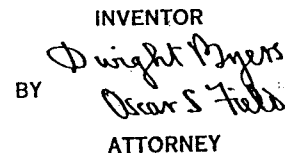


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## UNITED STATES PATENT OFFICE

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## MEANS FOR TESTING LEAKAGE THROUGH INSULATED JOINTS

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This invention relates to methods for detecting leakage through insulated joints such as joints used for insulating the block sections on railroads. It also comprises particular means for accomplishing this result.

One particular object of the invention is to detect leakage through the joint without interference from current flowing in extraneous circuits.

Another object is to provide means whereby the apparatus may be adjusted to neutralize flux conditions set up by such extraneous circuits that may be adjacent to the joint being tested, whereby the above purpose may be accurately accomplished.

A further object is to provide means for causing a leakage current of pulsating or alternating characteristics to flow through the joint and detect the presence of same and its intensity inductively.

With these objects in view and such other objects as will be apparent from the following specification and claims, I will now proceed to describe the particular embodiment of the invention disclosed.

Figure 1 shows diagrammatically the application of the device to an insulated rail joint.

Figure 2 shows the relative location of the collecting coils to the insulated joint when in operation.

Figure 3 shows diagrammatically how interference from currents flowing in extraneous circuits may be neutralized or tuned out.

Referring to Figure 1, I have shown two sections of rail 1 and 2 respectively insulated from one another by means of an end piece 3 made of suitable insulating material and insulating parts 4 and 5 adapted to lay between the respective ends of the rails 1 and 2, and fish plates 6 and 7. The fish plates are held in place by means of proper bolts and nuts 8 which are provided with insulating bushings not shown. From this description it will be apparent that the rail section 1 is completely insulated from rail section 2 and it is the object of the invention to provide means to detect any leakage of current from one rail to the other.

The apparatus used for detecting this leak-

age comprises a source of varying current so marked on the drawing which may consist of an alternating current supply, or direct current caused to vary by means of a buzzer or other similar device. This current is caused to pass through wire 9 and wire 10 to a suitable clamp 11 connected to rail 1. Any current which leaks through the insulation of the joint will pass from rail 1 through the insulating material to rail 2 through a suitable clamp 12, wire 13, back to source of varying current, thereby causing a fluctuating flow of current through the insulated joint. It will be readily understood that the potential of this current may be so adjusted that an appreciable flow of current may be caused to pass through the insulated joint and thereby maintain an oscillating flow through this path. A transformer member composed of laminated cores 14 is provided which is furnished with a primary winding 15 energized from the same source of varying current through wire 9 through an adjustable current controlling device 16 to the coils 15 and back through wire 17, wire 13, to the source of varying current. A secondary winding 18 is provided on the transformer which is connected by means of wire 19 to telephone receiver 20 back through wire 21, strap 22, strap key 23, contact 24, wire 25 to the transformer.

It will be seen that I have thus provided a variable source of energy for the telephone receiver 20 of identical periodic characteristics with the current through the insulated joint, which will flow when contact 24 is closed by depression of the strap 23. By listening in at the telephone receiver 20, the intensity of this current may be judged and by operating the slide contact 25 it may be varied. A yoke member 26 is provided to bridge the insulated joint as shown and is pivoted at 43 in order that it may be flexibly adapted to varying types or sizes of conductors or rails to be tested. Pivottally mounted by means of pivots 39 and 40 at the extremities of the yoke arms 26 are laminated core flux collectors 27 and 28 respectively. These collectors are furnished with laminated cores 29 which pass through the coils 30 and are

furnished with extended pole pieces 31 which are adapted to face the joint to be tested. These coils are connected together by means of wire 32 in such a manner that current induced in them will act accumulatively and are in their turn connected across the telephone receiver 20 through wire 33, wire 34, contact 35, strap 22, wire 21, telephone receiver 20, wire 19, wire 36 and wire 37 back to the coils. It will be seen that when current flows from the coils 30 it will pass through front contact 35 of strap key 23 to the telephone receiver 20. The current which leaks through the insulated joint will set up a magnetic flux part of which will be collected by the laminated cores 29 and will pass through the coils 30, thereby setting up a fluctuating E. M. F. in these coils which will be impressed across the telephone receiver 20.

In order to operate the device, the procedure is as follows: The operator will first listen in the telephone receiver 20 to the current set up by the coils 30 due to the leakage current in the insulated joint. He will then depress the strap 22 of strap key 23, opening contact 35 and closing contact 24. This will disconnect the telephone receiver 20 from the coils 30 and will connect the receiver 20 to the secondary winding 18 of the transformer. By adjusting the contact point 25 along the resistor 16 this current may be caused to give the same tone in the telephone receiver as the original current received from coils 30. When the current flowing through the receiver 20 is the same whether the strap key 22 is depressed or not, it will be apparent that the current flowing in both circuits is equal and that the contact point 25 has taken up a definite position along the resistor 16 which will represent the leakage which is occurring through the insulated joint. The resistor 16 may be provided with a properly calibrated scale 38 from which this leakage may be directly read. It will be apparent that the calibrations on the scale may be so arranged that they will indicate either the actual resistance of the joint or the amount of current which is leaking through the same.

By referring to Figure 2 it will be seen that the flux collectors 27 and 28 are placed at the center of the insulated joint. By so placing the inductors it will be apparent that only the actual current flowing through the rail joint will be detected and that current leaking through the ground will have no impression on the device.

The laminated core magnets 27 and 28 are flexibly mounted on pivots 39 and 40 so that they may be turned at an angle to the joint. The purpose of this will be apparent by referring to Figure 3 of the drawing.

In Figure 3 I have shown a rail 41, the insulated joint of which is being tested, and a rail 42 which may be lying in proximity to

the rail 41 and parallel to the same. It will be apparent that if when making a test the fluctuating current should leak through the ground or go back through any other connections that may exist, and pass through rail 42, a flux will be set up around rail 42 as indicated by the dotted lines. It will be apparent that under these circumstances the flux collector 27 is in closer proximity to the rail 42 than the flux collector 28, and if both the magnets were parallel to the lines of flux the collector 27 would be saturated to a greater density than the collector 28, thereby causing the potential in coil 30 of collector 27 to be higher than the potential in the coil 30 of collector 28, thereby causing a false flow of current in the detection circuit to telephone 20. In order to correct this discrepancy the collector 27 may be tipped at such an angle that the flux flowing through the core 29 of the same will be reduced to the same density as the flux flowing through the core 29 of detector 28. Equal inductive effects in the collectors 27 and 28 can be determined by testing the coil on each core separately, and adjusting the position of the collectors until an equal effect is obtained from each coil in the telephone receiver. This condition may readily be detected by absence of noise in the telephone receiver.

It will be understood that while I have disclosed and described one particular embodiment of the invention, there are a number of modifications in the details of construction which can be made without departing from the spirit of the invention.

What I claim is:

1. In a device for testing insulated joints, means for impressing a fluctuating current across the joint to be tested, laminated core members provided with windings which are adapted to be inductively energized by flux set up by leakage current through the joint, means whereby said core members may be tilted to neutralize the effect of stray fields set up by conductors in proximity to the joint being tested, and a detector operatively connected with said windings whereby leakage through the joint may be detected without interference by stray fields of flux.

2. In a device for testing insulated joints, means for impressing a fluctuating current across the joint to be tested, laminated core members provided with windings which are adapted to be inductively energized by flux set up by leakage current through the joint, means whereby said core members may be tilted to neutralize the effect of stray field set up by conductors in proximity to the joint being tested, a detector operatively connected with said windings and responsive to the induced energy, means for impressing a secondary source of energy across said detector and means whereby the secondary source of energy may be varied whereby by comparison

between the primary and secondary energies the extent of the leakage may be determined.

3. A system for measuring the resistance of an insulated joint in a conductor, in which  
5 two accumulative windings of an exploring coil are placed in inductive relation to current flowing in the joint and so placed as to be neutralized with respect to magnetic fields set up in parallel conductors, a detecting  
10 device in the circuit of said coils for detecting the presence of the induced currents therein and means for comparing the effect of said induced current with that of a current flowing through a known resistance.

15 4. A system for measuring the resistance of an insulated joint in a conductor in which two coils are arranged to be placed symmetrically with respect to the joint and adjustably supported and in inductive relation  
20 to current flowing in the joint, said coils being connected accumulatively and a device connected in series with said coils for comparing the current flowing in said coils with an equal current of the same voltage flowing  
25 through a calibrated current controlling device.

5. In a device for testing insulated joints, means for impressing a fluctuating potential across the joint to be tested, laminated core  
30 members provided with windings which are adapted to be inductively energized by flux set up by leakage current through the joint, means whereby the effect of stray fields set up by conductors in proximity to the joint being  
35 tested may be neutralized, and a detector operatively connected with said windings whereby leakage through the joint may be detected without interference by stray fields of flux.

40 6. In a device for testing the insulation of joints in a conductor, the combination of a yoke member bridging the conductor, laminated cores pivotally secured for rotation relative to said conductor to the ends of said  
45 yoke so that they may be placed at right angles to each other, a winding on said cores and detector means associated with said winding for determining the current flow through said joint.

50 In testimony whereof, I have signed my name to this specification.

DWIGHT BYERS.

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