United States Patent

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[54] **MOLDED CASE CIRCUIT BREAKER HAVING AN AUXILIARY CONTACT SEPARATING SPRING**
3 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **200/153,** 337/67
[51] **Int. Cl.** **H01h 3/00,** H01h 71/16
[50] **Field of Search** ..... 200/153 G, 153 H

[56] **References Cited**
UNITED STATES PATENTS

2,803,721	8/1957	Cole	337/75
2,811,605	10/1957	Christensen et al.	337/53

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ABSTRACT: A circuit breaker of the molded case type incorporating a spring that accelerates movement of the movable contact to the open circuit position without greatly increasing the manual effort required for closing the circuit breaker

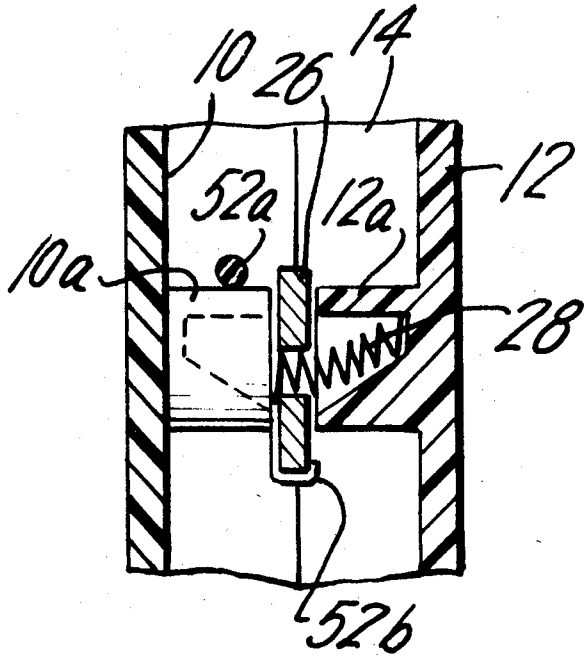


FIG. 1

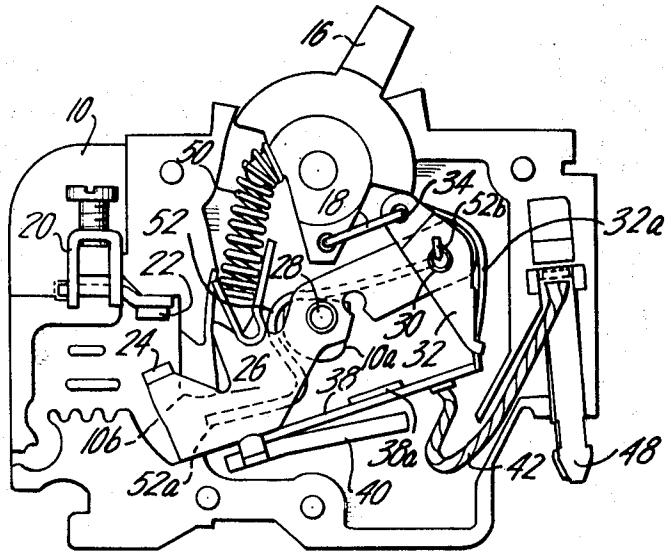
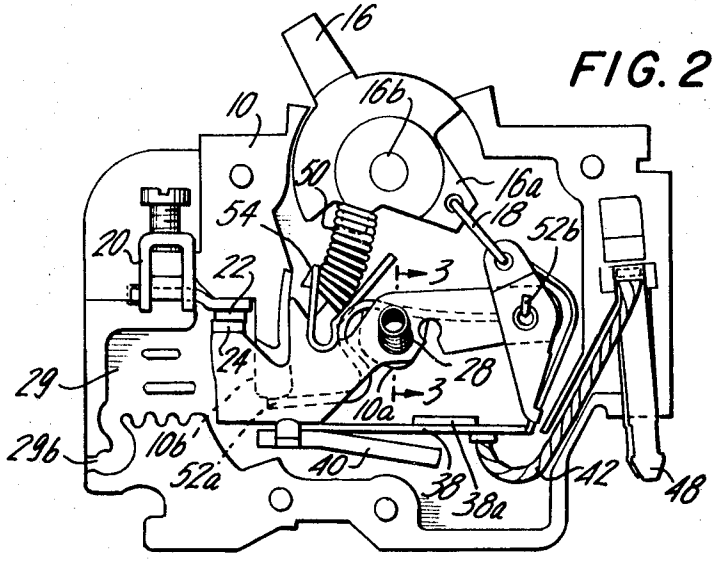


FIG. 2



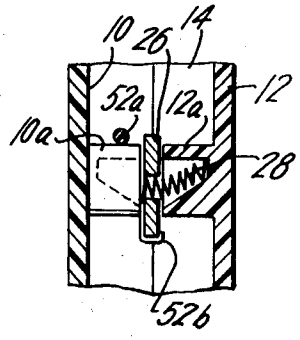


FIG. 3

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MOLDED CASE CIRCUIT BREAKER HAVING AN AUXILIARY CONTACT SEPARATING SPRING

This invention relates to circuit breakers and more particularly to improvements in molded case circuit breakers. In some respects this is an improvement over copending application Ser. No. 845,275 filed July 28, 1969.

As more and more electricity has been used in homes, offices and factories the capacity of the electric power distribution system serving such places has been increased to keep up with the increased demand. The increase in capacity has been accomplished by installation of additional and larger transformers and conductors. With the increased capacity has come an increase in the available short circuit current.

Molded case circuit breakers have been widely employed in the distribution and control of electricity and their popularity continues to increase. In the past the standard circuit breakers which had a short circuit current-interrupting capacity of 5,000 amperes have been satisfactory. However, in view of the increased short circuit currents available now, and the even greater currents which, it is expected, will be available in the future, it is important that the interrupting capacity of the circuit breakers be increased. Additionally, from an economic viewpoint the improved circuit breakers must be interchangeable with, and if possible externally identical to, the prior units so as to allow continued use of standardized panelboards, accessories and the like and to permit improvement or "upgrading" of existing installations. Therefore, it is an object of this invention to improve the short circuit current interruption capacity of molded-case circuit breakers. It is another object of the invention to improve the interrupting capacity of prior available circuit breakers with minimum external changes therein.

The invention is illustrated, in certain of its aspects, as applied to a single pole molded-case circuit breaker of well-known construction. The invention is equally applicable to multipole molded-case circuit breakers of the type illustrated and described in detail in U.S. Pat. No. 2,923,795.

The nature of the invention and its further objects and features of novelty will be better appreciated from the following detailed description of the illustrative embodiment which is shown in the accompanying drawings:

FIGS. 1 and 2 are side views of a circuit breaker with the cover removed, shown in the contacts-open and in the contacts-closed position, respectively, illustrating the invention.

FIG. 3 is a fragmentary cross section of a portion of the mechanism in FIG. 2 viewed along the line 3—3 therein.

Referring to the drawings there is shown a circuit breaker of the type described in detail in U.S. Pat. Nos. 2,803,721 and 2,811,605. The circuit breaker case has a first wall **10** that cooperates with a second wall **12** to form a cavity **14**. Cavity **14** contains a complete circuit breaker mechanism, including a pair of contacts, a contact-operating linkage, and an overload release means and an externally projecting operating handle **16**.

The circuit breaker shown includes a first terminal **20** rigidly carrying a stationary contact **22**. Movable companion contact **24** engages contact **22** when the circuit breaker is closed, movable contact **24** being supported on elongated contact-carrying member **26**. Contact-carrying member **26** is pivoted near its center on a transverse coil spring **28**. The contacts engage and disengage within a well-known type of arc chute **29** that includes venting passage **29*b***. Carried on pivot **30** in an insulating bearing (not shown) at the end of contact member **26** remote from contact **24**, is an actuator **32** having a bearing **34** which receives one leg of a U-shaped link made of bent wire. An ambient temperature compensating bimetal **32*a*** has its upper end curved about bearing **34** and its lower end, which constitutes its latched end, is slidably guided by a formed portion of actuator **32** so that the lower tip of bimetal **32*a*** is projected to a variable extent in dependence on the ambient temperature.

The overcurrent releasable mechanism includes a current-responsive bimetal **38** that is united at one end to the contact arm **26**, providing electrical connection and a rigid mechanical connection at this point. The elongated contact member **26** constitutes a conductive support that carries and unites bimetal **38** and the magnetic pole structure **40** of a tripping electromagnet. The pole structure **40** is also united to bimetal **36** and to contact arm **26** by a rivet that extends integrally, through the bimetal and the pole structure, from contact arm **26**.

Flexible braid **42** has one end connected to bimetal **38** and its opposite end is joined to terminal **48**, of a form suitable for panelboard plug-in installation as disclosed in U.S. Pat. No. 2,647,225. An electrical circuit may be traced through the circuit breaker from terminal **20** across contacts **22** and **24**, into elongated contact member **26**, via bimetal **38** and braid **42** to terminal **48**. There is no current bypass path bridging bimetal **38** by virtue of the insulated pivot **30** which is more fully disclosed in U.S. Pat. No. 2,647,186.

Transverse coil spring **28**, which serves a pivot for contact arm **26**, is housed in a pair of projecting bosses **10*a*** and **12*a*** that extend inwardly toward one another within the cavity **14**. Spring **28** biases contact arm **26** clockwise about pivot **30** when the breaker is closed and in this way spring **28** provides contact pressure between the contacts **22** and **24** and permits overtravel of the contact-carrying member **26** as more fully explained in U.S. Pat. No. 2,681,396.

A compression spring **50** is interposed between a handle **16** and "snap-lever" **54** that is carried by member **26** biasing both the contact member and the handle toward their "open" position when the circuit breaker is open. As shown in FIG. 2 this compression spring provides strong contact-opening bias when the breaker is closed. In the closed configuration of the mechanism shown in FIG. 2, actuator **32** is latched by bimetal **38** and the counterclockwise spring bias applied to contact-carrying member **26** is resisted by an overset toggle consisting of link **18** and arm **16*a*** of handle **16**. Counterclockwise motion of handle **16** is limited by the casing **10**. In this configuration, spring **50** provides a limited bias for operating handle **16** in the contact-opening direction, bias that is ineffectual due to the friction forces developed at pivot **16*b*** when the breaker is closed and latched.

In part, the speed of opening of the contacts upon occurrence of an overload determines the interrupting capacity of the circuit breaker. The speed of opening is largely dependent upon the force of compression spring **50**. An increase in force of spring **50** could produce faster opening. However, spring **50** and pivot spring **28** are in opposition and therefore an increase in force of spring **50** will result in a reduction in contact pressure. An increase of force in spring **50** is therefore not suitable as a way of increasing the speed of opening. A novel solution is provided to the problem of increasing the opening speed of the circuit breaker by the provision of a spring **52** that operates about the boss **10*a*** as a fulcrum. One end **52*a*** of torsion spring **52** engages a stop **10*b*** on the wall **10** and the other end is formed as a hook **52*b*** extending through pivot **30** at the end of contact-carrying member **26** remote from contact **24**. Spring **52** is positioned so that it reacts between the casing wall **10** and the contact arm to pivot the contact arm **26** counterclockwise about spring **28** as viewed in FIG. 2. Torsion spring **52** has no effect on the elongated contact-carrying member **26** in the closed condition of the breaker, since the spring acts only on stationary parts **10*a*** and **10*a*** and **10*b*** and on the erect toggle **16*a***, **18**. When release takes place as described below, spring **52** accelerates the movement of contact **24** to the open circuit position.

The toggle comprising arm **16*a*** of handle **16** and link **18** lock the contacts closed, under the control of bimetal **38** that acts as a latch. Upon downward deflection of the bimetal magnetically due to current in the bimetal developing a pull of armature **38*a*** on the bimetal toward pole **40** or by heating of current responsive bimetal **38**, elongated contact-carrying member **26** is driven counterclockwise by spring **50** and by spring **52**, as actuator **32** swings clockwise about its pivot **30**. Springs **50** and **52** are now free to accelerate the separation of the contacts **22**, **24**. The addition of spring **52** contributes increased speed of opening of the contacts.

Spring **52** is made of relatively heavy wire. In a single-pole breaker as shown, and especially in a multipole breaker where a separate spring **52** should be used for each of the contact arms, such a spring would tend to make it hard to close the circuit breaker. This effect is largely avoided by the following particulars.

As seen in FIG. **1**, which represents the breaker when open, there is a substantial space between stop **10***b* projecting inward from casing part **10** and end **52***a* of spring **52**. Toggle **16***a*, **18** is in its most buckled condition at this time. As handle **16** is moved counterclockwise, toggle **16***a*, **18** approaches its erect state and tends to be progressively easier to operate as it approaches fully erect condition. Spring end **52***a* reaches stop **10***b* when handle **16** has moved about halfway, or a bit more, toward its "closed" position. Thus, the mechanical advantage that can be realized by the toggle approaching its erect state makes it relatively easy to close the contacts and to develop considerable stress in spring **52**. When link **18** and arm **16***a* of the handle become aligned or erect, no manual effort at handle **16** is needed to overcome the force of spring **52** that is applied to the toggle **16***a*, **18**. A little further motion occurs, and the toggle becomes "overset," locking the breaker closed. In this overset condition of the toggle, clockwise bias on actuator **32** develops. The stress in spring **52** provides a large force that is available instantly to drive movable contact **24** open when the overcurrent latch deflects downward and releases actuator **32**. This makes available a large accelerating force at the instant of contact separation. The fact that the force of breaker—**52** disappears entirely when contact **24** has moved halfway toward its full open position is unimportant since by that time the contact arm is moving at high speed. The high-speed contact-opening operation attributable to the augmented bias provided by spring **52**, has made possible the interruption of arcs under severe conditions, as where 10,000 amperes is available in a 240-volt circuit. Greater contact-opening bias can be realized with this spring than with the auxiliary torsion spring in the above-mentioned application Ser. No. 845,285 and yet the manual effort needed for closing the circuit breaker—even multipole circuit breakers with one spring **52** per pole—remains quite reasonable.

While only one embodiment of the invention has been shown and described in detail it will be readily apparent to those skilled in the art that various changes and modifications may be made herein without departing from the spirit and scope of the invention.

What is claimed is:

1. A manually operable circuit breaker having an elongated movable contact member supported between its ends on a contact member pivot, said elongated movable contact member having a movable contact at one end, a companion contact engageable by and disengageable from said movable contact when the circuit breaker is closed and when it is open, respectively, said movable contact member having an actuator carried by an actuator pivot at the end of the movable contact member remote from said movable contact and bearing an overcurrent releasable latch normally restraining said actuator, a toggle including a pivoted handle and a link connected to said handle and said toggle being operable from a collapsed condition into erect condition for operating said actuator and for thereby operating said elongated movable contact member to close the contacts, spring means biasing said contact arm in the contact-opening direction, and an auxiliary spring acting on said elongated contact member in the contact opening direction wen the contacts are closed, said auxiliary spring bearing against a reaction point when the contacts are closed and when the contacts are part way open but not bearing against said reaction point when said circuit breaker is open or nearly open, whereby manual closing of the breaker is unimpeded by said auxiliary spring during the initial operation of the toggle part way toward its erect condition from its collapsed condition and the auxiliary spring is effective to accelerate the opening movement of the elongated contact member upon release of said overcurrent latch.

2. A manually operable circuit breaker in accordance with claim **1**, wherein said spring has one extremity acting at said actuator pivot.

3. A manually operable circuit breaker in accordance with claim **1**, further having a molded case, said molded case having an inward protrusion supporting said auxiliary spring between its extremities and an inward protrusion forming said reaction point for one of the extremities of the auxiliary spring and the opposite extremity of the auxiliary spring acting on said elongated contact arm at said actuator pivot.