(No Model.)

R. VARLEY, Jr.

METHOD OF TESTING INSULATED WIRES.

No. 464,125. Patented Dec. 1, 1891.

Fig. 1

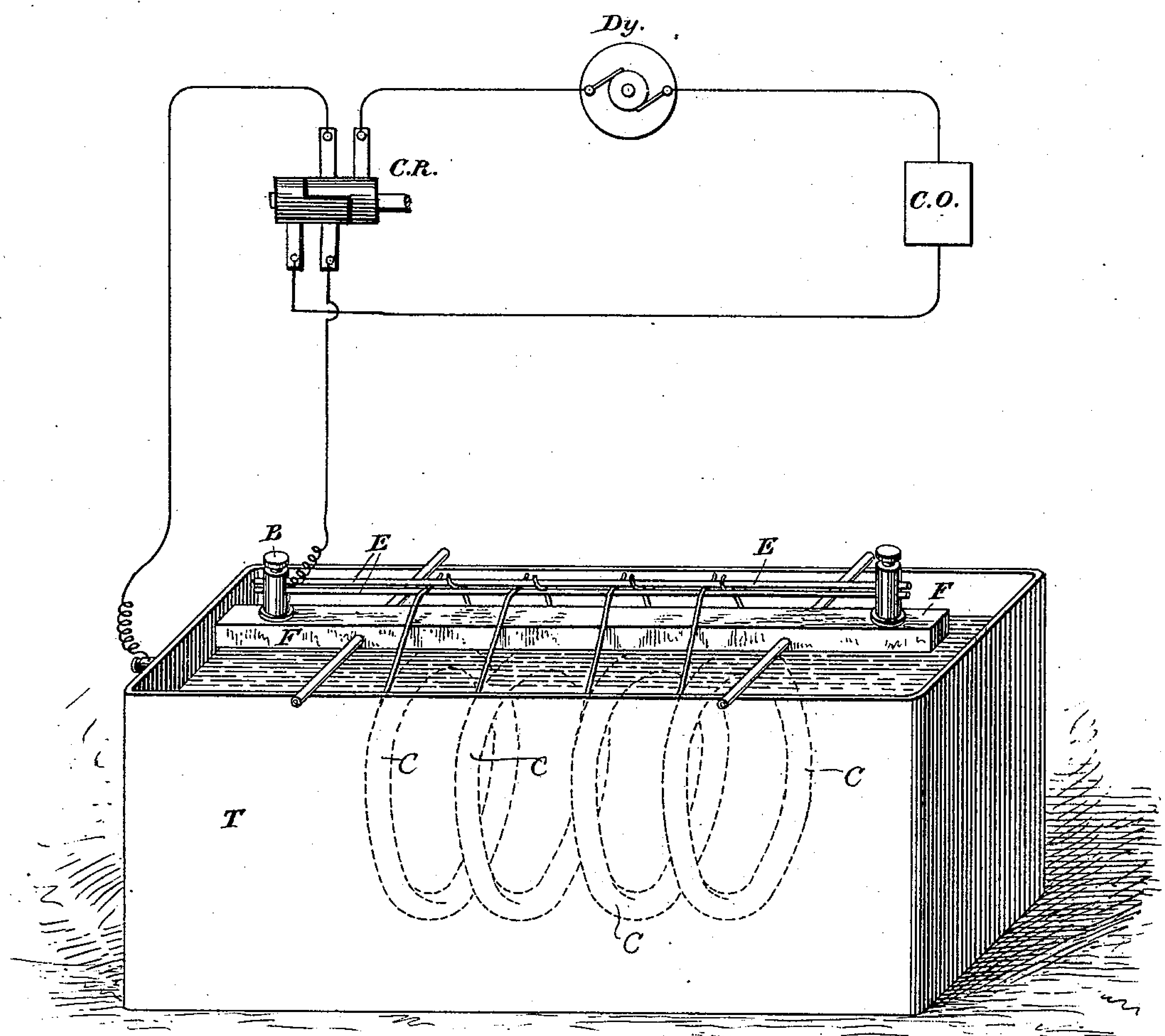


Fig. 3

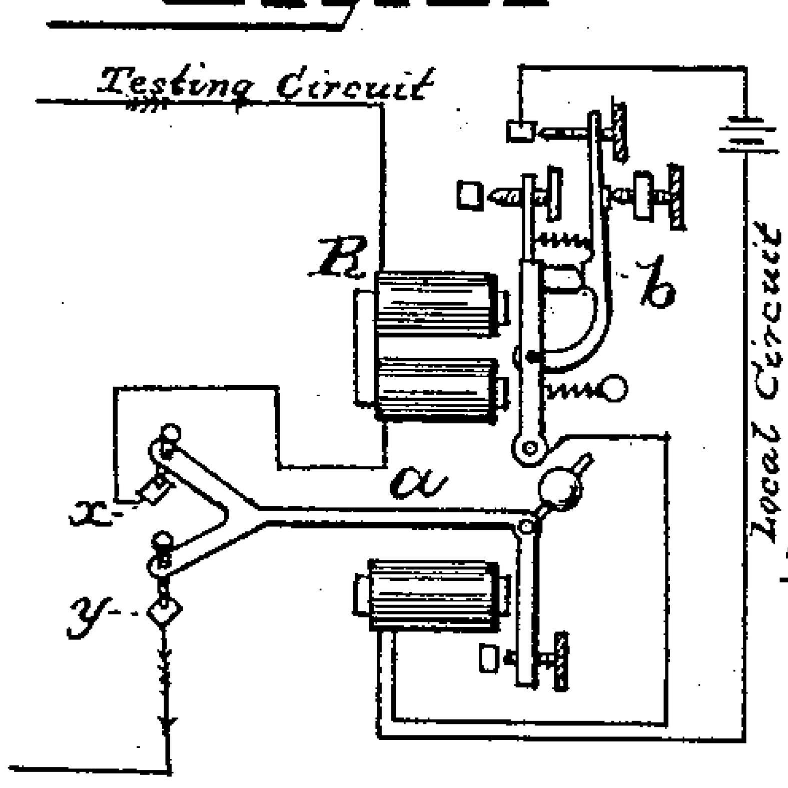
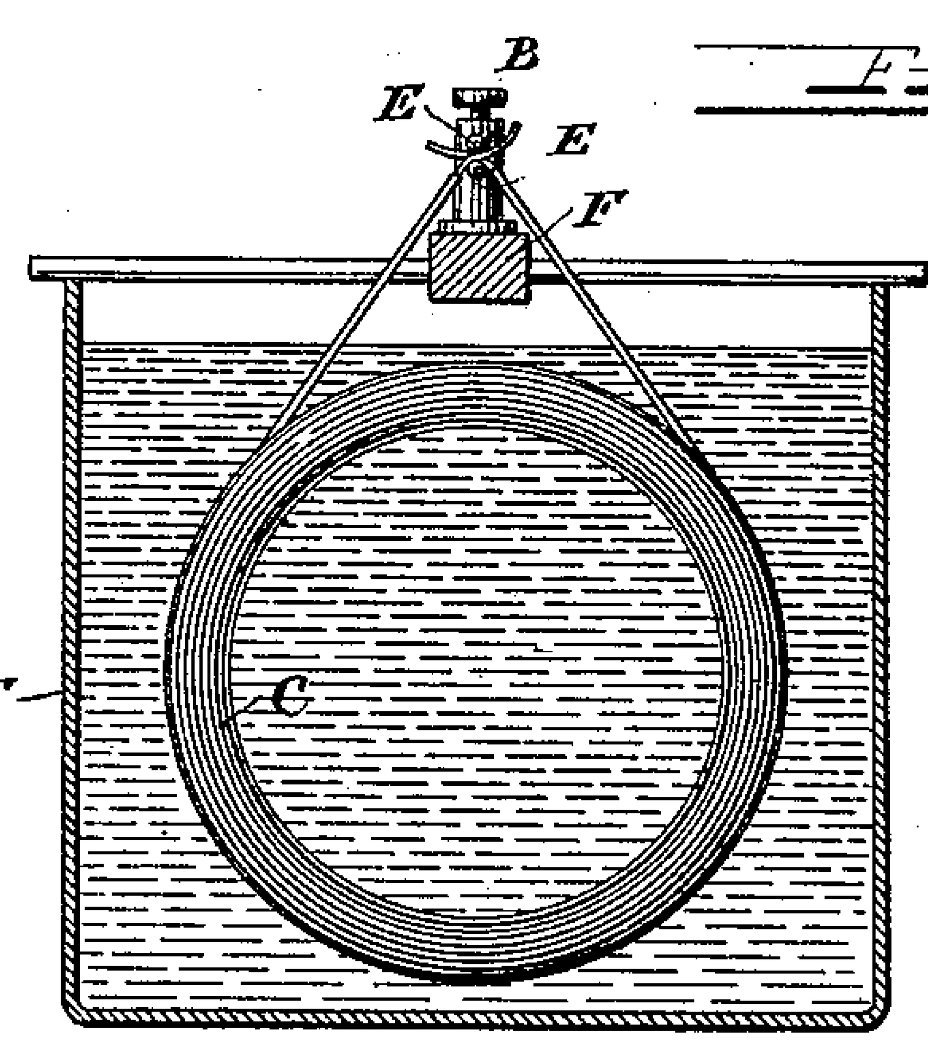


Fig. 2



Witnesses

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METHOD OF TESTING INSULATED WIRES.

SPECIFICATION forming part of Letters Patent No. 464,125, dated December 1, 1891.

Application filed February 10, 1891. Serial No. 380,970. (No model.)

To all whom it may concern:

Be it known that I, RICHARD VARLEY, Jr., a citizen of the United States, residing at Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Methods of Testing Insulated Wires; 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.

This invention relates to a method of testing insulated wires, and has for its object a rapid location of minute faults in insulation.

In covering electric conductors with insulating material it frequently happens that particles of dust or other foreign matter lodge upon the insulating material or otherwise become incorporated within it, or that the insulating material contains fine cracks or irregularities in thickness which lower its insulating power. A very large percentage of wires after being coated with insulating material contain such faults. It is a great desideratum to be able to locate them expeditiously and efficiently. Various modes of testing have heretofore been resorted to; but many of them require too much time for use where a large number of coils of wire must be tested. I have discovered that if an insulated wire be connected to one terminal of an electric circuit the other terminal of which is placed in close relation to the insulating covering throughout its length, and the circuit be charged with a current of high potential, a flash will be exhibited at such point or points of the conductor as are within the range of disruptive discharge. My method of testing, which I call a "flash test," is based upon this discovery.

My invention therefore consists in charging a circuit one terminal of which is connected with the wire to be tested and the other terminal of which is placed in close relation to the insulating covering with a current of sufficient electro-motive force to produce a flash at the point or points where faulty insulation exists. The best mode of bringing the terminals of the circuit into the proper relation to create the flash is to surround the insulated covering with a fluid-conductor, such as water, before charging the circuit.

My invention therefore, more specifically considered, consists in charging a circuit one terminal of which is connected with the insulated wire and the other terminal of which is connected with a fluid-conductor surrounding the insulating covering with a current of sufficient electro-motive force to produce a flash at points of weakness. I find that better results are produced when the circuit is charged with an alternating or reversed current than with a current of continuous direction.

My invention further involves other features which will hereinafter be definitely indicated in the claims.

In the accompanying drawings, which illustrate an organization of apparatus by which my method may be carried into effect, Figure 1 is a diagrammatic illustration. Fig. 2 is a sectional view of the tank, showing a coil in position. Fig. 3 is a diagrammatic view of the cut-out.

Dy represents a dynamo-electric generator or other source of electric energy, in the circuit of which is interposed a series of coils of insulated wire C C C, which are to be tested. As illustrated in the drawings, a source of direct current is used and a current-reverser C R is introduced to produce periodical reversals of current. One terminal of the circuit is connected to a binding-post B and the other terminal is electrically connected with a body of water contained within the tank T. One or both terminals of the coils of wire C C C are inserted between two metallic bars E E, supported in posts on the wooden beam F, supported on the tank, the bars being electrically connected with post B, or the connections may be made in any other manner. Thus the circuit between the wire forming the coils and the water is incomplete unless leakage should exist through the insulating covering. If now the circuit be charged with a current of from fifteen hundred to two thousand volts and the current-reverser caused to operate, a flash will be seen in the water at that point or points of any of the coils immersed therein where the insulating covering is insufficient to resist such a charge, such a flash being probably due to a disruptive discharge from the wire to the water. The current-reverser is preferably caused to operate at a speed of about sixty reversals per minute. If after such flash is developed the current be continued, the insulation would rapidly be destroyed, and in order to prevent such a result I interpose in the circuit, as indicated at C O in the drawings, any suitable form of electro-magnetic or other cut-out device thrown into operation by the current passing through the circuit when the arc or flash is developed.

Any suitable device which will automatically open the testing-circuit when the flash occurs may be used as a cut-out. The instrument I prefer, however, is a circuit-breaker, controlled by the relay described in my application, Serial No. 380,968, filed February 10, 1891.

The operation of the cut-out will be understood on reference to Fig. 3 of the drawings, where R is the relay in the testing-circuit, which circuit is normally held closed by an armature *a*. The armature of the relay has a pivoted contact-arm *b*, which lags, by reason of its inertia, when the armature is attracted, and does not therefore close the local circuit unless the current through the relay has a definite duration. By reason of this lagging the local circuit will not be closed under the charge and discharge of the reverse currents in the testing-circuit if the insulation be perfect, inasmuch as no current will flow, and the only effect produced in the circuit will be a static charge. The static charge will be sufficient to affect an ordinary relay if delicately adjusted, and therefore some provision is necessary to prevent the operation of the relay under the static effect. The lagging armature described accomplishes this result, inasmuch as the brief effect due to the static charge does not last long enough to hold up the armature until the lagging contact *b* is brought into engagement with its co-operating contact. However, if a leak should occur through the water in the testing-tank by reason of insufficient insulation a current will flow and will actuate the relay, close the local circuit, and thus lift the armature *a* away from contact *x y*, opening the testing-circuit. It will thus be seen that the lagging contact renders the cut-out apparatus inactive except when a deficiency in insulation in the wire being tested exists. A weight on the armature *a* is adjusted so that it normally holds the testing-circuit closed. When the armature is tilted, the weight is thrown past the center and holds the circuit open, thus acting as a cut-out.

The coil or coils which show a flash are removed from the tank and the operation is repeated with the remaining coils. Such coils as do not exhibit a flash are subjected to other tests to locate bare spots or other points of extremely low insulating power by other methods. The coils responding to the flash test, which form a very large proportion of the number of coils tested, are then subjected to a similar mode of testing, in which a mechanical switch manipulated by the operator is used to cut on or off the testing-current. While conducting this operation the operator manipulates the coils and by separating the convolutions locates the particular spot in the coil at which the flash occurs, which he marks in any suitable manner, so that the fault may be repaired. As indicated in the drawings, the several coils are in multiple-arc relation to the charging-circuit. They might also be arranged in series.

In lieu of the direct current and current-reverser a pure alternating current of slow alternations might be employed.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The method of testing an insulated wire, which consists in connecting the wire to one terminal of an electric circuit, bringing the other terminal into close relation to the insulating-covering throughout its length, so as to be equidistant from all parts thereof, and charging the circuit with a current of high potential, whereby a flash will be caused where the insulation is below a definite standard.

2. The method of testing an insulated wire, which consists in surrounding the insulating-covering with water or other liquid-conductor, connecting the wire and water with the terminals of an electric circuit, and charging the circuit with a current of a potential to create a disruptive discharge through the insulation when it is below a definite standard.

3. The method of testing an insulated wire, which consists in surrounding the insulating-covering with a fluid-conductor, connecting the wire and such fluid-conductor with the terminals of an electric circuit, and charging the circuit with an alternating or reverse current of sufficiently high potential to create a disruptive discharge through the insulation when it is below a definite standard.

4. The method of testing an insulated wire, which consists in surrounding the insulating-covering with a fluid-conductor, connecting the wire and such fluid-conductor with the terminals of an electric circuit carrying an alternating or reverse current, and interrupting the current when a flash is developed at a point of defective insulation.

5. The method of testing an insulated wire, which consists in connecting a wire with one terminal of an electric circuit, connecting a fluid-conductor surrounding a coil of the wire with the other terminal of the circuit, charging such circuit with a high-potential current, and periodically reversing the direction of charge in the insulated wire during the test.

6. The method of testing an insulated wire, which consists in connecting a wire with one terminal of an electric circuit, connecting a

fluid-conductor surrounding the insulating-covering with the other terminal of the circuit, charging such circuit with a high-potential current, periodically reversing the direction of charge in the insulated wire during the test, and opening the circuit when a flash through the insulation occurs.

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

RICHARD VARLEY, JR.

Witnesses:
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