July 8, 1958 D. C. BETTISON ET AL 2,842,292

INDICATING MEANS FOR RAIL FLAW DETECTING APPARATUS

Original Filed July 23, 1948

Fig-1

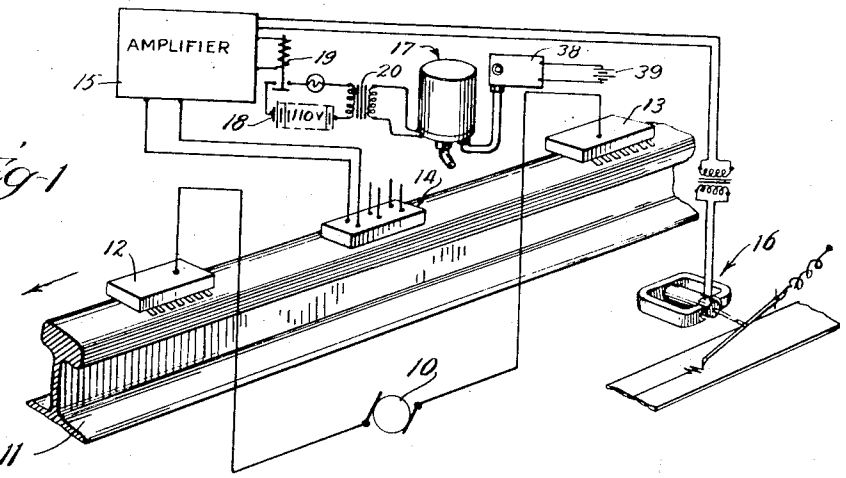


Fig-2

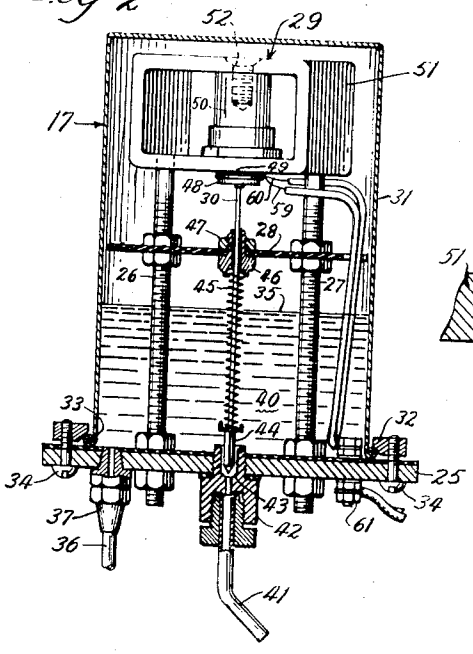
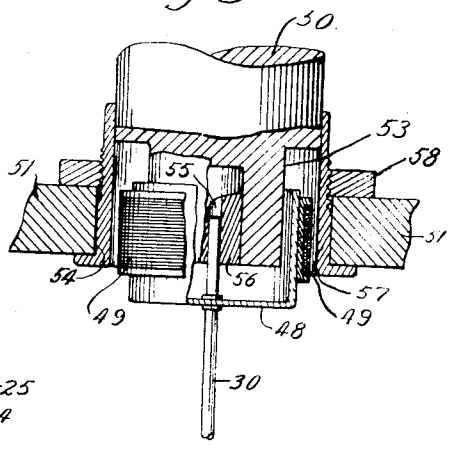


Fig-3



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INDICATING MEANS FOR RAIL FLAW DETECTING APPARATUS

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Original application July 23, 1948, Serial No. 40,278, now Patent No. 2,682,442, dated June 29, 1954. Divided and this application April 5, 1954, Serial No. 421,115

10 Claims. (Cl. 222—394)

This invention relates to apparatus for detecting flaws in rail, and is particularly concerned with the means for visually indicating the presence of a flaw.

Customarily, rail flaw detecting apparatus comprises a detector car which travels along the track and progressively energizes the rail, either by passing an electric current therethrough, or by longitudinally magnetizing the rail. In either case, the energizing of the rail causes magnetic conditions to be set up in the vicinity of fissures, and these are located by inductive coils that are moved over the surface of the rail head.

When a coil traverses a magnetic field such as is present in the vicinity of a fissure, a voltage wave is generated which is suitably amplified and then made to operate a pen unit associated with a moving tape, and this tape with its pen record is under the constant surveillance of the detector car operator.

To assist the car operator in correlating the pen record with rail conditions visible from the car, a paint gun is caused to operate concurrently with the pen to place a daub of paint or oil on the rail adjacent to the place causing the indication.

It is the principal object of this invention to improve the indicating means used with rail flaw detecting apparatus, and particularly the paint gun units which comprise a part thereof. More specifically, it is an object of the invention to cause these units to respond instantaneously to flaw impulses and produce a record or indication which facilitates the identification of flaws in rail.

A further object of the invention is to simplify the construction of the indicating means so that its initial cost is less and maintenance is reduced to a minimum.

These and further objects and advantages will become apparent as the disclosure proceeds and the description is read in conjunction with the accompanying drawings, in which

Fig. 1 is a diagrammatic perspective view showing the invention applied to the electro-inductive system of rail flaw detection;

Fig. 2 is a vertical sectional view showing a preferred form of a paint gun unit embodying the invention; and

Fig. 3 is an enlarged detail view showing the operating coil, and with parts of the view broken away to expose the structure beneath.

The choice of particular embodiments of the invention for specific illustration and description is merely a compliance with section 112 of title 35 U. S. C., and should not be construed as imposing unnecessary limitations on the appended claims.

Referring first to Fig. 1 which illustrates the invention applied to the electroinductive system of rail flaw detection, the generator **10** supplies a low voltage, high amperage current to the rail **11** by means of spaced current brushes **12** and **13**, and as the current brushes are moved along the rail in the direction indicated by the arrow, the rail becomes progressively energized to set up characteristic magnetic conditions in the vicinity of fissures.

A detecting unit, generally designated **14**, is mounted on the detector car between the curent brushes **12** and **13** and moves along the rail in close proximity thereto. The detecting unit comprises one or more induction coils (not shown), and these may be positioned either transversely of the rail or longitudinally thereof in a manner well known to the art. Ordinarily, the detecting coils are arranged in pairs connected in series-opposition so that variations in the current introduced into the rail will balance out in the detector coils, and only those magnetic conditions in the vicinity of fissures, or, in some cases, surface defects, will cause an impulse to be transmitted to the amplifying and recording apparatus.

Voltage impulses generated in the detecting unit **14** are passed through an amplifier **15** of suitable design, and the output of the amplifier is caused to operate indicating means comprising a pen unit, generally designated **16** (spring biased to center position), and a paint gun unit, generally designated **17**. For simplicity, only one amplifier, one pen unit, and one paint gun unit are shown in Fig. 1, but it will be understood that normally a detecting unit will comprise a plurality of sets of detector coils, each of which is channeled through its own amplifier and caused to operate its own pen in a gang pen unit. Ordinarily, only one paint gun unit will be employed on each side of the car (one associated with each rail), and the paint gun unit is so connected to the amplifier that an impulse delivered to the amplifier by any one of the sets of detector coils will cause the paint gun unit **17** to deliver a daub of paint or oil on the rail.

The paint gun unit **17** is preferably operated from a 110-volt direct current source as indicated at **18**, and a relay **19** connected into the plate circuit of the last tube of the amplifier or amplifiers closes the 110-volt circuit whenever any one of the detecting coil sets transmits a flaw impulse. The impulse set up in the 110-volt circuit upon the closing of the relay **19** is transmitted through a transformer **20** to the paint gun coil as will later be described.

All of this is conventional and need not be described further.

The paint gun unit **17** is shown in Figs. 2 and 3, and it comprises a base **25** from which rises a pair of studs **26** and **27** carrying a fibre disc platform **28** spaced from the base **25**, and also carrying at their upper extremities a magnet-coil unit, generally designated **29**, which serves to lift a plunger **30** momentarily in response to a flow impulse. A sheet metal housing **31** encloses the magnet-coil unit **29** and its associated structure, and is hermetically sealed by a clamping ring **32** which bears on the beaded rim **33** of the housing **31** and is clamped against the base **25** by screws **34**.

The housing **31** is filled to a predetermined level, as indicated at **35**, with paint or oil, and this is accomplished through a tubulature **36** having an appropriate fitting **37** for connection with the base **25**. Paint or oil is forced into the housing **31** from any suitable source, indicated diagrammatically at **38** in Fig. 1 and shown as including an auto pulse liquid pump having an electromagnetically actuated pumping diaphragm energized from a suitable source of electromotive force, as indicated at **39**. The pumping unit of the indicating liquid source **38** is designed to pump fluid until a predetermined head pressure is reached, after which the pumping stops until the head pressure is reduced below some predetermined smaller pressure. Since the tubulature **36** that delivers the indicating liquid **40** to the housing **31** is connected to the base **25** of the housing, the quantity of air in the housing is blocked from escape and remains permanently trapped. In this instance, the forcing of oil or paint into the housing **31** compresses the air trapped within the hous-

ing until a predetermined pressure is reached, say, six or seven pounds, and then the pumping stops. This results in the fluid 40 within the housing 31 being under a constant head pressure with the result that lifting of the plunger 30 will immediately cause fluid 40 to be ejected from the gun through a nozzle 41 having a suitable nipple connection 42 with the base 25. The nipple 42 has an internal seat 43 cooperating with a machined head 44 of the plunger 30 so that when the plunger is in its lower position, the interior of the enclosure 31 is sealed from the atmosphere.

The plunger 30 is normally held in its lower position by a compression spring 45 which extends between the head 44 and a guide collar 46 secured by a nut 47 to the platform 28. The plunger 30 is preferably a non-magnetic stainless steel rod or needle which carries the head 44 at its lower end and a cup-shaped, non-magnetic element 48 at its upper end with a coil 49 mounted firmly on the exterior of the element 48. Coil 49 cooperates with a magnetic circuit which comprises a strong permanent magnetic core 50 and a box-like soft iron pole piece 51. Core 50 may be secured to the pole piece 51 by a screw 52, and preferably its lower end is reduced, as indicated, at 53, where it passes through a circular opening 54 in the pole piece. The air gap between the pole piece 51 and the reduced portion 53 of the core 50 results in the coil 49 lying within a strong unidirectional magnetic field so that when the coil 49 is energized by the passing of a current therethrough, the magnetic field which it sets up coacts with the unidirectional magnetic field in the iron circuit (unidirectional in the sense that the poles 51 are of the same polarity, with the pole 53 of opposite polarity whereby the coil 49 when energized is subjected to a unidirectional force) to cause the plunger 30 to be lifted. Collapsing the field magnetism of transformer 20 causes a reverse current to flow through coil 49, thus forcing plunger 30 downwardly to close the paint valve 44. Spring 45 aids in closing the valve, and maintains the valve closed until the coil 49 is again energized.

The upper end of the plunger 30 is guided in a cylindrical recess 55 of a non-magnetic insert 56 fitted into the end of the core 50. In order to more accurately position the lower end of the core 50 within the opening 54 of the pole piece, a sleeve 57 may be fitted into the opening 54 to engage the core and fix its position. The sleeve 57 is made of non-magnetic material and is held in place by a nut 58 of like material.

The leads 59 and 60 from the coil 49 are suitably insulated from each other and connected to binding posts 61 on the base 25.

The operation of the paint gun in response to a flaw indication is obvious; energization of the relay 19 closes the 110-volt circuit, thereby causing an impulse to be delivered through the transformer 20 to the coil 49. This impulse momentarily causes the coil 49 to move upwardly translationally within the air gap, thereby unseating the head 44 and causing paint or oil to be ejected through the nozzle 41 by reason of the air pressure carried within the air dome or enclosure 31. The spring 45 immediately reseats the head 44 so that only a predetermined amount of paint is ejected for each energization of the coil 49.

Obviously, modifications in the structure of the paint gun unit will occur to those skilled in the art, without departing from the spirit of this invention.

This application is a division of our prior application, Serial No. 40,278, filed July 23, 1948, now Patent No. 2,682,442.

We claim:

1. Dispensing means comprising a hermetically sealed container adapted to contain an indicating liquid and a quantity of pressure fluid, said indicating liquid occupying the bottom portion of said container and said pressure fluid occupying the upper portion of said container, an outlet passage and associated valve seat formed in the bottom portion of said container such that said quantity of pressure fluid is permanently trapped in said container by said indicating liquid, a resiliently urged plunger mounted in said container and cooperating with said valve seat to block said outlet passage, magnetic means carried by said container, and cooperating means carried by said plunger and adapted to move relative to said magnetic means to unseat said plunger when one of said means is energized so that said indicating liquid is ejected under the pressure of said pressure fluid.

2. Dispensing means comprising a hermetically sealed container adapted to contain an indicating liquid and a quantity of pressure fluid, said indicating liquid occupying the bottom portion of said container and said pressure fluid occupying the upper portion of said container, an outlet passage and associated valve seat formed in the bottom portion of said container such that said quantity of pressure fluid is permanently trapped in said container by said indicating liquid, a resiliently urged plunger mounted in said container and cooperating with said valve seat to block said outlet passage, magnetic means carried by said container, and cooperating electromagnetic means carried by said plunger and adapted to move relative to said magnetic means to unseat said plunger when one of said means is energized so that said indicating liquid is ejected under the pressure of said pressure fluid.

3. Dispensing means comprising a hermetically sealed container adapted to contain an indicating liquid and a quantity of pressure fluid, said indicating liquid occupying the bottom portion of said container and said pressure fluid occupying the upper portion of said container, an outlet passage and associated valve seat formed in the bottom portion of said container such that said quantity of pressure fluid is permanently trapped in said container by said indicating liquid, a resiliently urged plunger mounted in said container and cooperating with said valve seat to block said outlet passage, magnetic means carried by said container, and cooperating electromagnetic means carried by said plunger and adapted to move relative to said magnetic means to unseat said plunger when said electromagnetic means is energized so that said indicating liquid is ejected under the pressure of said pressure fluid.

4. Dispensing means comprising a hermetically sealed container adapted to contain an indicating liquid and a pressure fluid, said indicating liquid occupying the bottom portion of said container and said pressure fluid occupying the upper portion of said container, an outlet passage and associated valve seat formed in the bottom portion of said container, a resiliently urged plunger mounted in said container and cooperating with said valve seat to block said outlet passage, and an operating coil rigidly carried by said plunger, said operating coil being mounted for substantially linear translational movement within the air gap of a unidirectional magnetic circuit whereby energization of the operating coil causes movement thereof relative to said magnetic field and unseats said plunger whereby said indicating liquid is ejected under the pressure of said pressure fluid.

5. Dispensing means comprising a hermetically sealed container adapted to contain an indicating liquid and a quantity of pressure fluid, said indicating liquid occupying the bottom portion of said container and said pressure fluid occupying the upper portion of said container, an outlet passage and associated valve seat formed in the bottom portion of said container such that said quantity of pressure fluid is permanently trapped in said container by said indicating liquid, a resiliently urged plunger mounted in said container and cooperating with said valve seat to block said outlet passage, magnetic means carried by said container, cooperating means carried by said plunger and adapted to move relative to said magnetic means to unseat said plunger when one of said means is energized so that said indicating liquid

is ejected under the pressure of said pressure fluid, and a source of indicating liquid including a pump connected to the bottom portion of said container and adapted to pump indicating liquid into said container until a predetemined head pressure is reached, after which the pumping stops until the head pressure is reduced below some predetermined smaller pressure.

6. Dispensing means comprising a hermetically sealed container adapted to contain a liquid under pressure, a source of fluid pressure above said liquid, an outlet passage and associated valve seat formed in the bottom portion of said container, a plunger slidably mounted in said container and cooperating with said valve seat to block said outlet passage, a permanent magnet having opposed concentric poles mounted within said container to provide a concentric air gap having a radially unidirectional magnetic field, and an operating coil rigidly mounted on said plunger and disposed within said air gap for substantially linear translational movement relative thereto, whereby energization of said operating coil causes movement thereof relative to said magnetic field to unseat said plunger so that said indicating fluid is ejected under the pressure of said pressure fluid and whereby deenergization of said operating coil causes reverse movement to seat said plunger.

7. Dispensing means comprising a hermetically sealed container adapted to contain a liquid under pressure, a source of fluid pressure above said liquid, an outlet passage and associated valve seat formed in the bottom portion of said container, a plunger slidably mounted in said container and cooperating with said valve seat to block said outlet passage, a permanent magnet having opposed concentric poles mounted within said container to provide a concentric air gap having a radially unidirectional magnetic field, an operating coil rigidly mounted on said plunger and disposed within said air gap for substantially linear translational movement relative thereto, whereby energization of said operating coil causes movement thereof relative to said magnetic field to unseat said plunger so that said indicating fluid is ejected under the pressure of said pressure fluid and whereby deenergization of said operating coil causes reverse movement to seat said plunger and spring means opposing movement of the plunger by said operating coil.

8. Dispensing means comprising a hermetically sealed container adapted to contain a liquid under pressure, and ejecting means comprising an operating coil, a plunger

rigidly secured to said operating coil, said operating coil being mounted for substantially linear translational movement within the air gap of a unidirectional magnetic circuit whereby energization of the operating coil causes movement thereof relative to said magnetic field, a source of fluid pressure above said liquid, and a valve operated by said plunger for ejecting fluid from the container whenever the operating coil is energized to a predetermined extent.

9. Dispensing means comprising a hermetically sealed container adapted to contain a liquid under pressure, ejecting means comprising an operating coil, a plunger rigidly secured to said operating coil, said operating coil being mounted for substantially linear translational movement within the air gap of a unidirectional magnetic circuit whereby energization of the operating coil causes movement thereof relative to said magentic field, a source of fluid pressure above said liquid, a valve operated by said plunger for ejecting fluid from the container whenever the operating coil is energized to a predetermined extent, and spring means opposing movement of the plunger by said operating coil.

10. Dispensing means comprising a hermetically sealed container, a quantity of pressure fluid permanently trapped under pressure in said container, indicating liquid in said container and subjected to the action of said pressure fluid, an outlet passage for said container and valve means therefor continuously subjected to said liquid, means for momentarily opening said valve, an inlet passage for said container continuously subjected to said liquid, and a source of indicating liquid including a pump connected to said inlet passage and adapted to pump indicating liquid into said container until a predetermined head pressure is reached, after which the pumping stops until the head pressure is reduced below some predetermined smaller pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 23,830	Mojonnier	May 18, 1954
44,873	Lynde	Oct. 22, 1864
1,892,826	Bettison et al.	Jan. 3, 1933
2,103,851	Jones et al.	Dec. 28, 1937
2,526,735	Duce	Oct. 24, 1950
2,623,766	Richard	Dec. 30, 1952
2,682,442	Keaton et al.	June 29, 1954

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,842,292 July 8, 1958

David C. Bettison et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 48, for "response to a flow" read -- response to a flaw --.

Signed and sealed this 23rd day of September 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

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