No. 869,359. PATENTED OCT. 29, 1907.

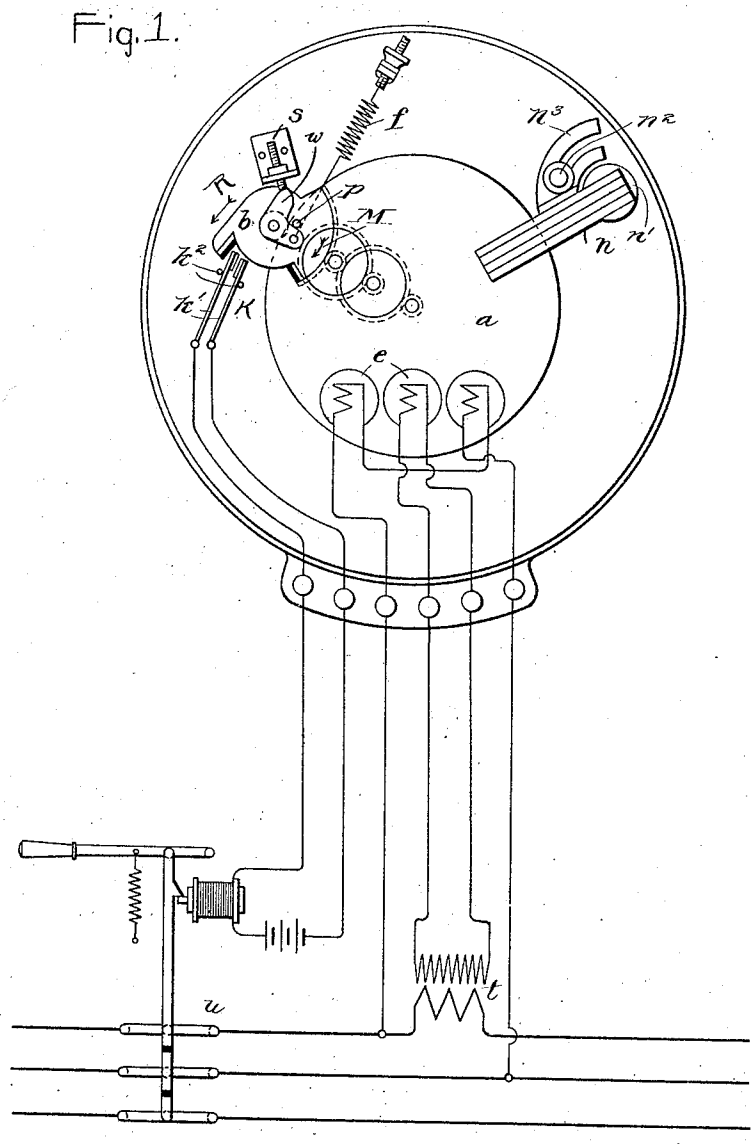
M. FUSS.

RELAY FOR CIRCUIT BREAKERS.

APPLICATION FILED AUG. 26, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Benjamin B. Hull

Allen Orford

INVENTOR:

Max Fuss.

by Allen B. Colman

Atty.

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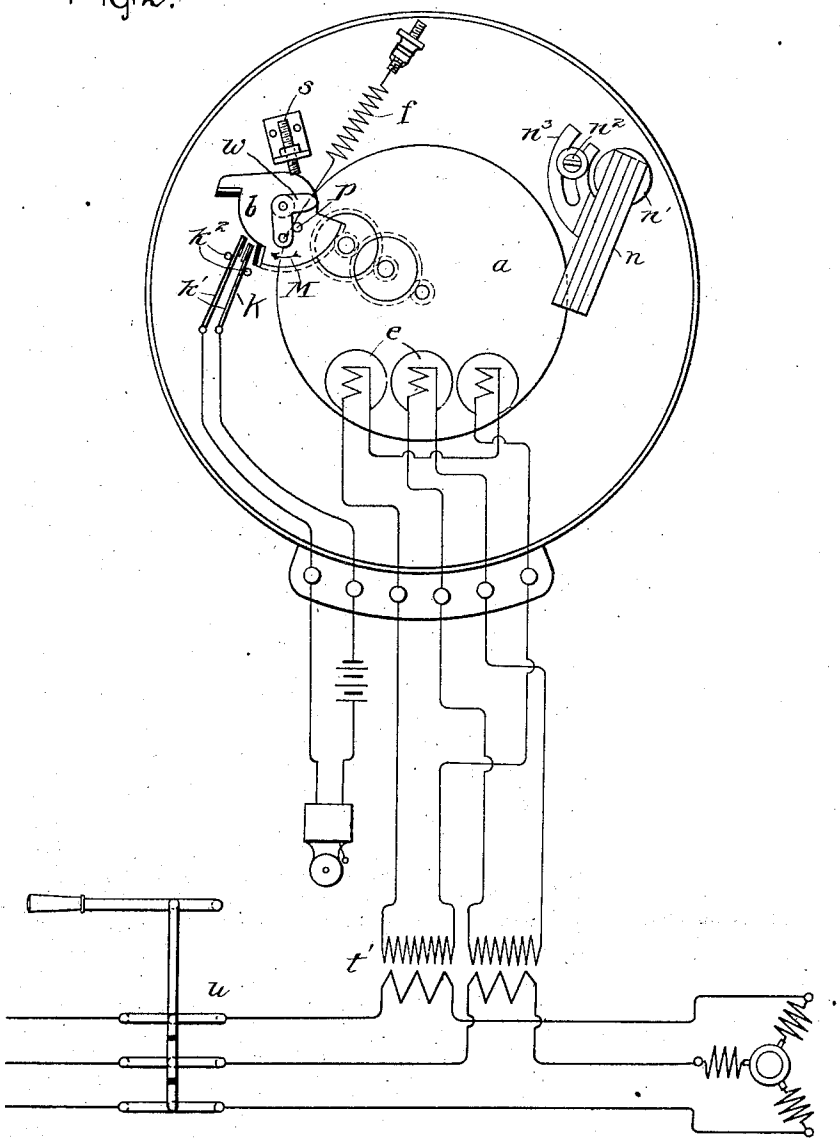
2 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

Benjamin B. Hull

Helen Orford

INVENTOR:

Max Fuss.

by Albert G. Davis

Atty.

UNITED STATES PATENT OFFICE.

MAX FUSS, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RELAY FOR CIRCUIT-BREAKERS.

No. 869,359. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed August 26, 1904. Serial No. 222,292.

To all whom it may concern:

Be it known that I, MAX FUSS, a subject of the King of Prussia, residing at Berlin, Germany, have invented certain new and useful Improvements in Relays for Circuit-Breakers, of which the following is a specification.

The present invention relates to relays for use in connection with circuit-breakers, and the like, and comprises novel mechanism by which the circuit may be broken practically instantaneously upon an excessive overload or after a time interval upon a slight overload, and also upon a reversal of current.

The object and nature of my invention will be more fully understood upon reference to the following description taken in connection with the accompanying drawing, and its scope will be specifically pointed out in the appended claims.

Figures 1 and 2 of said drawing are diagrams illustrating the relay connected up in circuit with the system to be protected, the connection being somewhat different in the two figures.

Referring in detail to Fig. 1, *e* designates a plurality of electromagnets which constitute the stator of an induction motor whose rotor consists of a disk *a* located in operative relation thereto. In the present instance three magnets are shown, the center one of which is energized from the current transformer *t* included in circuit with the line to be protected, which, in the present instance is part of a three-phase system. The outside magnets are excited either by means of potential transformer or by being connected directly across two of the legs of the line. With this organization a magnetic field is built up by reason of the phase difference between the current and voltage which exerts a pull upon the disk *a* tending to rotate it and a reversal of energy flow in the line will cause a reversal of flow in the center coil *e* and a subsequent reversal in the direction of rotation of the rotor *a*. The disk *a* is connected through a train of gearing to the contact wheel *b* which is adapted when rotated to close the switch *k* included in circuit with the trip-coil of the switch *u* in the main line. Mounted concentrically with the contact wheel *b* is an L-shaped member *w*. The member *w* and contact wheel *b* are mounted loosely on the same shaft. This member is acted upon by the tension-spring *f* and the adjusting screw *s*. The contact wheel *b* is provided with a projection *p* which is adapted to engage the member *w* whenever said wheel is rotated in the direction indicated by the arrow M. The disk *a* is also provided with a damping magnet *n*. The switch *k* consists of two blades *k'* normally resting against stops k^2 and each movable into engagement with the other to complete the trip coil circuit.

With this organization under normal conditions of current flow the torque of the motor will oppose the pull of the spring *f* but will be insufficient to rotate the disk *a* of the motor. However, when the current exceeds the adjusted rating, the torque will prevail and the contact *b* will rotate the member *w* which is ordinarily drawn against the adjusting screw *s* by means of the spring *f*. The direction of rotation of the contact wheel is indicated by the arrow M. If the excessive current continues a sufficient length of time the right-hand shoulder on the wheel *b* will engage the switch *k* and thereby close the circuit of the tripping coil of the main switch *u*, thereby breaking the main circuit before injury to the system. On the other hand, if the overload is of such short duration that the contact wheel does not close the switch *k* the torque of the motor will drop off and the spring *f* will turn the contact wheel *b* and the other parts back to their original position. In case of a change in the direction of energy flow, the direction of rotation of the magnet field will be changed and the metal disk *a* will rotate in the opposite direction causing a movement of the contact wheel *b* in the direction indicated by the arrow R. By reason of the proximity of the left-hand shoulder of the wheel *b* to the switch *k* under normal conditions, a small reverse current will be sufficient to close the switch *k* and trip the main switch *u*.

In the system of connections shown in Fig. 2 the relay is connected up so as to operate only as an overload time limit relay; consequently the coils of the magnets *e* are excited from current transformers *t'* placed in different phases. Obviously the switch *k* may be used to control any desired circuit such as the alarm circuit shown in Fig. 2. It will also be apparent that the time limit of the relay may be easily changed by varying the adjustment of the screw *s* or by changing the position of the damping magnet *n*. This adjustment is accomplished by rotating the magnet *n* about its pivotal support *n'* and tightening the screw n^2 upon the slotted tail-piece n^3 projecting laterally from the magnet *n* and slotted in an arc struck from the pivot *n'*. With this organization the time interval will vary inversely as the overload; in other words, the greater the overload the more rapid will be the break, and this action takes place automatically.

It will be apparent from the above description that many changes may be made in the specific matter illustrated without departing from the spirit and scope of the invention. I therefore do not wish to be limited to the specific disclosure but aim to cover by the terms of the appended claims all such arrangements and modifications.

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

1. In an electric system, the combination of an electric circuit and a controlling device for said circuit comprising a reversible motor movable in one direction by excess en-

ergy flow and in the other direction by reversal of energy flow, and means actuated by said motor to change the condition of said circuit upon a reversal and upon an excess of energy flow therein.

2. In an electric system, the combination of an electric circuit and a controlling device for said circuit comprising a reversible electric motor movable in one direction by excess energy flow and in the other direction by reversal of energy flow, and means for controlling said circuit actuated by said motor upon a reversal and upon an excess of energy flow in said circuit.

3. In an electric system, the combination of an electric circuit and a relay for controlling said circuit comprising a reversible electric motor movable in one direction by the excess energy flow and in the other direction by reversal of energy flow, adjustable means for opposing the movement of said motor, and means actuated by said motor to change the condition of said circuit.

4. In an electric system, a circuit controlling device comprising an electric motor connected in the circuit to be protected and rotatable in opposite directions upon reversals of energy flow in said circuit, means for opposing the rotation of said motor in one direction until the torque exceeds a definite amount, and means for changing the condition of said circuit upon the rotation of said motor in either direction.

5. In an electric system, a relay comprising an electric motor included in a circuit to be protected and rotatable in opposite directions upon reversals of energy flow in said circuit, means for opposing the rotation of said motor in one direction until its torque exceeds a definite amount, and a switch actuated by the rotation of said motor in either direction.

6. In an electric system, a circuit controlling device comprising a reversible electric motor, a normally open switch and a member actuated by said motor to close said switch upon the rotation of said motor in either direction.

In witness whereof, I have hereunto set my hand this fifteenth day of August 1904.

MAX FUSS.

Witnesses:
JULIUS RUMLAND,
WOLDEMAR HAUPT.