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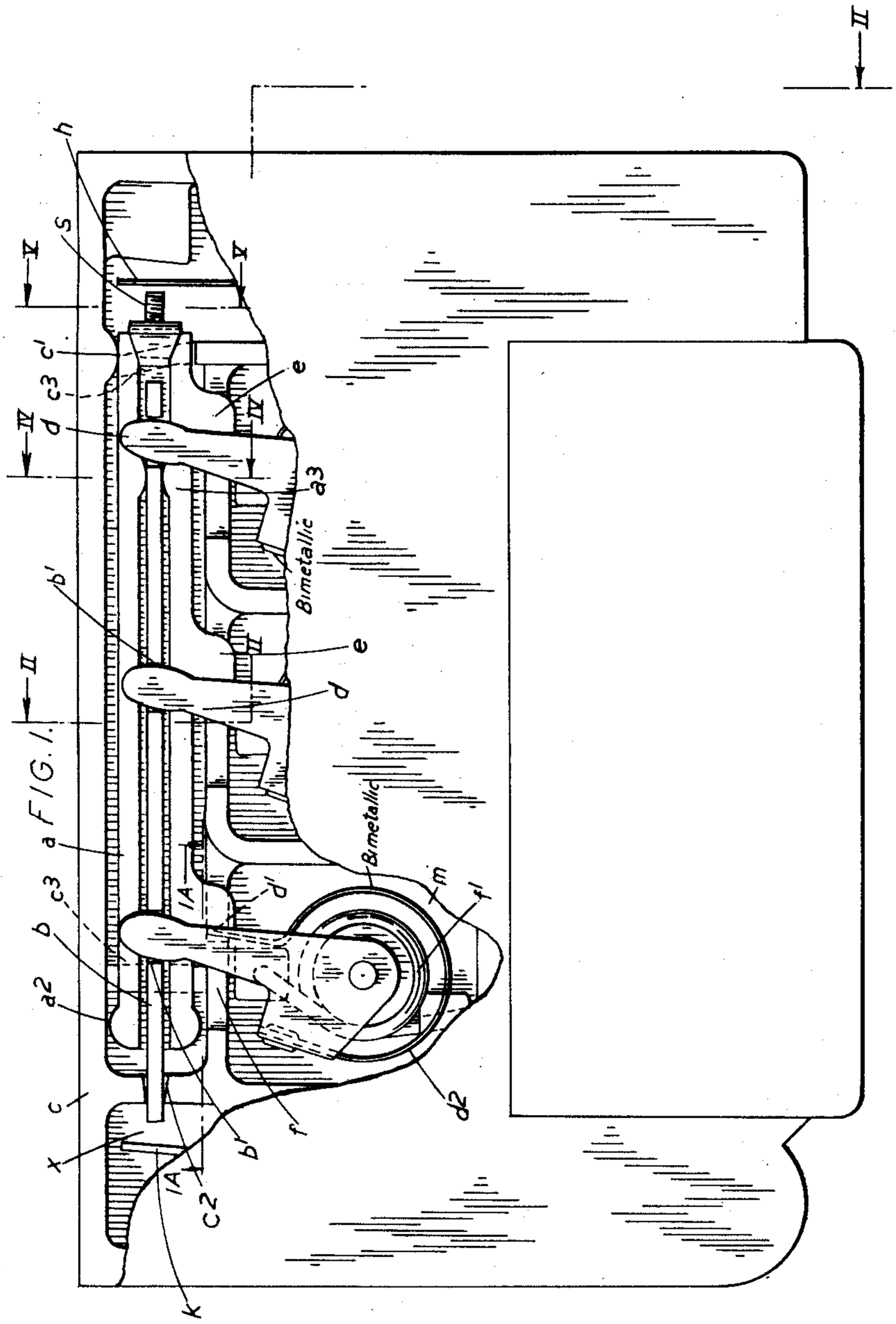
E. BESAG ET AL

2,527,907

AUTOMATIC CIRCUIT BREAKER HAVING THERMAL OVERLOAD RELEASE UNITS

Filed Feb. 11, 1948

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

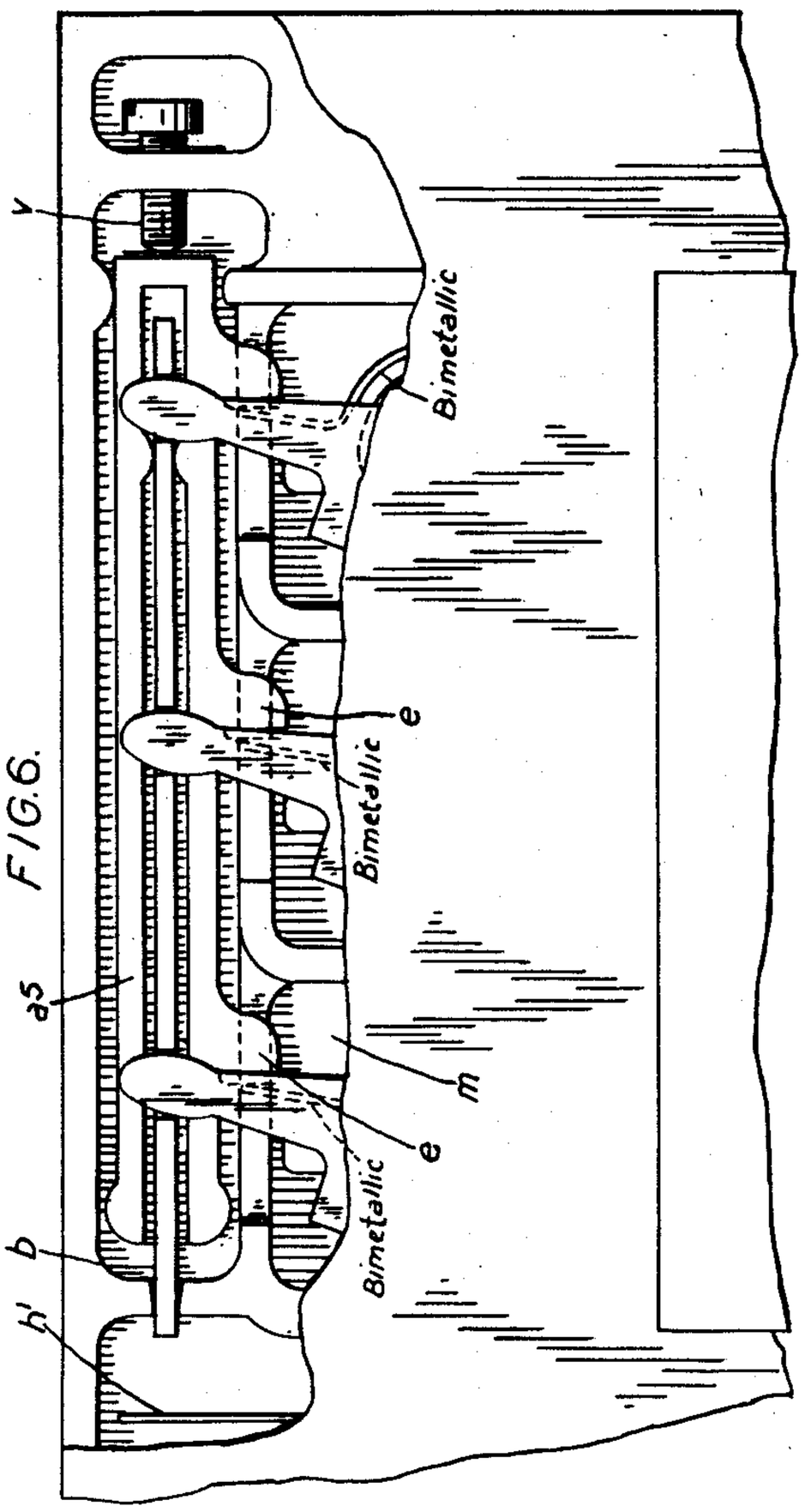

FIG. 6.

FIG. 1A.

FIG. 4.

FIG. 5.

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3 Sheets-Sheet 3

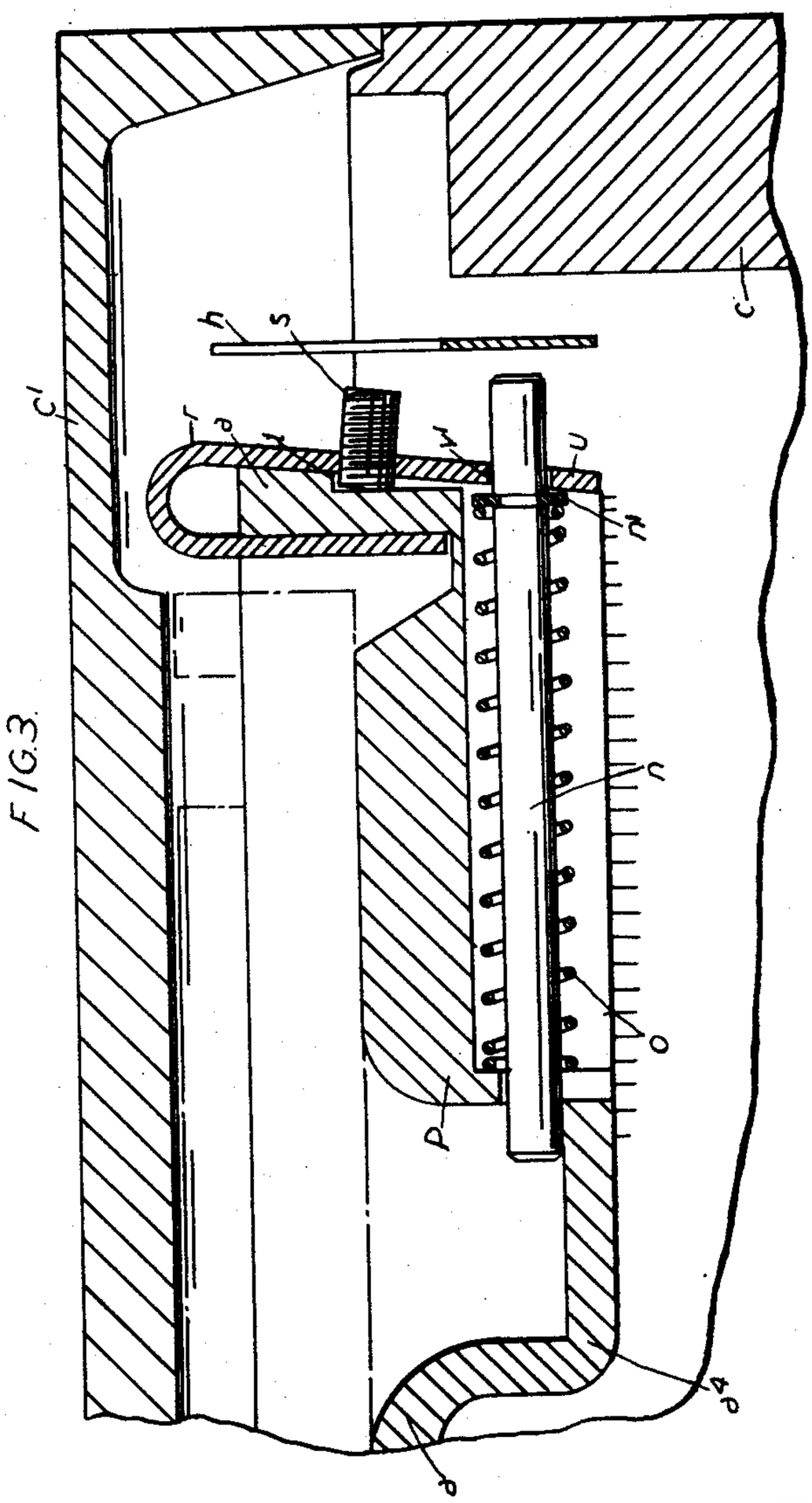

FIG. 3.

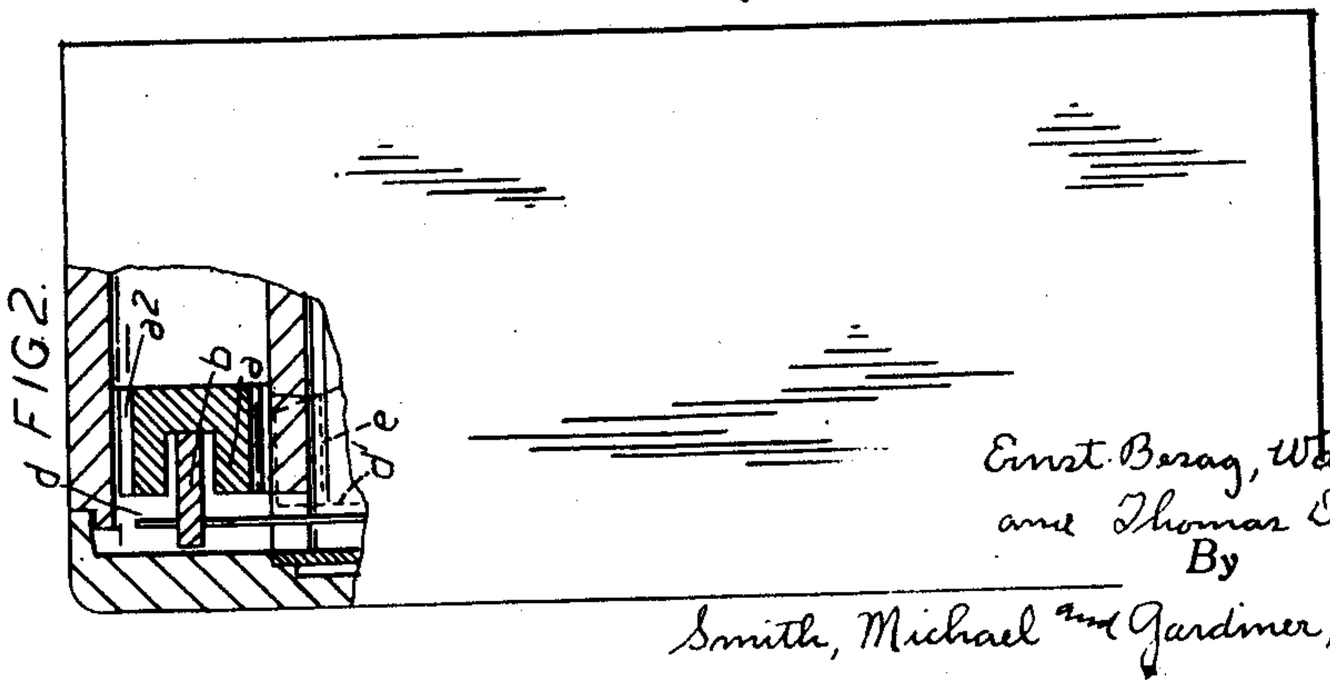

FIG. 2.

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2,527,907

AUTOMATIC CIRCUIT BREAKER HAVING THERMAL OVERLOAD RELEASE UNITS

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Application February 11, 1948, Serial No. 7,688
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10 Claims. (Cl. 200—116)

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This invention relates to improvements in and connected with automatic circuit breakers and similar electric switchgear, and is more particularly concerned with motor protective switches adapted to be tripped by thermally sensitive overload releases in the windings of a polyphase motor, in which a differential action is obtained to provide for such elements being uniformly distorted to cause tripping of the switch, after a predetermined interval, on the occurrence of a balanced and sustained overload in each of the predetermined phases; while causing the switches to open without such time interval, in the event of an unbalanced overload. The invention is applicable also for use as an adjustment of a plain overload, that is, one in which the differential feature is not present.

The object of the present invention is to provide an improved trip bar arrangement of compact and rigid construction adapted to withstand the distorting effects of heat, and in which frictional losses are low.

According to this invention, one of a pair of trip bars is of U or channel shape in transverse cross section for receiving the other bar within the channel thereof. The channel construction not only enables insertion of one bar within the other to produce compactness, but also ensures rigidity, thereby eliminating or minimising the possibility of distortion due to heat. The U-bar construction also affords a heat-protective barrier between the inner bar and the chambers containing the thermal overload devices. The U-bar may be in the form of a rectangular frame reinforced by transverse portions which enhance the strength of the construction. The narrow edges of the channel also minimize the sliding area in contact with the casing so as to reduce frictional losses.

In order to enable the invention to be readily understood, reference will now be made to the accompanying drawings illustrating, by way of example, two arrangements for carrying the invention into effect, in which drawings:

Figure 1 is a plan view of an overload release box, comprising a differential arrangement, certain parts of said box being removed to expose and show the construction more clearly.

Figure 1A is a sectional view on the line 1A—1A of Figure 1.

Figure 2 is a transverse sectional view on the line II—II of Figure 1.

Figure 3 is a longitudinal sectional view, on an enlarged scale, of one end of the trip bar shown in Figure 1.

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Figure 4 is a sectional view on the line IV—IV of Figure 1.

Figure 5 is a sectional view on the line V—V of Figure 1.

Figure 6 is a plan view of a modified arrangement of a plain overload release device.

Referring to Figures 1 to 5 of the accompanying drawings, the trip bar *a*, which is of channel or U-shape in transverse cross section, is formed from a moulding of insulating material, and the other bar *b* disposed within it, is made from a stamped strip of similar material. One end of the U-member *a* is closed, while the other end thereof is open. At this latter end, each side wall is formed on its outer surface with a rib or rounded protuberance a^2 for affording a restricted bearing surface on the casing *c*. At the closed end, the bar *a* has guiding engagement with a similar rib c^1 on the casing. The inner bar *b* is guided between two ribs a^3 on the inner surface of the U-bar near its closed end, and its other end, which extends through the open end of the outer bar *a*, is received in an opening c^2 in the casing, this opening c^2 being of gradually narrowing width for preventing jamming of the bar during its sliding movement. The lower wall of the U-bar *a* bears on two rounded ribs c^3.

The inner bar *b* is formed with slots or openings b^1 into each of which enters a lever *d* attached to one end of a bimetal element d^2. The other end d^1 of each bimetal element is disposed between a nose *e* projecting laterally from the U-member *a*, and a wall *f* of the thermal chamber or casing.

In operation, and on the occurrence of an equal overload in each of the phases, the heater coils f^1 cause their associated bimetal elements d^2 to be deflected uniformly, each end of each bimetal element moving outwardly during the early part of its deflection. Since the U-bar *a* is partially restrained by engagement of a projection *g* thereon with a blade *h* of a tripping device, movement is then transmitted through the levers *d* to bar *b* to cause said bar *b* to move to the left. The gap *x* between the end of this bar *b* and an adjustable stop *k*, which may be constituted by the blade for compensating for ambient temperature variations, is thereby taken up.

Upon the arrest of the bar *b*, the other extremities d^1 of the bimetal elements are compelled to act on the noses *e* of the U-bar *a* for causing its sliding movement to the right, thereby producing a tripping operation by movement of the blade *h*. In the event of expansion of the bimetal element due to an unbalanced overload,

created, say, by the current in one phase being interrupted, one of the elements remains substantially undistorted so that the bar *b* is restrained by virtue of the engagement of slots b^1 therein by a lever *d* of the bimetal element. Consequently, deflection of the other element or elements rapidly effects slidable movement of the U-bar *a* to the right for causing its impingement on the blade *h* for producing a tripping operation, the two hot bimetal elements being prevented from moving the bar *b* to the left by reason of the engagement of the cold bimetal element with the stop *f* of the casing. Hence, the immediate movement of the bar *a* to the right, and the elimination of the delay occupied in taking up the gap between the bar *b* and the ambient blade *k*.

With heavy overloads, the heat stored in the thermal chambers *m* may cause movement of the bimetal elements in excess of that required for tripping. As a result, the trip blade *h* might be over-stressed thereby producing its permanent distortion. For the purpose of avoiding such disadvantageous distortion, the projecting stop *g* on the closed end of the U-bar *a* is adapted for preventing excessive movement of the blade *h*. This member (see Figure 3) comprises a plunger *n* which projects beyond the closed end of the U-bar *a* and is adapted for engagement with the trip blade *h*. The bar *a* has a depressed well formation a^4 for accommodating the plunger *n* and associated parts. A helical compression spring *o* around the plunger *n* is operative between a wall *p* of the U-bar and a flange or ring n^1 on the plunger, for the purpose of projecting the plunger *n* towards the blade *h*. This spring *o* exerts a pressure which exceeds the force necessary to flex the trip blade *h*.

In order to ensure correct relative positioning of the trip bar *a* in the factory assemblage, a bent blade *r* is hooked over the closed end of the bar *a* and is secured in position thereon by a screw *s* engageable with an undercut portion *t* of the bar *a*.

The plunger *n* protrudes freely through an opening v^1 in the end of the bent blade *r*. Adjustment of the screw *s* causes the end *u* of the bent blade *r* to be moved outwardly, so that the plunger *n* is permitted to project farther beyond the trip bar, whereby the gap between the plunger and the trip blade *h* is adjustable. Adjustment of the screw *s* is effected by a screwdriver disposed in line with the bar *a* so that the pressure exerted during adjustment tends to take up any slack which may be present between the noses *e*, the stop formations *f*, and the ends of the bimetal elements.

The improved arrangement may be employed as an adjustment with a plain overload, that is, one not intended for use differentially as above described. In such modification as shown in Figure 6, the abutment *f* on the walls of the thermal chambers *m* would be omitted. The closed end of the bar a^5 is acted on by an adjustable device *y*, while the opposite end of the bar *b* is operatively engageable with a trip mechanism h^1. Turning of the screw *v* effects the adjustment of the noses *e* relatively to the bimetal elements, and varies the gap between the inner bar *b* and the trip blade h^1. If one bimetal element is heated on an unbalanced overload, the bars a^5 and *b* are movable freely without restriction from the other bimetal elements owing to the absence of the stops *f* of Figure 1.

We claim:

1. An automatic circuit breaker comprising a trip mechanism and a plurality of thermally sensitive overload release devices, and means for effecting operation of said trip mechanism by said release devices, said means including a pair of trip bars one of which is of U shape in transverse cross section for receiving the other bar therein.

2. An automatic circuit breaker comprising a plurality of thermally sensitive overload release devices, an insulating casing for said devices, a trip mechanism within said casing adapted to be operated by said devices, means including a pair of trip bars slidable in said casing for operating said trip mechanism upon actuation of said release devices, one of said bars being of U shape in transverse cross section for receiving the other bar therein, and said bars and said casing having formations thereon providing restricted bearing surfaces between them.

3. An automatic circuit breaker comprising a plurality of thermally sensitive overload release devices, an insulating casing for said devices, a trip mechanism within said casing adapted to be operated by said devices, and means including a pair of trip bars for operating said trip mechanism upon actuation of said release devices, one of said bars being of U shape in transverse cross section and the other of said bars being flat and being slidably disposed within said U section bar, said flat bar extending through an opening in the casing of gradually narrowing width.

4. An automatic circuit breaker comprising an insulating casing, a plurality of thermally sensitive overload release devices within said casing and including bimetal elements each disposed in a thermal chamber in said casing, and a pair of trip bars disposed in an elongated chamber in said casing and adjacent the thermal chambers therein, one of said bars being of U shape in transverse cross section and formed with spaced lateral noses, and the other bar being disposed within the U section bar and being flat and formed with spaced slots, one end of each bimetal element being engaged with a nose on the U section bar and the other end being engaged with a slot in the flat bar.

5. An automatic circuit breaker comprising a trip mechanism, a plurality of thermally sensitive overload release devices for operating said trip mechanism, a trip bar actuated by said devices, a trip blade adapted for actuation by said trip bar, and spring means interposed between said trip bar and said trip blade and adapted to prevent the latter from being overstressed in the event of excessive movement of said thermal devices.

6. An automatic circuit breaker comprising a trip mechanism, a plurality of thermally sensitive overload release devices for operating said trip mechanism, a trip blade for actuating said trip mechanism, a trip bar for actuating said trip blade, and resilient means on the end of said trip bar and impinging on said trip blade, said resilient means having a spring pressure exceeding the force necessary to flex said trip blade.

7. An automatic circuit breaker as defined in claim 6 in which the resilient means on the end of the trip bar comprises a spring-pressed plunger, and in which means are provided for adjusting the initial position of said plunger with relation to said trip blade.

8. An automatic circuit breaker in accordance with claim 7, in which the means for adjusting the initial position of said plunger with relation to said trip blade comprises a hook-shaped blade

one arm of which is apertured for the passage of the plunger therethrough, and in which a screw is operative on said one arm and is disposed substantially in line with the trip bar.

9. An automatic circuit breaker comprising a plurality of thermally sensitive overload release devices, a trip blade adapted to be operated by said devices, and means for actuating said trip blade and including a pair of trip bars, one of which is of U shape in transverse cross section for receiving therein the other bar, said last-mentioned bar being flat, the U section bar having one end closed and the other end open, the flat bar etxending through such open end, and the closed end having mounted thereon a spring-pressed plunger adapted for engagement with said trip blade.

10. An automatic circuit breaker in accordance with claim 9, in which a bent blade of substantially inverted U shape has an opening through one of its arms and is hooked over the closed

end of the U section bar and is secured in position thereon by a screw engageable with an undercut portion of said bar, and in which the outer end of said plunger projects freely through the opening in said bent blade and is positioned adjacent said trip blade.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,031,836	Cameron	July 9, 1912
2,199,477	Besag	May 7, 1940
2,253,390	Muller	Aug. 19, 1941
2,289,108	Eaton	July 7, 1942