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RAIL FLAW DETECTOR MECHANISM

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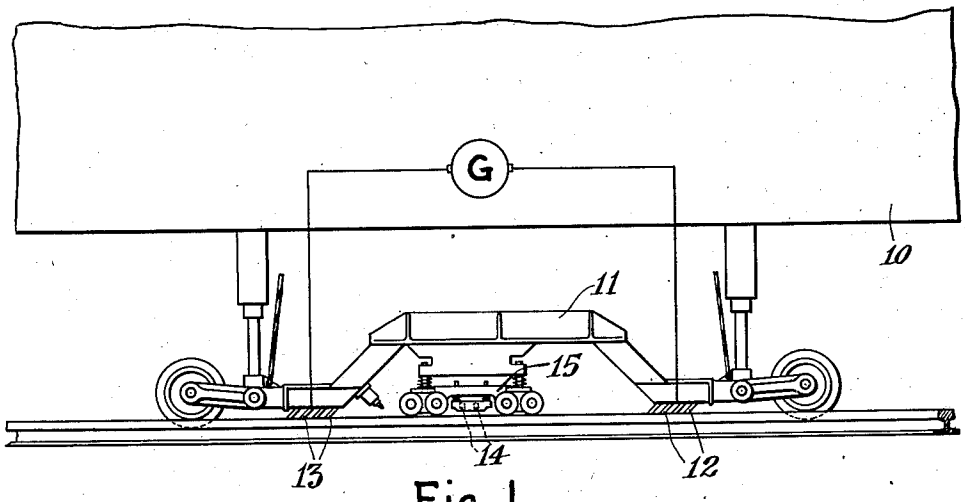


Fig. 1

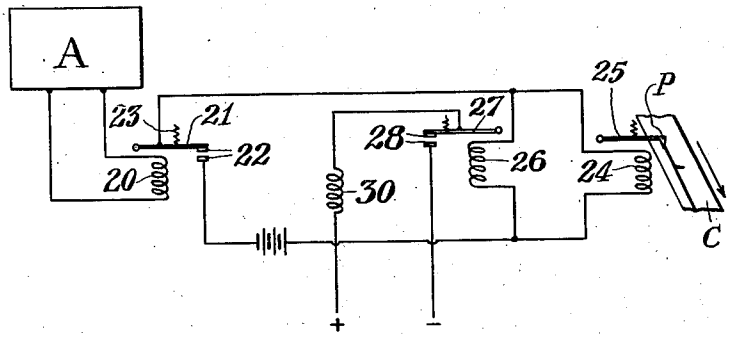


Fig. 2.

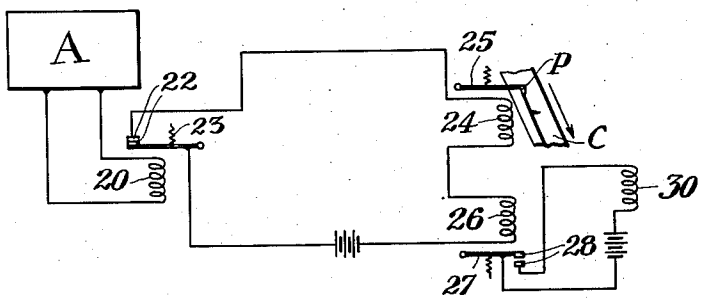


Fig. 3.

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RAIL FLAW DETECTOR MECHANISM

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3 Claims. (Cl. 177—311)

This invention relates to rail fissure detector cars adapted to travel over the rails in track and detect and mark for identification those rails having fissures or other internal defects. More particularly, the invention relates to the type of fissure detector mechanism embodied in the Sperry rail fissure detector cars. In said cars, the rail is energized, as the car travels along the track, by means of current passed therethrough to set up an electromagnetic field surrounding the rail, and any irregularities in said field due to internal defects are detected by means of a plurality of induction coils carried at a fixed distance above the rail. On entering a region of flaw one of said coils will cut a different number of lines of force from the other coil and this will generate a differential E. M. F. which after being suitably amplified may be caused to operate one or more indicating means. Such indicating means in the Sperry cars takes the form of one or more pens operating on a travelling chart to make a record thereon, and also a paint gun designed to discharge a quantity of paint at the region of flaw.

It is highly desirable that the paint mark discharged on the rail in the region of flaw be relatively small, on the order of two inches, since otherwise it has been found that where a paint mark extended for a considerable distance such as ten or twelve inches, it was frequently mistaken for a mark caused by an internal fissure positioned closely adjacent to said surface defect. It will be understood, of course, that in many instances a surface defect, such as a burn caused by slipping of the drivers of a locomotive, will operate the indicating mechanism in the same manner as an internal defect because such surface defect also causes displacement of the electromagnetic flux surrounding the rail and is picked up by the detector mechanism. If a short paint mark can be obtained, this paint mark will extend only within the limits of the surface defect, and should an internal defect appear in advance of or beyond said surface defect, even though closely adjacent thereto, such internal defect could be detected by reason of the fact that a second short paint mark would appear adjacent to the paint mark designating the surface defect. If, however, as is now the case, the paint gun discharges for a considerable period of time and causes a paint mark to be placed upon the rail extending for a distance of ten or twelve inches, in other words, extending beyond the surface defect and into the region of a possible adjacent internal defect, it is impossible for the operator to detect the internal defect because on looking from the rear of the car he sees the single large paint mark extending over the region occupied by the surface defect and adjacent regions. If, however, short paint marks could be obtained, then the operator at the rear of the car would see two paint marks in the region which at present is occupied by the single large paint mark and he could then distinguish the paint mark due to a surface defect from an adjacent paint mark due to an internal defect.

This invention, therefore, has for its principal object the provision of a rail operating marking means which will yield a relatively small paint mark on the order of one to three inches in place of paint marks now obtained which are relatively large on the order of ten or twelve inches or even more.

It is a further object of my invention to provide an arrangement as described above which will result in a quicker response of the rail marking mechanism than the marking means at present employed. In addition to speedier response, my device will also yield a mark on the rail of constant size regardless of the degree of energization of the flaw-responsive means.

It is also very desirable that the marks made by the pen on the travelling chart shall all be of equal size and also that said pen shall respond quickly when the flaw-responsive means encounters a flaw. Heretofore, the pen marks have varied in length depending upon the degree of energization of the flaw-responsive means, and also, there was a certain lag in the time between the energization of said flaw-responsive means and actuation of the pen. It is an object of my invention to provide an arrangement which will result not only in quicker response of the pen but also in a constant response to yield marks of constant length regardless of the degree of energization of the flaw-responsive means.

It is a further object of this invention to accomplish the above results with a minimum amount of change in the present Sperry mechanism.

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 elevation of a portion of a Sperry rail flaw detector car having my invention embodied therein.

Fig. 2 is a wiring diagram illustrating the principle of operation of the indicating means heretofore employed on Sperry rail flaw detector cars.

Fig. 3 is a wiring diagram similar to Fig. 2 but showing an arrangement constituting my invention.

Referring to Fig. 1 of the drawing, there is disclosed a portion of the car body 10 of a Sperry rail fissure detector car, from which is suspended the detector mechanism consisting essentially of a current brush carriage 11 having sets of current brushes 12 and 13 for supplying current to the rail from a generator G mounted within the car body. This sets up an electromagnetic field surrounding the rail and said field will be homogeneous except in the region of flaw, where it will be distorted. Such distortion may be detected by means of a pair of induction coils 14 supported on a carriage 15 at a constant distance above the railhead so that on encountering a region of flaw, first one and then the other of said coils will cut a different number of lines of force to generate a differential E. M. F. which after being amplified by an amplifier A may operate a pen P on a chart C to give an indication of the presence of a flaw.

Heretofore, said pen P was operated from the amplifier A by causing the output of said amplifier to energize a relay coil 20 which then attracted its armature 21 to close a set of contacts 22, said contacts being normally held open by spring 23, to energize a pen relay coil 24 which attracted its armature 25, said armature carrying the pen P.

At the same time that coil 24 was energized by the closing of contacts 22, the paint gun operating coil 30 was also caused to be energized by means of a relay coil 26, said coil 26 being in parallel with relay coil 24 and therefore simultaneously energized. Said coil 26 attracted its armature 27 to cause contacts 28 to close and energize the paint gun operating coil 30.

The system described above which has heretofore been in use on Sperry cars had several disadvantages among which may be listed, first, relative slowness of response; second, a paint mark on the rail of varying size, depending upon the degree of energization of the flaw responsive mechanism; third, a mark of relatively large size in the neighborhood of a foot or more in length which made it impossible to detect internal defects which were adjacent surface defects; and fourth, pen indications of variable length. The reason for these drawbacks is to be seen from an examination of Fig. 2. It will be noted that upon energization of coil 20 in response to a defect of some kind, contacts 22 were closed to energize the pen relay coil 24 and the paint relay coil 26. There was a lapse of time necessary for the contacts to close the gap between them and then for the current to build up in the pen relay coil and paint relay coil before the pen and the paint-gun could be operated. This period varied with the degree of energization of coil 20, so that not only was there delay in response of the pen and the paint-gun, but the degree of actuation varied with the degree of energization of coil 20. Thus, variable length paint marks were obtained on the rail and variable length pen marks were obtained on the chart, and on certain occasions where very short energization of coil 20 took place, there was noted failure of the pen relay coil and the paint relay coil to be excited even to a slight degree so that the pen and the paint gun failed to operate. When, however, the paint gun was energized due to the closing of contacts 22, it was found that excessively long paint marks were obtained on the rail, these marks ranging from one to two feet in length, so that a wide region was covered with a single mark which may have been due originally to a surface defect, but the size of the mark made it impossible to detect fissures in the immediate neighborhood of the surface defect. This was due to the fact that the coils 24 and 26 as shown in Fig. 2 were arranged in parallel and when the contacts 22 were opened the two coils and their connections provided a self-induction path, the induced current operating to continue the energization of the paint relay coil for considerable time after the contacts 22 were opened.

In Fig. 3, I have shown an arrangement wherein all of the above defects inherent in the pen and rail marking system heretofore employed are remedied. Referring to said figure, it will be seen in the first place that contacts 22 are normally closed and coils 24 and 26 are normally energized. When coil 20 is energized in response to a flaw the contacts 22 are broken to de-energize relay coils 24 and 26 which then release their armatures under the pressure of their springs. This action is immediate as soon as contacts 22 are opened and there is no elapsed time necessary for the contacts to traverse the gap nor for the coils to build up a flux. The circuit is broken instantly when the contacts disengage and the coils are deenergized immediately so that the spring-pressed armatures can be quickly withdrawn. The result is instantaneous response of the pen and the paint gun with no measurable lag.

Further, it will be seen from said Fig. 3 that instead of placing the pen coil 24 and the paint coil 26 in a parallel circuit, I have arranged them in series so that upon energization of coil 20 the pair of contacts 22 are broken to deenergize pen relay coil 24 which then permits its spring-pressed armatures to be released and cause the pen to make an indication. At the same time, paint relay coil 26 in series with pen relay coil 24 is deenergized to cause spring-pressed armature 27 to be withdrawn from coil 26 to close the contacts 28 to the paint gun coil 30. It will now be seen that opening of contacts 22 in response to a flaw deenergizes coils 24 and 26, but since these coils are connected in series there is no possibility of any prolongation of their action due to self-inductance since there is no closed circuit between coils 24 and 26. As a result, as soon as contacts 22 are opened coils 24 and 26 release their armatures instantly since the diminution of flux in said coils is such that the spring-pressed armatures quickly overcome the pull of said coils to release said armatures. As soon as contacts 22 are again made, coils 24 and 26 are energized to attract their armatures, thus deenergizing the paint gun coil 30 and returning the pen P to its original position. It will be seen that the deenergization of the paint gun relay operates on the break of contacts 28 and since there is no circuit for self-inductance of coil 26 the paint discharge is instantly stopped. It is therefore apparent that the initiation and cessation of operation of the paint gun are both controlled by the breaking of contacts 22 and 28 to give sharp definite control over said relay with no possibility of self-inductance. The result is a quick response of the paint gun to yield an extremely short mark on the order of two to three inches, of substantially constant length regardless of the degree of energization of coil 20.

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 mechanism, means responsive to flaw, a plurality of indicating means comprising a pen operating on a chart and rail marking means, an operating means for each of said indicating means, and means whereby said responsive means actuates said operating means, said last-named means including a normally closed electric circuit, said operating means being arranged in series in said circuit, and means whereby said responsive means opens said circuit in response to flaw.

2. In a rail flaw detector mechanism, means responsive to flaw, a plurality of indicating means, including rail marking means, and means whereby said responsive means actuates said indicating means, said last-named means including controlling means for each of said indicating means, said controlling means being connected in series in a normally closed electric circuit and means whereby said responsive means opens said circuit in response to a flaw.

3. In a rail flaw detector mechanism, means responsive to flaw, a plurality of indicating means, including rail marking means, and means whereby said responsive means actuates said indicating means, said last-named means including controlling means comprising a relay for each of said indicating means, said relays being connected in series in a normally closed electric circuit, and means whereby said responsive means opens said circuit in response to a flaw.

WALTER M. PERRY.