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RAIL FLAW DETECTOR MECHANISM

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FIG.1.

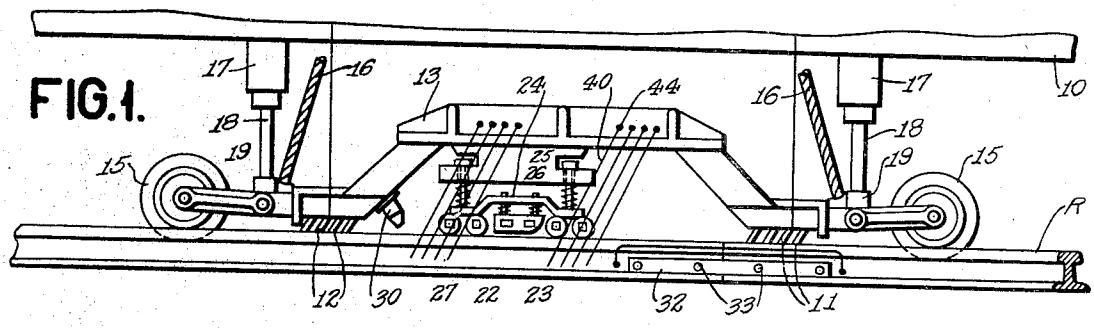
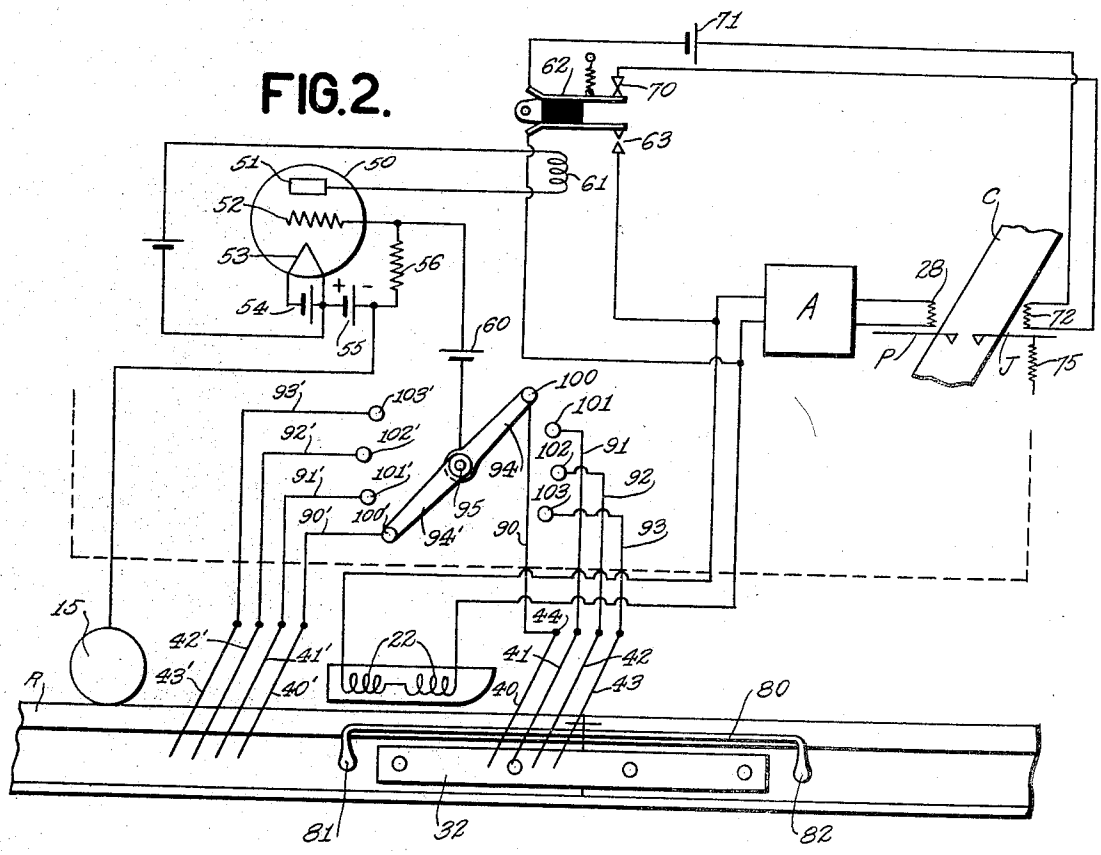


FIG.2.



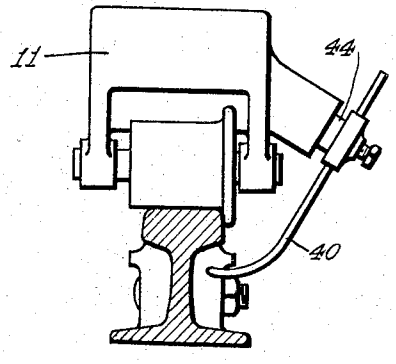


FIG.3.

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RAIL FLAW DETECTOR MECHANISM

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4 Claims. (Cl. 175—183)

This invention relates to rail flaw detector mechanisms and is particularly designed for application to the type of detector mechanism employed on the Sperry rail flaw detector car. This car operates on the principle of passing current through the rail to establish an electromagnetic field surrounding the same and exploring said field by flux responsive means to discover any irregularities caused by the presence of fissures or other discontinuities in the rail. Since rails are joined by joints comprising angle bars, bolts, etc., which joints constitute in themselves irregularities which will cause variations in the electromagnetic field in the same manner as internal fissures, means are provided for short-circuiting the connection between the detector mechanism and the indicating mechanism in the interval that the detector mechanism is passing over the rail joint. Since the indicating means may comprise a pen operating on the chart, and a paint gun for spraying paint on the rail in the vicinity of a flaw, the short-circuiting mechanism is effective to prevent actuation of the pen on the chart or discharge of paint by the paint gun at a joint.

The means which are employed for effecting the short-circuit of the connection between the detector mechanism and the indicating mechanism consist of fingers pivoted on the flaw detector carriage and so positioned that they will engage the angle bar when the detector mechanism has just reached the field of distortion created by the joint. The short circuit mechanism remains effective as long as the finger rides on the angle bar and an additional finger is provided at the rear of the detector mechanism adapted to engage the angle bar before the front finger leaves the same so that the short circuiting means will remain effective even after the front finger has left the angle bar and until the detector means has passed beyond the field of distortion created by the rail joint.

The special problem which this invention has solved arises from the fact that frequently electric bonding of rails at the joint is accomplished by means of bond wires consisting of copper-covered steel cores and which are connected to the rails at points spaced beyond the ends of the angle bar. These bond wires also create a distortion of the electromagnetic field which will be picked up by the detector mechanism and cause the indicating mechanism to operate unnecessarily and give a false indication of a fissure which is not in fact present because the distortion is due merely to the bond wire. When a stretch of rail which is bonded is encountered it has heretofore been necessary for the operator of the car to stop the car and to get out and make an adjustment in the positions of the joint fingers so that these fingers will engage the front and leaving ends of the angle bar when the detector mechanism is in a position to be affected by the points of connection of the bond wire with the rail. This meant spacing the fingers further apart, that is, further in advance and to the rear of the detector mechanism so that an entire stretch of rail at the joints will be passed over by the detector mechanism without operating the indicating mechanism.

It is the principal object of this invention to provide means whereby an operator within the car body, seated at his operating position, may vary the effective cutout range without leaving his post.

It is a further object of the invention to provide a joint cutout control mechanism of the type described above which will permit the operator to set the effective joint cutout distance at will to any of a plurality of settings.

It is still another object of this invention to provide a novel joint cutout operating arrangement which will be effective regardless of the high resistance condition of the joint bars.

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

In the accompanying drawing:

Fig. 1 is a side elevation of a portion of the rail fissure detector car having the invention applied thereto.

Fig. 2 is a view largely diagrammatic showing the electric connections.

Fig. 3 is a vertical section through the railhead showing the relative positioning of a joint finger.

Referring to Fig. 1 of the drawing, 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 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 normally 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 17 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 pair of opposed induction coils 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 the said carriage 24 may at all times maintain parallelism with the rail surface regardless of irregularities thereof. The coils 22 normally cut the same number of lines of force, but on entering a region of flaw, first one coil and then the other will cut a different number of lines of force to generate a differential E. M. F. which after being suitably amplified by an amplifier A may be caused to energize a coil 28 to actuate a pen P operating on a chart C. At the same time that the pen is actuated, there is actuated also marking means which may take the form of a paint gun 30 mounted on the current brush carriage 13 a sufficient distance behind the flaw responsive members 22 to compensate for the movement of the car and for the lag in operation of the paint gun.

As stated in the introduction hereto, the rails are held together by joints which may comprise an angle-bar 32, bolts 33, and additional members, all of which constitute the rail joint, and this rail joint serves to deflect the current passing through the rails and vary the electromagnetic field surrounding the same. Unless means were provided for preventing such action, it is understood that the searching unit would respond to the variation in electromagnetic field caused by the rail joint just the same as it responds to variations in the said field caused by fissures and other defects. Since it is not desired that the indicating mechanism and the paint gun be operated at every joint, means are provided for cutting out the action of the indicating means for the interval during which the searching unit is passing through the region of the electromagnetic field which is affected by the rail joint. The mechanism heretofore employed and to which this invention relates consists of a joint finger 40 pivoted at 44 on the current brush carriage and so positioned as to slide along the edge of the rail so that it will engage the angle-bar which will tilt the finger about its pivot. The engagement of finger 40 with the angle-bar 32 is caused to close a circuit which includes the carriage wheel 15, the rail R, angle bar 32, finger 40, the battery 60 and the resistance 56. The resistance 56 is also part of the grid circuit of an electronic tube 50 consisting of plate 51, grid 52 and filament 53. The filament receives energy from battery 54 and a negative bias is placed upon the grid 52 by means of battery 55 through high resistance 56. When finger 40 engages the angle bar 32 and closes the above circuit, the battery 60 places a positive bias on the grid 52 sufficient to overcome the negative bias of battery 55 and thus cause the tube to pass current to the plate 51 and energize relay coil 61 which then attracts its armature 62 to close contacts 63 which short-circuit the input from the detector coils 22 to the amplifier A. Thus the pen P and the paint gun 30 are rendered ineffective during the interval that the finger 40 is in engagement with the angle-bar 32. The finger 40 is positioned sufficiently in advance of the detector coils 22 so that it will engage the angle bar when the leading coil just reaches the field of distortion set up by the joint. This will be several inches before the leading coil reaches the angle bar. Since the finger 40 will have passed off the angle bar before the last detector coil 22 has passed over said bar, and has passed beyond the field of distortion set up by the joint, another finger 40' is provided in parallel with the finger 40 at the rear of the detector mechanism and is so positioned that it will engage the angle bar 32 before the front finger 40 leaves the angle bar and is positioned sufficiently behind the detector coils so that finger 40' will not have left the angle bar until the detector coils have passed beyond the field of distortion of the rail joint at the leaving end of the angle bar.

By means of the circuit described above for operating the short circuit, there is no time lag between the engagement of the joint cutout fingers and the angle bar for rendering the circuit effective, nor is there any time lag in rendering the circuit ineffective when the fingers leave the angle bar. Since dirt, rust and scale accumulate on the angle bar and would thus make poor contact, the battery 60 is provided with sufficient voltage such that even with poor contact between fingers 40 and 40' and the angle bar there would still be sufficient positive voltage on the grid 52 to overcome the negative bias placed thereon originally by battery 55. Thus, if the original bias is on the order of 4 or 5 volts, the battery 60 may be on the order of 90 volts.

At the same time that the short circuit is rendered effective by closing contacts 63, a joint pen J operating on the same chart C may be rendered effective to indicate the presence of the joint by the opening of contacts 70 in a circuit which comprises a source of energy 71 and a coil 72 which normally attracts pen J against the action of spring 75; but when contacts 70 are opened the pen J is released and spring 75 will cause the pen J to make a jog in the line to indicate that the mechanism is passing over a rail joint.

As described above, it has been stated that the finger 40 is positioned sufficiently in advance of the detector coils 22 so that the finger will engage the angle bar 32 when the leading detector coil has just reached the field of distortion set up by the rail joint. This field may begin some 3 or 4 inches in advance of the angle bar and may extend for 3 or 4 inches beyond the leaving end of the angle bar so that the rear finger 40' must be positioned to the rear of the detector coils a similar distance. As stated in the introduction, stretches of rail are frequently encountered where a special bonding technique is employed and a bond wire 80 is welded to the rails at 81 and 82 which are points several inches in front of and to the rear of the angle bar. Since these bond wires usually consist of an iron core covered with copper wire, it will be appreciated that this wire will also distort the electromagnetic field in the same way as the rail joint. With such construction the field of distortion set up by the rail joint and the bond wire may now extend up to 6 or 7 inches in advance of and beyond the angle bar and it can readily be understood that if the fingers 40 and 40' are set to render the short circuit effective within a range of 3 or 4 inches in front of and beyond the angle bar, the detector mechanism will nevertheless be affected by the field of distortion caused by the bond wire.

When such a stretch of track is encountered it is necessary for the operator to stop the car and to get out and readjust the fingers so that they will engage the angle bar when the detector mechanism is 6 or 7 inches from the angle bar and so that the finger 40' will still be on the angle bar until the detector coils have passed some 6 or 7 inches beyond the angle bar. This adjustment is

time consuming, particularly since trials must be run to determine whether the proper allowance has been made for the bond wire, and may require several adjustments before the proper spacing of the fingers 40 and 40' has been effected.

To obviate the above difficulty and to permit the operator to control the short circuit for various distances in advance and to the rear of the detector mechanism without the necessity of the operator leaving the car, there is provided a plurality of leading fingers 40, 41, 42, 43, each with its own lead wire 90, 91, 92, 93, leading to the battery 60 with a commutator consisting of a movable contactor arm 94 pivoted at 95 so that it may be rotated to engage any one of said lead lines 90, 91, 92, 93 at contacts 100, 101, 102, 103, respectively. Thus the operator within the car can, merely by swinging contactor arm 94 into engagement with contact 100, 101, 102, or 103, cause any one of fingers 40, 41, 42 or 43 to become the effective finger for controlling the short circuit. A similar set of fingers 40', 41', 42', 43' is provided at the rear of the detector mechanism with leads 90', 91', 92', 93' connected to fixed contacts 100', 101', 102', 103', and co-operating with a contactor arm 94' pivoted at 95. Thus, without leaving his position at the operator's desk, the operator can bring into play whichever of the front fingers and whichever of the corresponding rear fingers he finds to be the proper ones for the particular situation encountered. Thus if the bond wire terminals are only a short distance in front of and beyond the angle bar, he may swing contactor arms 94 and 94' into engagement with contacts 101 and 101' to render fingers 41 and 41' effective to control the short circuit. However, if the bond wire terminals extend out a greater distance he may find that it is necessary to render fingers 42 and 42' effective by causing contactor arms 94 and 94' to engage contacts 102 and 102'. When a normal stretch of track is encountered without bond wire terminals projecting beyond the angle bars, the operator will swing contactor arms 94 and 94' back to their initial positions wherein they engage contacts 100 and 100' to render fingers 40 and 40' again effective to control the short-circuiting of the detector mechanism.

Instead of having separate arms 94, 94' constituting the commutator whereby any one of the forward fingers may be selected in combination with any one of the rear fingers, I may form the commutator bar as a single integral arm whereby definite pairs of forward and rearward fingers may be rendered effective. Thus, if 94, 94' were a single rigid arm positioned as shown in Fig. 2, the finger 40 at the front and the finger 40' at the rear of the detector housing would be rendered effective. By moving this arm to the next position in contact with 101 and 101' the pair of fingers 41, 41' would be rendered effective, etc. This is a simpler construction and involves the operation of but one commutator arm instead of two, although it does not permit quite as varied combinations of front and rear cutout fingers as in the case described above where the parts 94 and 94' are independently movable arms mounted on the same pivot shaft 95.

In accordance with the provisions of the patent statutes, I have herein described the principle and operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other equivalent means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

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

1. In a rail flaw detector car adapted to move over the rails, in combination, flaw indicating mechanism, means responsive to flaw adapted to actuate said indicating mechanism, said rails having joints, said flaw responsive means responding also to joints, a plurality of sets of spaced means, each set of spaced means being responsive to the beginning and end of rail joints, means whereby said plurality of sets is capable of rendering said flaw indicating means ineffective when said first responsive means is in a plurality of respective relationships to the rail joint, and means whereby any of said plurality of sets may be selectively rendered effective.

2. In a rail flaw detector car adapted to move over the rails, in combination, flaw indicating mechanism, means responsive to flaw adapted to actuate said indicating mechanism, said rails having joints, said flaw responsive means responding also to joints, a plurality of sets of spaced means, each set of spaced means being responsive to the beginning and end of rail joints, means whereby said plurality of sets is capable of rendering said flaw indicating means ineffective when said first responsive means is in a plurality of respective relationships to the rail joint, and means positioned in said car whereby any of said plurality of sets may be selectively rendered effective.

3. In a rail flaw detector car adapted to move over the rails, in combination, flaw indicating mechanism, means responsive to flaw adapted to actuate said indicating mechanism, said rails having joints, said flaw responsive means responding also to joints, a plurality of pairs of means responsive to rail joints, means whereby said plurality of pairs of means is capable of rendering said flaw indicating means ineffective when said first responsive means is in a plurality of respective relationships to the rail joint, and means whereby any of said plurality of pairs of means may be selectively rendered effective.

4. In a rail flaw detector car adapted to move over the rails, in combination, flaw indicating mechanism, means responsive to flaw adapted to actuate said indicating mechanism, said rails having joints, said flaw responsive means responding also to joints, a plurality of pairs of means responsive to rail joints, means whereby said plurality of pairs of means is capable of rendering said flaw indicating means ineffective when said first responsive means is in a plurality of respective relationships to the rail joint, and means positioned in said car whereby any of said plurality of pairs of means may be selectively rendered effective.

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