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ELECTRIC CIRCUIT BREAKERS

Filed Jan. 18, 1960

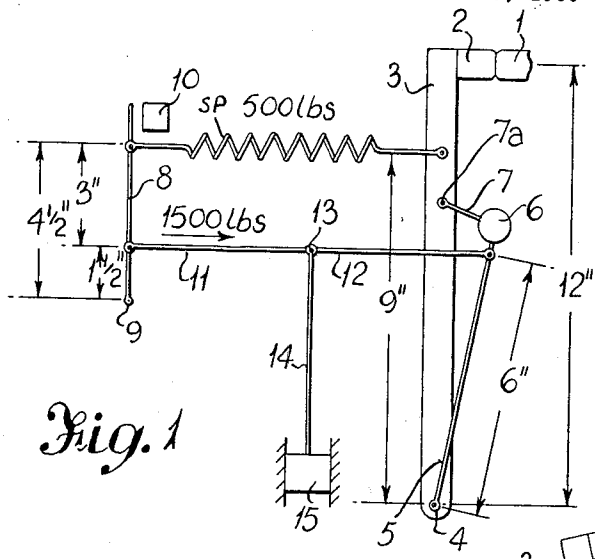

Fig. 1

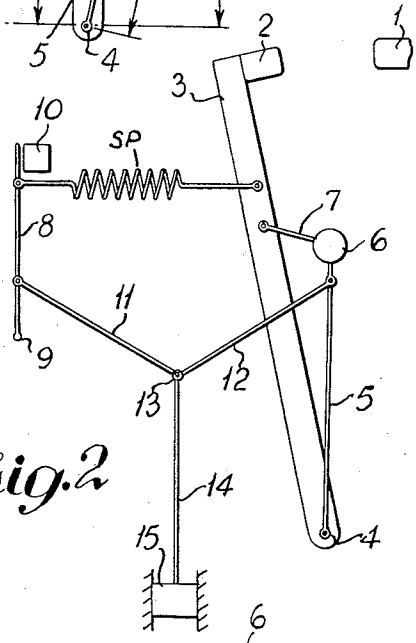

Fig. 2

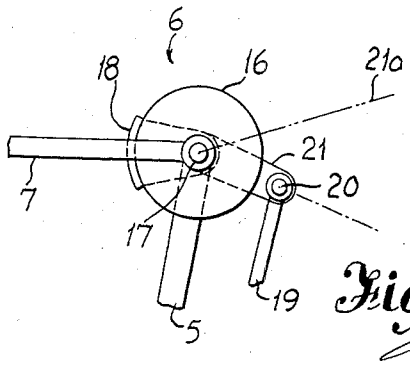

Fig. 3

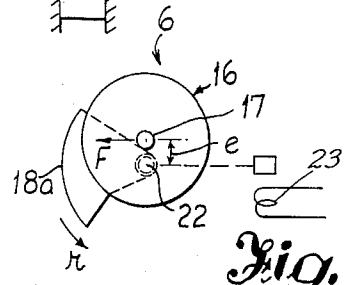

Fig. 4

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ELECTRIC CIRCUIT BREAKERS

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8 Claims. (Cl. 200—106)

This invention relates to electric circuit breakers and aims at providing an improved construction which affords adequate contact pressure and rapid contact breaking while the mechanism which controls the movable contact of the breaker and includes a biasing spring can be arranged sufficiently remote from the contact gap so that the serviceable life of the breaker is not affected by excessive heat when an arc is formed at the contact opening.

From a general aspect this invention resides in an electric circuit breaker including a pivoted contact arm connected to one end of a spring the other end of which is fastened to the free end of a first lever which is mounted for rotation about a fixed point and co-operates with a fixed stop holding it in an end position when the spring opens the contact movable with the contact arm, and a toggle mechanism having the outer end of one of its two arms, which tend to align when the toggle transmits power, linked to said first lever and the outer end of the other of said arms pivoted to a second lever which carries at its free end one of two co-operating parts of a latch, and a third lever pivoted to the contact arm at a point between the point where the spring is connected and the pivot point of the arm, said third lever carrying at its free end the second part of the latch, at least one of the co-operating latch parts being mounted for rotation, and means being associated with the other latch part for its displacement in two opposite directions to close the latch when force from the toggle has to be transmitted through it, and to release the latch for contact opening under the force of said spring.

In a preferred embodiment the two latch parts comprise a roller and a C-shaped catch and one of them is arranged to be moved into and out of its latching position by angular displacement.

Such a latching means may be made self-releasing under the baising force of the spring.

For instance the latch mechanism may comprise a C-shaped catch and a roller rotatably mounted on one and the other of two members which are under a biasing force tending to move them apart, so that the roller is engaged by the hollow side of the catch when the members are coupled together, and is disengaged allowing the members to separate under the biasing force, when the catch is rotated out of the direction of force which intersects the roller axis and is derived from the said biasing force.

When the arrangement is such that the catch and roller engage while the axis of rotation of an arm carrying the roller shaft does not coincide with the axis of rotation of the catch a latch opening force, eccentric relative to the roller is exerted by the force which biases the two members apart, as before mentioned, and an electro-magnet can be provided to oppose, when energised, this latch opening force. Then the latch will be released automatically by the said biasing force when a coil of the electro-magnet is de-energised.

More details will be seen from the following description referring to the accompanying drawings, in which:

FIG. 1 shows diagrammatically and by way of example a circuit breaker according to the invention with its contacts closed;

FIG. 2 shows the circuit breaker open;

FIG. 3 shows a latch as preferably used, and

FIG. 4 shows such a latch providing a self-release action when a holding coil is de-energised.

Referring to FIGS. 1 and 2 the fixed contact of a circuit breaker is shown at 1. A co-operating movable conatct 2 is mounted on a contact arm 3, which is pivoted at a fixed point 4. An actuating arm 5, representing the second lever mentioned above, is rotatable about a pivot preferably but not necessarily coaxial with the pivot 4 of the contact arm 3, and carries at its free end one part of a two-part latch 6 which is shown as a simple circle and may be of a known kind but is preferably of the kind described later in the specification. The third lever mentioned above and carrying the other part of the latch comprises a link 7 pivoted to arm 3 at a point 7*a* intermediate of the connecting point of a biasing spring SP and the pivot 4. The first lever mentioned above is denoted 8 and pivoted at 9. When the circuit breaker is open (FIG. 2) the lever 8 rests against a stop 10. Lever 8 and actuating arm 5 are interconnected by the two arms of a toggle mechanism denoted 11 and 12. The intermediate pivot 13 of the two toggle arms is movable through a vertical member 14 by a plunger or weight 15, which may conveniently be the armature of a solenoid arranged to be energised for closure of the circuit breaker. A cable (not shown) can be attached to the contact arm 3 near the pivot 4 in a known manner.

A convenient form of latch 6 comprises a mechanism as shown diagrammatically in FIG. 3. A roller 16 forming one part of the latch is mounted on lever 7 to be rotatable about pivot 17. A C-shaped catch 18 is mounted on the lever 5 to be rotatable about a pivot which in the closed position is coaxial with the pivot 17 so as to retain the roller against the biasing force exerted by lever 7 and to hold the latch closed for the closing operation of the switch when power has to be transmitted through the toggle to the contact arm. The angular position of the C-shaped member 18 is controlled as by a rod 19 pivoted at 20 to an arm 21 of the member 18, and linked to the switch opening mechanism, for instance to the arm 12 thereof. When the control rod 19 moves upwards and the centre line of arm 21 assumes the position 21*a* shown in dotted lines, the latch is released so that spring SP may cause opening of the circuit breaker by moving the contact arm 3 to the left. Thereby the contact arm is disconnected from the toggle mechanism to reduce inertia and ensure rapid opening of the circuit breaker.

FIG. 4 shows a modified construction of the latch which allows automatic latch release under the biasing force. In this case the latch is maintained closed during the normal operitaon of the breaker by means of an electro-magnet or a coil 23 which is deenergised for breaker opening.

It will be seen from FIG. 4 that a distance *e* is provided between a shaft or pivot 22 of the member 18*a* and the

pivot 17 of the roller 16 so that a force derived from the biasing force is eccentric and exerts a torque upon the roller tending to rotate the member 18*a* in the direction of the arrow *r* thereby to release the latch. For retaining the latch closed an opposing torque must be exerted through shaft 22 or members corresponding to the parts 19 and 21 of FIG. 3. If this opposing torque is removed, for instance by de-energising a tripping coil, the latch opens automatically under the biasing force.

The operation of the mechanism will be best understood if dimensions are assumed for the lengths of the levers as shown for instance in FIG. 1. It is also assumed that the spring SP exerts a force of 500 lbs. in its extended condition, when the contacts are closed as shown in FIG. 1.

A force of 1,500 lbs. transmitted by the toggle tending to rotate the actuating arm 5 in a clockwise direction, operating at a radius of 6" from the pivot 4, produces a torque of 750 lbs. ft. This is transmitted by means of the link 7 to the contact arm 3. The spring however, operating at a point 9" from the pivot 4 produces a torque in the opposite direction equal to 375 lbs. ft., so that there is a resultant torque in a clockwise direction of 375 lbs. ft. Since the contact is located at a radius of one foot from the pivot 4, the contact pressure is 375 lbs.

As soon as the latch 6 releases the link 7, the spring operates to produce a torque of 375 lbs. ft. to open the contacts. Simultaneously the spring causes the lever 8 to move clockwise about the pivot 9 until it abuts the stop 10, thus relieving the spring load on the toggle and allowing the plunger or weight 15 to drop under the action of gravity, causing the actuating arm 5 to move in an anticlockwise direction. Simultaneously the means controlling the latching operation resets the latch parts in readiness for the next contact closure. The final position of the members of the mechanism ready for contact closing, after contact opening, is shown in FIG. 2.

For subsequent closing of the circuit breaker an upward force is applied to the plunger 15.

It will be understood that variations are possible without departure from this invention and a single mechanism embodying the invention can be arranged to operate more than one contact in polyphase circuit breakers.

What I claim is:

1. An electric circuit breaker having a stationary contact, a movable contact, an arm carrying said movable contact, a spring having one end acting upon said arm to bias said movable contact away from said stationary contact, a toggle comprising two arms interconnected by a pivot, an actuating member for displacing said pivot in opposite directions for extending and for collapsing said toggle, a lever, means pivotally mounting said lever, means pivotally connecting said lever to an end of one of said toggle arms, means securing the other end of said spring to said lever at a point more remote from the pivotal mounting axis of said lever than the pivotal connection of said lever and toggle arm, an actuating arm pivoted to the free end of the other toggle arm, a link pivotally connected at one end to said contact arm, a coupling having two interengaging parts, one of said coupling parts being carried by said link and the other by said actuating arm, said two coupling parts being constructed and arranged to be engaged to provide a force transmitting connection when said toggle is extended by said actuating member providing for contact closure and to be disengaged when said toggle is collapsed by said actuating member.

2. An electric circuit breaker as claimed in claim 1, wherein the position of the link-pivot on the contact arm is between the said spring connection point and the arm pivot.

3. An electric circuit breaker as claimed in claim 2, wherein the contact arm and actuating arm are mounted to be rotatable about a common axis.

4. An electric circuit breaker as claimed in claim 1, wherein one of the two coupling parts is mounted for rotation, and a means is provided to displace angularly the other coupling part in one sense for coupling closure when the pivot of the toggle mechanism is displaced in the direction for force transmission and in the opposite sense for coupling release when the toggle pivot is displaced in the direction for contact opening.

5. An electric breaker as claimed in claim 4, wherein one of the two coupling parts comprises a C-shaped catch member and the other coupling part comprises a roller.

6. An electric circuit breaker as claimed in claim 4, wherein one coupling part comprises a roller, the other coupling part comprises a catch member, means for mounting said catch member for rotation about an axis parallel to the axis of said roller whereby a force eccentric with respect to said roller and tending to release the coupling is produced, and electromagnetic means for opposing said eccentric force and holding the coupling parts engaged when said latter means is energized and when de-energized allowing coupling release action by said eccentric force.

7. An electric circuit breaker including a contact arm, means pivotally mounting one end of said contact arm, a first lever which is mounted for rotation about a fixed point and having a free end, a spring connected to said contact arm and to said free end of said first lever, a fixed stop engageable by said first lever, a second lever, a toggle mechanism having a pair of arms with the outer end of one of said arms linked to said first lever and the outer end of the other of said arms pivoted to said second lever, a latch having two parts with one part carried by said second lever, a third lever pivoted to said contact arm at a point between the point of connection to said spring and said pivotal mounting of said contact arm, said third lever carrying at its free end a second of said latch parts, at least one of said latch parts being mounted for rotation on the member by which it is carried, means associated with the other of said latch parts for displacement of said other part in two opposite directions to close the latch when displaced in one direction when force from the toggle has to be transmitted through it and to release the latch when displaced in the opposite direction for contact opening under the force of said spring, said latch part which is displaceable in two opposite directions comprising a C-shaped catch member, and the other latch part comprising a roller, said two latch parts being associated with the said second and third levers respectively to move with them, said catch member being normally aligned with a force derived from the force of said spring for latching together said two latch members, and means for displacing said catch member out of said aligned position thereby to release said latch.

8. An electric circuit breaker including a contact arm, means pivotally mounting one end of said contact arm, a first lever which is mounted for rotation about a fixed point and having a free end, a spring connected to said contact arm and to said free end of said first lever, a fixed stop engageable by said first lever, a toggle mechanism having a pair of arms with the outer end of one of said arms linked to said first lever and the outer end of the other of said arms pivoted to a second lever, a latch having two parts with one part carried by said second lever, a third lever pivoted to said contact arm at a point between the point of connection to said spring and the pivot point of said contact arm, said third lever carrying at its free end a second part of said latch, at least one of said latch parts being mounted for rotation on the member by which it is carried, means associated with the other of said latch parts for displacement of said part in two opposite directions to close the latch when force from the toggle has to be transmitted through it and to release the latch for contact opening under the force of said spring, said latch parts comprising a roller and cooperating catch member, and the other latch part comprising a

roller, said two latch parts being associated with the said second and third levers respectively, said catch member being rotatably mounted about an axis parallel but not coincident with the axis of said roller whereby the force transmitted through the catch is eccentric relative to the roller and tends to release the latch, and electromagnetic means for opposing said eccentric force tendency when said latter means is energized and when de-energized allowing release of said latch by said eccentric force.

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