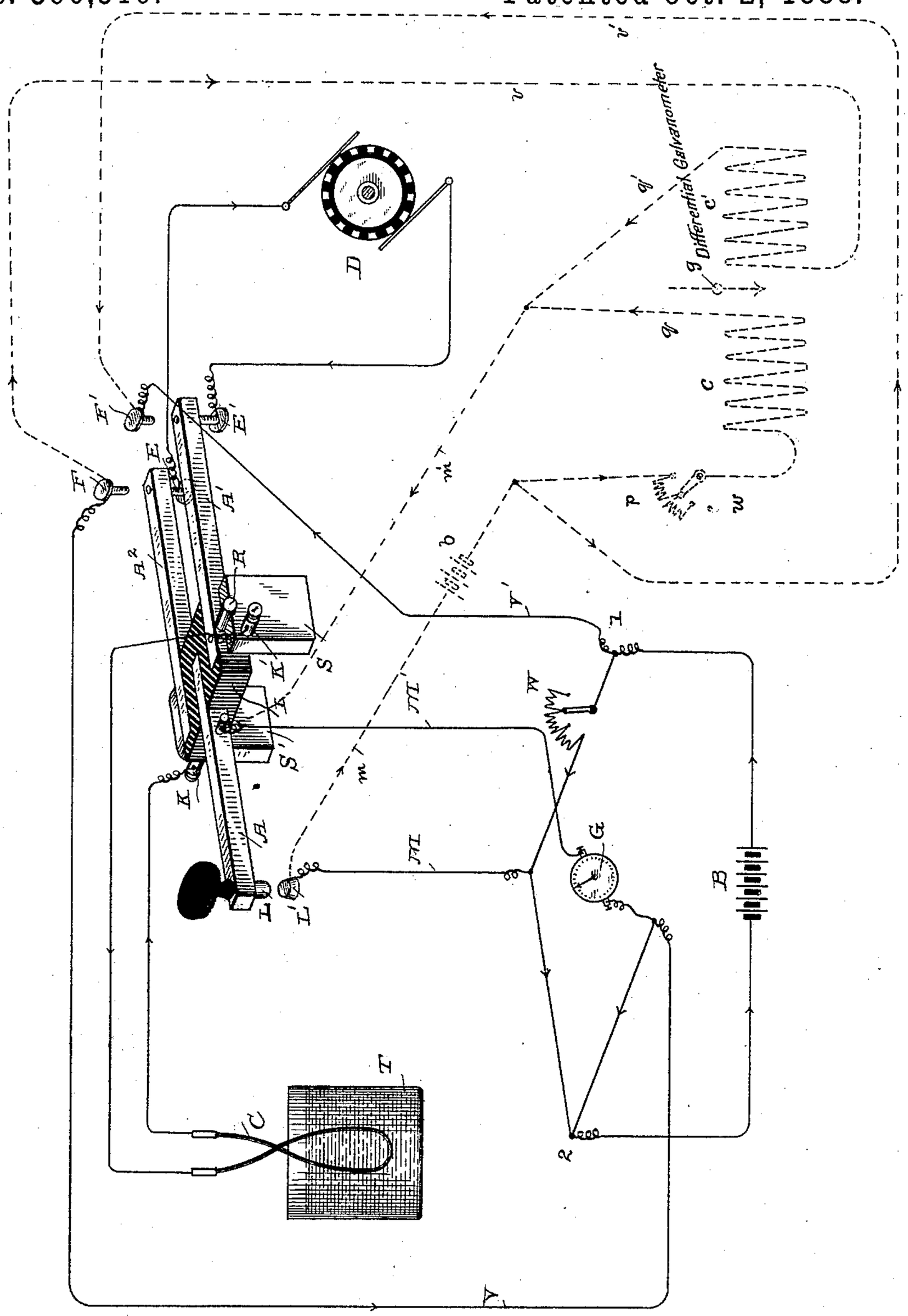
(No Model.)

J. W. PACKARD.

ELECTRICAL TESTING APPARATUS.

No. 390,310. Patented Oct. 2, 1888.



Witnesses
H. A. Lamb
N. W. Coffin

Inventor
James Ward Packard
by A. P. Smith
his Attorney

UNITED STATES PATENT OFFICE.

JAMES WARD PACKARD, OF NEW YORK, N. Y.

ELECTRICAL TESTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 390,310, dated October 2, 1888.

Application filed May 4, 1888. Serial No. 272,803. (No model.)

To all whom it may concern:

Be it known that I, JAMES WARD PACKARD, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electrical Testing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in a suitable arrangement of electrical circuits and contact-making devices by which a circuit which is being supplied with a current from any suitable source for the purpose of varying its resistance may be cut out from such source of current and thrown into circuit with a suitable testing device without moving any of the various parts of the apparatus other than the lever of the cut-out or switch.

The drawing represents my apparatus as it may be employed in the process of treating the carbon strips which are to be used in the manufacture of incandescent electric lamps. C is such carbon strip immersed in the carbon solution contained in tank T. From the dynamo D, or other suitable source of electricity, the current follows the direction of the arrow through the contact E′, the branch A′ of the cut-out lever, the trunnion R, the standard S, the binding-post K′, through the carbon C, back through the binding-post K, the standard S′, through its trunnion to the branch A^2 of the cut-out lever, and thence by way of the contact E to the other brush of the commutator of the dynamo

The passage of the current through the carbon C while the latter is immersed in the carbon solution in the tank T causes the carbon to deposit upon the strip, and thus increasing its cross-section it gradually diminishes its electrical resistance. It is desirable to test this electrical resistance from time to time without removing the carbon strip from the tank or receiver in which it may be placed. To do this I have devised the following arrangement of circuits and contact-making pieces, illustrated in the drawing, and now to be described.

To test the carbon in the manner desired, the operator presses down upon the button at the end of the branch A of the cut-out lever. This first raises the branches A′ and A^2 from off the contact-pieces E′ E, and thus cuts out the source of supply represented by the dynamo D. Continued movement of the cut-out lever brings the branches A′ A^2 against the contact-pieces F F′, thus throwing the carbon C into circuit with the connections V V′, which introduce the said carbon C into the circuit of one of the branches of the Wheatstone bridge, 1 2. In the other branch of the said Wheatstone bridge is an adjustable resistance, W, which may be set at that point to which it is desired to reduce the resistance of the carbon strip C. At the same moment that the branches A′ A^2 of the cut-out lever close the circuit by contact with the parts F F′ the part L, at the other end of the cut-out lever, touches the contact-piece L′ and closes the circuit of the galvanometer G through the connections M M′ and the branch A of the cut-out lever. The three parts A A′ A^2 of the lever are insulated one from another by the insulating-block I. The Wheatstone bridge is supplied by a suitable current from the battery B. Throughout the apparatus the current follows the direction indicated by the arrows.

It will be seen that while the testing portion of my apparatus is idle the circuit through the galvanometer is broken, and that such circuit is only closed at the very moment when the resistance which is to be determined is introduced into one branch of the Wheatstone bridge connection. Thus a galvanometer of the most delicate construction may be used, and its adjustment is not destroyed by continued passage of the current through its coils with the usual heating effect. Moreover, as the carbon strip is not removed during the operation, there is no possibility of breaking it, and if the process of varying its resistance has not been carried sufficiently far, as shown by the test, it is resumed without interruption by simply withdrawing all pressure from the button at one end of the cut-out lever, when the greater weight of the other end of the lever in the construction shown will cause it to assume the position shown in the drawings, and the source of current, D, will again be thrown into the circuit. Of course it would be possible to accelerate the action of the key or cut-out lever by means of a spring in the

usual way, which is too well understood to need illustration.

The carbon strip C and its connections leading to the cut-out lever I call the "work-circuit," while the dynamo D, or its equivalent, and its connections leading to the cut-out lever I call the "main-current-supply circuit."

While I have shown and described, as above, the adaptation of my invention to that particular arrangement of sub-circuits in shunt relation one to another, which constitute what is called a "Wheatstone bridge," it may evidently be applied to any arrangement of sub-circuits within the electrical or magnetic field of which a tell-tale or indicating device is placed. Thus in that portion of the figure drawn in dotted lines I have illustrated its application to another arrangement of sub-circuits which operate on the ordinary form of different galvanometer.

In the modification thus shown in dotted lines the current for testing purposes is supplied from the battery *b*. When the cut-out lever is pressed down, the current follows the respective directions indicated by the arrows. A part goes over the line V', through the work-circuit of the carbon strip C, as before described, along the line V, through one coil, *c'*, of the differential galvanometer, through the connections *q'* and *m'* to the part A of the cut-out lever, thence through the contacts L and L' and the connection *m* back to the other pole of the battery *b*. A second part of the circuit is shunted over the branch *p*, through the adjustable resistance *w*, and the other coil *c* of the differential galvanometer back by the connection *q* and line *m'*, through the cut-out lever, along the path before traced to the other pole of the battery.

As the resistance of the carbon strip C is greater or less than that of the ascertained resistance *w*, less or more current will go through the coils *c'* and *c* and the galvanometer-needle *g* will move under the influence of the preponderating coil. An advantage possessed by this particular arrangement is that the battery *b* is kept on open circuit at all times when not engaged in the actual useful work of testing, and therefore its energy is economized to the highest possible degree.

Having therefore described my invention both in essence and detail, what I claim as new, and desire to protect by Letters Patent, is—

1. In an apparatus for electrical testing, the combination of the work-circuit, the main-current-supply circuit, and a Wheatstone bridge supplied with an independent current from a second source, together with a suitable cut-out, which, by one movement of the lever, cuts out the work-circuit from the main source of supply, throws it into circuit with one branch of the Wheatstone bridge, and simultaneously closes the galvanometer-circuit of the bridge, substantially as described.

2. In an apparatus for electrical testing, a Wheatstone bridge, having an ascertained resistance in one of its branches, while the circuit through its second branch and the circuit through its galvanometer are normally broken, together with a cut-out, which, by one motion of the lever, simultaneously closes the galvanometer-circuit and introduces into the second branch of the bridge the unknown resistance which is to be tested, all in combination, substantially as described.

3. In an apparatus for electrical testing, the combination of the work-circuit, the main-current-supply circuit, and an arrangement of sub-circuits placed in shunt relation to each other, in one of which sub-circuits there is an ascertained resistance, and a current-indicating device within the influence of the currents flowing in the said sub-circuits, together with a suitable cut-out, which, by one movement of the lever, cuts out the work-circuit from the main source of supply, throws it into one of the sub-circuits, and simultaneously closes the remaining sub circuits, whereby the resultant effect of the currents thus shunted through the various sub-circuits will show by the current-indicating device the relation of the work-circuit resistance to the ascertained resistance, substantially as described.

4. In an apparatus for electrical testing, the combination of a work-circuit, a main-current-supply circuit, and an arrangement of sub-circuits such as shall constitute an indicating or tell-tale device, together with a suitable cut-out, which, by one motion of the lever, cuts out the work-circuit from the main-current-supply circuit and throws the work-circuit into connection with the tell-tale device at the same time that it closes all of those sub-circuits constituting the tell-tale device which are normally open, substantially as described.

In testimony whereof I affix my signature in presence of witnesses.

JAMES WARD PACKARD.

Witnesses:

W. D. PACKARD,

ED. BEESLEY.