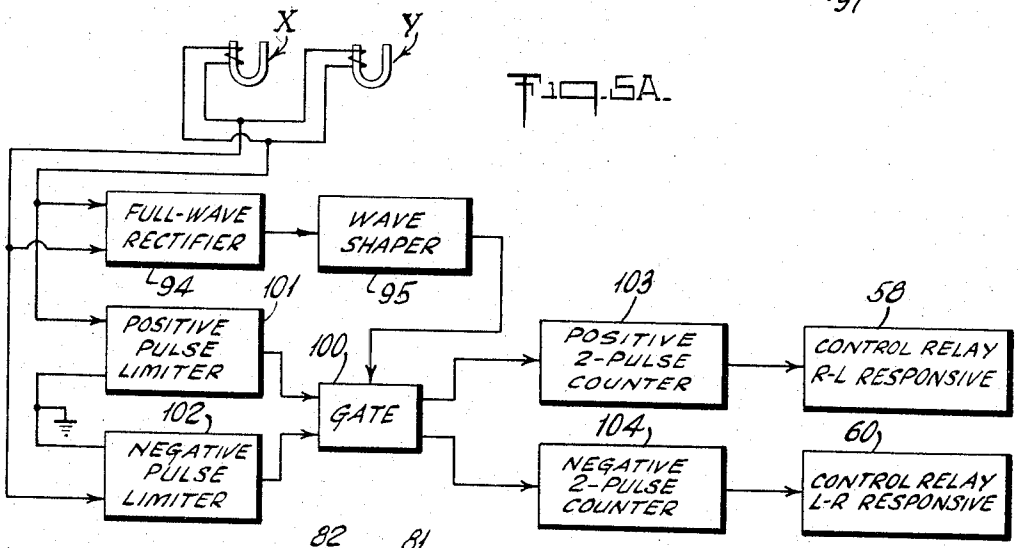
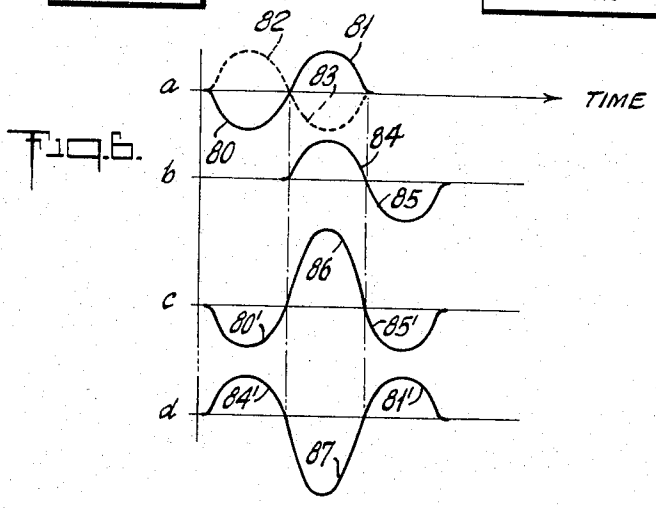


Fig. 6.



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United States Patent Office 3,359,417
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3,359,417

DIRECTIONAL RELAY

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Filed Nov. 18, 1966, Ser. No. 605,116
11 Claims. (Cl. 246—249)

This application is a continuation-in-part of my co-pending application, Ser. No. 308,980, filed Sept. 16, 1963, now abandoned.

My invention relates to an improved relay device responsive to a particular direction of vehicular-traffic motion to uniquely indicate that the traffic is moving in that particular direction, and not in the opposite direction.

The invention has particular application to railroads, as for example in a region in approach to a highway grade crossing where shunting or sorting operations are being conducted. Such operations necessarily involve train movement in first one and then the other direction, but of course there is need to operate highway traffic signals to "STOP" condition only if the train is actually going to cross the highway. In some situations, the shunting operations are conducted between and on both sides of two fairly closely spaced highway grade crossings, and there is need to signal highway traffic to "STOP" only when the particular highway is going to be crossed by the train.

It is accordingly an object to provide an improved directionally responsive relay construction.

Another object is to provide an improved relay subjected to railroad traffic in both directions but operative to create a remote actuation signal only in response to one to the exclusion of the other direction of traffic movement.

A further object is to provide an improved relay subjected to railroad traffic in both directions and operative to create a first remote actuation signal unique to traffic moving in a first direction and a second remote actuation signal unique to traffic moving in a second direction.

Still another object is to meet the above objects with a construction in which operation will unfailingly mean response to the desired (and not to the undesired) direction of train movement.

Other objects and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following description in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, preferred forms of the invention:

FIG. 1 is a circuit diagram schematically indicating components of one form of my invention;

FIG. 1A is a fragmentary view, partially in section, and showing a wheel trip positioned for response to a railroad-car wheel, the section being in the plane 1A—1A of FIG. 1;

FIG. 2 is a series of graphs depicting, on the same time base, voltage-pulse developments in the circuit of FIG. 1;

FIG. 3 is a diagram schematically indicating the relation of components in another form of the invention;

FIG. 4 is a series of graphs depicting, on the same base, voltage-pulse developments in the circuit of FIG. 3;

FIGS. 5 and 5A are electrical diagrams schematically illustrating alternative embodiments of a form of the invention particularly applicable to electrified rail territory; and

FIG. 6 is a collection of graphs depicting voltage relationships in the embodiments of FIGS. 5 and 5A.

Briefly stated, my invention contemplates detection

of a particular one direction of rail-traffic movement, in the presence of random movement in both directions past a given monitoring location. Basic response to train movement is developed by two closely spaced wheel-trip devices, which are preferably of the variety described in United States Letters Patent No. 3,151,827, issued Oct. 6, 1964, but which in any event present to passing car-wheel flanges a permanently magnetized air gap, so that an electric pulse output of a first polarity is produced as the wheel enters the gap and a similar pulse of opposite polarity is produced as the flange leaves the gap. By longitudinally spacing the air gaps of the two wheel trips such that for any given passing axle the second pulse for the first trip coincides in time with the first pulse for the second trip, and by utilized suitably polarized coincidence-detection means, it is possible to uniquely identify one (to the exclusion of the other) direction of train movement. Alternatively, where desired, each of the directions of train movement can be uniquely identified, for such remote signaling or actuating purposes as may be necessary.

In the form shown in FIGS. 1 and 2, the invention utilizes wheel trips which are each connected to the coincidence-detection means in oppositely polarized manner so that the detected coincidence involves like-polarity pulses of the respective wheel trips for a given direction of movement of a passing wheel. In the form of FIGS. 3 and 4, the wheel trips are each connected to the coincidence-detection means in like polarized manner whereby the detected coincidence involves the positive pulse of one wheel trip and the negative pulse of the other wheel trip for a given direction of passing traffic.

Referring to FIGS. 1 and 2, the invention is shown in application to a length of railroad track comprising two spaced rails **10** and accommodating rolling stock, such as a freight car having a truck **11**, a journal box **12** and a wheel **13**. The flange **14** of the wheel rides inside the railhead, as shown more particularly in FIG. 1A.

Secured to the web of the rail **10** at locations spaced by the amount designated D are first and second wheel trips schematically indicated at **15–16** in FIG. 1. For the view of FIG. 1, the web of the rail will mask the wheel trips **15–16** because they are secured inside the web, but the rectangular outlines at **15–16** will be understood to suggest the potted plastic confines of the two wheel trips, as described in greater detail in said copending application. It suffices for present purposes to explain in connection with FIG. 1A that the permanently polarized air gap cut by the flange **14** is established by a permanent magnet, such as a horseshoe magnet **17** secured to the web of the rail. Magnet **17** establishes the polarized air gap between the outer leg of the magnet core and the adjacent side of the railhead. A coil linked to the core **17** develops, at output connection **18**, a pulse or fluctuating electrical signal as each car wheel flange enters into or departs from the air gap. Such voltage fluctuations are depicted in the two curves *a* and *b* of FIG. 2.

In curve *a* (FIG. 2), there is illustrated the response of the first wheel trip **15** to the passage of the wheel **13** from right to left in the sense of FIG. 1; curve *b* illustrates the response of the second wheel trip **16** to the passage of the wheel **13** from right to left in the sense of FIG. 1. On the flange **14** entering the air gap for the first wheel trip **15**, a negative pulse **19** is developed at output connection **18**. This pulse reaches its negative peak before the flange has fully entered the air gap and proceeds to drop back to zero and to cross the axis in the development of a positive pulse **20** as the flange **14** leaves the air gap. In like manner, the same wheel flange **14** entering the air gap for the second wheel trip **16** will first develop a negative pulse **21**, and upon leaving the same, will develop a positive pulse **22**.

The spacing D between wheel trips **15–16** is such in relation to standard wheel sizes that the second pulse **20** for the first wheel trip **15** will substantially coincide in time with development of the first pulse **21** for the second wheel trip **16** on a freight car wheel, which is the usual situation encountered on a railroad track. The spacing D is preferably ten inches, but it will be appreciated that the duration of pulses produced by wheel trips of the character indicated is great enough so that time-coincidence for the oppositely polarized pulses **20–21** can occur for a variety of passing wheel flanges and flange heights.

As explained briefly above, the form of FIGS. 1 and 2 demonstrates like connection of the two wheel trips to the coincidence-detection system, meaning that reliance is placed upon the polarized nature of the oppositely polarized pulses **20–21** for which coincidence is to be observed. For the right-to-left traffic direction, FIG. 2 shows that the desired time coincidence involves the positive pulse **20** (curve *a*) while the curve *b* pulse **21** is negative. However, for the reverse direction of traffic, namely, from left to right in the sense of FIG. 1, the first wheel trip to develop a signal will be the wheel trip **16**, so that the pulse **21** for wheel trip **16** will first be developed; this is followed by a time coincidence between the second pulse **22** (positive) of wheel trip **16** with the first pulse **23** (negative) of wheel trip **15**, there being no time coincidence for the positive pulse **24** developed by wheel trip **15**. Thus, whatever the direction of traffic, time coincidence involves oppositely polarized pulses, but the sense of the difference between these pulses is unique in one polarity for left-to-right movement and in opposite polarity for right-to-left movement.

In FIGS. 1 and 2, the coincidence detection mechanism utilizes interconnected relays **25–28**, each of which is connected to a different one of the wheel trips; these relays are each shown as of the double-pole, double-throw variety, and it will be understood that, for each relay shown, two like single-pole relays may be connected with their windings in parallel to achieve the same result. The solenoid means for the relay **25** connected to the wheel trip **15** actuates two contact arms **26–27**, and the solenoid for the other such relay **28** actuates two similar arms **29–30**. For any given single direction of traffic movement to be monitored, only one pole of each of the relays **25–28** need be utilized. Thus, for the right-to-left detection situation, the back contact **31** of relay **25** is connected with the front contact **32** of relay **28**, and no connections are provided for the front contact **33** of relay **25** or for the back contact **34** of relay **28**. When the two relays **25–28** are suitably actuated, as in the presence of the second or positive pulse **20** of wheel trip **15**, and the first or negative pulse **21** of wheel trip **16**, the circuit is completed via the connection **35** to a relay coil **36** which, in turn, serves to actuate a control relay **37** for remotely actuating or indicating the right-to-left (R–L) traffic direction response. In the form shown, the particular circuit to the coil for relay **36** utilizes a direct-current source **38**, a suitable protective resistor **39**, and storage means **40** with a protective diode **41** to assure operation of the coil **36** only by pulses of desired polarity. The storage means **40** assures a predetermined holding-in of the contact arm **38'** of relay **36** after the coincidence of pulses **20–21** has terminated.

For detection of traffic in the left-to-right sense of FIG. 1, meaning that wheel trip **16** is first operated and that the coincidence of pulses **22–23** is to be detected, I employ the other pole of each of the relays **25–28**. Thus, the coincidence-detector connection for this situation involves the back contact **43** for arm **30** of relay **28**, and the front contact **44** for arm **27** of relay **25**, the remaining contacts **45–46** being not utilized. The relay system for remote indication or control may be as described for the right-to-left direction situation, and therefore I employ the same source **38** to excite the relay coil **47** which will complete a circuit through its contact arm **47'** to the control relay **48**, upon time-coincidence of the pulses **22–23**, meaning that left-to-right (L–R) traffic movement has been detected.

Because of the nature of the described coincidence-detection connections for the contacts of the relays **25–28**, it will be appreciated that any malfunction in the circuit will serve merely to avoid actuation of either of the control relays **37–38**. Thus, if these relays are operated at all, they correctly indicate the detected direction of traffic movement, and no false indications are developed with this circuit.

The arrangement of FIGS. 3 and 4 operates on the principle of detecting time-coincidence between pulses of like polarity developed by the two wheel trips **15–16**, which have been designated WT–1 and WT–2 in FIG. 3. This means that the output-circuit connections from wheel trips **15** and **16** will be connected to their respective coincidence-detection circuits in oppositely poled relation, as distinguished from FIGS. 1 and 2, wherein the wheel trips **15–16** have like-polarized connections to their coincidence detection circuits.

In the arrangement of FIGS. 3 and 4, coincidence detection involves the summation of two signals occurring at the same time, and therefore simple pulse shaping is involved, in order that varying train speeds and flange heights shall not impair desired operation. Pulse shaping is schematically indicated for the case of wheel trip **16** by a first positive pulse limiter **50** and by a second or negative pulse limiter **51**. Similarly, a negative pulse limiter **52** and a positive pulse limiter **53** are connected to the output of wheel trip **15**. The action of these pulse limiters **50** to **53** will be understood by reference to the curves of FIG. 4.

In curve *a* (FIG. 4) there is illustrated in solid outline (traffic proceeding left-to-right) the succession of pulse-output development for the wheel trip **16** being a positive pulse **54** followed by a negative pulse **55** as the wheel flange leaves its air gap. Because the wheel trip **15** is oppositely connected to its coincidence-detection circuit, as compared with the connections for wheel trip **16**, curve *b* shows the first pulse of wheel trip **15** as a negative pulse **56** followed by a second or positive pulse **57**. It is the coincidence of the two negative pulses **55–56** which signifies left-to-right traffic movement. These signals have been schematically indicated as B and C and they ultimately operate the left-to-right (L–R) responsive control relay **58**.

For traffic moving in the opposite direction, that is from right to left, curve *b* of FIG. 4 signifies that wheel trip **15** will develop its second or positive pulse **57** in time-coincidence with the first or positive pulse **59** of wheel trip **16**. These two pulses have been designated D and A, respectively, in FIG. 3, and it is the right-to-left (R–L) responsive control relay **60** which will ultimately respond to this coincidence of positive pulses. For this direction of train movement, the second or negative pulse **55'** of wheel trip **16** is not utilized.

In order that the coincidence detectors may function from the time-coincidence of two pulses of like polarity, they are, as indicated, shaped to uniform amplitude or magnitude suggested by the curves *c* and *d* of FIG. 4. The amplitude M chosen for such shaping applies both for positive and for negative pulses and has been so indicated by legends on curves *c* and *d*. This amplitude should be at such a relatively low level that no matter how slow the passing train, or how new (i.e. not worn) the wheel (meaning that the flange **14** does not project far from the wheel rim), there will still be adequate signal developed for a passing flange to permit of some degree of pulse limiting. The net result of limiting is to create flat-topped signals for each of the pulses. Thus, the positive pulse **54** shown in curve *a* becomes the flat-topped positive pulse **64** in curve *c*, and the negative pulse **55** of curve *a* becomes the flat-topped negative pulse **65** in curve *c*. In curve *d*, the negative pulse **56** becomes the

flat-topped negative pulse **66**, and the positive pulse **57** becomes the flat-topped pulse **67**. The flat-topped pulses **69** and **65'** will be understood to correspond to the pulses **59–55'** of curve *a*.

The signals labeled A, B, C, D in FIG. 3 will be understood to correspond respectively to the flat-topped signals described in conjunction with curves *c* and *d*, and thus for right-to-left (R–L) traffic detection, the coincidence detector **70** responds to signals A and D by adding them, and the control relay **60** functions upon detection of a signal exceeding the threshold preset by means **71** to a level greater than amplitude M and less than amplitude 2M. In like manner, the left-to-right concidence-detection functions at **72** involve summation of the two negative pulses B and C, and if these occur at the same time, meaning left-to-right traffic movement, the control relay **58** will be caused to operate because a signal exceeding the threshold set at **73** will have been detected.

In FIGS. 5 and 6, I illustrate application of principles of the invention to situations in which spurious signals may cause ambiguous operation, as for example in electrified territory, where the rail is relied upon to carry heavy currents, causing undesired induced voltages in both wheel-trip devices, such as the spaced trips X–Y. Trips X–Y may be of the nature previously described in connection with FIG. 1A, but to neutralize spurious induced voltages of the character indicated, the windings of trips X–Y are effectively connected back-to-back. This may be accomplished, for example, by using similar devices X–Y which have their output windings linked in opposite sense to their respective polarized cores, and by then connecting the coil outputs in parallel; alternatively, and as shown in FIG. 5, the turns of the respective windings of trips X–Y may be in the same direction of coupling to their respective polarized cores, in which case the coil outputs are connected in phase-opposition. The net result of so connecting the electrical outputs of trips X–Y is to not only neutralize the undesired induced voltages but also to make the interconnection of these windings an integral part of the coincidence-detection means which characterize the invention. This result more clearly appears from the diagrams of FIG. 6.

The solid curve at FIG. 6*a* may typically represent the electrical response of one of the wheel trips (X) to the passage of a wheel; this response may thus be characterized by a negative swing or pulse **80** (as the wheel flange enters the polarized air gap) followed by a positive swing or pulse **81** (as the wheel flange leaves the air gap). Now, if a pulse such as has been described at **80–81** should develop due to some rail current, rather than due to a wheel movement past trip X, the other trip Y will simultaneously induce precisely the same spurious wave form but due to the effective back-to-back connection of the windings of trips X–Y these two like induced voltages will cancel each other; the dashed waveshape **82–83** in FIG. 6*a* suggests the equal and opposite relation of such simultaneously induced spurious voltages at X–Y, and their self-cancelling relationship.

On the other hand, as has already been pointed out, the spacing D between wheel trips X–Y means a particular physical time difference between the positive and negative swings of the trip-output voltages. If trip X is first traversed by a wheel, then the swings **84–85** for trip Y will follow the swings **80–81** for trip X, in the general time relation illustrated by solid lines in FIGS. 6*a* and *b*; and, by virtue of the described interconnection of the output windings of trip X–Y, the second pulse of the first-traversed trip (X) coincides with and is of the same polarity as the first pulse of the second-traversed trip (Y). This fact and the result flowing therefrom are demonstrated in FIG. 6*c*, wherein the two positive pulses **81–84** indicate the desired coincidence by appearing as a new pulse **86** of double magnitude, the minor leading and trailing pulses **80'–85'** corresponding to the non-coincident remainders of voltage development at trips X–Y.

The foregoing discussion in connection with curve *c* of FIG. 6 will be understood to apply for the directional situation in which a wheel traverses trip X before it traverses trip Y. For traffic in the opposite direction, trip Y will be first traversed, so that the coincident pulses are negative, producing the large negative pulse **87**, between minor leading and trailing pulses **84'–81'** corresponding to the non-coincident remainders of voltage development at trips X–Y.

Thus, it is seen that the desired coincidence is effected and recognized for interconnected wheel-trip outputs. Viewed in one aspect, the traffic-direction information is inherent in the polarity of the central or major pulse **86** or **87**, as the case may be; viewed in another aspect, the traffic-direction information is inherent in the polarity pattern of a train of three alternating pulses. Depending upon the aspect with which the output information is viewed, suitable logic circuitry may be employed to actuate the correct R–L or L–R control relay, for the detected direction of traffic movement.

FIG. 5 schematically illustrates a situation in which directional information is extracted on the basis of identifying the large central pulse (**86** or **87**) and its polarity. For a first polarity, a first rectifier and storage circuit **88–89** is connected to store the peak voltage (in the combined outputs of trips X–Y) while a second and oppositely poled rectifier and storage circuit **90–91** is connected to store the peak for the opposite polarity. These peak voltages are differentially evaluated by simultaneously discharging the storage circuits through a read-out voltage divider or summing resistor **92**. Read-out is accomplished momentarily closing a contact **93** to ground, at the conclusion of each cluster of three pulses; FIG. 5 suggests accomplishment of this synchronizing function by utilizing a full-wave rectifier (effectively a 3-pulse counter) **94**, in conjunction with wave-shaping means **95**, to form a square wave for each group of three pulses (**80'–86–85'**, or **84'–87–81'**), then rectifying the differentiated square wave to obtain an end-marking synchronizing pulse to energize coil **98** for the read-out contacts **93**. The R–L and L–R responsive control relays **58'–60'** are suitable polarized to respond to the polarity of the read-out pulse whch develops across resistor **92** upon read-out.

FIG. 5A schematically illustrates a situation in which directional information is extracted on the basis of identifying the polarity pattern of the generated 3-pulse cluster (**80'–86–85'**, or **84'–87–81'**). A gate-open square wave for gate **100** is generated by rectifier **94** and wave shaper **95**, which is effective to pass limited positive pulses (at **101**) and limited negative pulses (at **102**) to suitably poled two-pulse counters **103–104**. Thus, for a given gate-open condition, one or the other (but not both) of counters **103–104** will achieve its count of two, which may be effective to change its state and thus activate the corresponding direction-indicating control relay **58** or **60**, as will be understood.

It will be seen that I have described a relatively simple relay configuration for uniquely detecting and displaying, and for remotely indicating or actuating suitable devices in accordance with the detection of a single particular direction of traffic movement. Whether the coincidence depends upon simultaneous connection of two oppositely polarized pulses, or upon the simultaneous detection of two like polarized pulses, the response to a given direction of traffic movement is unique. If desired, response to both directions may be achieved with indications unique to each of the two directions. Basically, all of the described forms are inherently simple and foolproof and make use of inherent polarizing properties in the signal development from the magnetic wheel trips and their connections to the coincidence-detection means.

While I have described the invention in connection with the preferred forms shown, it will be understood that the principles of the invention may involve modi-

fications without departing from the spirit of the invention as defined in the claims which follow.

What is claimed is:

1. Relay means responsive to a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices secured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange and developing an electrical output signal characterized by a pulse of one polarity followed by a pulse of opposite polarity for each passing wheel, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, whereby for each passing axle proceeding in a first direction there will be a coincidence of pulse outputs of said trips in a first unique polarized relationship, and further whereby for each passing axle proceeding in the opposite direction there will be a coincidence of pulse outputs of said trips in a second unique polarized relationship, and coincidence-detection means including a control relay responsive to detection of the coincidence in said first unique polarized relationship for producing a signal for remotely indicating that the passing traffic is in said first direction.

2. Relay means according to claim 1, and including additional coincidence-detection means including a further control relay responsive to detection of the coincidence in said second unique polarized relationship for producing a signal for remotely indicating that the passing traffic is in said opposite direction.

3. Relay means according to claim 1, in which each of said wheel-trip devices includes an electrical output winding, said coincidence-detection means including means interconnecting said windings in phase-opposition, whereby rail currents or the like acting simultaneously to induce corresponding voltages in both said windings will be effectively neutralized by said interconnection, and whereby said pulse coincidence will result in adding like-polarity pulse outputs of said windings, said like polarity being uniquely representative of the instantaneous direction of traffic movement.

4. Relay means responsive to a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices secured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, two separate double-throw relays having actuating coils connected similarly to each of said wheel trips, and output relay means including an excitation circuit requiring for its operation the completion of a circuit through the back contact of one of said double-throw relays and the front contact of the other of said double-throw relays.

5. Relay means according to claim 4, in which said last-defined means includes a storage circuit connected to receive its charge upon coincident closure of said back and front contacts, said storage circuit being effective to sustain a given actuation of said output relay means for a predetermined length of time after said coincident closure has terminated.

6. Relay means responsive ot a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices secured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, two separate double-pole double-throw relays having actuating coils connected similarly to each of said wheel trips, first output-relay means including an excitation circuit requiring for its operation the completion of a circuit through the back contact of a first pole of one of said double-throw relays and the front contact of a first pole of the other of said double-throw relays, and second output-relay means including an excitation circuit requiring for its operation the completion of a circuit through the front contact of the second pole of said one double-throw relay and the back contact of the second pole of said other double-throw relay.

7. Relay means responsive to a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices secured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange and developing and electrical output signal characterized by a pulse of one polarity followed by a pulse of opposite polarity for each passing wheel, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, whereby for each passing axle proceeding in a first direction there will be a coincidence of pulse outputs of said trips in a first unique polarized relationship, and further whereby for each passing axle proceeding in the opposite direction there will be a coincidence of pulse outputs of said trips in a second unique polarized relationship, and coincidence-detection means including a control relay responsive to detection of the coincidence in said first unique polarized relationship for producing a signal for remotely indicating that the passing traffic is in said first direction, said wheel trips being connected to said coincidence-detection means in like-polarized manner, whereby the detected coincidence involves the positive pulse of one wheel trip and the negative pulse of the other wheel trip for a first direction of passing traffic.

8. Relay means responsive to a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices secured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange and developing an electrical output signal characterized by a pulse of one polarity followed by a pulse of opposite polarity for each passing wheel, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, whereby for each passing axle proceeding in a first direction there will be a coincidence of pulse outputs of said trips in a first unique polarized relationship, and further whereby for each passing axle proceeding in the opposite direction there will be a coincidence of pulse outputs of said trips in a second unique polarized relationship, and coincidence-detection means including a control relay responsive to detection of the coincidence in said first unique polarized relationship for producing a signal for remotely indicating that the passing traffic is in said first direction, said wheel trips being connected to said coincidence-detection means in oppositely polarized manner, whereby the detected coincidence involves like-polarity pulses of said respective wheel trips for a given direction of passing traffic.

9. Relay means according to claim 8, in which said coincidence-detection means comprises signal-amplitude limiting means set to limit said like-polarity pulses to essentially one given level which is less than the maximum wheel trip pulse amplitude for the slowest moving anticipated traffic, and said control relay includes means set to operate upon detection of a threshold input signal representing the sum of said like-polarity pulses, said threshold level being intermediate said given level and twice said given level.

10. Relay means responsive to a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices se-

cured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange and developing an electrical output signal characterized by a pulse of one polarity followed by a pulse of opposite polarity for each passing wheel, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, whereby for each passing axle proceeding in a first direction there will be a coincidence of pulse outputs of said trips in a first unique polarized relationship, and further whereby for each passing axle proceeding in the opposite direction there will be a coincidence of pulse outputs of said trips in a second unique polarized relationship, first coincidence-detection means including a control relay responsive to detection of the coincidence in said first unique polarized relationship for producing a signal for remotely indicating that the passing traffic is in said first direction and additional coincidence-detection means including a further control relay responsive to detection of the coincidence in said second unique polarized relationship for producing a signal for remotely indicating that the passing traffic is in said opposite direction; said wheel trips being connected to said first coincidence-detection means in oppositely polarized manner, whereby the detected coincidence involves positive pulses of said wheel trips for one direction of passing traffic; and said wheel trips being also connected to said additional coincidence-detection means in oppositely polarized manner, whereby the detected coincidence involves negative pulses of said wheel trips for the opposite direction of passing traffic.

11. Relay means responsive to a particular one direction of traffic movement along a railroad track, comprising two rail-mounted magnetic wheel-trip devices secured in spaced relation along the same track, each of said devices presenting a magnetized air gap for interception of a wheel flange and developing an electrical output signal characterized by a pulse of one polarity followed by a pulse of opposite polarity for each passing wheel, the spacing between said trips being such that a wheel flange on a given axle is leaving the gap for one wheel trip as a wheel flange on the same axle is entering the gap for the other wheel trip, whereby for each passing axle proceeding in a first direction there will be a coincidence of pulse outputs of said trips in a first unique polarized relationship, and further whereby for each passing axle proceeding in the opposite direction there will be a coincidence of pulse outputs of said trips in a second unique polarized relationship, and coincidence-detection means including means interconnecting the outputs of said windings effectively in phase-opposition, whereby rail currents or the like acting simultaneously to induce corresponding voltages in both said windings will be effectively neutralized by said interconnection, and whereby said pulse coincidence will result in adding like-polarity pulse outputs of said windings, said like polarity being uniquely representative of the instantaneous direction of traffic movement.

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