No. 860,124. PATENTED JULY 16, 1907.

D. M. BLISS.

SWITCH.

APPLICATION FILED JULY 14, 1905.

Fig. 1,

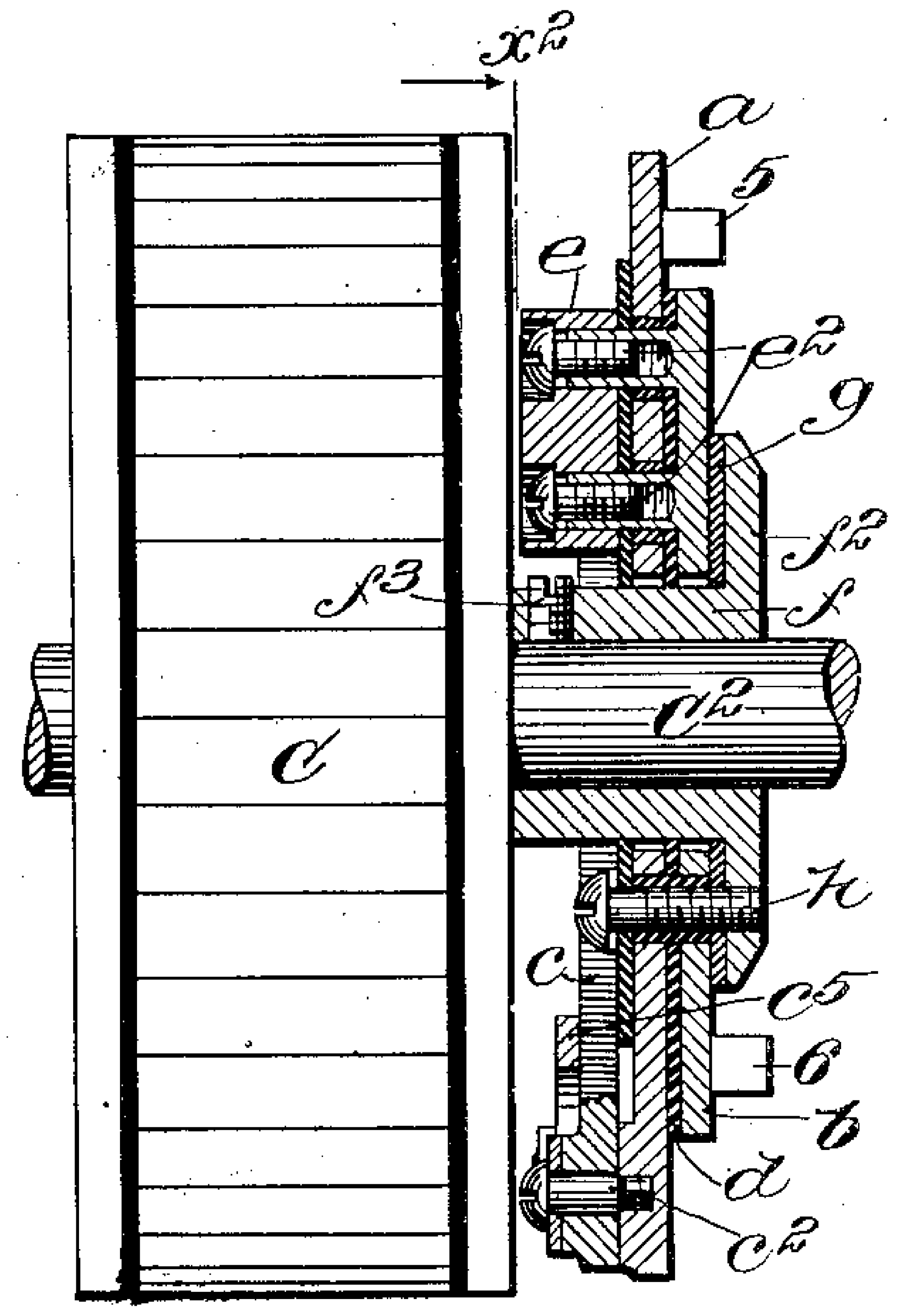


Fig. 2,

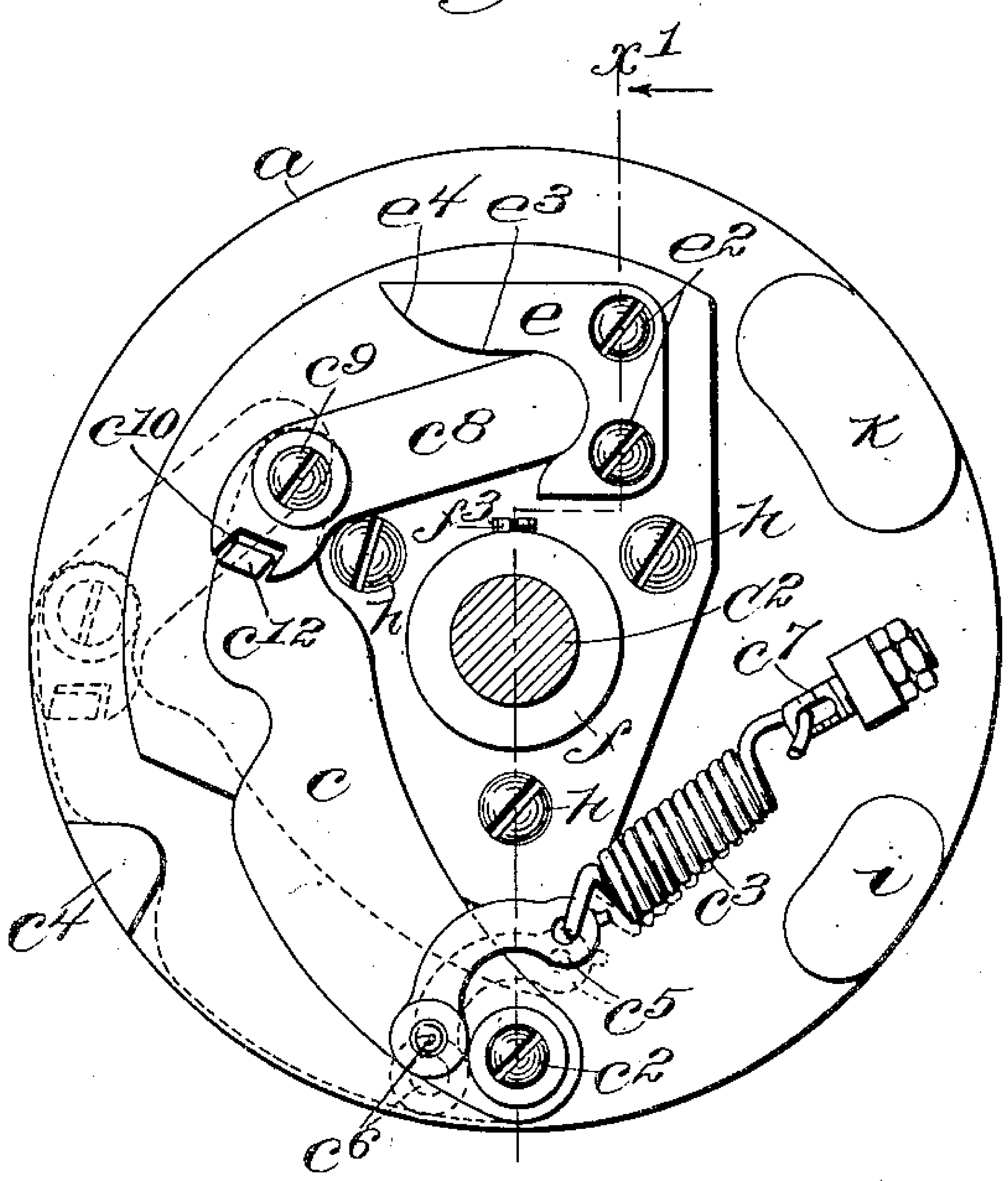
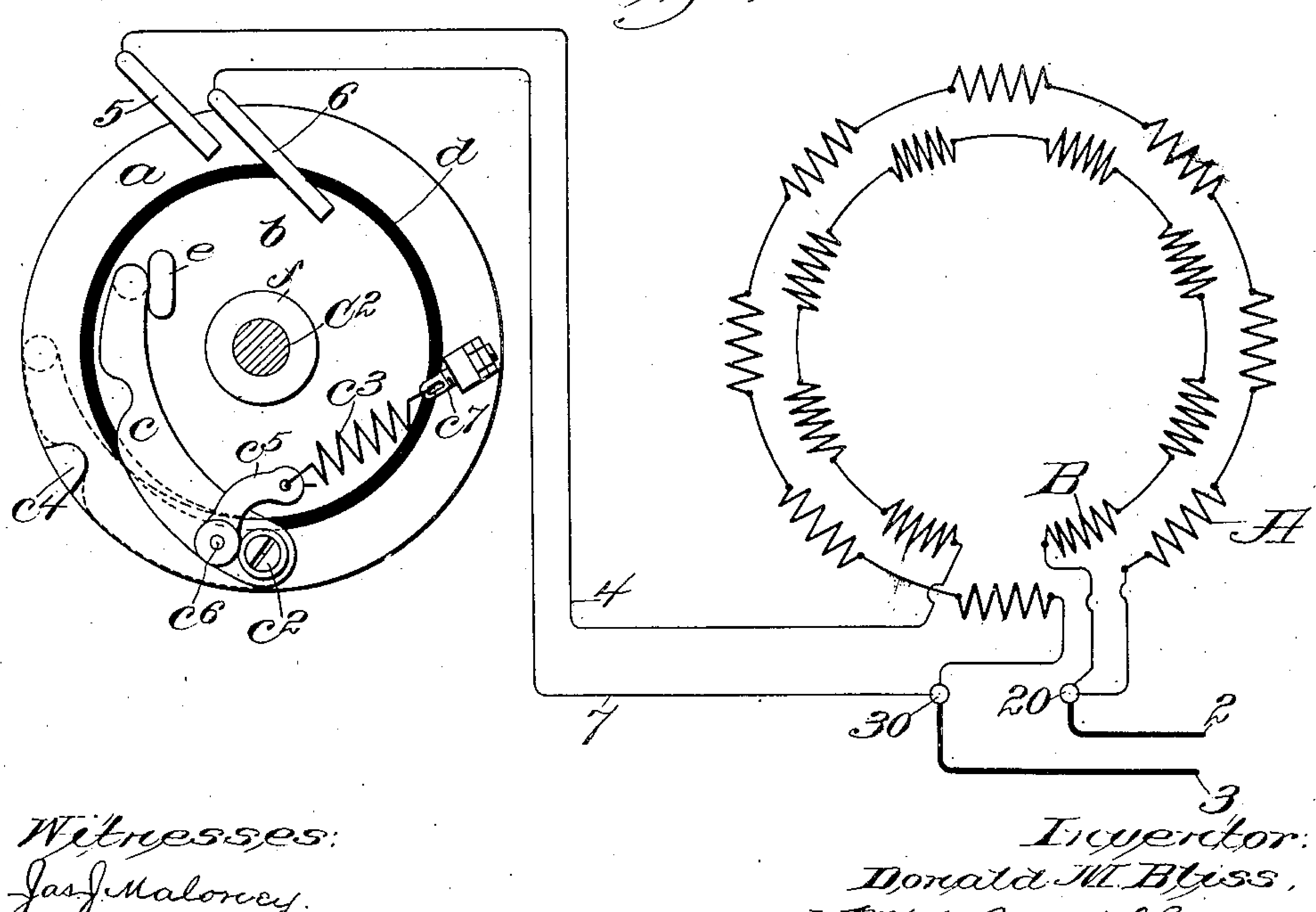


Fig. 3,



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UNITED STATES PATENT OFFICE.

DONALD M. BLISS, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO HOLTZER CABOT ELECTRIC COMPANY, A CORPORATION OF MASSACHUSETTS.

SWITCH.

No. 860,124. **Specification of Letters Patent.** **Patented July 16, 1907.**

Application filed July 14, 1905. Serial No. 269,649.

To all whom it may concern:

Be it known that I, DONALD M. BLISS, a subject of the King of Great Britain, residing in Brookline, in the county of Norfolk, State of Massachusetts, have invented an Improvement in Switches, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The present invention relates to an induction motor, and is embodied in an induction motor of the single phase type in which the motor is rendered self starting by means of phase displacements.

In a motor of this type, the stator is provided, in addition to the working winding, with a starting winding in multiple with the working winding, the said starting winding, however, being open-circuited after the rotor has reached a predetermined speed.

The present invention is embodied in an automatic switch for opening the circuit through the starting coils, the purpose of the invention being to obtain a switch which will open automatically after a certain speed has been reached, and remain open until the rate of speed has been materially reduced, so that minor changes of speed due to variations in load, or any other cause, will not produce a closing movement of the switch.

The switch embodying the invention is operated by centrifugal force which acts against a yielding force, such as that of a spring, and the connection between this spring and the centrifugally operated member is such as to vary the leverage through which the spring acts, so that more force is required to move the switch from its closed to its open position, than is required to restore the switch to its closed position after it has once been opened.

A further feature of the invention consists in an arrangement whereby the contact member of the switch is acted upon by centrifugal force in such a manner as to insure a firm sliding contact during the first opening movement of the switch and the final closing movement thereof.

Figure 1 is an elevation of the rotor member of an induction motor, the switch mechanism being shown in section, the section taken on a line x^1 of Fig. 2; Fig. 2 is a section on the line x^2 of Fig. 1, looking in the direction of the arrow, and showing, in full and dotted lines, the switch mechanism in elevation; Fig. 3 is a diagram of the stator circuits and a partial view of the switch to illustrate the operation.

Referring to Fig. 3, the current is supplied to the stator from the line conductors 2 and 3, the working coils A being directly connected with the line terminals at the points 20 and 30. One terminal of the starting winding B is connected with the line 2 at 20, while the other terminal leads through a conductor 4 to a brush 5 which bears upon a collector ring a, the circuit being completed through a brush 6 bearing upon a collector ring b and a conductor 7 which leads to the terminal 30. So long, therefore, as the collector rings a and b are electrically connected, current will flow in multiple circuit through both the windings A and B. It is desirable, however, to cut out the starting coils B after the rotor has reached a predetermined speed, and, for this purpose, the connection between the collector rings a and b is arranged to be broken by means of a switch member c which is pivotally supported at c^2 upon one of the collecting rings, the said switch member being arranged to be moved in one direction by centrifugal force, and in the opposite direction by a yielding mechanical force as that of a spring c^3.

The switch member c is electrically connected with the collecting ring a, the pivot member c^2 affording means for electrically connecting these parts, as best shown in Fig. 1. The rings a and b are separated from each other by a sheet of insulating material d, so that when the switch is open, there is no electrical connection between the brushes 5 and 6. When, however, the switch is closed, the current can pass through the brush 5 and the ring a to the switch member c which, as best shown in Fig. 2, is in electrical contact with a contact block e electrically connected through fastening screws e^2 with the collector ring b. When, therefore, the rotor is at rest, the switch will be closed, and when the current is turned on, the coils A and the coils B will both be in circuit, thus producing the phase displacement necessary for starting the rotor. As soon, however, as the rotor has reached the speed for which the switch is adjusted, say, for example, one thousand revolutions per minute, the centrifugal force acting on the switch member c will overcome the stress of the spring c^3, and cause the said switch member c to move to the position shown in dotted lines, Fig. 2, such movement being limited by means of a stop c^4. This breaks the circuit through the coils B cutting out the said coils and leaving the working winding A alone in circuit.

In order to prevent the closing of the switch in response to a slight reduction in speed, the arrangement is such that the effective force of the spring c^3 is less when the switch is open than it is when the switch is closed, this being accomplished, as herein shown, by connecting the spring with the switch member c in such a way that the line of pull is brought nearer the pivotal axis of the switch member as the switch opens. As will be seen from Fig. 2, the spring c^3, which is pivotally connected through a curved arm c^5 with the switch member c at the point c^6, acts at first on a lever-arm, the length of which is equal to the distance between the axis of the pivotal support c^2 and a line drawn through the pivotal connection c^6 and the retaining device c^7 to which the other end of the spring is connected. This line, as clearly indicated in the dotted line position of the switch, is moved nearer to the axis of the pivotal support c^2 when the switch is open, thereby shortening the lever-arm upon which the spring acts and reducing the efficiency of the spring as a restoring device for the switch arm. The parts may be so adjusted, therefore, that, although the switch will not open until the rotor has reached the velocity of, say, one thousand revolutions per minute, the said switch will remain open until the speed has been materially reduced, say, for example, down to five hundred or six hundred revolutions per minute. The starting coils B, therefore, will not be cut out until the motor has reached its normal maximum speed, but the speed may afterwards be reduced through variations in load, or for other causes, without causing the starting coils to be included in the circuit. In order to insure a good sliding contact between the switch member *c* and the contact member *e*, the said switch member is herein shown as provided with an arm c^8 which is pivotally connected at c^9 with the member *c*, while the contact member *e* has an extended contact portion e^3 having a curved guiding surface e^4, so that contact is insured during the preliminary movement of the member *c* in response to the centrifugal force.

The supplemental arm c^9 normally stands in such a position that the centrifugal force developed by the rotation of the switch member will tend to throw it into contact with the surface e^3 and maintain it in such contact during the first part of the outward movement of the member *c*.

In order to keep the member c^8 in approximately the same position at all times, and at the same time to admit of the slight movement thereof, due to centrifugal force, the said member is shown provided with a recess c^{10}, the walls of which stand at opposite sides of a lug or projection c^{12} on the switch member *c*, and thereby serve as stops to limit the pivotal movement of the member c^8.

In the construction shown, the operating parts of the switch are inclosed between the main body of the rotor and the collecting rings, and the whole being within the stator member, the working parts thus being entirely inclosed. The collecting rings *a* and *b* are shown as mounted on a sleeve *f* which has a flange portion f^2 on its outer surface, the sleeve being fastened, as by a set screw f^3, to the shaft C^2 of the rotor C. The collector ring *b* rests against a sheet of insulating material *g* interposed between the flange f^2 and the outer surface of said collector ring, the insulation *d* being between the collecting ring *a* and the collecting ring *b*. The rings *a* and *b* and the sheets of insulation *d* and *g* are clamped together by means of screws *h* which extend through from the inner surface to the flange f^2. The parts indicated by the reference letters *i* and *k*, Fig. 2, are merely lugs cast on the member *a* for the purpose of affording weight to counterbalance the movable switch member and the parts coöperating therewith.

While the specific construction herein shown and described for the purpose of illustrating the invention is practical and efficient, it is obvious that modifications may be made in the construction without departing from the invention.

Claims.

1. In a single phase induction motor, starting coils; collecting rings insulated from each other; brushes or collectors connecting said rings respectively with the terminals of said starting coils; a fixed switch member electrically connected with one of said collecting rings; a pivoted switch member electrically connected with the other of said collecting rings and adapted to be operated by centrifugal force; and means for exerting a mechanical force in opposition to said centrifugal force and shifting the line through which said mechanical force acts with relation to the pivotal axis of the switch member.

2. In an electric switch, a rotary support provided with a fixed contact and with a pivotally supported switch member adapted to be moved away from said fixed contact by centrifugal force; means for resisting said centrifugal force; and a contact member pivotally connected with said switch member and so positioned as to be retained by centrifugal force in contact with said fixed contact while the switch remains closed.

3. In a single phase induction motor, starting coils; collecting rings insulated from each other; brushes or collectors connecting said rings respectively with the terminals of said starting coils; a fixed switch member electrically connected with one of said collecting rings; a centrifugally operated switch member electrically connected with the other of said collecting rings; a spring to act against the centrifugal force in the operation of said movable switch member; and means for varying the line of pull of said spring with relation to the axis of said movable contact member, substantially as described.

4. In an electric switch, a rotary support; a fixed contact thereon; a coöperating movable contact carried by said support and insulated from said fixed contact and normally engaging but adapted to be moved out of engagement with said fixed contact by centrifugal force; and means for exerting a mechanical force in opposition to said centrifugal force, and shifting the line through which such mechanical force acts with relation to the pivotal axis of the switch member.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

DONALD M. BLISS.

Witnesses:
MARGARET E. COVENEY,
HENRY J. LIVERMORE.