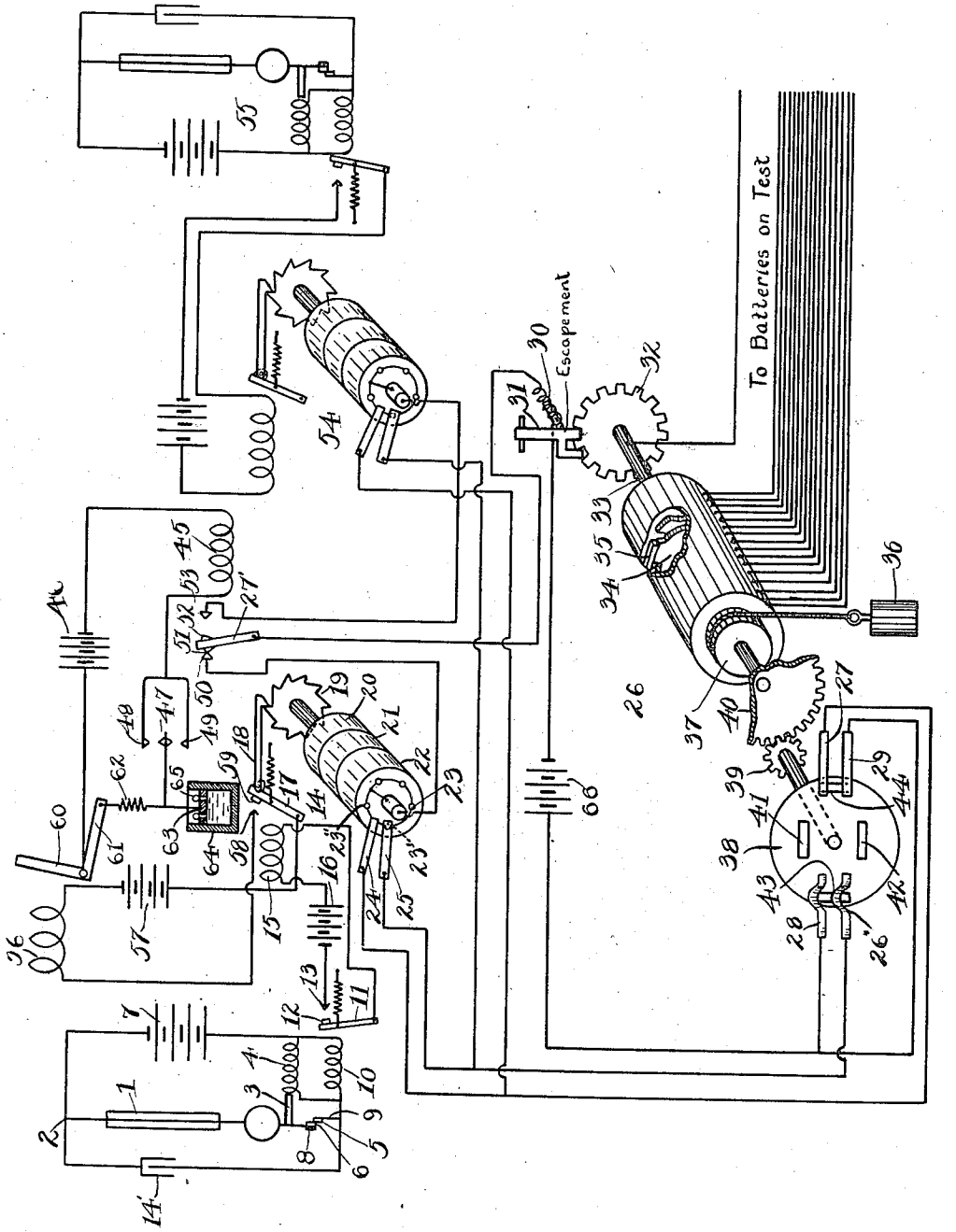
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APPARATUS FOR TESTING DRY CELLS.

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WITNESSES:

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JOSEPH H. GOODWIN AND FRANK A. ADAMSKI, OF FREMONT, OHIO, ASSIGNORS TO NATIONAL CARBON COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF NEW JERSEY.

APPARATUS FOR TESTING DRY CELLS.

1,205,343. Specification of Letters Patent. Patented Nov. 21, 1916.

Application filed May 12, 1913. Serial No. 767,065.

To all whom it may concern:

Be it known that we, JOSEPH H. GOODWIN, a subject of the King of England, and FRANK A. ADAMSKI, a citizen of the United States, both residing at Fremont, in the county of Sandusky and State of Ohio, have invented a certain new and useful Improvement in Apparatus for Testing Dry Cells, of which the following is a full, clear, and exact description.

Our invention relates to mechanism for testing dry cells.

Dry cells are tested by connecting them in circuit with standard resistances for a certain length of time at stated intervals. There are several forms of tests made on dry cells, particularly tests reproducing as near as possible conditions met with in telephone service. In one, three cells in series are connected in circuit with a resistance of twenty ohms for four minutes each hour for ten hours each day for six days a week and for four minutes each two hours for ten hours on the seventh day of the week.

In prior testers the contact mechanism is controlled by an ordinary clock arrangement which closes the circuit of certain relays to carry out the test. Due to the slow approach of the clock driven contacts, to irregular length of the contact teeth, and to lost motion in the contact device, it is difficult to accurately time the occurrence and duration of the contact periods. The contact is often made and broken several times in rapid succession before it is finally and permanently closed.

It is the object of our invention to provide a timer to close the circuit decisively at the correct time, to hold it closed for the correct period and to open it decisively at the end of this period.

It is the further object of our invention to provide a device which operates continuously without winding, which is of simple, rugged construction, and which is not likely to be stopped, like the usual clock, by dust or vibration.

It is a further object of our invention to provide a safety arrangement which will continue the test, and thus protect the cells on test from continuous closed or open circuit, if any part of the timer should become inoperative.

The single figure of the drawing represents diagrammatically the arrangement for carrying out the invention.

Pendulum 1, compensated for isochronism with changes of temperature, suspended from the point 2, carries an iron core 3 adapted to enter the solenoid 4. The circuit of the solenoid is completed through the contacts 5 and 6 and the battery 7. The contact 6 is secured to the pendulum, and one side of it is insulated with mica, 8, or other insulating material. The contact 5 is supported by a flexible spring 9, and so placed that it will touch contact 6 for only a very short time at the center of the swing of the pendulum 1. By this means the iron core 3 receives a momentary pull from the solenoid 4 only when swinging to the right as shown in the figure and only when the pendulum is passing through the neutral position. In this way the free oscillation of the pendulum is retained at both ends of its swing and its isochronism is not impaired. A condenser 14′ is connected in parallel with the contacts 5 and 6 to suppress sparking at the contacts. By this means and by the rubbing of the contacts, they are kept smooth, and in good condition.

Each time contacts 5 and 6 come together, current also flows from the battery 7, through the electro-magnetic relay 10, causing the pivoted armature 11 to open the contacts 12 and 13 for a short interval. The electro-magnetic coil 15, receiving energy from the battery 16 through the contacts 12 and 13, operates the timer designated as a whole by 14 through the pivoted armature 17, which by means of the dog 18, moves the toothed wheel 19 through one notch or one tenth of a revolution, for every complete period of vibration of the pendulum 1. The electro-magnetic coil 15 requires considerable energy and time to actuate, and for this reason it is preferable to operate it through the relay contacts 12 and 13 instead of from the pendulum contacts direct. The contacts 12 and 13 remain closed all the time except for the very short intervals during which they are opened by the electro-magnetic relay 10.

The ratchet wheel or step-by-step device 19 actuates a timer designated as a whole

by reference character 14. The brushes 24, 25 of the timer are spaced apart a distance corresponding to one-tenth of a revolution of the wheel 22 so as to engage alternately the five contacts 23 in succession. The brushes 24 and 25 are connected to a test mechanism designated as a whole by 26 which periodically closes in the desired way the circuit of the batteries to be tested. This testing mechanism *per se* forms no part of our invention, and is, therefore, not shown in detail. Brushes 24 and 25 are connected to brushes 27 and 26′ respectively. Two contacts 28 and 29 electrically joined are connected to an electro-magnet 30 which operates an escapement 31 meshing with the gear 32 on the axle 33. The escapement mechanism 31 is also an old and well known form and is shown diagrammatically. The axle operates the circuit closing means through cams 34 and switch closing levers 35, the cover being broken away to show two of these. A weight 36 suspended from sheave 37 on the axle 33 moves the connected parts whenever the escapement permits. The circuit breaker 38 is geared to the axle 33 through pinion 39 and gear 40, the latter being broken away to better illustrate the test mechanism. The circuit breaker 38 has two inner contacts 41, 42 adapted to contact with brushes 26′ and 28, and two outer contacts 43, 44 adapted to contact with brushes 27 and 29.

Since dry cells are tested over a long period of time, in order to accurately determine their qualities, it would be fatal to the test if the timer should stop and leave them continuously on open or closed circuit. In order to avoid this, a safety arrangement is used. This safety arrangement consists of an electro-magnetic coil 45 which receives energy from the battery 46, through the contacts 47 and 48, or 47 and 49, and actuates the armature 27′ to open the contacts 50 and 51, thus cutting the inoperative timer 14 out of service, and closing the contacts 52 and 53 which bring into service the timer 54 of a reserve clock arrangement 55, which is kept in continuous operation in readiness to be put into use when the first clock arrangements get out of order. The reserve clock is preferably a duplicate of the one just described, and we have therefore illustrated it thus.

The electro-magnetic coil 56 receives energy from the battery 57 through the contacts 58 and 59 which, like contacts 12 and 13, remain closed all the time except for a very short interval once in each complete period of vibration of the pendulum 1, when contacts 5 and 6 are in engagement. The electro-magnetic coil 56 when energized attracts the pivoted armature 60, thus raising the arm 61, to which is attached the spring 62 supporting the contact 47 and the piston 63 in oil or other fluid in the dash pot 64. The piston contains holes closed on top by balls or valves 65 so that it can descend rapidly during the short interval that the armature 60 is released, and ascend slowly during the longer interval that it is attracted. In this way the contact 47 is maintained floating about midway between contacts 48 and 49, neither of which it touches under normal conditions of operation. However, if the pendulum 1 ceases to swing or if the armature 11 or 17 for any reason cease to operate properly, the armature 60 will remain permanently attracted or permanently released, and the contact 47 will slowly move up and touch the contact 48, or more rapidly move down and touch the contact 49, either of which will cause the electro-magnetic coil 45 to cut out the defective timer 14, and bring into operation the reserve timer 54. The reserve clock arrangement being shown as identical with that just described need not be referred to in detail.

The operation is briefly as follows: The pendulum 1 moves the wheel 20 through one-tenth of a revolution by means of the relays, ratchets, etc., previously described, every time it makes a complete swing. The wheels 20, 21 and 22 are geared together to move intermittently like the ordinary cyclometer or counter in such a way that the wheel 21 remains stationary while wheel 20 makes nine movements, but the two are moved forward together during the tenth movement, and the wheel 22 remains stationary during the first nine movements of wheel 21, but moves forward with it during the tenth movement, that is the wheel 22 remains stationary during the first 99 swings of the pendulum 1, but moves forward one-tenth of a revolution during the hundredth swing. The timer 14, being constructed in a well known manner and forming no part of our invention, is illustrated diagrammatically so as not to needlessly multiply the illustration. When wheel 22 is finally moved forward a tenth of a revolution, contact is broken between 23′ and brush 25, and contact is made between 23″ and brush 24. Current will then flow from battery 66 through coil 30, safety contact 50, 51, contact 23″, brush 24, brush 27, contact 44, brush 29, back to battery 66. The coil 30 is thus energized and moves the escapement mechanism to permit the weight 36 to move the gear 32 and connected parts a distance corresponding to the pitch of the teeth. Each time the magnet is energized, the escapement is moved to permit the gear to move through the distance of one tooth only. The ratio of the number of teeth in the gears 39 and 40 is such that this movement of gear 32 turns the circuit breaker 38 through 90 degrees and breaks contact between brushes

27 and 29 and makes contact between brushes 26′ and 28. Brushes 26′ and 28 are positioned so that they contact only with the inner contacts 41 and 42 while the brushes 27 and 29 are positioned so as to contact only with the outer contacts 43 and 44. The coil 30, therefore, is deënergized as soon as it operates the escapement.

The movement of gear 32 closes a circuit of a group of cells under test by means of cam 34 and lever 35, and the circuit remains closed until the gear moves forward another tooth. As has been previously stated this feature is not our invention and merely enough of it is shown to enable one skilled in the art to understand our improvement.

When the pendulum moves through the 200th swing, the wheel 22 will again be moved forward a tenth of a revolution, moving contact 23″ from under brush 24 and bringing it under brush 25. This again completes the circuit of coil 30 through these two points, brush 26′, contact 41, previously moved thereunder, brush 28 and the remaining connections as previously traced out. The coil 30 will be again energized, permitting the movement of the testing mechanism 26 through another notch, opening up the circuit of the batteries closed on the prior movement and closing the circuit of another set. The movement of the testing mechanism causes the circuit breaker 38 to move through 90 degrees as before which breaks the circuit of the magnet 30 at the brushes 26′, 28 and connects together the brushes 27, 29 in readiness to complete the circuit when the wheel 22 is again operated.

If the first clock mechanism should get out of order, the safety coil 45 will disconnect it from the testing mechanism and throw in the reserve clock arrangement 54, 55 which will operate it in exactly the same way, as previously described.

To more clearly illustrate the operation, sparate batteries 7, 16, 66, 46 and 57 are shown furnishing the energy to various parts of the apparatus. In actual practice, however, only one battery is used.

Having described our invention, what we claim is:

1. In a battery tester, a contact-closer having a series of spaced contacts, a pair of contact arms spaced apart, and a chronometer means to move intermittently the contact-closer to connect the contacts alternately with said contact arms in succession.

2. In a battery tester, a contact-closer having a series of spaced contacts, a pair of contact arms spaced apart a distance equal to an odd multiple of half the distance between said contacts, and chronometer means to intermittently move the contact-closer half the distance between said spaced contacts to connect them alternately with said contact arms in succession.

3. In a battery tester, a contact-closer having a series of spaced contacts, a pair of contact arms spaced apart a distance equal to an odd multiple of half the distance of said contacts, chronometer means for moving the contact-closer, a second contact closer, an electro-magnet adapted to cause said second circuit closer to move a predetermined distance, and means moved by the second contact-closer for connecting said electromagnet alternately with said contact arms.

4. In a battery tester, a test mechanism, a timer adapted to be connected thereto, means for periodically operating said timer and means for disconnecting said mechanism from said timer when it ceases to operate.

5. In a battery tester, a test mechanism, a timer adapted to be electrically connected thereto, means for operating said timer including an electro-magnetic coil, a switch in the circuit of the coil, a pendulum for opening and closing the switch, a switch in the connection between the timer and the mechanism and means for opening the second mentioned switch when the timer ceases to operate.

6. In a battery tester, a test mechanism, a timer adapted to be electrically connected thereto, means for operating said timer, including an electro-magnetic coil, a switch in the circuit of the coil, means for opening and closing the switch periodically, a switch in the connection between the timer and the mechanism, and means for automatically opening the second mentioned switch when the timer ceases to operate.

7. In a battery tester, a test mechanism, a timer adapted to be electrically connected thereto, an electro-magnetic coil for operating said timer, a switch in the circuit of the coil, means for periodically opening and closing the switch, a switch in the circuit of the timer, an electro-magnetic coil controlling the second mentioned switch, means including a retarding device associated with the first mentioned coil for closing the circuit of the second mentioned coil when the timer ceases to operate.

8. In a battery tester, a test mechanism, a timer adapted to be electrically connected thereto, an electro-magnetic coil for controlling said timer, means for periodically opening and closing the circuit of the coil, a relay controlled by said coil having an armature connected to a retarding device, a floating contact on said armature, stationary contacts on each side of the floating contact, an electro-magnetic coil connected to the stationary contacts and the floating contact and a switch controlled by said second coil, adapted to open the connection between the timer and the test mechanism.

9. In a battery tester, a test mechanism, a timer, an electro-magnetic coil for operating

the timer, means for periodically opening and closing the circuit of the coil at regular intervals, a relay controlled by said coil having an armature, a dash pot for retarding the movement of the armature, a yielding connection between the armature and the movable part of said dash pot, two spaced contacts, a second electro-magnetic coil having one of its terminals connected to said contacts and the other terminal connected to said armature, a contact on said connection adapted to float between the stationary contacts, and a switch in a circuit between the timer and the test mechanism controlled by the second mentioned coil.

10. In a battery tester, a test mechanism, a timer adapted to be electrically connected thereto, means for operating said timer, including an electro-magnetic coil, a switch in the circuit of said coil, a pendulum controlled by said coil adapted to open and close said switch, an electro-magnetic coil, a switch controlled thereby in a circuit between the timer and the test mechanism, and means for closing the circuit of said second mentioned coil when said means ceases.

11. In a battery tester, a test mechanism, a timer electrically connected thereto, a pawl and ratchet for operating the timer, an electro-magnet having an armature connected to the pawl, means for periodically opening and closing the circuit of said magnet, a relay having a circuit adapted to be closed by said armature, an armature for said relay, a retarding device for the second mentioned armature, and means for opening the electrical connection between the timer and the test mechanism controlled by the second mentioned armature.

12. In a battery tester, a test mechanism, means for controlling said mechanism including a periodically oscillating member and a switch, and means for disconnecting said oscillating member and switch from said test mechanism when the switch remains either open or closed longer than a predetermined time.

13. In a battery tester, a test mechanism, a timer connected thereto, means for operating said timer, an electro-magnetic coil controlling said means, a switch in the circuit of said coil, a pendulum adapted to open and close said switch, and means for opening the connection between the timer and the test mechanism if said switch remains open or closed longer than a predetermined time.

14. In a battery tester, a test mechanism, a plurality of timing devices for opening and closing the circuit to the batteries after predetermined time intervals, means for periodically operating each of said devices, means for connecting one of said devices to the test mechanism and means for connecting a second timing device to the testing mechanism when the first one ceases to operate.

In testimony whereof, we hereunto affix our signatures.

JOSEPH H. GOODWIN.
FRANK A. ADAMSKI.

Witnesses:
LESTER WILSON,
THOMAS J. REISLY.