Dec. 28, 1937. W. M. PERRY 2,103,868

RAIL FLAW DETECTOR MECHANISM

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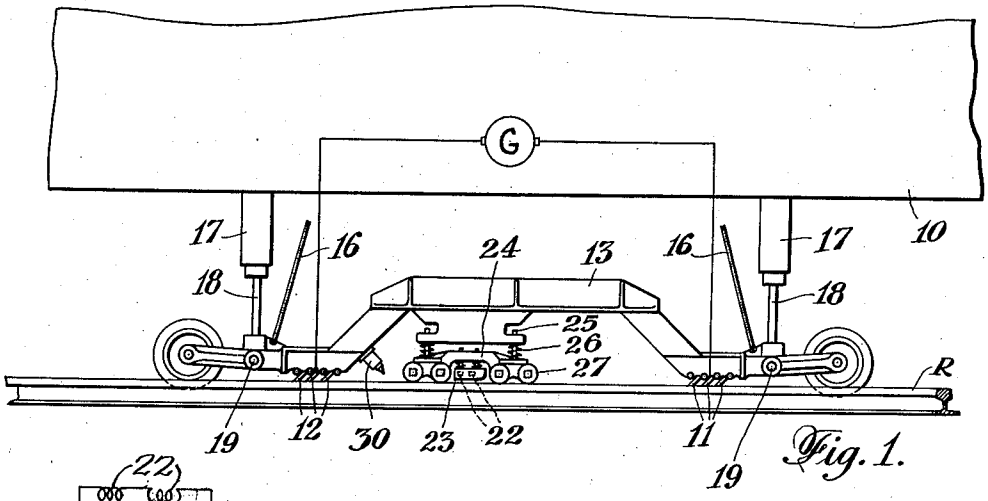


Fig. 1.

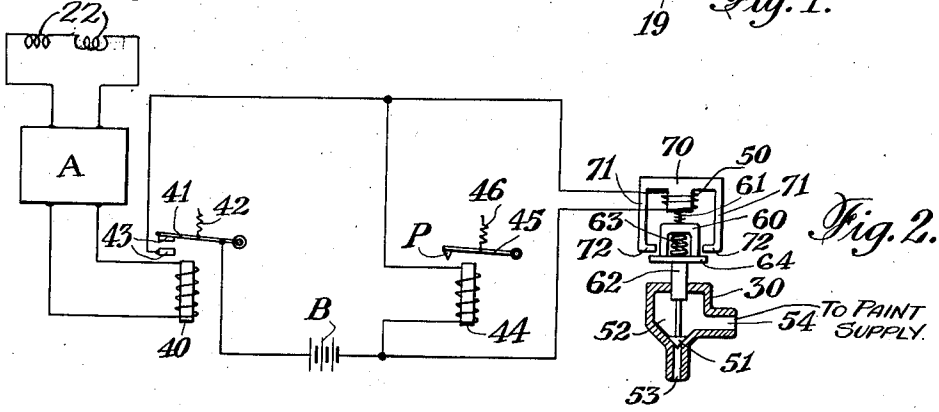


Fig. 2.

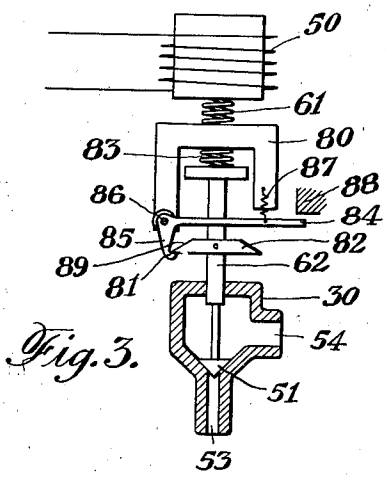


Fig. 3.

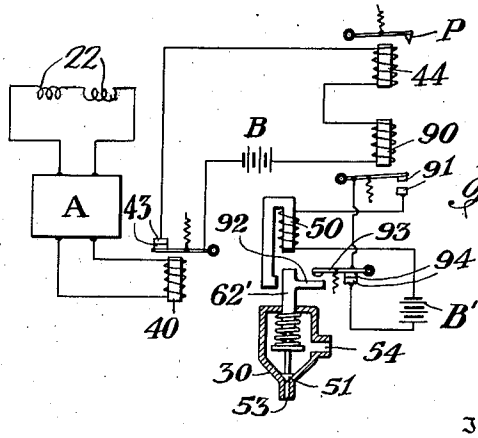


Fig. 4.

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RAIL FLAW DETECTOR MECHANISM

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8 Claims. (Cl. 177—311)

This invention relates to rail flaw detector mechanisms of the type embodied in the Sperry rail flaw detector. The operation of these mechanisms is now well known and consists of a car which operates along the rails and carries a mechanism responsive to internal flaws. When such a flaw is encountered an indication is made upon a chart in the moving car and at the same time marking means such as paint is discharged on the rail in the region of flaw.

It is highly desirable that the marking means should operate quickly in response to energization in order that the mark on the rail may be properly located, and it is further desirable that the mark be limited in extent to substantially the region of a flaw. If the marking means is slow in responding to an impulse it may be that the paint will be placed upon the rail at a point several inches removed from an actual flaw and may be located at a surface defect such as a burn which the operator will misinterpret. Also, if the mark is too long it may be that the said mark originally was made in response to a surface defect but extends along the rail to such a distance that a fissure near a surface defect will be missed since the operator will interpret the mark, no matter how long, as being due to the surface defect.

This invention, therefore, has for its principal object the provision of rail marking means and actuating means therefor which will result in a quick response of the marking means and which will yield a mark of relatively short length.

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

In the accompanying drawing,

Fig. 1 is a side view of a Sperry rail fissure detector car, the main portion of the car being broken away to show the detector mechanism.

Figs. 2 to 4 inclusive are views largely in the form of wiring diagrams illustrating various forms of my invention.

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 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 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 actuate a pen P operating on a chart, not shown. At the same time that pen P 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, it is highly desirable that the paint gun be so operated that a relatively short mark will be placed upon the rail in the region of flaw, regardless of the magnitude of the impulse passing through the amplifier A or the length of time that said impulse persists. For this purpose I have provided various forms of my invention, one of which is disclosed in Fig. 2. In this form of the invention the impulse from amplifier A energizes magnet 40 which attracts its armature 41 against the action of spring 42 to close a set of contacts 43 and close a circuit including a source of energy such as battery B to energize a magnet 44 which attracts an armature 45 against the action of a spring 46 to actuate the pen P on the chart, not shown. The pen P normally draws a straight line on the chart which is moving continuously, but when

actuated by the magnet 44 it makes a notch in the straight line, indicating the presence of a flaw in the rail.

At the same time that closing of contacts 43 energizes pen magnet 44 it also energizes a magnet 50 in parallel with pen magnet 44, said magnet being adapted to operate the paint gun 30 to lift the valve 51 therein and permit the paint within chamber 52 to discharge through nozzle 53. Paint is normally supplied to chamber 52 by way of inlet 54 connected to the source of paint supply.

The mechanism by which magnet 50 operates the paint gun valve 51 is designed to limit the actuation of said valve, that is, the length of time that said valve is open, regardless of the length of time that magnet 50 is energized, so that no matter what the magnitude of the impulse passing through amplifier A, the paint gun will be actuated for a constant time to give a constant and limited paint mark on the rail. For this purpose, the magnet 50 is caused to attract the permanent magnet 60 in the form of a U-shaped member and against the action of a spring 61. Said spring is sufficient to keep magnet 60 out of engagement with magnet 50 at all times regardless of the degree of energization of magnet 50, but said magnet 60 will be drawn toward magnet 50 to a greater or lesser degree depending upon the degree of energization of said magnet 50. The open end of the U-shaped member 60 normally attracts a magnet plate 64 at the upper end of stem 62 which carries the paint valve 51 at its lower end. A spring 63 is interposed between the base of member 60 and the magnetizable plate 64. The magnet 50 is supported on a fixed member 70 having arms 71 extending downwardly, said arms being provided with stops 72 at the lower end of said arms and extending in the path of movement of plate 64 as said plate is moved upwardly with magnet 60 when magnet 50 is energized.

The operation of the above mechanism is as follows: When an impulse from amplifier A energizes magnet 50 it attracts magnet 60 and therefore lifts magnet 60, plate 64, valve stem 62 and valve 51 as a unit to permit paint to be ejected through nozzle 53. As the said magnet 60 travels upwardly in response to the attraction of magnet 50 it carries the plate 64, valve stem 62 and valve 51 therewith until said plate 64 strikes the stops 72, which causes the plate 64 to be detached from permanent magnet 60 so that the valve stem 62 and valve 51 drop to shut off the paint gun, and thereafter no more paint is ejected regardless of how long magnet 50 is energized or of how far magnet 60 travels toward magnet 50. The stops 72 are so positioned with respect to plate 64 that the paint valve 51 will remain open for a period sufficient to make a paint mark of desired minimum length, which is on the order of 3''. Thus it will be seen that regardless of the size of the impulse through amplifier A or of its duration, the paint gun will be actuated only to a predetermined degree as a maximum, said maximum being a fraction of the total time that magnet 50 attracts magnet 60. The parts are so adjusted that any impulse from amplifier A which is sufficient to actuate the pen P will be sufficient to cause plate 64 to strike stop 72. Thus there is obtained a constant paint mark of predetermined size at each actuation of the magnet 50 due to closing of contacts 43.

In Fig. 3 I have shown a modified form of my invention. Similar parts bear the same numerals. In this form the member attracted by magnet 50 is not a permanent magnet but is merely of magnetizable material so that it may be attracted by magnet 50 against the action of spring 61. Said member 80 is connected to the paint gun valve stem 62 by means of a catch 81 extending beneath a flange 82 carried by the valve stem 62. A spring 83 is interposed between the upper end of the valve stem and the member 80. It will now be seen that when magnet 50 is energized it will attract member 80 which will lift member 81 and hence will lift the valve stem by reason of the member 81 engaging on the flange 82 fixed to the valve stem. This will lift the paint valve 51 from its seat and permit paint to be ejected. The means which I provide for securing a constant predetermined actuation of the paint gun in this case may take the form of an arm 84 which is one arm of a bell-crank the other arm 85 of which carries catch 81 which extends beneath flange 82. Arm 84 is connected to member 80, not only by a pivotal connection 86 but through springs 87. The said arm 84 is of such length that in the upward movement of member 80 which, of course, carries arm 84 therewith, said arm 84 will strike a stop 88 in its path when said member 80 has been lifted a predetermined distance. As arm 84 strikes stop 88 the bell-crank is swung around pivot 86 to cause catch 81 to disengage flange 82 and permit spring 83 to lower the valve stem and seat valve 51 to shut off the paint gun. Further movement of member 80 in response to continued energization of magnet 50 cannot cause any further actuation of the paint gun. The stop 88 is, of course, positioned with respect to arm 84 such that the arm 84 will engage stop 88 and cause catch 81 to disengage flange 82 when the paint valve 51 has been opened a predetermined time. When magnet 50 is de-energized spring 61 returns member 80 to its original position and catch 81 slides down the inclined surface 89 of flange member 82 until it again catches beneath said flange member. The parts are then again ready for actuation when magnet 50 is energized.

In the Fig. 4 form of the invention, the output from amplifier A energizes magnet 40 to break a set of contacts 43 and thus deenergize pen magnet 44 to operate pen P and also deenergize a magnet 90 which controls the energization of the paint gun magnet 50. Thus, when magnet 90 is deenergized it permits contacts 91 to close to energize magnet 50 by closing a circuit including a source of electric energy B'. The magnet 50 attracts the valve stem 62' forming the armature for said magnet, said valve stem carrying the valve 51 at the lower end thereof.

In order to obtain the same result in the Fig. 4 form of the invention as in the Figs. 2 and 3 forms, that is, of limiting the actuation of the paint gun regardless of the length of impulse issuing from amplifier A, I provide the valve stem 62' with a projection 92 adapted to engage a lever 93 carrying one of a set of contacts 94. When said projection 92 engages lever 93 in the upward movement of the valve stem 62', it will open contacts 94 which are in the circuit of magnet 50 to deenergize the same. This will permit valve stem 62' to drop and close valve 51.

Since the detector unit is travelling along the rail and since a fissure is of very slight thickness, the time of deenergization of magnet 90 is very short so that contacts 91 will be closed for only a brief interval. This interval is only sufficient to permit the current in the circuit of magnet

coil 50 to build up sufficiently to cause said magnet to attract its armature 62'. The contacts 91 do not remain closed long enough after arm 92 has opened contacts 94 to permit contacts 94 to close and to permit the current in magnet coil 50 to build up again sufficiently to attract armature 62' a second time corresponding to the single output from amplifier A in response to one flaw.

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 flaw detector mechanism, means responsive to flaw, the duration of response varying with different flaws; marking means, means including an operating connection whereby said responsive means actuates said marking means as long as said connection remains effective, and means for limiting the actuation of said marking means regardless of the duration of the response of said responsive means, said last-named means comprising means for rendering said connection ineffective after a predetermined duration of actuation of said marking means.

2. In a flaw detector mechanism, means responsive to flaw, marking means, means whereby said responsive means actuates said marking means, said last-named means including a two-part operating device, means for interconnecting said parts and means for actuating said device, the actuation of said device operating to actuate said marking means only as long as said parts are interconnected, and means whereby said interconnecting means is rendered ineffective after a predetermined duration of actuation of said device.

3. In a flaw detector mechanism, means responsive to flaw, marking means, means whereby said responsive means actuates said marking means, said last-named means including a two-part operating device, means for actuating said device, a trigger carried by one of said parts and normally engaging the other of said parts to cause said parts to operate as a unit, said device being effective for actuating said marking means when said parts operate as a unit and being ineffective when said parts are disengaged, and means for causing said trigger to disengage said other part after a predetermined duration of actuation of said device.

4. In a flaw detector mechanism, means responsive to flaw, marking means, means whereby said responsive means actuates said marking means, said last-named means including a magnet adapted to be energized by said responsive means, a two-part operating device, one of said parts forming the armature for said magnet, means for interconnecting said parts, the energization of said magnet operating to actuate said marking means only as long as said parts are interconnected, and means whereby said last-named means is rendered ineffective after a predetermined duration of actuation of said magnet.

5. In a flaw detector mechanism, means responsive to flaw, marking means, means whereby said responsive means actuates said marking means, said last-named means including a magnet adapted to be energized by said responsive means, a two-part operating device, one of said parts forming the armature for said magnet, a trigger carried by one of said parts and normally engaging the other of said parts to cause said parts to operate as a unit, said device being effective for actuating said marking means when said parts operate as a unit and being ineffective when said parts are disengaged, and means for causing said trigger to disengage said other part after a predetermined duration of actuation of said magnet.

6. In a flaw detector mechanism, means responsive to flaw, marking means, means whereby said responsive means actuates said marking means, said last-named means including a two-part operating device, one of said parts being a magnet and the other of said parts being normally attracted into engagement with said magnet, means for actuating said device, the actuation of said device operating to actuate said marking means only as long as said parts are interconnected, and means for causing said parts to be disengaged after a predetermined duration of actuation of said device.

7. In a flaw detector mechanism, means responsive to flaw, marking means, means whereby said responsive means actuates said marking means, said last-named means including a magnet adapted to be energized by said responsive means, a two-part operating device, one of said parts being a magnet and the other of said parts being normally attracted into engagement with said first part, one of said parts forming the armature for said first magnet, the energization of said magnet operating to actuate said marking means only as long as said parts are interconnected, and means for causing said parts to be disengaged after a predetermined duration of actuation of said device.

8. In a flaw detector mechanism, means responsive to flaw, marking means, means including an electric circuit whereby said responsive means actuates said marking means, and means for limiting the actuation of said marking means regardless of the extent of energization of said responsive means, said last-named means comprising means for breaking said circuit after a predetermined duration of actuation of said marking means.

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