

UNITED STATES PATENT OFFICE.

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TESTING INSTRUMENT.

1,104,753.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HAMILTON BALUSS, a citizen of the United States, residing in Kennett Square, Pennsylvania, have invented certain new and useful Improvements in Testing Instruments, of which the following is a specification.

This invention aims to provide an improved apparatus adapted for testing electrical joints especially for testing the efficiency of rail bonds such as are commonly used for making electrical connection between the ends of railway rails.

A specific object of the invention is to determine whether any given rail joint is of less, greater or equal electrical resistance with respect to that of a predetermined standard.

The accompanying drawing represents, with the electrical parts in diagram, an embodiment of the invention.

Referring to the specific embodiment of the invention illustrated the rails A and B are connected by a bond C which is to be tested. This is done by passing a current, independent of the propulsion current in the rails, which for the sake of distinction I call a main current, through the bond and shunting a part of the main current around the bond and comparing the relative strengths of the main and shunt currents. The contacts are made by means of a hand tool or holder and which may be used either with the electrical apparatus described or with various other electrical apparatuses. It comprises four contacts D, E, F and G arranged in pairs; the first two, for engagement with the rail A, being carried on a short holder H of wood or other non-conducting material and the second pair F and G, for the rail B, being carried by a similar holder J. A bar K also of wood or other non-conducting material is provided with a handle L and carries the two shorter bars H and J, each of these being connected at an intermediate point of its length through a link M with the long bar K. By means of the handle L the operator can shift the contact holder easily so as to place it in the correct position upon the rail. By bearing down on the bar K the two shorter bars are pressed down and the link serves as an

equalizer to distribute the pressure to the contacts of each pair. The several contacts D, E, F and G are connected by wires H, O, P and Q to mechanism carried in or upon a box R which is thus flexibly connected with the contact holder so that the operator may sling the box over his shoulder and carry the contact holder in one hand and thus proceed rapidly from joint to joint as well as quickly pick up the apparatus and set it down. The contacts may be of any suitable form and material and attached in any suitable way to their supporting bars. They are preferably sharp steel points, the shanks of which are screwed or bolted into the bars. The pivotal connection of the bars H and J to the long bar K equalizes any differences in the level between the tops of the two rails.

The box R carries a primary battery S, preferably of two or three dry cells; and the battery is in a circuit comprising a magnetic interrupter, such for instance, as a small buzzer T, a switch U, wire Q, contact G, the rails and the bond, contact D and wire N; the contacts D and G being called the main contacts. The magnetic interrupter is a simplified construction of an electric buzzer which rapidly interrupts and remakes the circuit, and produces a magnetic field. Adjacent to it is an induction coil of the type used for telephones and comprising an adjustable iron core V, a primary coil W and a secondary coil X in circuit with a telephone receiver Y, the latter being connected either permanently or by binding posts to which it is attached. The primary W of the induction coil is in circuit through a switch Z with the wires O and P so as to form a shunt around the bond by way of the contacts E and F. The telephone may be provided with a headpiece for securing it to the operator's ear, or not, as desired. The several switches of the apparatus may be placed upon the box or at any other convenient point.

The direction of flow of the current in the main and shunt circuits is as follows: Assuming that the current in the main circuit flows from the battery to the interrupter, it then passes through switch U, the wire Q, contact G, rail B, bond C, rail A, contact D and wire N back to battery. In the shunt

circuit, the current splits from the main circuit at F, passes through wire P to the primary of the induction coil W, switch Z and wire O to contact E, rail A, contact D and wire N of the main circuit.

The instrument is not designed to give the ohmic resistance, but merely to determine whether the resistance is greater or less than a standard amount for which the instrument is adjusted. This may be illustrated by the manner of adjusting the instrument. The instrument is put in position upon a joint whose resistance is as high as is permissible without rebonding. This is referred to herein as the standard of resistance. While upon such a joint of standard resistance the instrument is calibrated as hereinafter described until the volume of the sound (not the tone) is equal when the switch Z is open and when it is closed. This is readily determined by a few trials. If the instrument is placed, after adjusting, upon a joint of less resistance than the standard the sound with the switch Z closed is fainter, than with such switch open. If placed upon a joint of greater resistance than the standard the sound is greater with the switch Z closed.

The reasons why the sound, with the switch Z closed, is greater (relatively to the sound with the switch open) for a joint of greater resistance, and fainter for a joint of less resistance, are the following: with the shunt O, P open at Z, the only sound produced by the receiver Y is that due to the action of the stray magnetic field of the buzzer on the induction coil, and this sound will remain nearly constant (with the shunt O P open) on all joints which are not entirely open-circuited. On the other hand, supposing the shunt O, P closed at Z, a part of the current passes through the induction coil W, the direction of the shunted circuit having been hereinbefore described and indicated by arrows on the drawing. In case the rail joint is reasonably well bonded, the joint substantially short circuits the contacts E and F and allows only a small portion of the total amount of current to pass through the induction coil W. This is so because the wire conductor portion of this shunt circuit offers a high resistance compared to that of a well bonded rail joint. With the switch Z closed, therefore, a current will be passing through the buzzer circuit and also through the transformer circuit, and while the current passing through the transformer circuit may be small, it would still have a very decided effect upon the secondary of the induction coil, as compared with the effect thereon of the flux due to the buzzer. In other words, the effect of the induction coil, with even a very small current, is

greater than and is opposed to the effect of the buzzer, wherefore the induction coil predominates, and the sound produced with the switch Z closed is due to the predominant effect of the induction coil over that of the buzzer. When the switch Z is open, the sound is due to the effect on the induction coil of the flux produced by the buzzer.

To calibrate the device, it is placed upon a joint having a predetermined resistance, which will be known as the standard resistance. The buzzer, being flexibly mounted and connected with the main circuit, is then moved into various positions until the volume of the sound (not tone) is the same with the switch Z open as it is with the switch Z closed. If this position is not found in a minute or so, then the connections of the buzzer are reversed, and when the buzzer has been placed in such a position that the volume of sound with the switch Z closed is equal to the volume of sound with the switch Z open, then all the electrical connections are correct, and the instrument is properly calibrated for a bond of predetermined standard resistance. It will now be quite apparent that the sound with the switch open is due entirely to the effect on the induction coil of the flux produced by the buzzer, while the sound with the switch Z closed is due, not to the cumulative effect of the current passing through the shunt circuit and the effect of the flux produced by the buzzer, but to the predominant effect of the current passing through the induction coil over and in opposition to that produced by the flux of the buzzer. It will be understood that if the effects of the induction coil and of the flux produced by the buzzer were cumulative, then no point of equal volume of sound could be found, because when the switch is closed the volume of sound would always be increased and would always be greater than that due to the effect of the buzzer alone. Besides moving the buzzer, the instrument may be calibrated in other ways. For example, by turning the induction coil V, W, Z into various positions with respect to the buzzer, or by varying the distance between the buzzer and the induction coil, which adjustments will change the amount of induction in the secondary coil from the action of the buzzer and will change the sound of the receiver. The same effect can be brought about by placing a damper α or thin sheet of iron between the buzzer and the induction coil and shifting its plane with respect to either the buzzer or the coil. The induction coil can be adjusted by shifting the core V or in any other usual or suitable way.

Another and very simple method of varying the effect of the buzzer on the induction coil is to provide a second buzzer T' with a

switch U' (the switches U and U' being separately operable) the second buzzer being designed to have a different effect upon the induction coil from that produced by the first buzzer; and switching in either buzzer or both, according to need. Where a second buzzer is not to be used there is no need for the switch U since the buzzer T may be permanently connected to the wire Q. The sensitiveness of the instrument can be further varied by varying the number of electrical cells in the circuit or by making the receiver more or less sensitive.

In using the present instrument, it is placed in position, as illustrated in the drawing, with the contacts G and F on one rail, and the contacts E and D on the abutting rail. The switch Z being open, the telephone receiver Y is placed to the ear and a mental note is made of the volume of sound produced by the receiver. The switch Z is then closed and the sound given off by the receiver Y is again noted. If the volume of sound with the switch Z open is the same as with the switch Z closed, then the bond C is of standard resistance, because the instrument has been calibrated to produce equal volumes of sound with the switch Z open and closed when applied to a joint having a bond of standard resistance. If, however, the volume of sound produced with the switch Z closed is greater than that produced with the switch Z open, then the bond is of greater resistance than standard, for the reason that, with the bond of greater resistance, a larger amount of current will be shunted through the circuit O, P, and consequently the predominating effect of the induction coil will be greater and the sound given off by the telephone receiver Y will be greater. On the other hand, if the sound given off by the receiver Y is less with the switch Z closed than with the switch Z open, the bond C is of less resistance than standard, for the reason that the resistance of the shunt circuit O, P being greater than the resistance of the rail bond C, a smaller amount of current will pass through the shunt circuit O, P than with a bond of standard resistance, and consequently the predominating effect of the current passing through the shunt circuit on the induction coil over that produced by the flux of the buzzer is less than with a bond of standard resistance.

The connections of the handle L to the bar K near its end leaves the middle free so that the operator can put his foot on it and press with substantially his whole weight on the contact, a good connection at the several points being of considerable importance.

An important advantage of the invention lies in the fact that the instrument is self contained and does not depend upon any return current in the rail; in other words, it

can be used whether or not a return current is flowing and whether such a current be continuous or alternating.

Though I have described with great particularity of detail certain specific embodiments of my invention, yet it is not to be understood therefrom that the invention is restricted to the complete apparatus specifically described. Various modifications, therefore, in whole or in part may be made by those skilled in the art without departure from the invention.

What I claim is:

1. A testing instrument for rail bonds and the like comprising means for passing a main current through the bond, means for shunting a current around the bond, and a telephone receiver actuated differently by the two different currents.

2. A testing instrument for rail bonds and the like comprising means for passing a main current through the bond, means for shunting a part of the main current around the bond, an interrupter actuated by the main current for generating a magnetic field, a telephone receiver having a circuit passing through said magnetic field and an induction coil in the circuits of the shunt current and the receiver.

3. A testing instrument for rail bonds and the like comprising a circuit in which is an interrupter adapted to generate a magnetic field, rail contacts for said circuit, another circuit passing through said magnetic field, rail contacts for said other circuit, an indicator in operative relation to the two circuits, and means for adjusting the effect of said interrupter upon said other circuit.

4. A testing instrument for rail bonds and the like comprising a circuit and an interrupter therein for generating a magnetic field, rail contacts for said circuit, another circuit passing through said magnetic field, rail contacts for said other circuit, a telephone receiver in operative relation to the two circuits, and means for adjusting the effect of the interrupter upon said other circuit.

5. A testing instrument for rail bonds and the like including four contact points in pairs, a separate holder for each pair and a bar to which an intermediate point of each holder is pivotally attached.

6. A testing instrument for rail bonds and the like including four contact points in pairs, separate holders H and J, one for each pair, a bar K having a handle and having a pivotal connection to each of the holders H and J at an intermediate point of the length of the holder.

7. A testing instrument for rail bonds or the like comprising an induction coil, wires for connecting said coil between points at opposite sides of the bond, a battery, means

for generating a magnetic field and wires
for connecting said battery and said means
for generating a magnetic field between
points at opposite sides of the bond, said
5 induction coil being in position to be in-
fluenced by said magnetic field.

8. A testing instrument for rail bonds or
the like comprising an induction coil, wires
for connecting said coil between points at
10 opposite sides of the bond, a battery, means
for generating a magnetic field and wires
for connecting said battery and said means
for generating a magnetic field between
points at opposite sides of the bond, said
15 induction coil being in position to be in-
fluenced by said magnetic field connected
to said wires and a holder carrying said con-
tacts.

9. A testing instrument for rail bonds or
20 the like, comprising an indicator, two elec-
tric circuits in operable relation thereto,
and means controlled by the circuits for ac-
tuating the indicator to substantially the
same degree under the combined influence

of the circuits and under the influence of 25
one of the circuits when used upon the
bonded joint of standard resistance.

10. A testing instrument for rail bonds
and the like, comprising a main circuit hav-
ing rail contacts disposed to include the 30
rail bond to be tested, a shunt circuit to
shunt said main circuit with respect to the
rail bond, an indicator associated with the
two circuits for actuation thereby for indi-
cating the relation, above or below a stand- 35
ard resistance, of the resistance of the bond
being tested, and means to subject the indi-
cator to the action of one of the circuits
and also to the simultaneous action of both-
of the circuits. 40

In witness whereof, I have hereunto signed
my name in the presence of two subscribing
witnesses.

HAMILTON BALUSS.

Witnesses:

J. J. NILAN,
JOHN T. DOUD.