

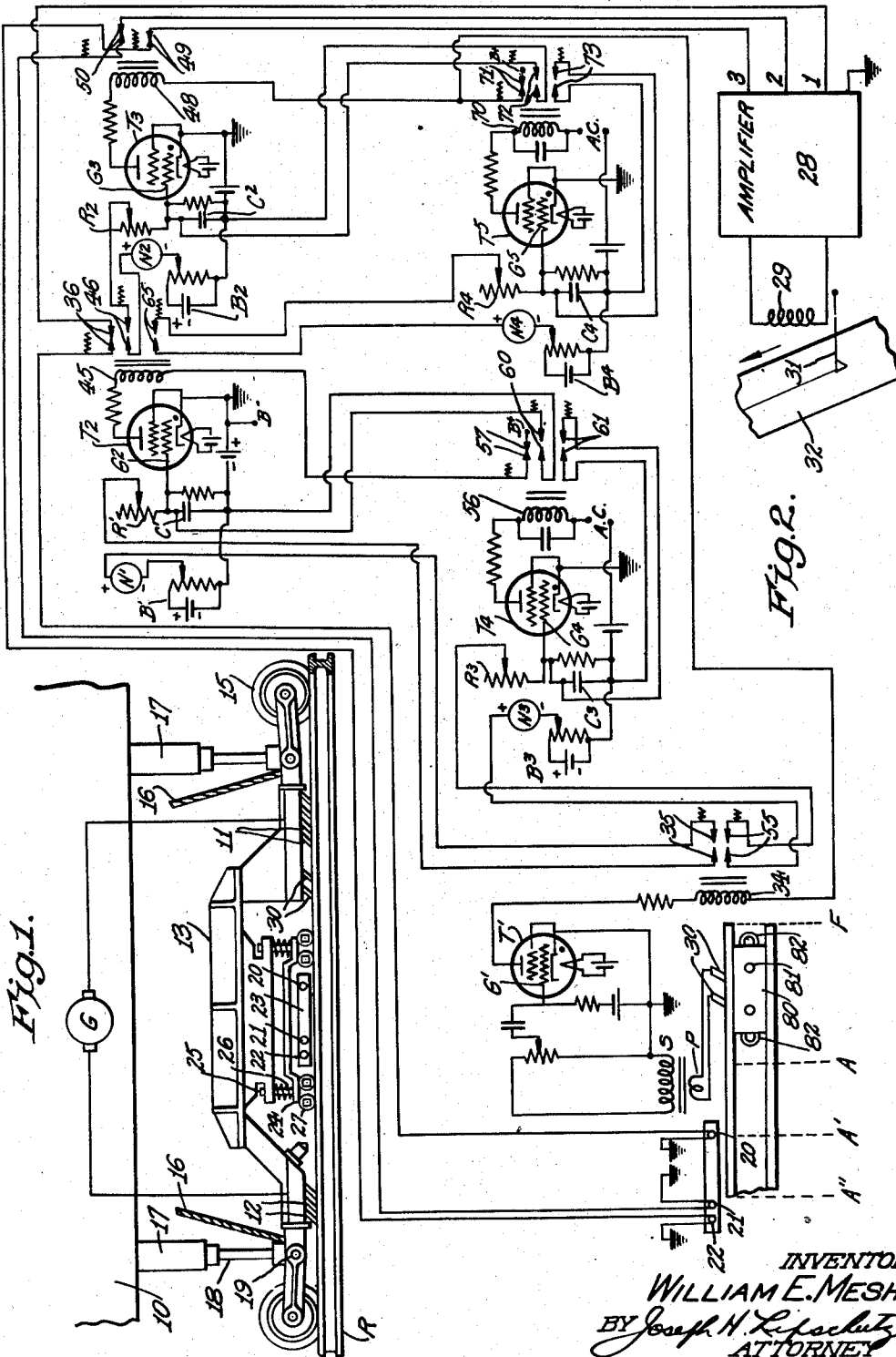
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RAIL FLAW DETECTOR MECHANISM

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RAIL FLAW DETECTOR MECHANISM

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This invention relates to rail flaw detector mechanisms such as are now employed on the Sperry rail flaw detector cars. These cars run along the railroad tracks and pass current continuously through the rails between spaced contact brushes to set up an electromagnetic field surrounding the rail. Flaws in the rail caused by fissures are discovered by reason of the fact that they set up non-uniform regions in the said electromagnetic field. Such non-uniformities are detected by means such as induction coils maintained at a constant distance above the rail-head, the coils normally cutting a constant number of lines of force, but on encountering a region of flaw they cut a different number of lines of force to generate a differential E. M. F. which after being suitably amplified may be caused to operate indicating means. Such indicating means may take the form of one or more pens operating on a moving chart within the car and also the deposit of paint on the rail in the region of flaw by reason of the simultaneous operation of a paint gun.

It will be understood that rail joints which consist of angle bars, bolts, etc., serving to connect the adjacent rail ends, will also cause non-uniformity in the electromagnetic field surrounding the rail, and unless means were provided for taking care of this situation, such variation in field caused by the angle bar would affect the detector mechanism in the same manner as an internal fissure and, moreover, would actuate the detector mechanism throughout the entire passage of the detector mechanism over the angle bar. To prevent such response of the detector mechanism to the entire region of the angle bar, the patent to H. C. Drake No. 2,069,030 for Rail fissure detector, granted January 26, 1937, discloses a joint cutout mechanism for the purpose of cutting out the operation of the detector mechanism during the interval that the detector mechanism is passing through an angle bar. The means there employed consists of a plurality of fingers which extend below the rail-head on the gauge side thereof so that normally the fingers are free of engagement with the rail, but when an angle bar is approached, the fingers will successively be rocked about their pivots to cause the detector mechanism to be rendered ineffective.

The use of pivoted fingers for the purpose of responding to the angle bar has been found to be accompanied by difficulties such as the mechanical damage to the fingers necessitating replacement and continuous readjustment and realign-

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ment. Also, these fingers extending below the rail head engaged other objects besides the angle bar, such as, for example, spikes, road crossings, high ballast, snow and ice, all of which caused the joint finger to be swung around its pivot and to actuate the joint cutout mechanism when such actuation was not warranted. It is therefore one of the principal objects of this invention to provide a joint responsive mechanism which does not consist of pivoted members extending below the rail head but rather comprises a pair of potential contacts adapted to slide on the rail head and to actuate the cutout mechanism in response to the relatively large drop in voltage which occurs at the meeting ends of the rail.

Heretofore when it was attempted to employ pairs of contacts in sliding engagement with the rail head for the purpose of detecting the variation in voltage at a rail joint for the purpose of actuating the cutout mechanism, it was found that the contact voltages generated between each contact and the rail yielded voltage outputs which were of the same order as the voltage drop between the contacts at a joint and therefore caused many false actuations of the cutout mechanism. It is therefore another object of this invention to provide a pair of potential contacts in combination with means whereby the contact voltages generated between each contact and the rail will not actuate the cutout mechanism, but such mechanism will be actuated only in response to the substantial drop in potential occurring between the contacts when they span the rail joint.

When a joint responsive means such as joint fingers or pairs of potential contacts are employed it will be understood that there is a certain distance between the joint responsive means and the fissure detector means corresponding to the region of flux distortion extending beyond the ends of the angle bars. These regions vary with the type of joints, the kind of bonding, etc., and therefore it is necessary to provide for variations in the spacing between the joint responsive means and the fissure detector means. When joint fingers were employed it was necessary to reset the fingers at the different distances. It is one of the objects of this invention to provide means whereby the time interval which elapses between the engagement of the joint responsive means with the joint and the actuation of the cutout mechanism may be varied at will without the necessity of mechanically displacing the joint responsive means. Varying the time of actuation of the cutout mechanism is equivalent to varying

the distance between the joint responsive means and the flaw detecting means.

As stated above, the cutout mechanism is rendered ineffective a predetermined time after the joint responsive means engages the rail joint. This time interval corresponds to a distance, but this distance will vary if the speed of the car varies. It is therefore another object of this invention to provide means whereby the time interval between the engagement of the joint responsive means with the joint and the actuation of the cutout mechanism will be rendered independent of changes in car speed.

In the Sperry rail flaw detector car the detector mechanism comprises a plurality of sets of induction coils arranged in spaced relation longitudinally of the rail. It will thus be apparent that the leading induction coils will reach the area of flux distortion at the joints before the succeeding induction coils. Each of these induction coils feeds into a separate channel in an amplifier whose output actuates the fissure indicating means. If all of the induction coils were rendered ineffective to actuate the indicator when the leading induction coils reached the area of flux distortion, it is apparent that there would be a portion of rail several inches long corresponding to the distance between the leading and last induction coils which would remain untested by the succeeding coils even though the succeeding coils had not yet reached the area of flux. A similar condition would appear at the leaving end of the angle bar. Therefore, it is an object of this invention to provide means whereby each of the sets of detector coils is separately and independently rendered ineffective to actuate the indicator as each set of coils reaches the area of flux distortion, and similarly means whereby each set of coils is separately rendered effective to actuate the indicator when the respective set of coils leaves the area of flux distortion.

It is another object of this invention to provide in a device as described above, means whereby rendering one set of coils ineffective to actuate the indicating means energizes the means for rendering the succeeding set of coils ineffective.

Still another object of this invention is to provide in a device as described above means whereby the means which renders the detector means ineffective to actuate the indicating means simultaneously renders effective the means which will render the detector coils again effective to actuate the indicating means after a predetermined interval of time.

Further objects and advantages of this invention will become apparent in the following detailed description thereof.

In the accompanying drawings,

Fig. 1 is a side view of a portion of a Sperry rail fissure detector car having my invention applied thereto.

Fig. 2 is a wiring diagram illustrating the principles of this invention.

Referring to Fig. 1 of the drawings, there are shown the parts of a standard Sperry rail fissure detector car which includes a car body 10 operating along the rails R. Fissure detection is accomplished by passing current through each rail from a generator G within the car body supplying current to spaced current brushes 11 and 12 supported upon the current brush carriage 13 which when in lowered or effective position is adapted to ride upon the rail by means such as wheels 15. The current brush carriage 13 is nor-

mally held in elevated or ineffective position by means of springs, not shown, and cables 16, but when it is desired to lower said carriage, fluid pressure, such as compressed air, is supplied to the cylinders 11 to force out pistons 18 which are pivotally connected at 19 to the current brush carriage 13. The current passed through the rail by way of spaced brushes 11 and 12 will establish an electromagnetic field surrounding the rail and this field will be uniform except in the region of flaw where it will be distorted. Such distortions of the electromagnetic field are detected by a flaw responsive mechanism which may take the form of a plurality of induction coils 20, 21, 22 supported in a housing 23 at a constant distance above the rail surface by means of a carriage 24. Said carriage 24 is mounted on current brush carriage 13 by means of loosely fitting bolts 25 and springs 26 to permit said carriage 24 while riding on the rail on means such as wheels 27 to move independently of carriage 13 so that said carriage may at all times maintain parallelism with the rail surface regardless of irregularities thereof. The flaw responsive mechanism may include one or more pairs of coils, three such pairs 20, 21, 22 being shown in the present instance. Each pair of coils is connected in series and oppositely wound so that variations in flux which affect both simultaneously, such as variations in the current supply or equal variations in the distance of the coils above the rail, will affect both equally and oppositely and thus will not affect the flaw detection. On entering a region of flaw, however, first one and then the other of said coils will cut a different number of lines of force from that which was previously cut, to generate a differential E. M. F. Each set of coils operates into a separate channel of an amplifier, said channels being indicated as Nos. 1, 2, and 3, respectively, and the output from said amplifier is caused to energize a relay 29 to actuate pen 31 which operates on a moving chart 32. A notch thus formed in the straight line being drawn by the respective pen indicates the presence of a fissure.

As stated in the introduction to this specification, a joint comprising angle bars 30, a plurality of bolts 31 and bond wires 32 will distort the electromagnetic field surrounding the rail in the same manner as a fissure, and throughout the entire passage of the detector mechanism over the joint, indications would be coming through on the chart, causing continuous actuation of the pens, thus obscuring the chart and making it difficult to read. This is particularly dangerous with respect to actual fissures existing near the angle bars, because it would be impossible to distinguish such a pen indication from the plurality of pen indications immediately adjacent thereto and caused by the joint construction. For this reason, in the said prior Patent No. 2,069,030 there were provided a pair of spaced fingers mounted on the current brush carriage 11 in advance, and to the rear, of the detector coils within housing 23. These fingers were adapted to engage the angle bar when the detector coil approached the region where the angle bar began to distort the electromagnetic field and controlled a circuit which rendered the indicating mechanism ineffective while the detector mechanism was passing over the angle bar, the rear finger engaged said angle bar so that after the leading finger passed beyond the angle bar the circuit through the indicating mechanism nevertheless remained ineffective be-

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cause the rear finger was now on the angle bar.

The use of the joint fingers for this purpose gives rise to difficulties for the reasons fully stated in the introduction hereto and therefore I propose to provide as a joint responsive means a pair of potential contacts 30 in sliding engagement with the upper or tread surface of the rail. The drop in voltage between contacts 30 at portions of the rail other than the end is relatively slight in comparison to the drop in voltage across the rail ends. I utilize this sharp difference in potential to actuate means for opening the circuits between the detector coils and the input channels to the amplifier. The means for opening said circuits will be described in detail hereinafter.

One of the difficulties heretofore experienced in the use of pairs of potential contents has been, as stated in the introduction hereto, the generation of contact voltages between each contact and the rail. These generated contact voltages acted in the same manner as the voltage drop across the rail ends and thus rendered this arrangement inoperative. I have devised means, however, whereby this difficulty is overcome and it is possible to distinguish between the voltage generated at a joint across rail ends and the contact voltages generated between each contact and the rail. For this purpose I take advantage of the fact that the contact voltage generated between each contact and the rail is of relatively low wattage, i. e., while the momentary voltage may be high, the current is low. The wattage of the voltage drop between the contacts 30 at a joint is high because of the high current, usually on the order of 2,000 to 3,000 amperes, flowing through the rail. Therefore, I connect the potential contacts in a low impedance circuit, in this case a primary winding P of a transformer. This winding being purposely made of very low impedance, there results a relatively low IR drop across the impedance in response to the contact voltages generated between a contact 30 and the rail, because the amperage behind such generated voltage is relatively low. Therefore the potential across low impedance P under these conditions is small. On the other hand, since the variation in potential between contacts 30 across the rail ends has high current behind it, the IR drop through impedance P will nevertheless be high even though the impedance is low, due to the high amperage. Hence, the voltage drop between contacts 30 across the rail ends will generate a voltage sufficient to actuate the circuit breaking means for the input channels of the amplifier, whereas the voltage generated across the impedance P by the contact voltages between each contact 30 and the rail will be insufficient to actuate said circuit breaking means.

The means whereby the voltage generated across low impedance P when contacts 30 span the rail ends actuate the circuit breaking means comprises the secondary S of the transformer which applies the generated voltage to the grid G' of a gas discharge tube T' to cause said tube to discharge and energize a relay 34 to close a set of contacts 35 which is designed to place a charge on grid G2 of tube T2 to cause said tube to discharge and open a set of contacts 36 in the circuit from the front set of detector coils 20 to the amplifier by way of channel 1.

It will be seen that when potential contacts 30 span the rail ends at a joint, the leading set of detector coils 20 is still a considerable distance from the region of beginning of distortion indicated at A. It is therefore necessary to introduce

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a time delay between the engagement of contacts 30 with the rail ends and the breaking of the circuit of channel 1. For this purpose closing of contacts 35 by the discharge of tube T does not result in placing a voltage immediately on grid G2 because the voltage controlled by contacts 35 is passed through a delayed action circuit consisting of a resistance R' and capacity C' either of which may be variable. In the form shown, R' is variable. The voltage controlled by closing of contact 35 may come in part from a battery B' and in part from a generator N' driven from the axle of the car so that the voltage generated thereby is a function of the speed of the car. Thus the voltage which is applied to G2 by the closing of contacts 35 may be supplied from both generator N' and battery B', or, if desired, from the generator alone. This voltage will cause the tube T2 to discharge only after a predetermined interval of time as determined by R' and C'. This interval of time is indicated by the predetermined distance AA'.

It will be apparent that if the car speed should be increased, the time interval represented by R', C' will correspond to a greater distance than is indicated at AA', while if the car speed decreases the interval of time R', C' will represent a smaller distance than AA'. However, this change in speed is neutralized by the fact that grid G2 receives its voltage either entirely or mainly from generator N' on the car axle so that as the car speeds up more voltage will be applied to R', C' to cause tube T2 to fire sooner, while when the car slows up less voltage will be applied by generator N' to R', C', and hence tube T2 will fire later. Thus, the time interval is automatically regulated so as to vary inversely with the speed of the car, and thus maintain the predetermined distance AA' constant.

When the set of coils 20 has reached the position A which is the limit of the field of distortion, contacts 36 are opened to break channel 1 of the amplifier and thus the set of coils 20 is ineffective to actuate the indicator which may be a pen 31 operating on a chart 32. The pen may normally be actuated by the energization of relay 29 from the output of the amplifier 28. While coils 20 have reached the field of distortion at point A, it is evident that sets of coils 21 and 22 have not yet reached the position A and, therefore, if channels 2 and 3 into the amplifier controlled by coils 21 and 22 were also broken at the time that channel 1 was broken, then a portion of the rail to the left (in Fig. 2) of position A corresponding to the distance between coils 20 and coils 21 and 22 would remain untested by coils 21 and 22. In order to obviate this condition, channels 2 and 3 are not broken until coils 21 and 22 have reached substantially position A. In order to effect this operation, I cause the discharge of tube T2 which breaks contacts 36 to open channel 1, also to render effective the means which will open channels 2 and 3 after a predetermined interval of time corresponding to the time it takes the coils to travel the distance from A'' to A'. For this purpose the discharge of tube T2 which energizes a coil 45 to break contacts 36, also causes contacts 46 to close. This closes a circuit including a generator N2 and battery B2 which apply voltage to grid G3 of tube T3 to cause said tube to discharge after a predetermined time interval which is determined by resistance R2 and capacity C2, one of which is variable. The time constant R2, C2 is set to correspond to the time of travel of the car from A'' to A' so that when coils 20 have

reached A contacts 46 close and after a time interval corresponding to A'-A'' tube T3 will discharge to energize relay 48 to break contacts 49 and 50 in channels 2 and 3 of the amplifier.

By the above described arrangement, coils 20 and coils 21 and 22 will each be effective up to position A which is the outer limit of the field of distortion. Coils 21 and 22 have been treated as a unit because they are close together, but a similar arrangement may be provided whereby breaking channel 2 when coils 21 reach position A energizes the means which will cause coils 22 to break channel 3 when the last-named coils reach position A.

On leaving the field of distortion at position F it is necessary to render the coils again effective to operate indicator 31, and therefore it is necessary to close channels 1, 2 and 3. I have provided means whereby as coils 20 reach F, channel 1 is rendered effective and as coils 21 and 22 reach position F channels 2 and 3 are rendered effective. The means for rendering coils 20 effective at position F is set into operation at the same time that relay 34 closes contacts 35 for setting into operation the means which breaks channel 1. Thus when contacts 35 close, contacts 55 also close to close a circuit including a source of voltage comprising generator N3 on the axle of the car and, if desired, also a battery B3 which supplies voltage to the grid G4 of a tube T4 by way of a circuit which includes a time constant consisting of resistance R3 and condenser C3. The discharge of tube T4 energizes a relay 56 which opens contacts 57 in the plate voltage supplied to tube T2 to render the tube non-conductive and thus permit contacts 36 to close, whereby channel 1 is closed. The time constant R3, C3 is so chosen that tube T4 does not discharge until coils 20 have reached position F. Since contacts 55 are closed when coils 20 reach position A', the time constant must be such as to prevent tube T4 from discharging until the coils 20 have travelled the distance A'-F. In order to restore tubes T2 and T4 quickly to operative position, the condensers C1 and C3 may be short-circuited when relay 56 is energized by causing contacts 60 and 61 to close.

Similarly, at the same time that the discharge of tube T2 closes contacts 46 to energize the circuit of tube T3 it also closes contacts 65 which energize a circuit which includes a source of voltage in the form of a generator N4 on the car axle and if desired also a battery B4 which is designed to apply its voltage to a grid G5 of a tube T5 after a time interval determined by time constant elements R4 and C4. This time constant is determined as follows: The contacts 46 are closed when coils 20 are in position A. The coils 21 and 22 are rendered ineffective to actuate the indicator through channels 2 and 3 after a time interval A'A'' and must be kept ineffective for the additional distance AF. Therefore, the time constant R4, C4 is set for a time interval corresponding to the time it takes the car to travel the distance A'A'' plus AF. The discharge of tube T5 will energize relay 70 which will open contacts 71 to break the plate circuit of tube T3 to deenergize relay 48 and permit contacts 49 and 50 to close and thus render channels 2 and 3 again effective. Short circuits may be provided for condensers C2 and C4 by closing contacts 72 and 73 when relay 70 is energized.

Generators N2, N3 and N4, like the generator N', make automatic compensation for the varying speed of the car by applying less voltage when the car moves slowly so as to increase the time

constant and applying more voltage when the car moves quickly so as to decrease the time constant.

The foregoing description of the invention is merely illustrative and changes may be made within the scope of the appended claims.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, detector means responsive to variations in flux caused by defects in the rail, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, cutout means for rendering the detector means ineffective to actuate the indicator, means whereby the joint responsive means renders the cutout means effective in response to a joint, said last-named means including time delay means, means for adjusting the time delay means corresponding to the time of travel of the detector means to the region of joint flux distortion after the joint responsive means responds to the joint, and means for rendering the cutout means ineffective; the improvement which comprises means whereby rendering the cutout means effective energizes the means for rendering the cutout means ineffective, said means for rendering the cutout means ineffective including a second time delay means, and means for adjusting the second time delay means corresponding to the time of travel of the detector means through the region of joint flux distortion.

2. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, detector means responsive to variations in flux caused by defects in the rail, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, cutout means for rendering the detector means ineffective to actuate the indicator, means whereby the joint responsive means renders the cutout means effective in response to a joint, said last-named means including time delay means, means for adjusting the time delay means corresponding to the time of travel of the detector means to the region of joint flux distortion after the joint responsive means responds to the joint, and means for rendering the cutout means ineffective; the improvement which comprises means whereby rendering the cutout means effective energizes the means for rendering the cutout means ineffective including a second time delay means, and means for adjusting the second time delay means corresponding to the time of travel of the detector means through the region of joint flux distortion, said first and said second time delay means each including means responsive to the car speed.

3. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, a plurality of detector means responsive to variations in flux caused by defects in the rail, one of the detector means being positioned in advance of the other detector means, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, a plurality of cutout means for rendering the leading detector means and the following detector means,

respectively, ineffective to actuate the indicator, and means whereby the joint responsive means renders the cutout means for the leading detector means effective in response to a joint, said last-named means including time delay means and means for adjusting the time delay means corresponding to the time of travel of the leading detector means to the region of joint flux distortion after the joint responsive means responds to a joint, means whereby rendering effective the cutout means for the leading detector means energizes the cutout means for the following detector means, said last-named means including a second time delay means, and means for adjusting the second time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means; the improvement which comprises means whereby rendering effective the cutout means for the leading detector means energizes means for rendering the same cutout means ineffective, said last-named means including a third time delay means and means for adjusting the third time delay means corresponding to the time of travel of the leading detector means through the region of joint flux distortion, and means whereby rendering effective the cutout means for the following detector means energizes means for rendering the same cutout means ineffective, said last-named means including a fourth time delay means, and means for adjusting the fourth time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means and through the region of joint flux distortion.

4. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, a plurality of detector means responsive to variations in flux caused by defects in the rail, one of the detector means being positioned in advance of the other detector means, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, a plurality of cutout means for rendering the leading detector means and the following detector means, respectively, ineffective to actuate the indicator, and means whereby the joint responsive means renders the cutout means for the leading detector means effective in response to a joint, said last-named means including time delay means and means for adjusting the time delay means corresponding to the time of travel of the leading detector means to the region of joint flux distortion after the joint responsive means responds to a joint, means whereby rendering effective the cutout means for the leading detector means energizes the cutout means for the following detector means, said last-named means including a second time delay means, and means for adjusting the second time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means; the improvement which comprises means whereby rendering effective the cutout means for the leading detector means energizes means for rendering the same cutout means ineffective, said last-named means including a third time delay means and means for adjusting the third time delay means corresponding to the time of travel of the leading detector means through the region of joint flux distortion, and means whereby rendering effective

the cutout means for the following detector means energizes means for rendering the same cutout means ineffective, said last-named means including a fourth time delay means and means for adjusting the fourth time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means and through the region of joint flux distortion, said first, said second, said third and said fourth time delay means each including means responsive to the speed of the car.

5. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, detector means responsive to variations in flux caused by defects in the rail, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, cutout means for rendering the detector means ineffective to actuate the indicator, means whereby the joint responsive means renders the cutout means effective in response to a joint, said last-named means including time delay means, and means for adjusting the time delay means corresponding to the time of travel of the detector means to the region of joint flux distortion after the joint responsive means responds to the joint; the improvement which comprises said time delay means including a gaseous discharge tube having a cathode, an anode and a grid, and means including a generator adapted to be driven from the car axle for applying bias voltage to the grid, whereby the bias will be a function of the car speed.

6. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, detector means responsive to variations in flux caused by defects in the rail, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, cutout means for rendering the detector means ineffective to actuate the indicator, means whereby the joint responsive means renders the cutout means effective in response to a joint, said last-named means including time delay means and means for adjusting the time delay means corresponding to the time of travel of the detector means to the region of joint flux distortion after the joint responsive means responds to the joint, means for rendering the cutout means ineffective, and means whereby rendering the cutout means effective energizes the means for rendering the cutout means ineffective; the improvement which comprises said means for rendering the cutout means ineffective including a second time delay means and means for adjusting the second time delay means corresponding to the time of travel of the detector means through the region of joint flux distortion, said first and said second time delay means each including a gaseous discharge tube having a cathode, an anode and a grid, and means including generator means adapted to be driven from the car axle for applying bias voltage to the grids, whereby the bias will be a function of the car speed.

7. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, a plurality of detector means responsive to variations in flux caused by defects in the rail, one of the detector means being positioned in

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advance of the other detector means, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, a plurality of cutout means for rendering the leading detector means and the following detector means, respectively, ineffective to actuate the indicator, and means whereby the joint responsive means renders the cutout means for the leading detector means effective in response to a joint, said last-named means including time delay means and means for adjusting the time delay means corresponding to the time of travel of the leading detector means to the region of joint flux distortion after the joint responsive means responds to a joint, and means whereby rendering effective the cutout means for the leading detector means energizes the cutout means for the following detector means; the improvement which comprises said last-named means including a second time delay means and means for adjusting the second time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means, said first and said second time delay means each including a gaseous discharge tube having a cathode, an anode and a grid, and means including generator means adapted to be driven from the car axle for applying bias voltage to the grids, whereby the bias will be a function of the car speed.

8. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for energizing the rail with flux, a plurality of detector means responsive to variations in flux caused by defects in the rail, one of the detector means being positioned in advance of the other detector means, an indicator adapted to be actuated by the detector means, means positioned in advance of the detector means and responsive to rail joints, a plurality of cutout means for rendering the leading detector means and the following detector means, respectively, ineffective to actuate the indicator, and means whereby the joint responsive means renders the cutout means for the leading detector means effective in response to a joint, said last-named means including time delay means and means for adjusting the time delay means corresponding to the time of travel of the leading detector means to the region of joint flux distortion after the joint responsive means responds to a joint, and means whereby rendering effective the cutout means for the leading detector means energizes the cutout means for the following detector means; the improvement which comprises said last-named means including a second time delay means and means for adjusting the second time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means, means whereby rendering effective the cutout means for the leading detector means energizes means for rendering the same cutout means ineffective, said last-named means including a third time delay means and means for adjusting the third time delay means corresponding to the time of travel of the leading detector means through the region of joint flux distortion, and means whereby rendering effective the cutout means for the following detector means energizes means for rendering the same cutout means ineffective, said

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last-named means including a fourth time delay means and means for adjusting the fourth time delay means corresponding to the time of travel of the following detector means through the distance between the leading and the following detector means and through the region of joint flux distortion, said first, said second, said third and said fourth time delay means each including a gaseous discharge tube having a cathode, an anode and a grid, and means including generator means adapted to be driven from the car axle for applying bias voltage to the grids, whereby the bias will be a function of the car speed.

9. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for sending current through the rail, flaw detector means, an indicator adapted to be actuated by said detector means, cutout means for rendering the detector means ineffective to actuate the indicator, means positioned in advance of the detector means and adapted to respond to the joints, and means whereby the joint responsive means renders the cutout means effective in response to the joints, characterized by said joint responsive means comprising a pair of spaced contacts in engagement with the rail surface and means for distinguishing between contact, galvanic and other relatively low power voltages generated between each contact and the rail and the relatively high-power voltage drop in the rail between the contacts, said last-named means comprising a conductive circuit including said contacts, said circuit having relatively low impedance.

10. In a rail flaw detector car adapted to travel over rails connected by joints and comprising the following elements: means for sending current through the rail, flaw detector means, an indicator adapted to be actuated by said detector means, cutout means for rendering the detector means ineffective to actuate the indicator, means positioned in advance of the detector means and adapted to respond to the joints, and means whereby the joint responsive means renders the cutout means effective in response to the joints, said cutout means being actuated in response to voltage in excess of a predetermined voltage, characterized by said joint responsive means comprising a pair of spaced contacts in engagement with the rail surface and means for distinguishing between contact, galvanic and other relatively low power voltages generated between each contact and the rail and the relatively high power voltage drop in the rail between the contacts, said last-named means comprising a conductive circuit including said contacts, said circuit having sufficiently low impedance so that said relatively low power generated voltages will be less than the predetermined voltage necessary to actuate the cutout means while said relatively high power voltages generated between the contacts at a joint will be at least equal to said predetermined voltage necessary to actuate the cutout means.

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