(No Model.)

J. W. HOWELL.

ELECTRICAL PRESSURE INDICATOR.

No. 480,947. Patented Aug. 16, 1892.

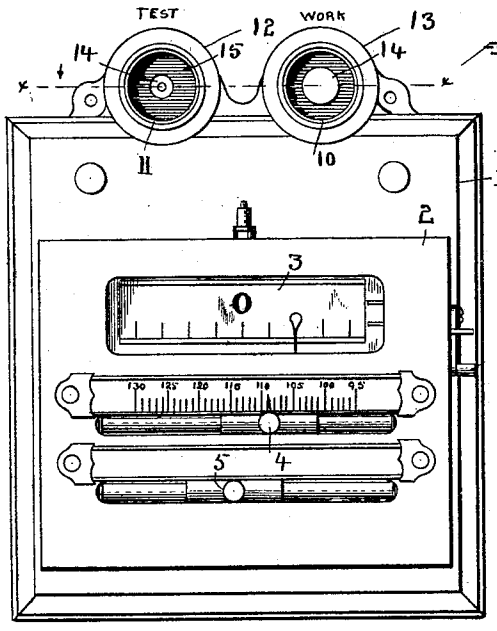

Fig. 1.

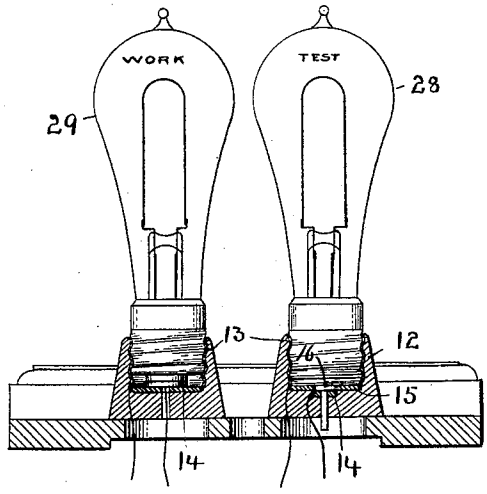

Fig. 2.

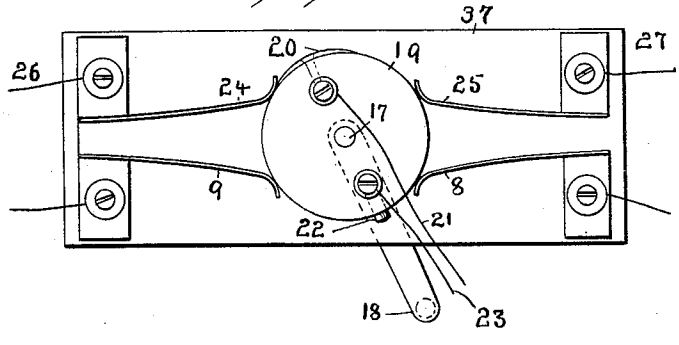

Fig. 3.

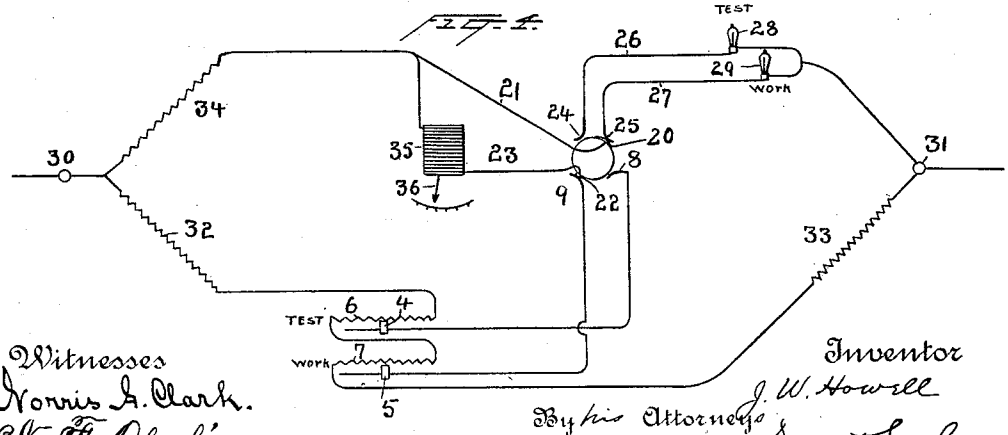

Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRICAL PRESSURE-INDICATOR.

SPECIFICATION forming part of Letters Patent No. 480,947, dated August 16, 1892.

Application filed January 2, 1892. Serial No. 416,791. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. HOWELL, a citizen of the United States, residing in Newark, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Electrical Pressure-Indicators, of which the following is a specification.

The present invention relates to electrical pressure-indicators, and more especially to that class now in general use, in which a series of balanced resistances are employed, one of said resistances being sensitive to changes in temperature, such variations serving to throw more or less current through the indicating-coil. Since the temperature is dependent on the current passing through said variable resistance, the position of the pointer moved by the indicating-coil shows the condition of pressure on the line.

My patent, No. 339,058, dated March 30, 1886, sets forth the general construction and operation of this class of indicators, and it is unnecessary to describe the same in detail in this specification.

The objects of the invention are to provide means for insuring correct indications and to simplify and improve the construction of this form of apparatus.

The invention consists, mainly, in an improved arrangement of work and test conductors, preferably incandescent lamps, and in improved circuit connections and controlling apparatus therefor, as hereinafter more fully described, and specified in the claims.

It is found in practice that the resistance of the filament of the work-lamp—that is, the lamp which forms the conductor sensitive to changes in temperature in the instrument as ordinarily used—changes, owing to electrical carrying and other causes, so that after the indicator has been used for a time as originally adjusted the indications given are incorrect and it becomes necessary to readjust the indicator, and in order to know whether such change has occurred it is necessary to provide means for testing, and, if so, to make the necessary adjustment to restore the balance of the system. I accomplish this by providing two lamps forming part of the indicator, one being the regular work-lamp and the other being a standard test-lamp for occasional use. I prefer to make the bases of these two lamps and also their sockets different from each other, so that the work-lamp can only be used in its socket and the test-lamp can only be used in its socket. The work-lamp socket will generally be an ordinary socket, while the other will be of special construction. The lamps may have distinctive marks or color, so that users may be sure to leave the test-lamp out of circuit, except during the momentary and occasional closures of circuit through it for the purpose of testing. Because the use of this lamp is so rare and for so brief a time its filament will maintain its initial resistance a long period of time, and will hence form a proper standard or test resistance. I provide a switch for throwing the work-lamp out of circuit and the test-lamp into circuit, which is adapted by a simple movement to first open the galvanometer-circuit and then the work-lamp circuit, and then to close the test-lamp circuit, and finally to again close the galvanometer-circuit. The purpose of this will hereinafter appear.

In the accompanying drawings, illustrating the improvement, Figure 1 is a face view of the apparatus. Fig. 2 is a section on line $x\,x$ of Fig. 1. Fig. 3 is an enlarged view of the switch, and Fig. 4 is a diagram illustrating the circuits of the indicator.

On the base 1 is mounted a box 2, within which the resistance-coils, the galvanometer-coil, and other working parts of the apparatus are mounted, and the particular construction of which need not be shown or described, since they are well known in the art. In the front of the box 2 is a sight-opening, through which the scale 3 can be seen, and through two slots in the front of the box project handles 4 5 of the sliders or contact devices, which serve to connect the galvanometer at one point when the work-lamp is in circuit and at another point when the test-lamp is in circuit. The resistances shown at 6 7 in the diagram are directly and continuously in cir-

cuit, the former being termed the "test-resistance" and the latter the "work-resistance." The movable device 4 is connected to the switch-spring 8, while the corresponding device 5 is connected to the switch-spring 9.

On the base at some convenient place I provide two lamp-sockets 10 11, the former being for the work-lamp and the latter for the test-lamp. The construction of the sockets is shown in Fig. 2, in which 12 are insulating-sleeves, within which are mounted two socket-terminals 13 14, against one of which the screw-threaded sleeve on the base of the lamp is adapted to make contact and against the other of which the end plug of the lamp is adapted to bear in the well-known manner. If lamps of other style than the Edison be employed, the sockets will be changed accordingly. In order to make it impossible to get the lamps in the wrong sockets, I so arrange the contacts that the ordinary work-lamp cannot be used in the test-socket, neither can the test-lamp be used in the work-socket. In the form illustrated this is accomplished by placing the contact 14 in the test-socket below the insulating-washer 15, which has a central opening over the plate 14, which opening is too small to receive the end plug of the work-lamp. The test-lamp, however, has an end plug or contact 16 of such size that it can pass through the central opening and bear on the plate 14. This lamp may also be provided with a smaller pin projecting from the end of the contact 16 and adapted to pass through an opening at the center of contact 14. Such pin would prevent the test-lamp from being used in the socket at the left. Other means for accomplishing this same object may be employed.

The switch which I prefer to use is illustrated in Fig. 3 and consists of an insulating-plate 37, at the center of which is a spindle 17, carrying a handle 18 and an insulating-disk 19. On the latter are mounted a long contact 20, to which the circuit-wire 21 is connected, and a short contact device 22, to which the circuit-wire 23 is connected. The springs 24 25 of the switch are connected by wires 26 27 to the test and work lamps 28 29, respectively. It will be seen from Fig. 3 that the contact 20 touches its spring 24 or 25 when the switch is moved before contact 22 touches its spring 8 or 9.

Referring now to the diagram, 30 31 are binding-posts connected to two points, between which the difference in potential it is desired to know.

32 33 are practically constant resistances, preferably wire coils, in one branch of the Wheatstone bridge and in series with resistances 6 7.

34 is a similar resistance in the other branch of the Wheatstone bridge and in series with the work or test lamp or conductor, according as the switch is in one position or the other.

35 is the coil of a galvanometer or similar apparatus, having an indicating hand or device 36.

As already indicated, the work lamp or conductor is used a great deal more than the test-lamp, and as a consequence its filament does not maintain the same resistance that it had when the indicator was first used. At intervals the person in charge of the indicator will move the switch from the position which it occupies in the diagram, in which the work-lamp is in circuit, to its second position, in which the work-lamp circuit will be open and the test-lamp circuit will be closed. In making this movement the contact-pin 22 first leaves the spring 9, opening the galvanometer-circuit. The long contact 20 then leaves the spring 25 and then comes in contact with spring 24. This closes the circuit through the test-lamp, and before pin 22 reaches spring 8 the lamp filament will be thoroughly heated, so that when the galvanometer-circuit is closed the bridge will be balanced, as it is adjusted for the resistance of the filament when hot. If the circuits through the lamp and galvanometer were closed simultaneously, the bridge would not be balanced, and the current resulting in the galvanometer branch would cause a large and sudden movement of the indicating-pointer. It is desirable to avoid such abnormal movements, in order that the readings can be quickly and correctly taken. When the test-lamp is thrown into circuit, as just described, if the hand 36 moves to the same point on the scale as it occupied when the work-lamp was in circuit, it will be evident that the resistance of said latter lamp has not changed since the indicator was first adjusted; but should the hand move to a different point on the scale it will show that the resistance has varied, and hence that the indications given by the instrument when the work-lamp was in circuit contained an element of error. To overcome this, the point to which the hand moves when the test-lamp is in circuit is noted, the work-lamp is then substituted, and the sliding galvanometer-contact 5 is adjusted until the pointer moves to the same position. This completes the readjustment of the apparatus, and it will be seen that the adjustment is made without varying the position of the galvanometer-contact for the test-lamp, but simply by adjusting the position of the galvanometer-contact for the work-lamp.

Without limiting myself to the details of construction shown, what I claim is—

1. An indicator having a resistance sensitive to changes of current and having another such resistance normally not in use, but reserved as a test-resistance, and a switch constructed to throw either one of these resistances in circuit and at the same time to change the galvanometer-contact from one point of connection to another, as described.

2. The combination, in an indicator of the character described, of a galvanometer, two ad-

justable galvanometer-contacts making contact at different points, and a work and a test resistance, one of said contacts being for the work-resistance circuit and one for the test-resistance circuit, substantially as described.

3. In an indicator of the character described, having two resistances sensitive to current changes, the combination, with said resistances, of a galvanometer and a switch constructed to throw one or the other resistance in circuit and at the same time to open and close the galvanometer-circuit, the changes being made in the order described.

4. The combination, in an indicator, of a conductor subject to changes of resistance and a practically constant resistance in one side of a Wheatstone bridge, two constant resistances in the other side of the bridge, a current-indicator connected between the two sides, an adjustable galvanometer-contact in use with the first-mentioned conductor, a constant test-conductor, means for substituting it for the changeable conductor, and an adjustable contact device in use with the test-conductor, substantially as described.

5. The combination, in an indicator having resistances sensitive to changes of current, of a work-lamp forming one of said resistances, a test-lamp normally out of use forming a second resistance, and two sockets for said lamps, each adapted to receive its lamp, but not to receive the other, substantially as described.

This specification signed and witnessed this 28th day of December, 1891.

JOHN W. HOWELL.

Witnesses:
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