A. S. CUBITT.

ELECTROMAGNETICALLY CONTROLLED SWITCH.

APPLICATION FILED MAR. 30, 1908.

925,160.

Patented June 15, 1909.

Fig. 1.

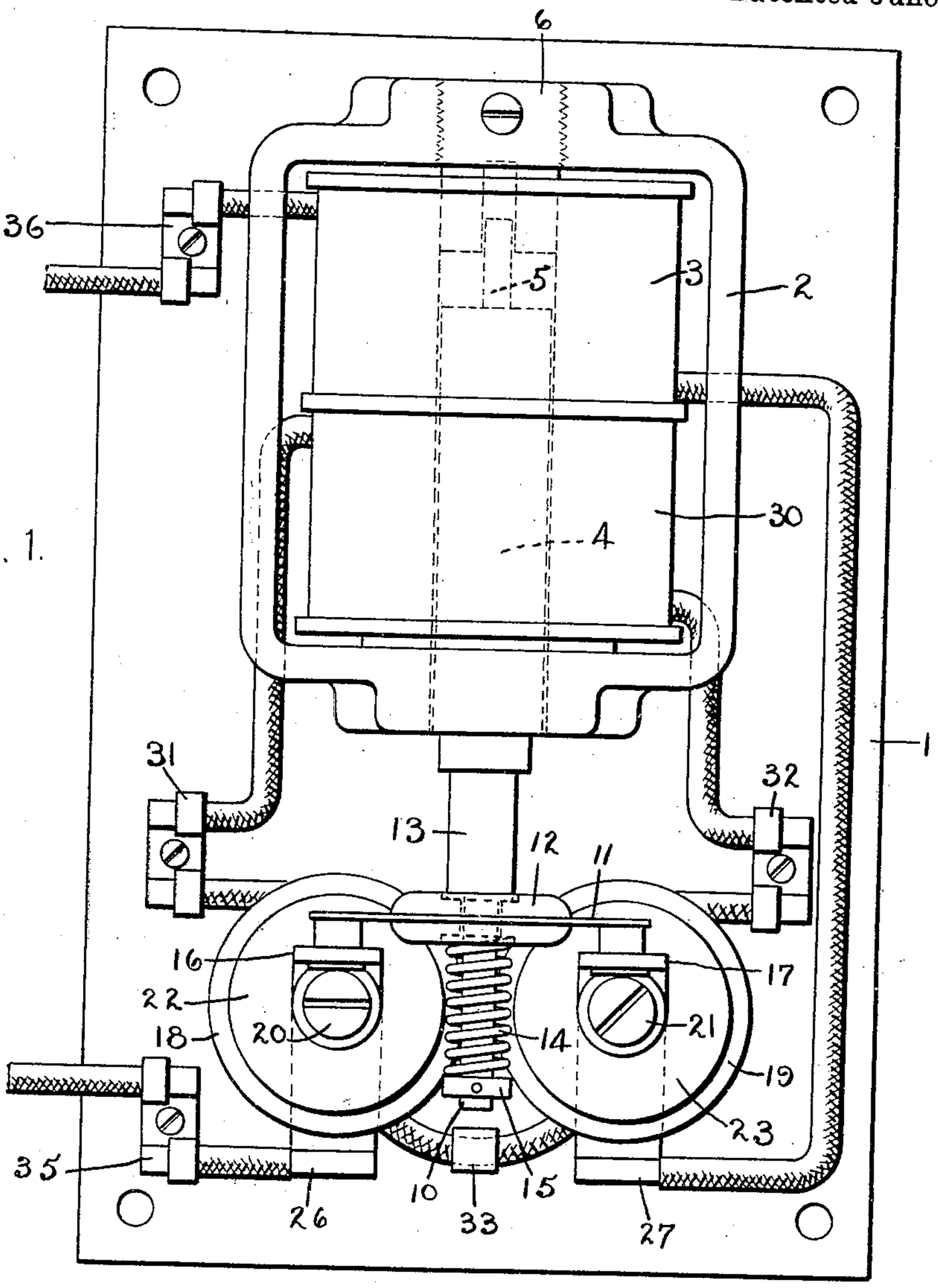
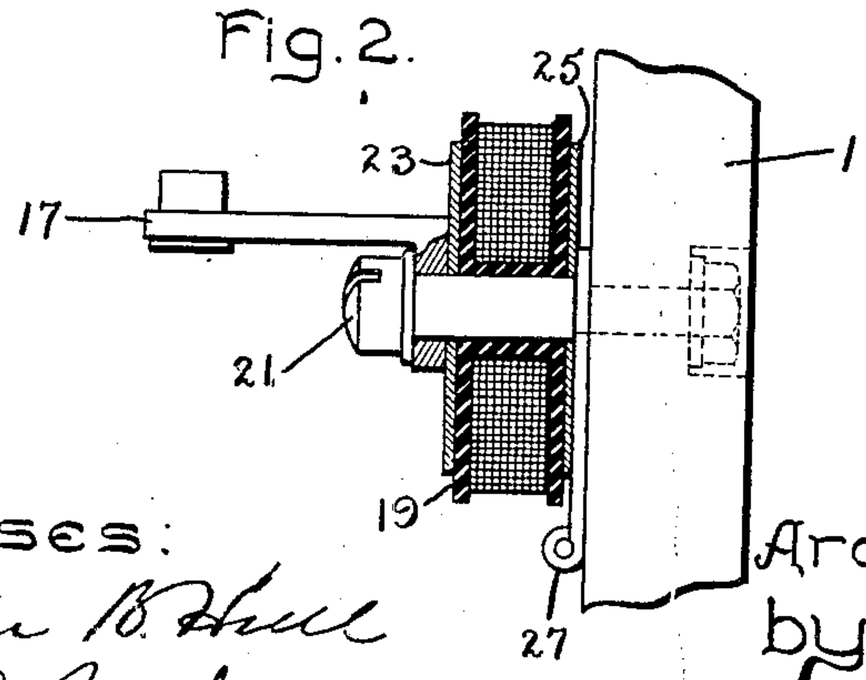


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETICALLY-CONTROLLED SWITCH.

No. 925,160. Specification of Letters Patent. Patented June 15, 1909.

Application filed March 30, 1908. Serial No. 424,047.

To all whom it may concern:

Be it known that I, ARCHIBALD S. CUBITT, a subject of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electromagnetically-Controlled Switches, of which the following is a specification.

My invention relates to electro-magnetically controlled switches and contemplates particularly the provision of means whereby the operation of a switch may be retarded through a certain interval of time after the energization of the coil by which it is controlled.

The necessity for retarding the operation of an electro-magnetically controlled switch after energization of its control circuit has arisen particularly in connection with systems of motor control in which a plurality of electro-magnetically operated switches operate automatically in succession to cut out resistance in the motor circuit. In such systems it is customary to provide a switch or relay which, after the operation of each resistance controlling switch, will temporarily interrupt the actuating circuit for the next succeeding switch and in this way prevent too rapid cutting out of resistance in the motor circuit. The contacts of this relay and its actuating coil are generally connected in series in the actuating circuit for the resistance controlling switches, and this relay in pulling up, therefore, interrupts its own circuit as well as the actuating circuit leading to the coils of the resistance controlling switches. This "notching relay", as it is called, is intended to pull up immediately after each resistance controlling switch operates and thus to prevent the next resistance switch from operating at once. It has been found necessary in practice to retard the operation of the notching relay slightly in order to give the resistance controlling switches time to close before their actuating circuit is interrupted, and for this purpose several arrangements have been used, among others, a lost-motion connection between the movable element of the relay and the movable contact lifted by it.

It is an object of my invention to provide electrically controlled means for retarding the movement of a relay or switch under the above described conditions, or under any others.

In order that my invention may be fully understood I have shown and described one form in which it may be embodied. I wish it understood, however, that I realize that it may be applied to switches of many kinds and may be embodied in many constructions without departing from its spirit. For instance, although I have shown my invention as applied to what may be called a purely "time limit" relay, it may equally well be used in connection with a relay provided with a coil intended to carry motor current and thereby hold the relay up if when it has operated the motor current exceeds a certain value.

Referring to the drawing; Figure 1 is a front elevation of a switch or relay having my invention applied thereto; and Fig. 2 is a detail view, partly in section, of the same.

In the drawing, the switch or relay in which my invention is embodied is shown as mounted upon a back plate 1 of any suitable insulating material. The iron frame 2 of the relay is supported on the plate 1 in any suitable way, and within this frame is mounted a coil of wire 3 wound and insulated in any well-known manner. This coil 3 serves as the actuating coil of the switch. Passing through the frame 2 and arranged for movement within the field produced by the coil is a core 4 of magnetic material. This core may be guided and arranged in any suitable manner, and as shown is provided with a pin 5 which extends into a hole in a plug 6 of magnetic material screwed into the top of the frame 2. The core 4 is extended at its lower end and on a reduced portion 10 carries insulated therefrom a disk 11 of magnetic material such as steel. This disk 11 may have a hub 12 of insulating material, the hole in which is somewhat larger than the extension 10 of the core 4, and this disk is normally held against a shoulder formed by a larger portion 13 of the core 4 by means of a spring 14 located between the insulating hub 12 of the disk 11 and a collar 15 fixed upon the reduced extension 10. The disk 11 serves as a movable contact member and coöperates with fixed contacts 16 and 17 of magnetic material, such as steel. The bottom surface of the disk 11 and the tops of the contacts 16

and 17 may be silver plated for a purpose hereinafter explained. Between the contacts 16 and 17 and the back plate 1 are located coils 18 and 19 of insulated wire, bolts of magnetic material 20 and 21 being arranged to clamp the contacts 16 and 17 to the coils 18 and 19 respectively, and to the base-plate 1 in the manner clearly shown in Fig. 2. Brass washers 22 and 23 are clamped to the front side of coils 18 and 19 and iron washers 24 and 25 to the back side of said coils. The contacts 16 and 17 are electrically connected to the bolts 20 and 21 respectively, and terminals 26 and 27 are connected to said bolts.

Mounted within the frame 2 is a second coil 30 of insulated wire, said coil being so arranged that much of the magnetic flux produced by the energization of the coil 3 will thread the coil 30. This coil 30 is, therefore, inductively arranged with respect to coil 3 and will act as the secondary of a transformer of which the coil 3 is the primary; that is, while the magnetic field produced by the coil 3 is building up or dying out current will be induced in the coil 30. The ends of this coil are connected respectively to the terminals 31 and 32 which are also connected respectively to a terminal of the coil 18 and a terminal of the coil 19, the other ends of these coils being connected together at 33. It is apparent, therefore, that the coils 30, 18 and 19 are connected permanently in series. In the particular form or relay shown the circuit through the coil 3 is from the terminal 35 to terminal 26, through bolt 20, fixed contact 16, movable contact disk 11, fixed contact 17, bolt 21, terminal 27 to and through the coil 3 to the terminal 36. When so arranged the relay will in pulling up open its own actuating circuit. My invention, however, will be in no way affected if the circuit through the coil 3 is altogether independent of the contacts controlled by the relay, which contacts might be used to control some other circuit.

The operation of the device is as follows: The relay being in the position shown, when current is supplied to the coil 3 a magnetic field is produced into which the core 4 of the relay tends to rise. The core 4 will, therefore, pull up. While the magnetic field of the coil 3 is building up, current will be induced in the coil 30 and will pass around the closed circuit formed by this coil and the coils 18 and 19. This current will be sufficient to produce a magnetic field, the flux of which will pass from one of the steel contacts 16 or 17 to the other, through the steel disk 11 and around behind the coils 18 and 19 through iron washers 24 and 25 and across a small air gap. As long as this magnetic field exists the disk 11 will be held in contact with the fixed contacts 16 and 17 even though the core 13 pulls up, this being permitted by the compression of the spring 14. As soon as the field produced by the coil 3 has become steady the current induced in the coil 30 dies out and the magnetic field produced by the coils 18 and 19, therefore, fades away. The disk 11 is then no longer held in engagement with the fixed contacts 16 and 17 and it flies upward under the action of the spring 14. The silver on the cooperating surfaces of disk 11 and contacts 16 and 17 furnishes a gap in the magnetic field at these points and prevents sticking of the disk to the fixed contacts. The silver will also insure good contact between the disk and fixed contacts as is well understood.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In an electro-magnetically controlled switch, an actuating coil, a movable element magnetically controlled by said actuating coil, a second coil located in inductive relation to said actuating coil, and electro-magnetically controlled means receiving current from said second mentioned coil for retarding the operation of the switch in response to the energization of said actuating coil.

2. In an electro-magnetically controlled switch, an actuating coil, a movable element magnetically controlled by said actuating coil, contacts controlled by said movable element, a second coil located in inductive relation to said actuating coil, and electro-magnetically controlled means receiving current from the second mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

3. In an electro-magnetically controlled switch, an actuating coil, a movable element magnetically controlled by said actuating coil, contacts controlled by said movable element, a second coil located in inductive relation to said actuating coil, and electro-magnetically controlled means including an actuating coil receiving current from the second mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

4. In an electro-magnetically controlled switch, an actuating coil, a movable element magnetically controlled by said actuating coil, contacts controlled by said movable element, a second coil located in inductive relation to said actuating coil, and electro-magnetically controlled means including an actuating coil arranged in series with said second mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

5. In an electro-magnetically controlled switch, an actuating coil, a movable element magnetically controlled by said actuating coil, contacts of magnetic material controlled by said movable element, a second

coil located in inductive relation to said actuating coil, and a coil receiving current from the second mentioned coil and arranged to produce a magnetic field through said contacts.

6. In an electro-magnetically operated switch, an actuating coil, a movable element magnetically operated by said actuating coil, a second coil located in inductive relation to said actuating coil, and electro-magnetically controlled means receiving current from said second mentioned coil for retarding the operation of the switch in response to the energization of said actuating coil.

7. In an electro-magnetically operated switch, an actuating coil, a movable element magnetically operated by said actuating coil, contacts opened and closed by the movement of said movable element, a second coil located in inductive relation to said actuating coil, and electro-magnetically operated means receiving current from the second mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

8. In an electro-magnetically operated switch, an actuating coil, a movable element magnetically actuated by said actuating coil, contacts opened and closed by movement of said movable element, a second coil located in inductive relation to said actuating coil, and electro-magnetically operated means including an actuating coil receiving current from the second mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

9. In an electro-magnetically operated switch, an actuating coil, a movable element magnetically operated by said actuating coil, contacts opened and closed by movement of said movable element, a second coil located in inductive relation to said actuating coil, and electro-magnetically actuated means including an actuating coil arranged in series with said last mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

10. In an electro-magnetically operated switch, an actuating coil, a movable element magnetically operated by said actuating coil, contacts of magnetic material opened and closed by movement of said movable element, a second coil located in inductive relation to said actuating coil, and a coil receiving current from said second mentioned coil and arranged to produce a magnetic field through said contacts.

11. In an ~~electro~~-magnetically operated switch, an actuating coil, a core of magnetic material arranged for movement in the field thereof, a movable contact member movable with said core, a stationary contact with which said movable contact member co-operates, a second coil located in inductive relation to said actuating coil, and electro-magnetically controlled means including an actuating coil receiving current from the second mentioned coil for retarding the relative movement of the contacts in response to the energization of said actuating coil.

12. In an electro-magnetically operated switch, an actuating coil, a core of magnetic material arranged for movement in the field thereof, a movable contact member of magnetic material movable with said core, a stationary contact of magnetic material with which said movable contact member coöperates, a second coil located in inductive relation to said actuating coil, and a coil receiving current from the second mentioned coil and arranged to produce a magnetic field through said movable contact member and said stationary contact.

13. In an electro-magnetically operated switch, an actuating coil, a core of magnetic material arranged for movement in the field thereof, a movable contact member of magnetic material movable with but yieldingly connected to said core, stationary contacts of magnetic material with which said movable contact member coöperates, and coils receiving current from the second mentioned coil and arranged to produce a magnetic field through said stationary contacts and said movable contact member.

14. In an electro-magnetically operated switch, an actuating coil, a core of magnetic material arranged for movement in the field thereof, a disk of magnetic material carried by said core and movable thereon, a spring tending to keep said disk in a certain position on said core, fixed contacts of magnetic material with which said disk is in engagement when said actuating coil is deënergized, a second coil located in inductive relation to said actuating coil, and coils receiving current from the second mentioned coil and arranged to produce a magnetic field through said fixed contacts and said movable contact member.

In witness whereof, I have hereunto set my hand this 27th day of March, 1908.

ARCHIBALD S. CUBITT.

Witnesses:
HELEN ORFORD,
L. A. HAWKINS.