

No. 702,318.

Patented June 10, 1902.

D. McF. MOORE.
AUTOMATIC CIRCUIT INTERRUPTER.

(Application filed Jan. 2, 1902.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.

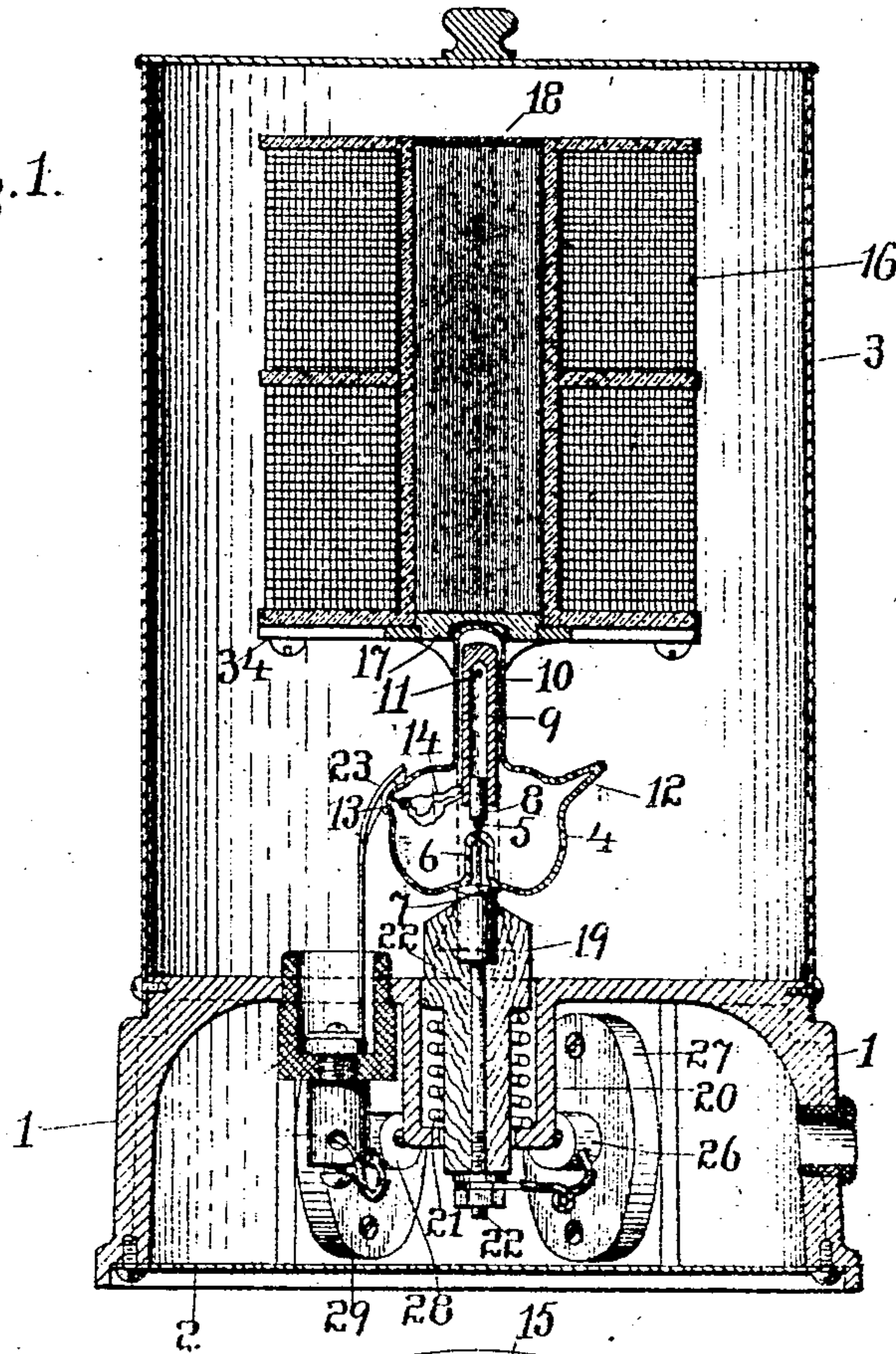
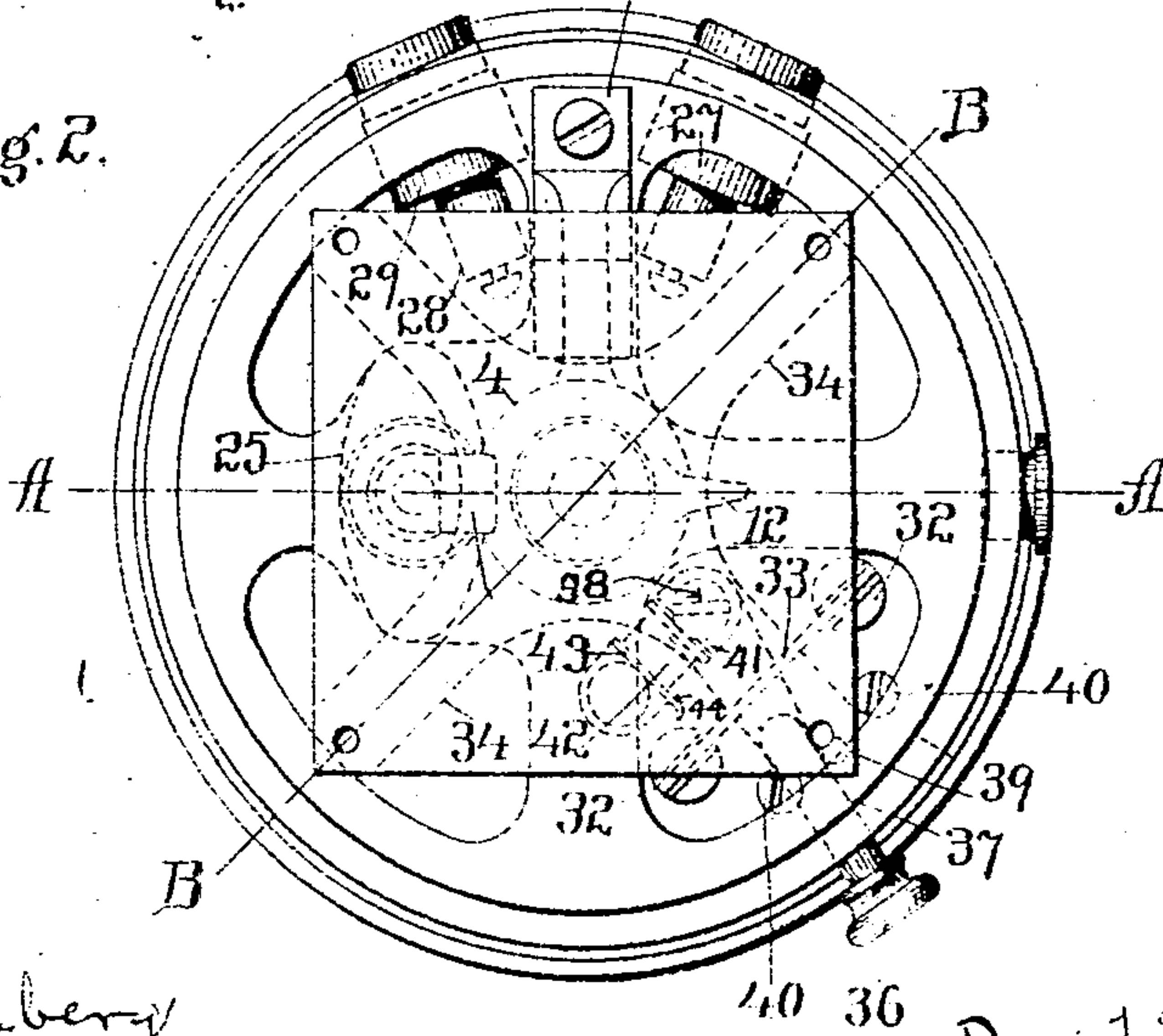


Fig. 2.



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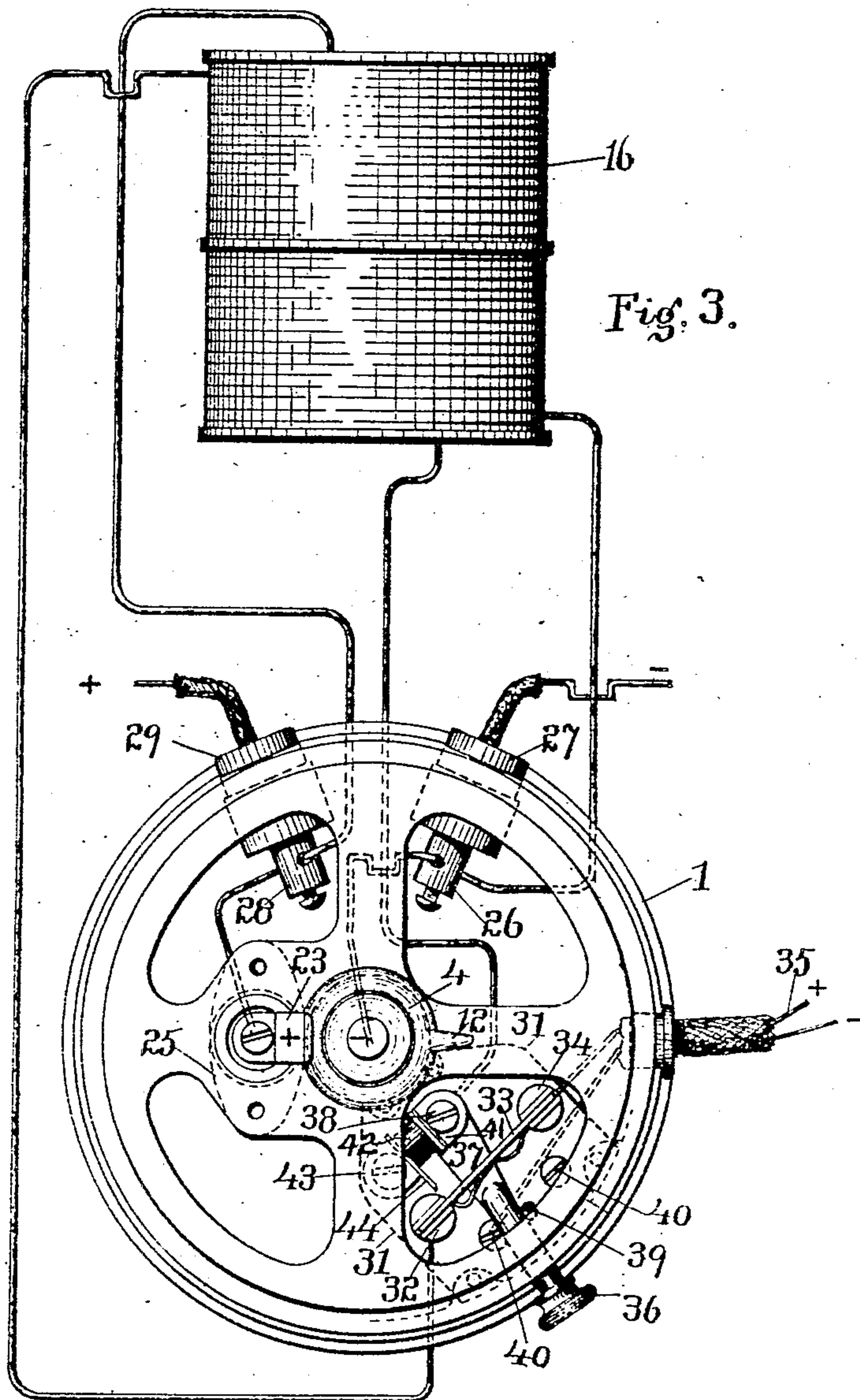
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Fig. 4.

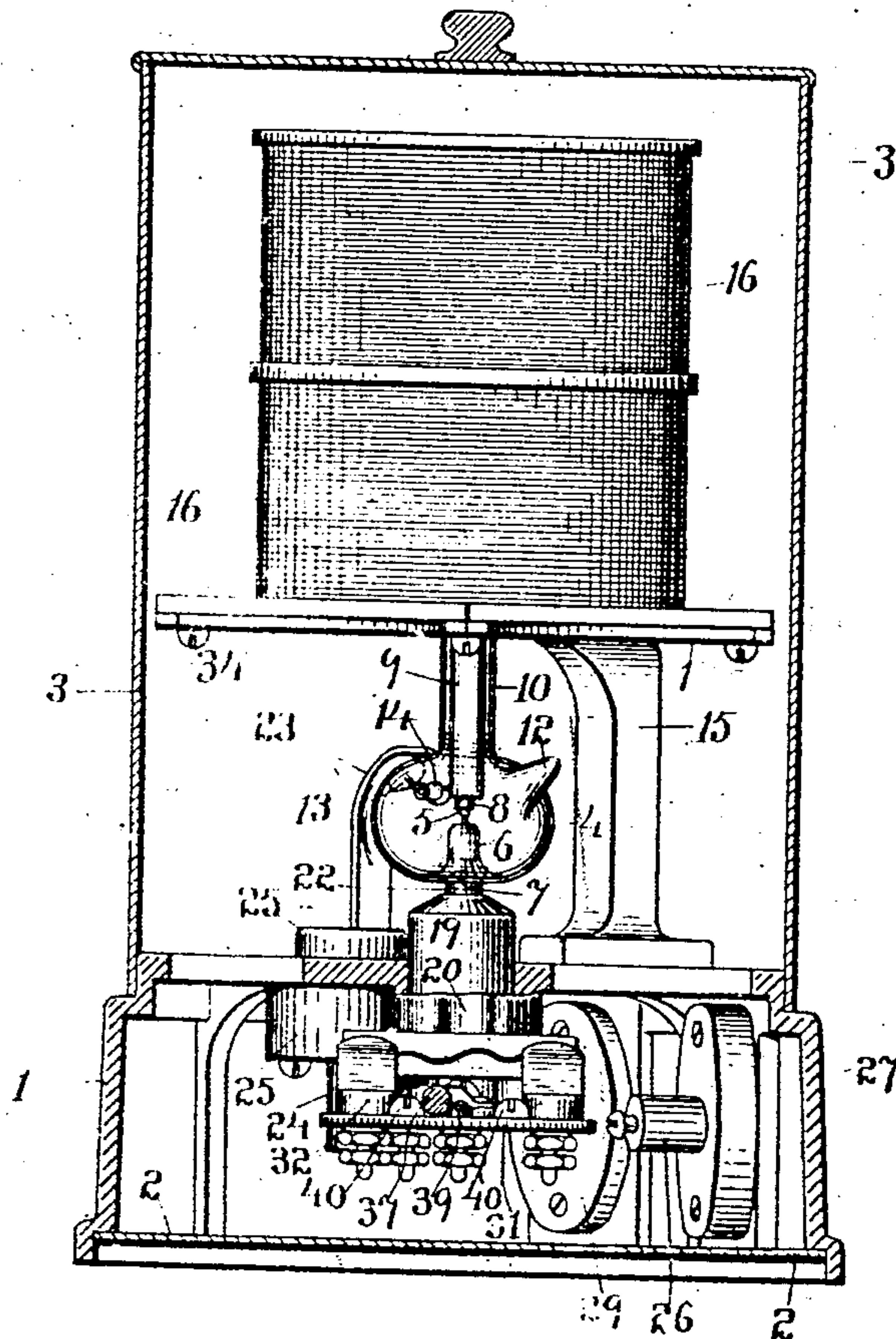
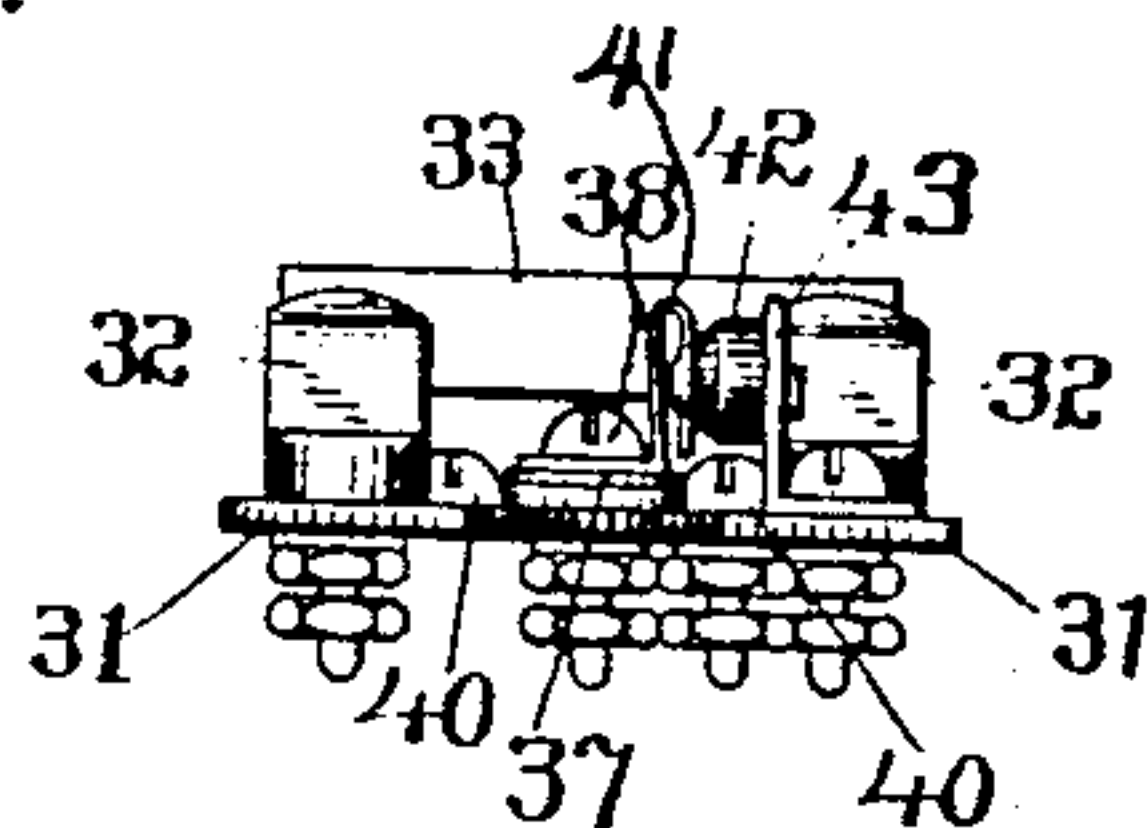


Fig. 5.



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UNITED STATES PATENT OFFICE.

DANIEL MCFARLAN MOORE, OF NEWARK, NEW JERSEY.

AUTOMATIC CIRCUIT-INTERRUPTER.

SPECIFICATION forming part of Letters Patent No. 702,318, dated June 10, 1902.

Application filed January 2, 1902. Serial No. 88,006. (No model.)

To all whom it may concern:

Be it known that I, DANIEL MCFARLAN MOORE, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Automatic Circuit-Interrupters, of which the following is a specification.

My invention relates to automatic circuit-interrupters designed to produce a rapid make and break of an electric circuit, and is especially useful for employment in connection with induction-coils, reactive coils, and other devices employed for X-ray work, wireless telegraphy, electrotherapeutics, electric-tube lighting, or for other purposes.

The chief objects of my invention are to secure compactness, cheapness, and reliability and to obtain other advantages which will be more apparent from the subjoined description and accompanying drawings.

I have described my invention as employed on a circuit containing reactive or self-inductive coils the self-induction of which affords a high tension of current at each interruption, which is conveyed to a working circuit for application to any device or object connected therewith; and one of the features of my invention consists in the manner in which the self-inductive or reactive coils are arranged with relation to said circuit and at the same time are employed as operating-coils for the circuit-interrupter.

Another feature of my invention consists in the composition of the contacts of the interrupter itself, one of which I make of suitable hardened steel and the other of iridium or other highly-refractory metal, although I find that the best results are obtained from the use of iridium as the negative, while steel is employed for the positive electrode of the interrupter.

Another feature of my invention relates to the construction of an automatic interrupter whose contacts or operating parts are contained in a sealed receptacle of glass or other suitable material and are provided with an actuating-armature within said receptacle operating by means of an electromagnet exterior thereto.

The object of this part of my invention is to avoid the use of special binding-posts, in-

terior levers, glass bearings for the same, and to secure other advantages which do away with the difficulties heretofore experienced in adjusting the various parts of the device to one another and to the operating-magnet when the interrupter is made with a vibrating lever, as has heretofore been my practice.

My invention consists, further, of certain details of construction and combinations of parts, which will be more particularly hereinafter described, and then specifically set forth in the claims.

In the accompanying drawings, Figure 1 is a general vertical section of an apparatus embodying my invention, taken on the line A A, Fig. 2; and Fig. 2 is a plan of the apparatus with the casing and actuating-magnet removed from the supporting frame or plate. Fig. 3 shows the parts in plan with the magnet and the bulb-receiver, which contains the parts of the vibrator or interrupter, removed, and also illustrates the manner of connection of the various parts of the apparatus. Fig. 4 is a side elevation with the lower portion of the apparatus shown in vertical section on the line B B, Fig. 2. Fig. 5 is a rear elevation of a detail shown in Fig. 4 in front elevation.

1 indicates the base of the apparatus, which is preferably a casting of metal constructed in hollow form to form a protective inclosure for parts of the apparatus which are supported therein, as shown, and are inclosed against tampering or accidental displacement or damage by the plate 2, fastened to the bottom of the casting 1, as shown in Fig. 1.

3 is a protective cover of sheet metal secured to the casting or base-plate 1 and affording protection for the parts above the base-plate.

The operating parts of the circuit-interrupter are contained in a sealed receptacle 4, which is preferably made of glass and is preferably exhausted of air to as high a degree of rarefaction as possible in order to secure an effective and sudden interruption of circuit at the contacts within the same and to, as far as possible, prevent wear of said contacts by arcing.

The negative electrode or contact 5 is of any suitable highly-refractory metal, but is preferably iridium. It is supported within

the receptacle or bulb 4 on the hollow column of glass 6, forming a part of the wall of the receptacle, and sealed around the wire or conductor which carries the contact or electrode 5 and which terminates in a button 7 of considerable surface or extent outside said electrode. The button or contact 7 bears against the wall of the receptacle around the base of the column 6 and is preferably cemented to the receptacle 4 to hold the parts against displacement and to assist in supporting the contact or electrode 5. The button 7 is the terminal, which is adapted when placed on a suitable support to register with a contact of said support, and thereby afford a connection to the exterior circuits from the contained electrode 5. The opposite or positive electrode 8 of the interrupter consists, preferably, of a piece of case-hardened steel inserted in the hollow end of a tubular piece of soft iron 9, which works up and down in a tubular extension 10 of the receptacle 4, being guided therein during its movement upward and downward under the alternate action of an electromagnet, which raises it, and of gravity, which causes it to fall and complete the circuit when the magnet is discharged through the interruption of its circuit produced by the lifting action upon the armature 9.

The armature 9 consists, preferably, of a piece of Norway steel drilled out to give lightness and having, as shown at 11, an opening to allow the escape of any air imprisoned within it when the hardened-steel point 8 is driven into the open end. The steel point 8 may be case-hardened, preferably in cyanid of potassium.

When the receptacle 4 is exhausted through the sealing-off nipple 12, any air within the hollow armature is permitted to escape by the opening 11, so that there may be no danger of deterioration of the vacuum during operation from the presence of any concealed body of air. This combination of materials for the contacts of the interrupter gives excellent results in certainty of contact and freedom from burning or deterioration by the arc, and also is of advantage in that there is less tendency to disturbance of the vacuum from the release of occluded gases at the contacts through the operation of the device on an electric circuit.

The contact or electrode 8 is suitably connected by wires with a contact-button 13, cemented upon the exterior of the bulb and having a stem sealed in the wall of the bulb 4 and extended into the vacuum space for attachment of the loose conductors 14, the latter being of thin flexible wire, so as not to interfere with the free reciprocation of the contact 8 and armature 9.

The operating-magnet of the interrupter is supported over the bulb 4 upon a plate or frame 34, carried by and, if desired, forming one piece with a post 15, suitably fastened to the base 1.

The electromagnet having any number of coils, but preferably two separate coils 16, has its coils wound upon a molded or made-up spool of any suitable material, one head of which spool is fastened to the plate 34, as clearly shown.

In line with the extension 10 for the bulb 4 there is an opening in said plate 34, adapted to support or carry a piece of vulcanized fiber 17 or other suitable material, resting by a shoulder or off-set on the edges of the opening and formed with a socket or depression to receive the end of the tubular extension 10. Above said fiber or other socket and in line with the extension 10 and armature 9 is disposed the iron core for the coils 16. Said core is preferably made of fine iron wires, as indicated, and rests upon and is supported by the fiber socket 17, as indicated. The socket in the fiber piece 17 not only serves to retain and hold the tubular extension 10, but also permits the end of the armature 10 to be located in very close proximity to the core, for which purpose the dividing-wall between the bottom of the socket and the ends of the iron wires is made as thin as practicable.

By making the socket of vulcanized fiber or similar comparatively soft material I avoid the danger of scratching the glass of the receptacle, which would be liable to happen if said socket were of iron or steel, and I thus avoid the liability of breakage which would exist from the mere scratching of the glass.

In making up the parts the spool, with the coils wound thereon, would be fastened in place to the plate 34, after which the piece of fiber 17 would be dropped into place and then the iron wires making up the core would be inserted within the hollow spool and a suitable cementing material applied at 18 at the upper end of the spool to hold said core in place.

The receptacle 4 is held in the position shown, with the tubular extension 10 seated in the socket 17, by means of a spring-actuated plunger or follower 19 beneath the bulb or receptacle. The plunger or follower 19 works in the hollow guiding boss or projection 20, formed on the frame or base-piece 1, and is actuated by the coil-spring 21, working between the base of the boss 20 and the shoulder upon the plunger 19, as indicated.

The plunger 19 is preferably of insulating material and carries a centrally-disposed conducting-rod 22, which terminates at its upper end in the head having a depression adapted to receive the button-electrode 7, as shown, and to thereby form electrical connection with the negative contact of the interrupter. This depression acts also as a socket to hold the receiver or receptacle 4 in position when it is pressed upward by the action of the spring 21, so as to force the tubular extension 10 into the socket 17.

When the receiver 4 is inserted in the position shown between the sockets, its button

or electrode 13, which is in connection with the positive electrode of the interrupter, registers with and makes contact upon terminal contact-spring 23, adapted to exert lateral pressure toward the bulb.

The spring 23 is supported in any suitable manner—as, for instance, by being clamped to one end of a conducting-post 24 within the hollow porcelain insulator 25, whose general shape or configuration is oblong, as shown in Fig. 2.

The insulator 25 is fastened by its oblong projections to the upper plate of the frame 1 and at its center is provided with the tubular bushing or extension which passes upward through the plate and affords protection and insulation for the spring 23.

The lower end of the rod 22 is provided with suitable clamping devices for attachment of a wire or conductor which leads from and is clamped in the post 26, similar to post 24 and similarly supported in another porcelain insulator 27, similar to 25 and fastened in an upright position within the hollow base 1. The post 24 is connected by a wire with the post 28, seated in another insulator-block 29, which, like the insulator-block 27, has its bushing seated in and projecting laterally through the wall of the base 1, as more clearly indicated in Fig. 3.

The posts 28 and 26 may be used as the terminal posts or electrodes of the apparatus. In one manner of connecting up the same, as shown in Fig. 3, they are the terminals for the working circuit upon which the high-tension currents produced by the interruptions of circuit are utilized.

Other appliances which it is preferred to use in connection with the parts already described consist of a spark-arrester, fuse, and simple form of snap-switch mounted upon a plate 31, of vulcanized fiber or other suitable insulating material, which is secured within the frame 1 in horizontal position by being supported upon proper lugs or projections and secured thereto by suitable screws. This plate is shown in dotted lines in Fig. 3 and in full lines in edge view in Fig. 4.

32 indicates the spring-clips for the fuse 33. The clips 32 are formed on the upper ends of posts which pass through the plate 31, and are provided beneath the plate with suitable clamping-nuts, as shown. The fuse 33 is of any suitable form and may consist of a piece of mica or other suitable insulating material bearing the fuse-wire, whose ends terminate in conducting-pieces supported on the mica plate and adapted to be received between the jaws of the clips 32.

The terminal wires of a circuit connected with any suitable source of energy are indicated at 35. One of said wires connects with one of the clips 32, the remaining clip being connected by a suitable conductor with the actuating-magnet coils of the apparatus.

The actuating-handle 36 of a spring-switch is shown projecting through an opening in the

side of the base 1. Said switch consists of a blade-spring 37, fastened to a plate or post 38 at one end and carrying at its outer or free end a rod of metal, to which the handle 36 is secured. The rod is rounded at its lower side, thereby adapting it to slip over the head of a pin 39, of insulating material, fastened in the plate 31 centrally between the two contact screws or points 40. The switch-arm on being turned from one position to the other slips over the head of the pin 39 and snaps down into position between said head and the head of one or the other of the contacts 40. The snap action is given by the spring effect of the blade-spring 37 cooperating with the rounded surfaces of the pin 39 and the switch-bar mechanically engaged, as just described.

The post 38, to which the spring 37 is secured, bears an upright spring plate or support 41, as shown in Fig. 5, which plate may be perforated to receive the end of a piece of carbon 42, held between said plate and the spring end of another plate 43, from which projects a point 44, separated by a narrow air-gap from the post carrying one end of the fuse.

The carbon block 42 affords a non-inductive resistance of high value across the terminals of the apparatus, but permits the passage of any high-tension current of sufficient strength to force its way across the air-gap just mentioned, thereby protecting the apparatus from damage in case of irregular action or the exposure of the apparatus to a current of abnormally high voltage.

When the apparatus is used for the purpose of producing rapid interruptions on a circuit of induction the discharge of which is to be applied directly to a working circuit, it is preferred to connect up the apparatus in the manner shown in Fig. 3, wherein the circuits may be traced as follows: from the primary or current-supplying wire 35 marked with the sign + as follows: to and through the fuse and to and through one of the coils 16, to the post 28, thence to 24, to the contact-spring 23, through the contacts of the interrupter, to the contact on the plunger 19, thence to the post 26, through the other coil 16 of the electromagnet, and to the post 38, to which the switch is pivoted, and then through said switch when in closed position to the contact 40, and out to the negative pole of the circuit 35.

The posts 28 and 26, respectively, may form the terminals of the circuit to which the currents of high tension derived from interruptions of the circuit of the coils 16 are applied.

It will be seen that the coils 16 are in the circuit of the supply-current on opposite sides of the interrupter-break, respectively, and that also they will when suitably wound conspire or assist one another in actuating the interrupter. By this means I not only secure the advantages obtained by having the self-inductive coils on opposite sides of the break, respectively, as set out in my Pat-

ent No. 604,684, of May 24, 1898, but I also secure a strong magnetic action upon the interrupter, thus insuring operation and enabling me to dispense with the use of special mechanical devices for jarring or striking the receptacle containing said interrupter which it has heretofore been desirable to employ for the purpose of insuring the continued operation of the same.

10 In my improved interrupter the parts are all secured against damage and are well insulated, while, moreover, they are of extreme simplicity and are cheaply and easily made. The device also affords a ready means where-
15 by working parts may be substituted for those which become damaged or inoperative and makes it certain that the substituted interrupter will be in proper position with relation to the operating-magnet and to the circuit in
20 which it is to be operated.

What I claim as my invention is—

1. In an automatic circuit-interrupter, an actuating-magnet having two coils conspiring to actuate the armature of the interrupter
25 and placed respectively on opposite sides of the break.

2. In an automatic interrupter, the combination substantially as described with a double-wound magnet having its coil on opposite
30 sides of the break, of interrupter-contacts contained in a sealed receptacle and having an armature guided in the walls of said receptacle, as and for the purpose described.

3. In an automatic circuit-interrupter, interrupter-contacts composed respectively of
35 hardened steel and iridium.

4. In an automatic interrupter, a sealed and exhausted receiver containing interrupter-contacts composed respectively of hardened
40 steel and iridium or its equivalent.

5. In an automatic interrupter, a sealed all-glass receptacle containing an armature guided in the glass wall of said receptacle and carrying one of the contacts, and an opposite
45 electrode supported on a stem or column projected into the interior of said receptacle, as and for the purpose described.

6. In an automatic interrupter, the combination with a sealed all-glass receptacle having a stem or column supporting one of the electrodes, and a glass tubular extension in line therewith, of an armature working in said tubular extension and carrying at its lower end an electrode or contact of the inter-
50 rupter.

7. In an automatic interrupter, the combination substantially as described of a fixed contact supported or carried by a wire sealed in the bulb or column projecting inwardly,

and an opposite electrode carried by an armature guided in the wall of said receptacle, of a contact-terminal in the side of said receptacle loosely connected with the armature-contact.

8. In an automatic interrupter, the combination with the receptacle carrying an armature guided in the wall thereof and provided with one of the contacts, and an opposite cooperating contact rigidly supported in the wall of said receptacle, of a socket for said
65 receptacle one member of which is located in proximity to the core of an electromagnet, while the other or opposite support cooperating therewith is a spring-pressed support carrying one of the contact-terminals of the ap-
70 paratus.

9. In an automatic interrupter, the combination with the sealed receptacle carrying the armature guided in a tubular extension thereof, of a socket adapted to receive said
80 extension, a spring-pressed actuated plunger carrying a contact and a cooperating laterally-pressing spring adapted to engage with a contact secured in a wall of said receptacle and joined by flexible conductors with the
85 movable contained contact of the device.

10. The combination substantially as described of a base 1 carrying the post 15, an actuating-magnet mounted on said post, the plunger 19 mounted in the base 1, and a
90 socket carried by the supporting-frame for the magnet in line with said plunger, as and for the purpose described.

11. The combination in an automatic interrupter of the base 1, an electromagnet supported over the same by a suitable standard secured to said base and an automatic interrupter consisting of a closed glass receptacle containing an armature to be actuated by the magnet, a socket for receiving the upper
95 end of the receptacle, and a spring-actuated plunger supported in the frame 1 and carrying a contact, as and for the purpose described.

12. The combination with an automatic interrupter having an all-glass receptacle containing the interrupter-contacts, of the snap-switch consisting of the blade-spring 37, provided with an actuating-stem rounded as described and cooperating with two contact-stops and an intermediate pin, as and for the
105 purpose described.

Signed at New York city, in the county of New York and State of New York, this 28th day of December, A. D. 1901.

DANIEL MCFARLAN MOORE.

Witnesses:

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H. C. TOWNSEND.