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MAGNETIC REED PROXIMITY SWITCH

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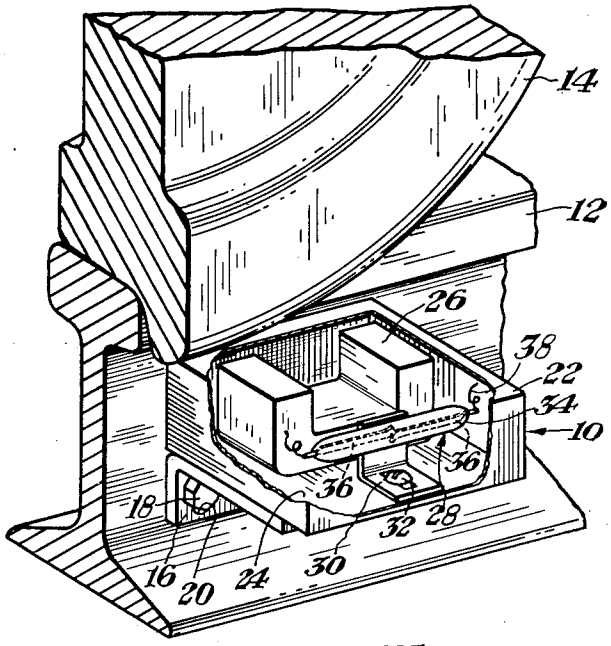


Fig. 1.

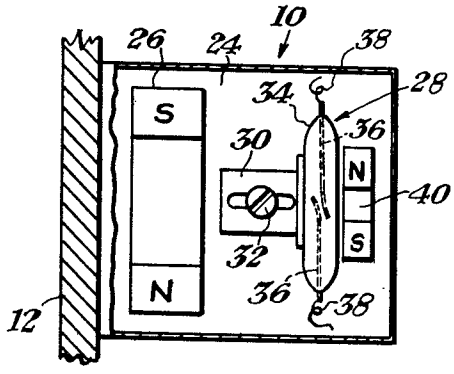


Fig. 3.

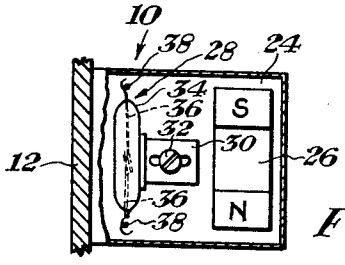


Fig. 2.

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MAGNETIC REED PROXIMITY SWITCH

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This invention relates to proximity detectors and, more particularly, to a detector which is influenced by the wheels of cars or trains passing along the rail.

Proximity detectors of the type comprehended by this invention find application in a variety of fields, notably in railway car detection and signaling systems. They comprise basically a magnetized assembly associated with the rail structure. This assembly usually includes a magnetized element mounted on one of the rails to form a magnetic circuit having a gap through which the wheels of a moving car pass and in so doing modify the condition of the circuit. This change in the condition of the circuit is, in turn, detected by various types of elements or devices which serve to actuate appropriate recording and/or indicating units.

In the fields of application of such devices, a number of factors are of major importance in determining the practical utility and economic suitability of the device. For example, among these important factors are small size, simplicity of structure, low manufacturing cost, facility of assembly and disassembly as for repair, replacement and maintenance. Prior art structures are not entirely satisfactory from the standpoints indicated.

One general object of this invention is to improve proximity detectors of the type noted.

More specifically, objects of this invention are to reduce the size of such devices, simplify the structure thereof, reduce the manufacturing cost, and enable ready assembly and disassembly.

A still further objective of this invention is to provide a magnetically operated proximity detector, the operation of which is independent of the speed of the object to be detected.

Generally speaking, the proximity detector embodying this invention, which is responsive to a passing permeable object, consists of a magnetically operated switch mounted in spaced relation to a source of magnetic flux which is arranged to project a first portion of its field into the path of the passing object and a second portion of its field through the magnetic contacting members of the switch, urging the contacting members into a closed actuated position during the absence of a permeable object within the first portion of the magnetic field. However, when the passing permeable object is within the first portion of the magnetic field, the second portion of the field is shifted away from the contacting members of the switch and toward the permeable object, thereby allowing the contacting members to assume an open deactuated position.

Other objects, purposes and characteristic features of my invention will become, in part, obvious from the accompanying drawings and, in part, pointed out as the description of my invention progresses, and reference is made to the accompanying drawings, in which similar reference characters refer to corresponding parts throughout the several views, and in which:

FIG. 1 is a perspective view of a rail onto which an embodiment of the invention has been mounted, with portions broken away to illustrate to better advantage certain details of construction;

FIG. 2 is a plan view showing a modification of the detector illustrated in FIG. 1, and

FIG. 3 is a plan view of another modification of the illustrative embodiment shown in FIG. 1.

The apparatus shown in connection with FIG. 1 relates to railway systems and the control of traffic thereon. However, it should be understood that the principles of the invention are of general application and their association with railway systems is shown only as a matter of convenience.

Referring to the constructional details shown in FIG. 1, the proximity detector 10 of the present invention is shown positioned adjacent the web of a rail 12 and is operated by the flange portion of wheel 14 of a passing railway vehicle.

The detector of the present invention is shown fixedly mounted on an inverted L-shaped bracket 16, the vertical leg of which is adjustably secured to the web portion of rail 12 by bolts 18 which pass through elongated openings 20 in bracket 16.

As shown, detector 10 is mounted on the horizontal leg of bracket 16 and is enclosed within a nonmagnetic housing 22 which is substantially water and dust proof.

The elements within housing 22 which make up the detector of this invention are shown mounted in spaced relation on a base 24, and consist of a U-shaped magnet 26 and a switch 28 fixedly mounted on the upstanding portion of an L-shaped bracket 30, formed of a nonmagnetic material such as brass, which is adjustably secured to base 24 by means of screw 32.

In the embodiment of the invention shown for illustrative purposes, the bight portion of magnet 26 is shown secured to base 24, as by welding for example, with its leg portions projecting upwardly. As a result, the main field of the magnet curves upwardly from one leg of the magnet to the other toward the head of rail 12 with a portion of the fringe area of the main field extending horizontally through switch 28. Preferably the magnet used is of permanently magnetizable material capable of being very strongly magnetized and having a high degree of retentivity. An example of a material which has these qualifications is the alloy of aluminum, nickel and cobalt sold commercially under the trade name "Alnico."

The switch 28 is a well-known type of magnetically controlled switching device, which generally takes the form of a cylindrical enclosure 34 of electrically insulating nonmagnetic material such as glass, surrounding a pair of reeds or electrical contacting members 36 extending into the enclosure 34 from opposite ends. Reeds 36, which are of magnetic material such as soft iron and may have precious metal contact surfaces, are positioned to overlap at their spaced inner extremities, the inner extremities, however, being normally biased apart by a small distance. Leads 38 are secured, as by soldering, to the outer extremities of reeds 36 and extend through housing 22 to an appropriate counting circuit and/or indicating device (not shown).

In accordance with the operation of the preferred embodiment of the proximity detector illustrated and described herein, switch 28 is adjusted and positioned on base 24 with respect to magnet 26 so that reeds 36 are in the path of the horizontal portion of the fringe area of the magnetic flux field established by magnet 26 so as to influence and thereby cause reeds 36 to close in the absence of permeable material within the main field of magnet 26 and to open during the presence of permeable material within the main field. This adjustment is made by vertical manipulation of detector 10 along the web of rail 12 and horizontal manipulation of switch 28 on base 24. When this adjustment is achieved, further vertical movement of detector 10 is prevented by tightening bolts 18 against bracket 16, and further horizontal movement of switch 28 is prevented by fixedly securing bracket 30 to base 24 by tightening screw 32.

When the proximity detector of the present invention has been mounted and adjusted in the manner shown and described, a magnetic circuit may then be traced, in the

absence of permeable material in the main field, between magnet 26 and switch 28, from one leg of magnet 26 across the air gap separating the elements, through reeds 36 and back through the air gap to the opposite leg of magnet 26. As a result of this arrangement and adjustment, reeds 36 of switch 28 are actuated to a closed, energized position.

When a permeable material, such as the flange of wheel 14 of a railway vehicle, is within the upwardly projecting main field of the magnet, the flux in the main field is increased because of the lower reluctance in the upper path, thereby shifting and weakening the strength of the horizontal fringe area through reeds 36 of switch 28 and allowing them to separate. The resulting interruption of current flow through switch 28 can then be detected by an appropriate indicating and/or recording device (not shown).

As wheel 14 moves along rail 12 and away from detector 10, the fringe area of the main magnetic field again shifts back to influence and thereby close reeds 36 of switch 28.

The illustrative embodiment of the invention just described and shown in FIG. 1 discloses a detector having reeds or contacts normally actuated to a closed condition in the absence of permeable material. However, other arrangements utilizing the underlying principles of construction and operation of this invention are possible and, depending upon the particular circumstances, perhaps even preferable.

Thus, for example, FIG. 2 shows an arrangement wherein the position of the elements in detector 10 are just the reverse of that shown in FIG. 1. In other words, in this modification, switch 28 is positioned on base 24 between rail 12 and magnet 26.

FIG. 3 illustrates another modification of the proximity detector described above which has a switch having reeds or contacts normally actuated to an open position in the absence of permeable material. The arrangement of the elements within the modified detector illustrated in FIG. 3 is substantially the same as that shown and described with respect to FIG. 1. However, in order to provide a detector with a normally open switch in the absence of a permeable object, a small permanent magnet 40, preferably U-shaped, is positioned adjacent switch 28 with its pole pieces projecting upwardly and arranged so that its polarity arrangement is the reverse of magnet 26. The strength of the flux field of magnet 40 should be sufficient to close reeds 36 when the fringe area of the main field of stronger magnet 26 is shifted and thus weakened during the presence of permeable material. In addition, switch 28 is so positioned on base 24 that the influence of magnets 26 and 40 on the switch offset each other and thereby allow reeds 36 to remain separated during the absence of permeable material within the main field above magnet 26. By having magnet 26 considerably stronger than magnet 40, a gap between magnet 26 and switch 28 may be provided to facilitate accurate adjustments without affecting the offsetting influence each magnet has on the other with respect to the switch.

When the permeable object to be detected is within the main upwardly projecting field of magnet 26, the weakening of its horizontal fringe area through switch 28 enables the weaker magnet 40 to close the reeds 36 of switch 28. When the permeable object passes and is no longer within the main field of magnet 26, the horizontal fringe area of the main flux field of the stronger magnet 26 then shifts back through the switch and again offsets the influence of magnet 40, thereby enabling the reeds 36 of switch 28 to separate.

As is apparent from the foregoing description, no source of power is required to control the operation of the detector. Furthermore, with the exception of reeds 36, there are no moving parts in the detector to wear out. Also, as a result of the comparatively high power handling capabilities of reed switches, no power amplification is generally required when the track instrument is used to drive other apparatus.

Although the present invention provides an instrument for, in effect, counting the axles of railway cars, it is to be understood that this form is selected to facilitate the disclosure of the invention and is not intended to limit the number of applications in which it may be employed. Moreover, it is to be further understood that various modifications, adaptations and alterations may be applied to the specific forms shown to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention.

Having thus described my invention, what I claim is:

1. A device responsive to the presence at a point along a predetermined path of a passing permeable object comprising, a housing including a base mounted adjacent said point, a U-shaped magnet mounted on said base and arranged to project its main flux field in an upwardly direction from said base into the path of said object, with a portion of the fringe area of said field extending horizontally from said magnet during the absence of a permeable object within said main field, a bracket mounted on said base in spaced relation to said magnet, and a magnetically operated switch secured to said bracket in juxtaposed relation to said U-shape magnet and actuated to a first condition when within a portion of the fringe area of said main field and to a second condition when without the fringe area of said field.

2. A device for detecting a permeable object passing along a predetermined path comprising, a base securely fastened adjacent said path, a magnetically operated switch mounted on said base and having a first actuated condition and a second biased condition, a U-shaped magnet positioned in juxtaposed relation to said switch and having its bight portion secured to said base with its legs extending upwardly therefrom projecting its main flux field into the path of said permeable object with a portion of the fringe area of said main field extending through and influencing said switch to a first condition during the absence of permeable material in said main field, said fringe area shifting away from said switch during the presence of permeable material in said main field enabling said switch to assume its second biased condition.

3. A device responsive to the presence at a point along a predetermined path of a passing permeable object comprising, a base mounted adjacent said point, a bracket adjustably mounted on said base, a magnetically operated switch secured to said bracket with its longitudinal axis substantially parallel to said base and actuable to a first condition and biased to a second condition, a U-shaped magnet positioned in juxtaposed relation to said switch and having its bight portion secured to said base with its leg portions extending upwardly therefrom projecting its main field into the path of said object with a portion of the fringe area of said field extending through and influencing said switch to its first condition during the absence of a permeable object in said main field, said fringe area being shifted away from said switch during the presence of said permeable object in said main field allowing said switch to assume a second biased condition.

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