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RAIL FLAW DETECTOR MECHANISM

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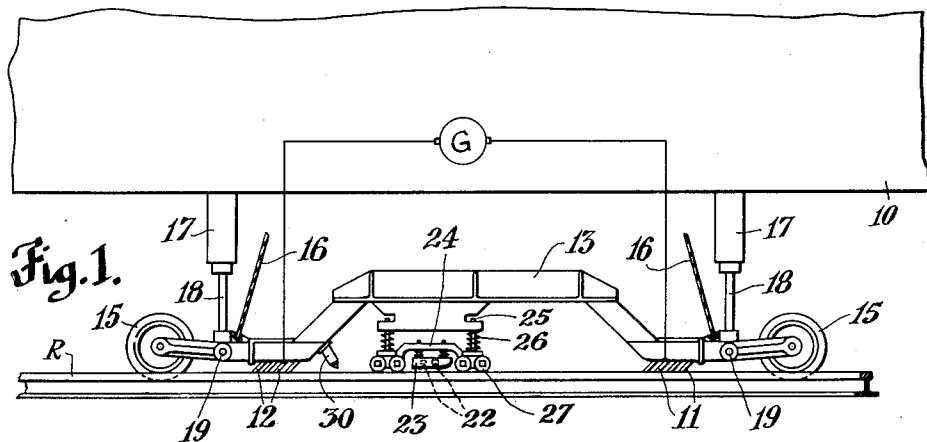
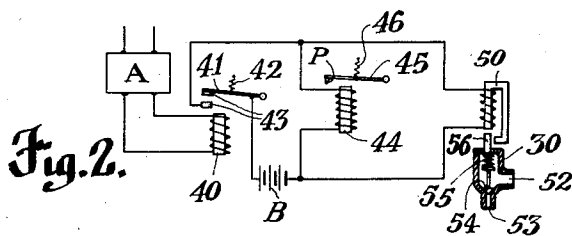
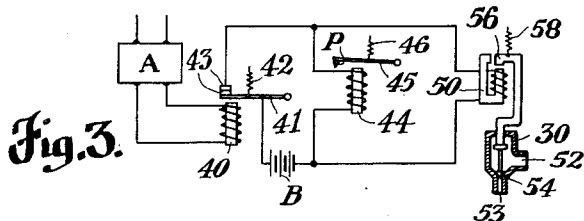
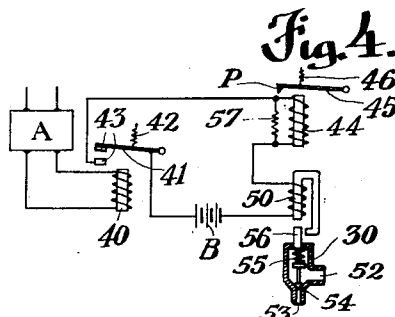
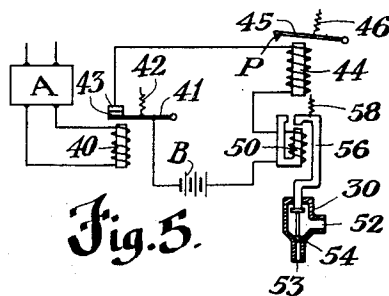
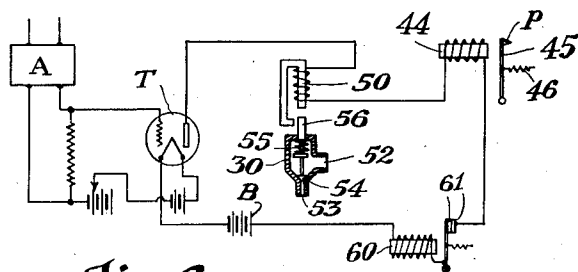


Fig. 6.

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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 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 6 inclusive are similar views, largely in the form of wiring diagrams, illustrating various forms of our 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 operated promptly in response to an impulse from the amplifier A and also that said paint gun shall cease operating as soon as the impulse has ceased. For this purpose we have provided various forms of our 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.

Heretofore the impulse from amplifier A was caused to actuate the marking means, in this case the paint gun, at the same time that the pen P was actuated. For this purpose a relay was provided in parallel with magnet 44 and said relay closed a circuit through the marking means magnet. This system had two disadvantages. In the first place, the interposition of a relay system caused a lag in the operation of the paint gun so that it did not respond as quickly as it should have. In the second case, the relay magnet and the pen magnet 44, being in parallel, were of such characteristics that when the contacts 43 opened, an inductive circuit was established between the relay magnet and the pen magnet 44 which caused the relay to continue to be energized and therefore to continue to close the circuit through the paint gun magnet, which resulted in energization of the paint gun after the contacts 43 had opened, that is, after the impulse from amplifier A in response to a flaw had ceased.

To obviate the disadvantages of the said known system, we have provided in the Fig. 2 form of the invention for the complete elimination of any relay system between contacts 43 and the paint gun operating magnet 50. To do this, we have placed the paint gun magnet 50 in parallel with the pen magnet 44. Further, we have provided that the paint gun magnet 50 shall have the following characteristics: low resistance, high current, and high inductance. When contacts 43 open, the high inductance of magnet 50 would ordinarily cause a current to be induced in the parallel circuit between magnets 44 and 50 which would keep magnet 50 energized and continue the operation of the paint gun after the contacts 43 had opened and the impulse from amplifier A had ceased. In order to obviate this condition, we provide for the following characteristics of magnet 44: high resistance, low current, low inductance. The high resistance of magnet 44 will prevent the surge of current from magnet 50 therethrough when the contacts 43 open. Thus it will be seen that we have provided for a system wherein the paint gun 30 is actuated as soon as pen magnet 44 is actuated, without any intermediate relay causing delay, and that said paint gun magnet 50 is de-energized completely as soon as contacts 43 open, thus limiting the length of the paint mark.

The paint gun may take the form shown in Fig. 2 where paint is ordinarily supplied from a source not shown to a port 52 leading to the discharge nozzle 53 which is normally held closed by a valve 54 pressed against its seat by means such as spring 55. The valve stem 56 forms an armature for the magnet 50 so that when the magnet 50 is energized the valve 54 is lifted and paint is discharged through nozzle 53.

In the Fig. 3 form of our invention we have shown a slight modification of the Fig. 2 form in the following respect: The contacts 43, instead of being normally open, are normally maintained closed and magnets 44 and 50 are normally energized. When an impulse passes through amplifier A in response to a flaw, contacts 43 are opened to de-energize magnets 44 and 50 to release the pen armature 45 to permit spring 46 to move the pen P on the chart. The de-energization of paint gun magnet 50 permits a spring 58 to lift the valve 54 from its seat. Said valve is normally maintained on its seat by reason of the magnet 50 attracting its armature 56 against the action of spring 58. This form is slightly more desirable than the Fig. 2 form since it relies upon de-ener-

gization of magnets which takes place somewhat quicker than energization because in energizing magnets a certain time elapses during which the current must build up.

In Fig. 4 we have disclosed still another form of our invention. The parts bearing numerals similar to the Figs. 2 and 3 forms of the invention are the same as in said forms. Instead, however, of connecting magnets 44 and 50 in parallel as shown in the Figs. 2 and 3 forms of the invention, we connect the said pen magnet and said paint gun operating magnet in series. This ensures simultaneous energization of magnets 44 and 50 as well as simultaneous de-energization, since no inductive circuits can be set up. A shunt 57 may be placed across magnet 44 since a larger current must traverse magnet 50 than magnet 44.

In Fig. 5 we have illustrated a slight modification of the Fig. 4 form of the invention. In this form the contacts 43 are normally closed to keep magnets 44 and 50 normally energized so that when an impulse from amplifier A opens contacts 43 the pen P and the paint gun are both actuated by the deenergization of magnets 44 and 50.

In the Fig. 6 form of the invention we have illustrated a slight modification wherein the impulse from amplifier A instead of operating magnet 40 to open and close contacts 43 discharges into a gaseous discharge tube T known as a Thyratron tube which has the property of passing plate current only when a predetermined voltage has been impressed on the grid. Thus, the tube will discharge always at a constant point in the output curve of amplifier A and the paint mark will be more accurately located with respect to the flaw. The discharge current from the plate of tube T energizes directly paint gun magnet 50 and pen magnet 44 which may be arranged in series with the tube T. To limit the operation of the paint gun, the plate current energizes a delayed-action magnet 60 to open a set of normally closed contacts 61 after the paint gun has operated for a predetermined period.

In accordance with the provisions of the patent statutes, we have herein described the principle and operation of our invention, together with the apparatus which we now consider to represent the best embodiment thereof, but we 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 our invention, what we claim and desire to secure by Letters Patent is:

1. In a rail flaw detector mechanism having means responsive to flaw, a pen magnet, a pen actuated by said magnet, a marking gun magnet, marking means controlled by said marking gun magnet, a direct parallel connection between said magnets whereby both magnets are simultaneously energized to actuate said pen and marking gun, and means whereby said responsive means controls the actuation of said magnets, characterized by said pen magnet being of high resistance, low current response and low inductance and said marking gun magnet being of low resistance, high current response and high inductance.

2. In a rail flaw detector mechanism having means responsive to flaw, a pen magnet, a pen

actuated by said magnet, a marking gun magnet, marking means controlled by said marking gun magnet, a direct parallel connection between said marking gun magnet and said pen magnet where-
5 by both magnets are simultaneously energized to actuate said pen and marking gun, and means whereby said responsive means controls the actuation of said magnets, characterized by said marking gun magnet being of relatively high in-
10 ductance and low resistance and said pen magnet being of relatively low inductance and high resistance.

3. In a rail flaw detector mechanism having means responsive to flaw, a pen magnet, a pen
15 actuated by said magnet, a marking gun magnet, marking means controlled by said marking gun magnet, a direct parallel connection between said magnets whereby both magnets are simultaneously energized to actuate said pen and marking gun, means normally maintaining both magnets energized, and means whereby said responsive means de-energizes said magnets in response to a flaw, characterized by said pen magnet being of high resistance, low current response and low in-

ductance and said marking gun magnet being of low resistance, high current response and high inductance.

4. In a rail flaw detector mechanism having means responsive to flaw, a pen magnet, a pen
5 actuated by said magnet, a marking gun magnet, marking means controlled by said marking gun magnet, a direct connection between said magnets whereby both magnets are simultaneously energized to actuate said pen and marking gun, said
10 flaw responsive means being adapted to generate an impulse when a flaw is encountered, means for amplifying said impulse, a relay actuated directly by the output of said amplifying means, and means whereby said relay directly controls said
15 direct connection between said magnets, characterized by said marking gun magnet being of relatively high inductance and low resistance and said pen magnet being of relatively low inductance and high resistance.

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