

UNITED STATES PATENT OFFICE.

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AUTOMATIC CIRCUIT-BREAKER.

1,058,570.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERIK ARTHUR FAGERLUND, engineer, a subject of the King of Sweden and a citizen of Sweden, residing at 4 Blecktornsgränd, Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Automatic Circuit-Breakers, of which the following is a specification.

This invention relates to rocking solenoid circuit-breakers having cores or armatures which slide longitudinally of the same to shift the center of gravity and cause such rocking, and it consists in the construction and combination of parts hereinafter set forth and claimed.

The accompanying drawing represents in central longitudinal section a solenoid circuit breaker embodying my invention, some of the parts appearing in elevation, together with a diagrammatic view of the preferred form of circuit connections.

A solenoid *a* is mounted near its middle at *o* on a support *b* so that it may be tilted into either the position shown in solid black lines in the figure or that shown by dotted lines, these positions being relatively of greater and of less inclination from the vertical line, but on the same side of the horizontal plane. A longitudinal tube *c*, fitted in the said solenoid, is filled with some viscous liquid, for instance glycerin or petroleum, and extended at its lower end considerably beyond the lower end of the solenoid to increase the leverage of the tubular sliding core *d* as it descends in said solenoid, bringing down with it the center of gravity of the latter. The lower part of the solenoid carries a contact *g*, which is pressed against a fixed contact *i* when the solenoid is in the dotted line position, but away from it and against another fixed contact *h* when the solenoid is in the full line position. When in the latter, a rigid armature *l*, extending laterally from said solenoid, is in contact with a magnet *k* and the attraction of the latter resists the shifting of the solenoid to the other position. The hollow interior of the core *d* is closed as it moves downward by a valve *e* at its lower end, this valve being preferably provided with a rod *f* extending through said core to the upper end of the latter. This core, as shown, permits sufficient liquid to pass up between it

and the tube *c*, by external grooving or lesser diameter, or its closing may be sufficiently obstructed to allow a slight upward flow through the hollow interior of the core; for either plan makes the downward movement feasible. When the core ascends, the valve of course opens and the resistance of the viscous liquid will be less.

As shown in the figure the positive wire *m* supporting the lamps *L* runs to movable contact *g* and the negative wire *n* has two branch wires *p* and *q*, the former running to the negative pole of the solenoid, the latter to the contact *h*. The contact *i* is connected with the magnet by a short wire *u*. The wire *q* has a series of push buttons *S* or other circuit closing devices arranged so that the actuation of any one of them will close circuit through it.

When the movable contact *g* is against the contact *i* and a push button *S* is pressed to close circuit, the circuit is from the positive wire *m* through the lamps *L* to the movable contact *g*, the fixed contact *i*, the solenoid, the wire *q* and said push button and the negative wire *n* to the source of electrical power. When the contact *g* is against contact *h* the circuit is from positive wire *m*, movable contact *g*, fixed contact *h*, wire *p* and negative wire *n*, or a part of said current may pass through wire *q* to wire *n* if a push button *S* be closed, in either case not energizing the solenoid and effecting nothing. It will be obvious that the wire *p* may be dispensed with and the contact *h* treated as a mere stop and this in practice is often done.

As the core, actuated by gravity, slides down so as to shift the center of gravity of the solenoid lower and lower, the solenoid will turn on its pivot carrying the movable contact *g* away from the stop or contact *h* and against the contact *i*, where it will remain if there be no pressure on any push button *S* to close the circuit; but when the button is pushed to close the circuit through the lamps and the contact *i* as before described the current passes through the coils of the solenoid, energizing it and drawing up the core into the same. When the pressure on the push button is again released the solenoid is deenergized and the core left free to descend again. The descent of the core is of course retarded by the liquid be-

low it to a degree regulated by the amount of said liquid permitted to slip past or through said core as hereinbefore described.

The magnet *k* and armature *l* resist the earlier part of the tilting movement from the full line position to the dotted line position, and aid the latter part of the like movement from the dotted line position to the full line position. In the former case, this action is due to the complete overcoming of the attraction between *k* and *l* by gravity; in the latter, to the reestablishment of such attraction as an efficient agency by the approach of the armature *l* to the magnet *k*. In both cases there is a sudden acceleration of motion; and in the latter an assurance of more perfect new contact by reason of the continuous and certain action of magnet *k* while the upward movement of the core continues and during the early part of its descent.

Of course the arrangement of circuit wires, switches and contacts above described and shown in diagram is only by way of illustration and convenient instance. The same is true of the form of the parts and like variable matters.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A pivoted solenoid, in combination with a liquid-containing tube within the same, a core arranged to slide down by gravity in said tube against the resistance of said liquid, said core and tube being provided with means for allowing the gradual escape of fluid upward through or past said core during such descent, a fixed contact, a movable contact carried by said solenoid and arranged to be brought into touch with said fixed contact as the solenoid is tilted on its pivot by such descent of the core, circuit connections through said contacts and solenoid and a circuit closer operated at will

for making this circuit draw up the core into the solenoid.

2. A tilting solenoid in combination with a sliding core arranged to vary its center of gravity, a pair of magnetic devices held in contact with each other by said solenoid in the highest position of said core and operating to effect a sudden acceleration of the movement of said core near the end of its upward and its downward travel.

3. A tilting solenoid in combination with a tube arranged within it but extending beyond it at one end, a core sliding in said tube and occupying said end of the tube in its lowest position and shifting the center of gravity of said solenoid to tilt the same on its pivot and circuit breaking and closing devices operated by said solenoid.

4. A solenoid arranged to tilt from either one to the other of two positions as its center of gravity shifts, circuit contacts for each position closed by said solenoid, a core sliding in said solenoid reciprocally by the alternate action of magnetic attraction and of gravity, supplemental devices for accelerating the tilting movement toward the end of the same and means for closing circuit through the contacts while in one of said positions to energize the magnet.

5. A tilting solenoid, in combination with a core sliding lengthwise within it under the influence of gravity and of said solenoid, a pair of contacts arranged to be brought together by the tilting of the solenoid in one direction, conductors making circuit through said contacts and solenoid, and a stop or contact limiting the movement of the solenoid in the opposite direction.

In testimony whereof I have affixed my signature in presence of two witnesses.

ERIK ARTHUR FAGERLUND.

Witnesses:

HARRY ALBILIN,

TORVALD NYSTROM.