

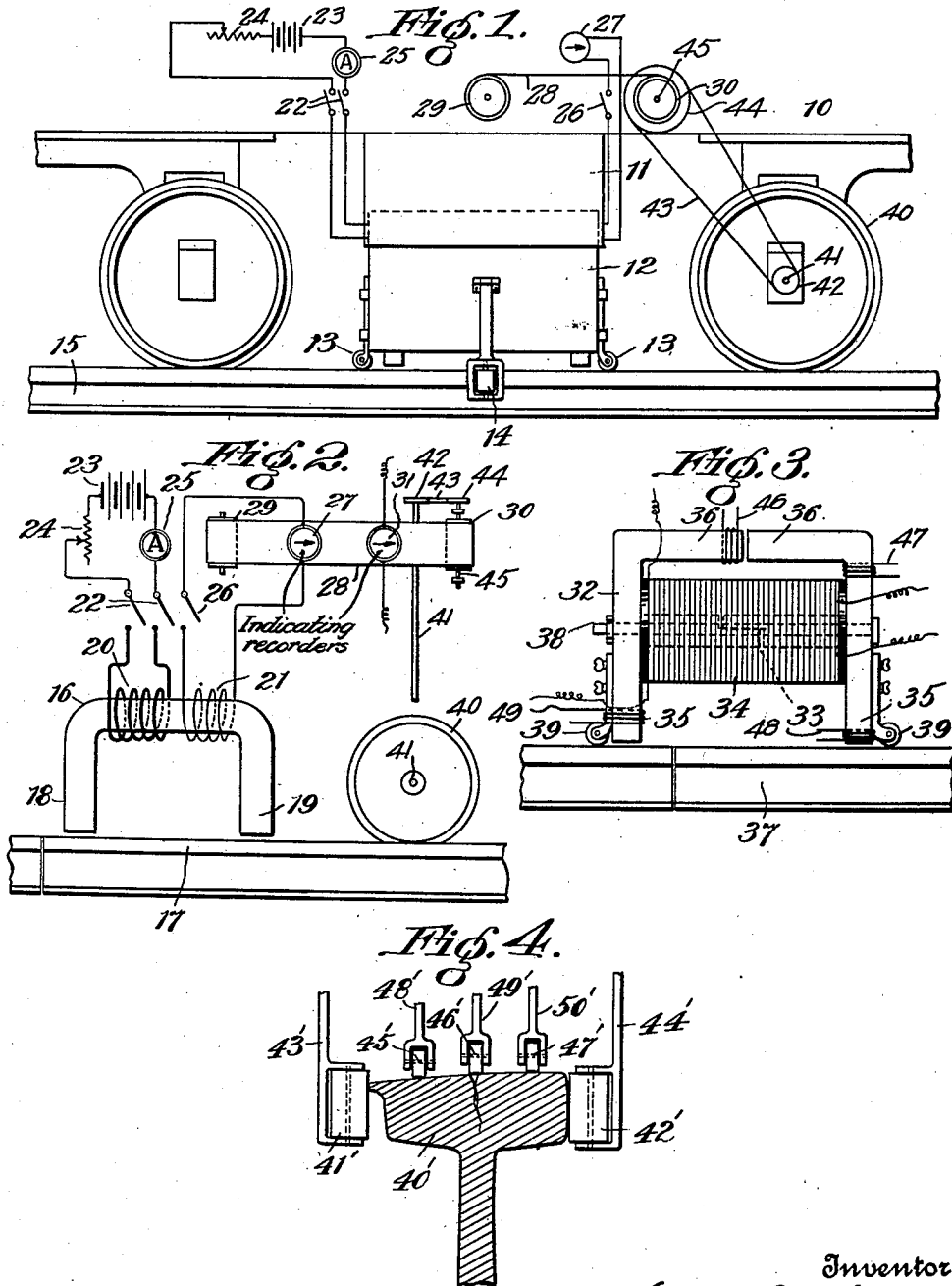
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RAIL TESTING APPARATUS

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RAIL TESTING APPARATUS

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This invention relates to rail testing apparatus and has for its main object to provide mechanism which can be carried by a railway truck or any desired conveyance along a rail whereby the surface of the rail under test will be traversed. By this invention the rail under test is traversed with a testing device giving indications capable of being recorded in any desired manner, according to the particular properties or conditions of the rail to which the testing device responds.

The particular object of this invention is to provide mechanism for testing the rail heads of a track at any time with great rapidity, and without altering the position of the rails as laid on the road bed.

The investigation of rails or other steel or iron members for internal defects by magnetic exploration with the aid of suitable electric apparatus has been the subject of experimentation for a considerable period of years, but earlier devices developed for this purpose were not of a practical character, the principal difficulty being that the testing process was too slow and that it could not be carried out on rails in track. The present invention provides a marked improvement in developments along this line by which a practical application to rails in track is made.

Various physical and chemical properties of the steel in rails alter their wear-resisting qualities; rails having flaws, or which are soft, or hard, etc., will have different wearing qualities; they are subject to cracking, splitting, crushing, breaking, etc., and in use the heads of the rails are affected most by the wear and are most apt to give trouble.

The apparatus disclosed in the drawings, hereinafter referred to, is primarily for traversing the heads of the rails for detecting these properties and conditions of the rails, and also for use in connection with other objects and materials.

By this invention, an electromagnet having a constant magneto-motive-force applied to it is passed along the head of the rail and the magnetic flux passing through the core of the magnet and rail head will vary to a certain extent according to the properties and conditions of the rail head; this variation in magnetic flux can be detected by means of test coils connected with indicating devices.

The invention also provides for testing for defects in the form of the rail head, due to wear and strain, by mechanical testing devices which traverse the surface of the rail head and are moved according to the shape the head has taken

due to the wear on it. Such a mechanical testing device is in fact mechanism for measuring the rail head, and it indicates high and low portions of the rail head, or variations in its width, thus giving a direct indication of the manner in which the rail has worn due to traffic over it.

Further objects and details of the invention will appear as described in connection with the accompanying drawings, and hereinafter set forth and claimed.

In the drawings illustrating the invention,

Figure 1 is a fragmentary elevation of a railway truck or detector car illustrating means for suspending a rail testing device adapted to traverse the surface of a rail.

Figure 2 is a diagrammatic representation illustrating a simple form of magnetic rail testing apparatus adapted to traverse the surface of a rail as shown in Figure 1.

Figure 3 is an elevation illustrating details of a magnetic testing apparatus adapted for use in testing rails.

Figure 4 is a fragmentary view of a mechanical form of a rail testing apparatus adapted to traverse the surface of a rail as shown in Figure 1.

In Figure 1 of the drawings the vehicle, truck or detector car, 10, is represented as being provided with a casing, 11, which may be suitably mounted on the truck frame between supporting wheels, in such a manner that it will act as a guide and carrier for the rail testing mechanism, 12. The rail testing mechanism is provided with rollers, 13, and 14, which engage the head of the track, 15, and its engagement with the casing is such as to permit it to ride on the rail in a substantially constant relation with the head of the rail.

Figure 2 is a diagram of a magnetic testing device for testing metallic bars, rails or the like in accordance with this invention. The magnetic testing device comprises a suitable iron core, 16, adapted to traverse the rail, 17, with its poles, 18, and 19, adjacent to the rail head, material or object.

The apparatus comprises an electro-magnetic induction device or transformer including primary and secondary coils, 20, and 21, respectively, suitably arranged on the core, 16. The primary, or magnetizing coil, 20, is connected by means of a switch, 22, with a source of electromotive force, 23, such as a storage battery; a regulating rheostat, 24, and ammeter, 25, may also be connected in the primary circuit. The secondary, or test coil, 21, which may be of a vari-

[illegible]

tion of the indicating instrument 27. The tape or chart 28 is moved in proportion to the movement of the truck being drawn by the roller 30 as previously set forth. Thus in the deflections of the instrument as represented by the position of its indicating member, there will be recorded upon the tape as it is moved, a record of the magnetic characteristics of the head of the rail. The result of such a magnetic survey of the rail by moving the apparatus along it and producing this record, is that defects in the rail head will be indicated by deflections from a straight line record, and if the record produced is a straight line, the indication is that the test piece is of homogeneous material and free from transverse fissures or other faulty portions.

The relative location of the rails under test may be indicated on a chart, or the tape, by marks made by a recording instrument 31, operated in any desired manner to show the distance passed over, etc., for facilitating reading of the indications on the tape. When the indicator is operated to mark the distance traversed, it merely marks the tape along its length in proportion to the distance passed over, since the tape is drawn from roller, 29, in that proportion by the driving connection between the truck wheel and roller, 30, and from there the tape is passed on and collected in any suitable manner until the test is completed. Other features, such as curves in the track, etc., may also be made of record on the tape.

As heretofore pointed out, defects in the heads of the rails are of greatest importance since they cause most of the trouble due to imperfect rails. It is for this reason that the invention is directed to the test of the heads of the rails, and as will be seen in the drawings the magnetic flux will be greatest in the rail heads, and, therefore, various characteristics of the heads will produce the indications thereof. If it is desired to test other portions of the rail, the form of the electro-magnet may be varied to accommodate itself to the particular portion of the rail to be tested.

It is obvious that the shape of the core of the electro-magnet may be varied, see Figures 2 and 3; it will also be seen that the primary and secondary coils need not be wound together, (preferably not), and they may be placed in any desired position; the secondary windings might be placed otherwise with respect to the rail under test, on any or all of the pole pieces, 35, 36, (see Figure 3), as indicated at 46, 47, 48, and 49 and any one or more may be properly connected for producing deflections of the indicating instrument corresponding with the changes in the magnetic flux in the rail heads.

The particular form of conveyance and supporting means may vary, as where the test is to be made with rails embedded, such guide rollers as 14, disclosed in Figure 1, could not be employed.

I do not wish to limit myself to any of the specific constructions or modes of operation described above in this specification for purposes of giving examples or illustrations of employment of the invention, for it will be obvious that wide departure from the above may be made without departing from the spirit and scope of my invention, which is as set forth in the following claims.

I claim:

1. In a flaw detector for rails and the like, a detector car, means for passing electrical energy between spaced points of said rail, means movable relatively to said rail for detecting variations in the electrical energy flow from point to

point, means for carrying and maintaining the detector in the same relative position with respect to the rail during a lengthwise movement of the detector and rail with respect to each other, and flaw indicating means carried by the car and actuated by said detecting means.

2. An electro-magnet for testing magnetizable objects having a U-shaped core adapted to be movably supported over the object, adjustable supports on the core for holding the pole faces at the proper distance above the object and for engaging the object, and a mounting for said electro-magnet for guidingly carrying it over the object.

3. An electro-magnet for testing magnetizable objects having a two-part core, a pole member on each part extending at right angles thereto, a pole member on each part also extending at right angles thereto and having their ends bent towards each other, and means for adjusting the two-part core in a manner to vary the distance between the ends of the last said pole members.

4. A magnetic testing device including a yoke member, pole members at each end thereof, said pole members each having a pole face extending to a common plane and each a pole face in parallel planes and facing each other, means for adjusting the position of the first mentioned pole faces with respect to an object being tested, and means for adjusting the space between the second set of pole pieces.

5. A magnetic testing device for rails including an electro-magnet movably supported with respect to a rail under test, means for causing movement of the device and rail with respect to each other lengthwise of the rail, and means for maintaining the device in the same relative position with respect to the rail during the lengthwise movement of the device and rail with respect to each other.

6. A magnetic testing device for rails including means for producing a magnetic field in a portion of the rail adjacent to and beyond which it is supported, means for moving the device and rail longitudinally of the rail with respect to each other and for maintaining the device in the same relative position with respect to the portion of the rail during the lengthwise movement, and a test coil for measuring variations in the magnetic flux produced in the portion of the rail under test while the device and rail are being moved with respect to each other.

7. Apparatus for testing material comprising a plurality of contacting members with their lower ends in spaced relationship over the material under test and adapted to bridge a portion of the material, means for measuring the character of the electrical energy therebetween, means for moving the testing apparatus along the material, and means for guidingly maintaining the same relative position of the testing apparatus with respect to the material during the movement of the testing apparatus with respect to the material under test.

8. In a vehicle, a transformer carried by the vehicle having a primary and a secondary winding, with an air gap for reluctance between the magnetic cores of said windings, all so arranged that when said vehicle carried transformer is brought into proximity with a magnetic element flux in said transformer core is diverted through said magnetic element and shunted from said secondary winding.

9. Apparatus for testing material comprising

a plurality of poles adapted to bridge a portion of the material, means for varying the distance between said poles, means for measuring the character of electrical energy therebetween, and
5 a plurality of rollers, said poles being mounted thereon so as to be supported in a movable relationship above the material under test.

10 10. An apparatus for testing rails, metallic bars and the like comprising an electro-magnet having a U-shaped core adapted for relative movement lengthwise of the rail to be tested, means for supporting said core above the rail and so as to space the core ends from the rail and in the same relative position with respect to the portion
15 of the rail under test during the lengthwise movement of the magnet with respect to the rail, and means comprising a winding and an electric indicating instrument connected therewith for indicating an electro-magnetic effect resulting from
20 the absorption by the rail of magnetic energy generated by the electro-magnet.

11. An electro-magnetic induction device for use in connection with magnetizable objects, having a core and downwardly extending poles, means
25 for supporting the core and poles over the object and maintaining the ends of the poles in a predetermined position with respect to the object during a lengthwise movement of the magnet with respect thereto, and an electrical circuit co-
30 operating with the electro-magnet and influenced by the relative movement between the magnet and the object.

12. An electro-magnet for testing magnetizable objects including a core, a pole member at each
35 end of the core extending at right angles thereto, a pole member at each end of the core also extending at right angles thereto, each having an end bent towards the other.

13. An electro-magnet for testing magnetizable
40 objects including a core, a pole member at each end of the core extending at right angles thereto, a pole member at each end of the core extending at right angles thereto, each having an end bent towards the other, and means for adjusting the
45 pole members at the ends of the core toward and away from each other in a manner to vary the distance between the first said pole members and also the ends of the last said pole members.

14. An electro-magnet for testing magnetizable
50 objects including a core comprising, a yoke, a pole member at each end of said yoke extending at right angles thereto and having pole faces at their outer ends in a common plane, means for adjusting said pole members toward and away from
55 each other in a manner to vary the distance therebetween, means for supporting the core with said pole faces in spaced relation with respect to the object under test, and means for moving the electromagnet with respect to the object.

15. Apparatus for testing materials for flaws
60 and the like including, a mounting movable relatively to the material, a testing device guidingly carried by said mounting and thereby maintained in a predetermined relationship, and means on
65 the testing device for engaging the material so as to permit the device to ride thereon in a substantially constant relationship with respect thereto.

16. In a wheeled truck mounted to move relatively along rails, apparatus for testing bars, rails, and the like for flaws including, a device
5 for testing the rails for flaws, means for guidingly carrying the device from the truck to maintain said device in a predetermined position with respect to the rails and to permit the device to engage the surface of the rails in a substantially
10 constant relationship as the truck and rails are moved with respect to each other.

17. Apparatus for testing rails laid in a track, comprising a flaw detector movably supported
10 above a rail under test, means for causing movement of the detector and rail with respect to each other lengthwise of the rail, and means for main-
15 taining the detector in the same relative position with respect to the rail during the lengthwise movement of the detector and rail with respect to each other.

18. In combination a vehicle carried trans-
20 former comprising a secondary with its core, a primary and its core in an intermediate position with respect to said secondary and its core, pole members extending downwardly from said pri-
25 mary core, and a stationary shunting means for magnetically shunting the secondary in the movement of the vehicle transformer with said downwardly extending pole members over the shunt-
ing means.

19. In a flaw detector for metal bars, rails, or
30 the like, means movable relative to the bar for introducing electrical energy into the bar between spaced points as said bar and means move relatively, a plurality of means for shunting a
35 portion of the electrical energy, and means for indicating variations in the electrical energy shunted through said second means.

20. Apparatus for testing rails, metallic bars
40 and the like in accordance with claim 17 in which supporting means for the flaw detector consists of a casing in which it is guided and carried, and rollers supporting the detector engaging the sur-
face of the rail head spacing the detector there-
from.

21. Apparatus for testing rails, metallic bars
45 and the like in accordance with claim 17 in which supporting means for the flaw detector consists of a casing in which it is guided and carried, and rollers mounted on the detector for engaging the
50 upper and side surfaces of the rail head which cooperate with said casing for maintaining a substantially constant relationship of the detector with respect to the rail head.

22. An apparatus for testing magnetizable ob-
55 jects comprising an electro-magnet having a U-shaped core adapted for relative movement with respect to the object to be tested, rollers mounted on the ends of said core and adapted to space the core ends from the object, means for adjusting
60 the rollers to vary the space between the core ends and the object, means for indicating an electro-magnetic effect resulting from the absorption by the object of magnetic energy generated by the
65 electro-magnet, and a mounting for said apparatus for guidingly carrying it over the object under test.

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