May 28, 1940. W. H. FRANK 2,202,626

CIRCUIT BREAKER

Filed Feb. 15, 1938 3 Sheets-Sheet 1

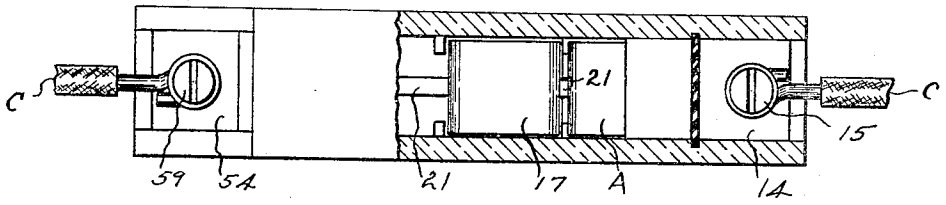


Fig. 1

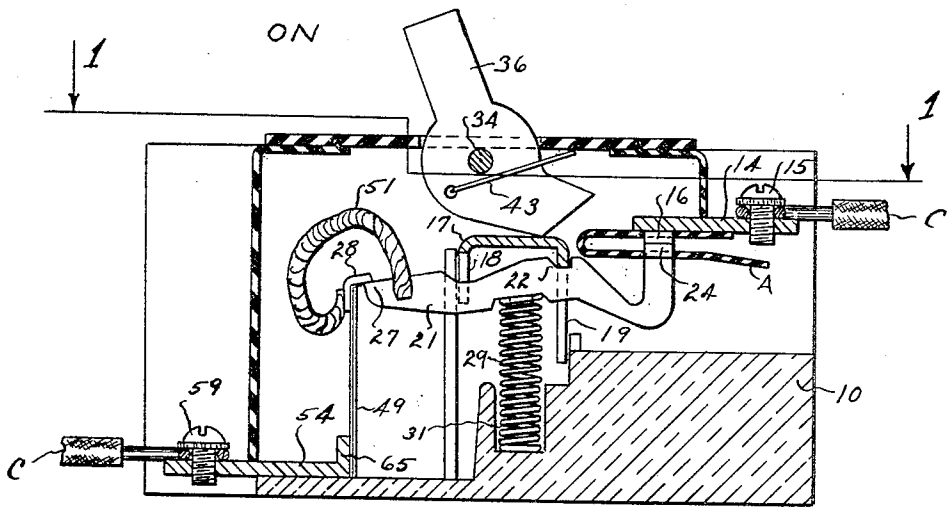


Fig. 2

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CIRCUIT BREAKER

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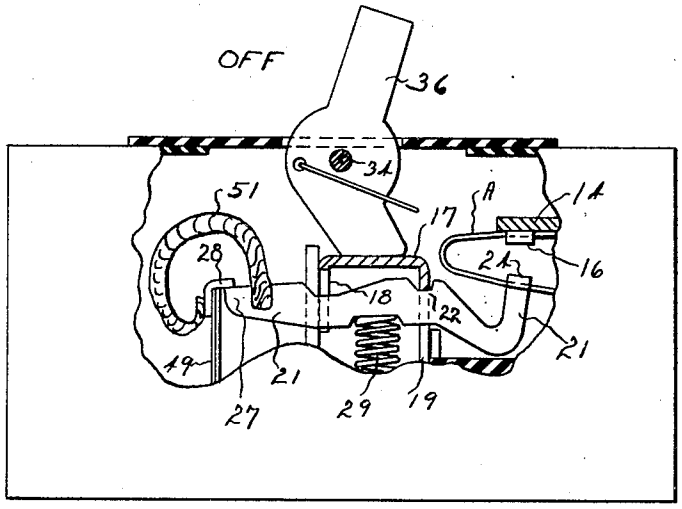


Fig. 3

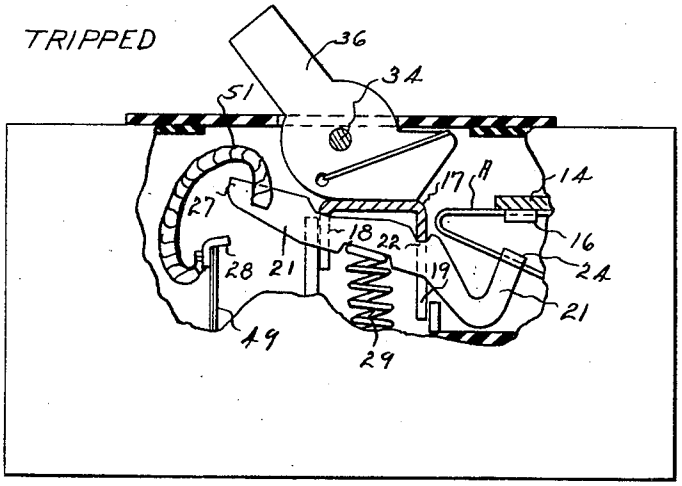


Fig. 4

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CIRCUIT BREAKER

Filed Feb. 15, 1938 3 Sheets-Sheet 3

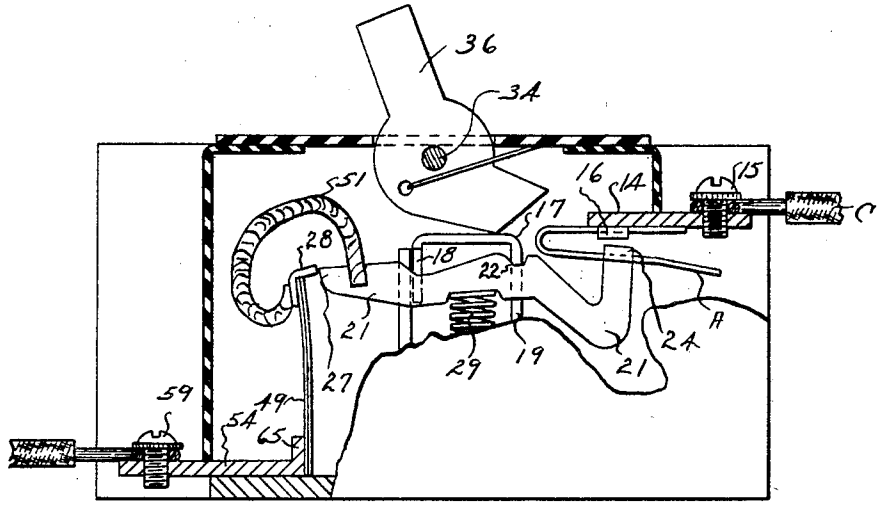


Fig. 5 TRIPPING

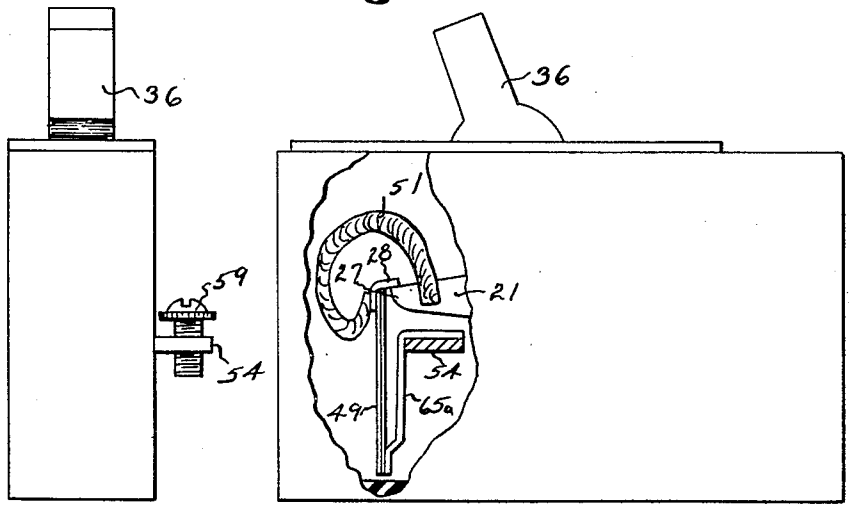


Fig. 6 Fig. 7

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2,202,626

UNITED STATES PATENT OFFICE

2,202,626

CIRCUIT BREAKER

William H. Frank, Detroit, Mich.

Application February 15, 1938, Serial No. 190,649

1 Claim. (Cl. 200—116)

This application relates to circuit breakers and discloses breakers containing improvements over a known type of breaker, such as the one that is disclosed in the patent to Jackson No. 2,096,544, of October 19, 1937.

Referring to that patent, it will be observed that the breaker disclosed therein, like other breakers of this type, contains parts so arranged that if there is any magnetic force present on overload, such force tends to oppose the mechanical force (a spring) which is relied upon for breaker release on overload. This, of course, is objectionable because instead of opposing the mechanical force, the magnetic force should assist the mechanical force. Consequently, it is the purpose of this invention to provide a circuit breaker which, though it might be considered as being of the same type as that of Jackson patent aforesaid, has its parts so arranged that the overload currents will create strong magnetic forces and these are so directed that they aid the mechanical tripping force, rather than oppose them. This purpose is effected without sacrifice of the desirable features of the type of breaker of the Jackson patent aforesaid particularly such features as small size, economy of manufacture, and simplicity of construction.

The improvement resides in the disposition of the thermal latch of the breaker and the contact arm of the breaker at sharp right angles to each other whereby on overload there will be set up a magnetic force which not only tends to bias the latch into released position but also tends to move the contact arm away from its held position and consequently this magnetic force may be seen to assist the spring generally relied upon to move the contact arm when the latter is released by the latch.

It is also the purpose of this invention to provide in a breaker, which may be considered as being of the same type of that of the Jackson patent aforesaid, an improved arc control arrangement operating for arc quenching and arc baffling and which also operates, by utilizing the existing gas pressure, to assist in opening or releasing or tripping the breaker, thus assisting the mechanical force which ordinarily is the only force that is relied upon for tripping.

A further purpose is to provide in a breaker a contact set which provides an abrupt or sharp or right angle turn in the current path which operates to divert any existing arc on contact break and project it towards an open end of the casing and into the ambient atmosphere, thus preventing the arc from being confined in the casing. The sharp bend creates a magnetic force and this force diverts the arc towards the open end of the casing. In addition this force may be relied upon to help extinguish the arc by blowing it away from the contact set.

This magnetic force also may be relied upon to help separate the contacts, and in this manner it acts like the gas pressure force at the contact set to help release the breaker on overload.

Thus it will be seen that in the instant breaker there is not only the mechanical force relied upon for tripping, but in addition, there are created magnetic forces at the opposite ends of the contact arm, and a gas pressure force at the contact set, and that these forces also aid in breaker release, as contra-distinguished from the previously known breakers, such as that of the Jackson patent, aforesaid, where there are neither mechanical forces nor gas pressure forces, or where, if either of these forces do exist, they operate to oppose the tripping influences of the mechanical force, rather than to assist it.

For an understanding of these improvements, reference should be had to the appended drawings. In these drawings,

Fig. 1 is a section view on line 1—1 of Fig 2, of a breaker, with parts removed for purposes of clarity;

Figs. 2–3–4 are views of the breaker in "on," "off" positions, respectively;

Fig. 5 shows the parts during the tripping operation;

Figs. 6 and 7 show a modified form of breaker.

Referring to the drawings, it will be observed that the breaker hereof comprises an insulating casing 10 containing a conducting strap 14 into which is threaded a binding screw 15 for a circuit conductor C, the strap 14 having thereon a stationary contact 16.

Withing the breaker is an element 17, provided with slots 18 and 19 within which is disposed a rigid conducting contact bar 21 provided with a notch 22 receiving the ends of slot 19 of the element 17.

On one end of the contact bar 21 is a movable contact 24 for engaging the stationary contact 16. The opposite end of the contact bar 21 is formed as a latching surface 27 adapted to cooperate with a latching tip 28 supported on a movable structure to be hereinafter described in detail.

A heavy compression spring 29, guided within a cup portion 31 of the casing base, engages the bar 21 and tends to bias it in a manner later to be described.

Journalled on a cross shaft 30 connecting the sides of the breaker casing is the operating handle 36 of the breaker and this handle is provided with a spring 43 which tends to rotate it in a clockwise direction as shown.

The latching tip 28 is formed on the end of a bimetallic thermal latch 49, whose free end is connected by a flexible lead 51 to the contact bar 21; the latch is mounted on a strap 54, having a binding post 59 for a circuit conductor C, through a portion 65.

It will be understood that on the arising of an overload the latch 49 warps to the left so that its latching tip 28 leaves the contact bar 21, whereupon the spring 29 causes such contact bar to rock, at its notch 22 as a pivot, to open the circuit between contacts 24 and 16.

It is observed that the parts 49—51—21 together form a conductor carrying an electrical current and that this conductor has a sharp bend at point 27—28. The flow of current in such conductor past such sharp bend creates a magnetic force which tends to move the bimetal latch 49 towards its released position and which also tends to move contact arm 21 clockwise and towards its released position. This magnetic force becomes significant and worthy of consideration when heavy overloads, or short circuit currents, pass through the breaker as is sometimes the case and against which case the breaker is provided as insurance.

Similarly there is a sharp bend at the conductor formed by parts 21—14 of the breaker; the flow of heavy overload current or short circuit current through the contact set will create a substantial magnetic force at such bend and this will tend to move arm 21 clockwise.

Thus on overload at each end of the arm 21 there arise magnetic forces tending to move the arm 21 clockwise and open the circuit. In addition the magnetic force at the contact set operates to divert or project the arc, if any exists, towards the right or open end of the breaker casing. Further, if any arc exists at such contact set and is of sufficient capacity to generate gases, the pressure of such gases will tend also move the arm 21 clockwise.

The latch 49 may be mounted with respect to strap 54, not in the manner shown in Fig. 2, but rather in the manner shown in Fig. 7, employing a supplementary mounting strap 65*a*, whereby there will be created an additional magnetic loop to aid in unlatching the latch 49. Referring to Fig. 7, it will be observed that overload current flowing through parts 65*a* and 49 together will tend to move latch 49 towards its unlatched position and thus assist the spring 29 in causing overload release.

The contact end of the contact bar 21 is formed in a manner to provide an abrupt right angle turn in the current path through the contact set 16—24 which tends to divert any arc existing on contact break towards the open end of the casing adjacent the contact set. The contact bar 21 is formed to provide a leg of considerable length between the contact 24 and that part of the bar through which the current flows in a path parallel to the path through the strap 14, and such leg, being of considerable length and being normal to the strap 14, provides a long path leading to the movable contact 24, transverse to the path leading away from contact 16.

To aid in blocking the escape of gases generated on arcing into the interior of the casing where it can injure the delicate mechanism within the casing, there is provided at the contact set an arc shield A, in the nature of a V-shaped strap on those interior sides are the contacts and whose sides are relatively movable, pivoting on the apex of the V where the sides join integrally, such joint providing a barrier. The shield may be of a fibrous material having a tendency to emit gases in the presence of arcs which aids in extinguishing arcs. Gases generated within the shield will not escape to the interior of the casing but will rather be diverted to the open end of the casing by the effect produced by the abrupt turn in the current flow, as above described.

As previously described, if there is any gas formed by arcing at the contact set, such gas will create a pressure; this pressure will tend to blow out the arc by blowing it away from the contact set and towards the open end of the casing. The gas pressure will tend to rotate the contact arm 21 clockwise and thus will aid tripping of the breaker. The gas pressure will act against the opposite sides of the shield A (the latter is flexible) and since one side only, namely the lower side of such shield, is movable, and since such movable side is fixed to arm 21 the gas will force the contact end of the arm downwardly thus assisting the spring 29.

Now having described the circuit breaker disclosed herein and particularly those features thereof which distinguish such breaker from known breakers, such as those of type disclosed in the Jackson patent aforesaid, reference should be had to the claims which follow for a determination of my inventions.

It is to be understood, however, that while my inventions and improvements are disclosed in a breaker of the type disclosed in the Jackson patent aforesaid, that it is not my intention to limit my protection to these improvements only when in association with the breaker such as that of Jackson patent for it is intended to cover the improvements and inventions hereof wherever such improvements are utilized and it is obvious that such improvements might be utilized in breakers differing somewhat from that of the Jackson patent aforesaid.

I claim:

In a circuit breaker, an operating bar, a thermal latch therefor, and a flexible loop connecting the latch and the bar whereby the circuit controlled by the breaker includes the latch and the bar, and a spring for moving the bar in one direction upon latch release, the parts being so arranged relatively that the loop tends to straighten out in proportion to the amount of current flowing through it, the arrangement of the parts being such that such tendency exerts a force on the bar tending to move the bar away from the latch in the same direction that the spring tends to move the bar whereby the effect of a flow of current on overload through the loop tends to aid the spring and thus accelerate contact separating movement of the bar.

WILLIAM H. FRANK.