United States Patent [19]

Kidd et al.

[11] **3,906,414**

[45] **Sept. 16, 1975**

[54] **ELECTRIC CIRCUIT BREAKERS**

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[73] Assignee: **Dorman Smith Switchgear Limited**, Preston, England

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[21] Appl. No.: **505,224**

[30] **Foreign Application Priority Data**

Oct. 4, 1973 United Kingdom..... 46292/73

[52] **U.S. Cl.**..... **335/42**; 335/176

[51] **Int. Cl.**[2]..... **H01H 69/01**

[58] **Field of Search** 335/176, 42, 8, 9, 10, 335/38, 172, 173, 174, 175

[56] **References Cited**

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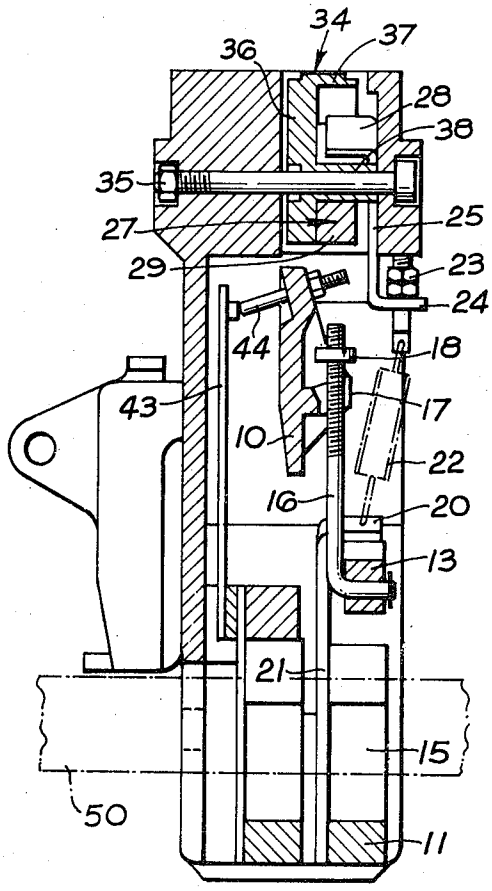
Attorney, Agent, or Firm—Ross, Ross & Flavin

[57] **ABSTRACT**

In an electric circuit breaker having a pivotable armature which is caused to swing, upon passage of a short circuit current, to actuate a trip bar to trip the circuit breaker, the load against which the armature is swung is variable by adjustment of an eccentric boss accessible outside the circuit breaker.

4 Claims, 12 Drawing Figures



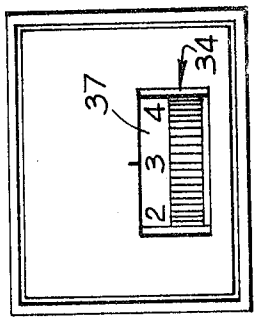

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Fig. 2.

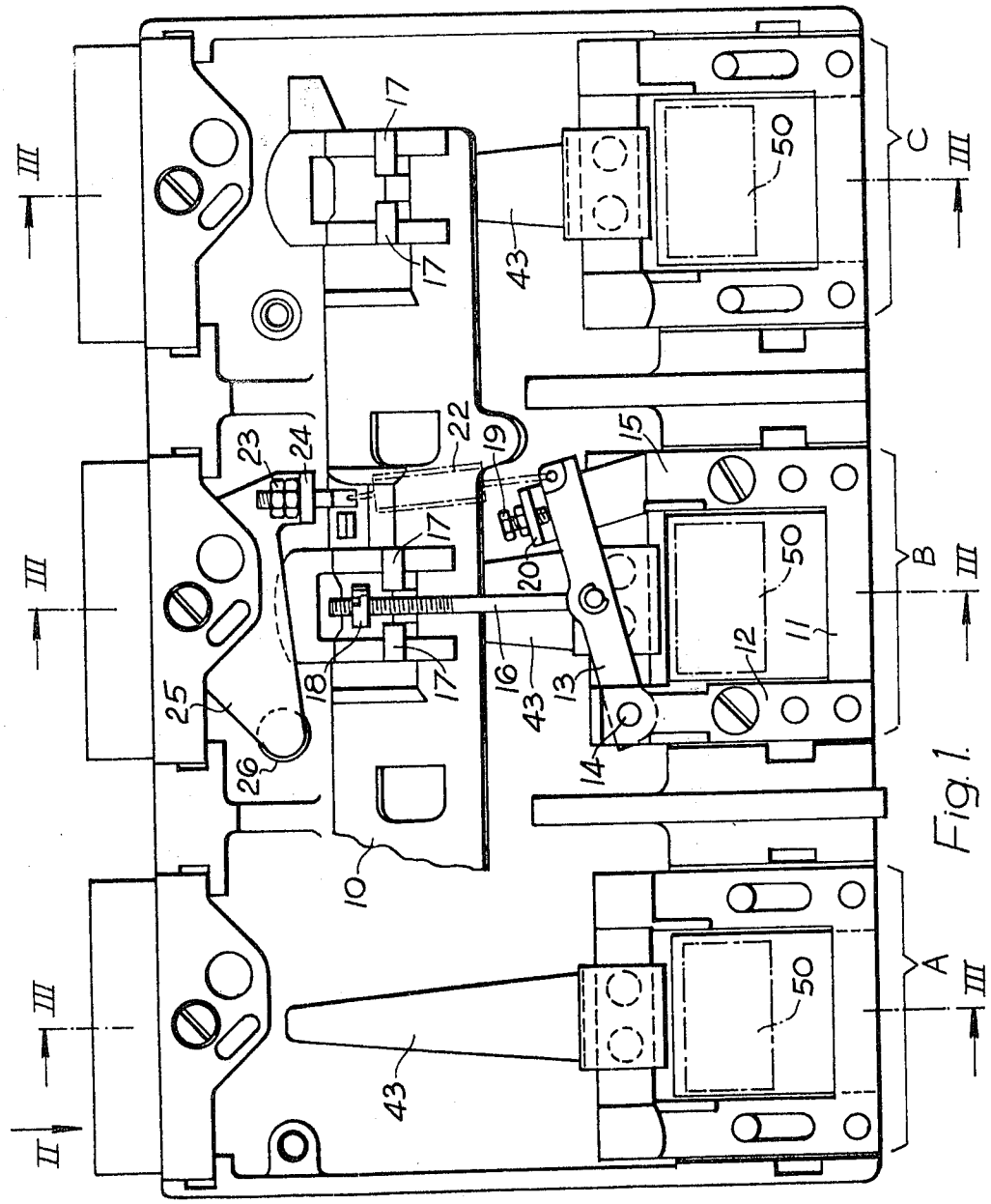
III
II
17
43
50
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Fig. 1.

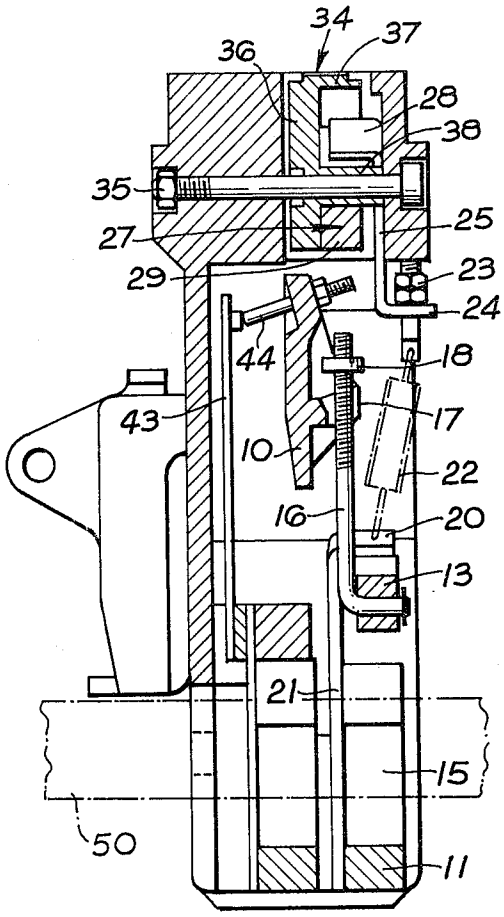

Fig. 3.

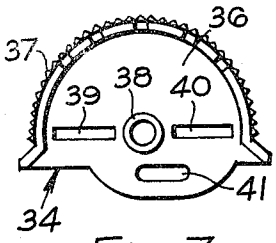

Fig. 7.

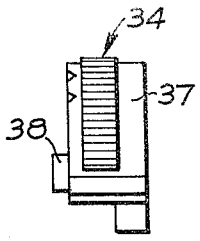

Fig. 9.

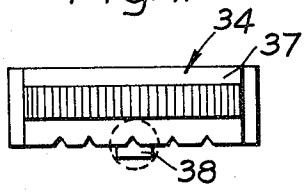

Fig. 8.

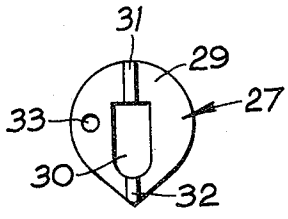

Fig. 10.

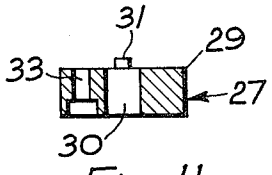

Fig. 11.

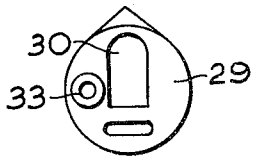

Fig. 12.

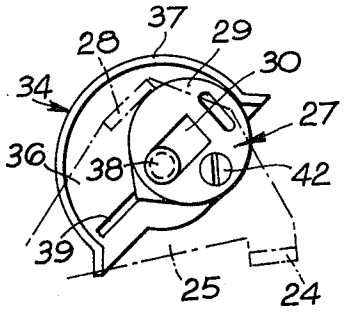

Fig. 4.

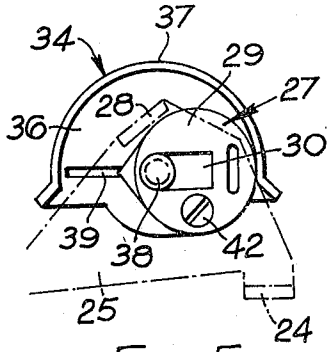

Fig. 5.

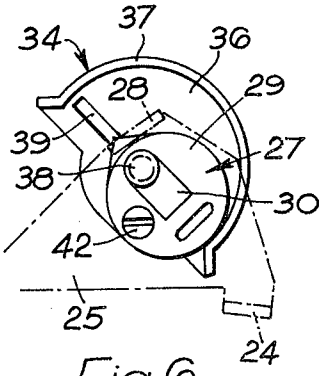

Fig. 6.

ELECTRIC CIRCUIT BREAKERS

This invention concerns electric circuit breakers of the type which includes a pivoted armature forming part of an electromagnetic circuit through which a conductor extends so that a short circuit current passing through the conductor causes pivoting of the armature by reason of magnetism induced in the electromagnetic circuit by such current, the armature's movement serving to cause movement of a trip bar of the circuit breaker, whereby the latter is tripped.

An object of the invention is to provide a simple arrangement permitting adjustment of the force against which the armature must pivot to cause tripping of the breaker, whereby the rating of the circuit breaker can be varied and the breaker can be set manually to a selected rating in a current range.

With this object in view the present invention provides an electric circuit breaker of the kind referred to wherein pivoting movement of the pivoted armature occurs against the action of a resilient member loading the armature, and is characterised in that the load applied by said resilient member is variable by adjustment of an eccentric boss rotatable manually by means of a knob accessible externally of the circuit breaker.

Conveniently the knob is shaped to provide a recess in which the boss is secured, and the securement of the boss to the knob is preferably adjustable to provide for the eccentricity of the boss to be varied thereby to vary the extent of adjustment which is achieved by rotating the knob.

The boss and the knob are conveniently formed the one with a groove and the other with a complementary rib engaging with the groove, said rib and groove extending diametrically relative to the axis of rotation of the knob and providing for corresponding diametral adjustment of the boss.

In a preferred practical embodiment of the invention a pivoted lever, having the resilient member connected thereto, abuts the eccentric boss and is adapted to be adjusted in its pivotal position by rotation of the boss, thereby to vary the loading applied to the armature by the resilient member.

The resilient member is conveniently a spring connected by one end to the lever and by the other end to the pivoted armature.

In order that the invention may be fully understood, it will be described further, by way of example, with reference to the accompanying drawings, in which:-

FIG. 1 is an elevation of the tripping mechanism of a three-pole circuit breaker conforming to the present invention;

FIG. 2 is a plan view taken as indicated by the arrow II of FIG. 1;

FIG. 3 is a cross-section through any of the three poles of the circuit breaker as indicated by the three section lines III—III in FIG. 1 certain of the components of the mechanism being omitted or broken away for clarity;

FIG. 4 is a detached elevation showing a boss and knob which form part of the mechanism of FIGS. 1 to 3 these being shown in one end position of adjustment;

FIG. 5 is a view similar to FIG. 4 but showing the boss and knob in a median position;

FIG. 6 is a view similar to FIGS. 4 and 5 but showing the boss and knob in its other end position of adjustment;

FIG. 7 is an elevation showing the knob alone;

FIG. 8 is a plan view corresponding to FIG. 7;

FIG. 9 is a side view corresponding to FIGS. 7 and 8;

FIG. 10 is a rear elevation of the boss alone;

FIG. 11 is a sectional plan corresponding to FIG. 10; and

FIG. 12 is a front elevation of the boss.

The illustrated tripping mechanism of an electric circuit breaker conforming to the invention comprises a trip bar **10** which is common to and extends across the three poles of the circuit breaker, which poles are indicated generally at A, B and C. This trip bar **10** is mounted so as to be pivotable, about an axis which extends longitudinally of the trip bar **10**, from the position shown in FIG. 3 in a clockwise direction, to effect tripping of the circuit breaker.

An electromagnetic circuit for each pole of the circuit breaker comprises a substantially U-shaped electromagnetic element **11** to one limb **12** of which a respective armature **13** is pivotally connected by a pivot **14**, the armature **13** being connected by one end to the limb **12**, and projecting by its other end over the other limb **15**. The element **11** and armature **13**, as well as their associated components, have been omitted from poles A and C in FIG. 1 and have been shown only at pole B, so as to facilitate appreciation of all of the components of the mechanism.

A pull rod **16** is pivotally connected by its lower end to the armature **13** approximately midway along the length of the latter and extends through a gap provided between a pair of tongues **17** formed integrally with and projecting from the trip bar **10**, being provided with an adjustable nut **18** at the end remote from the armature **13**. It will thus be understood that upon the armature **13** pivoting from its position shown in FIG. **1**, in a clockwise direction, the resultant movement of the pull rod **16** causes the nut **18** to engage with the tongues **17** and effect pivoting of the trip bar **10** to trip the breaker. In operation of the circuit breaker, such pivoting of the armature **13** will occur in the event of passage of a short circuit current passing through a conductor **50** extending through the electromagnetic circuit provided by the electromagnetic element **11** and the armature **13**, by reason of magnetism induced in such circuit by the short circuit current.

The armature **13** is resiliently loaded into its rest position, which is illustrated in FIG. **1** and which is defined by a stop screw **19** through an angle piece **20** of a stop strip **21** (see FIG. 3) bolted to the limb **15** of the electromagnetic element **11**, by a resilient member in the form of a helical tension spring which is indicated generally by the reference numeral **22**. One end of the spring **22** is connected to the free end of the armature **13** and the other end thereof is connected to an adjusting bolt **23** through a respective angle piece **24** provided integrally with a lever **25** which is pivoted at **26**.

The load applied by the spring **22** to the pivoted armature **13** is variable by adjustment of an eccentric boss **27** against which abuts a lug **28** formed integrally with the lever **25**, the pivotal position of the lever **25** about its pivot **26** depending upon the eccentric location of the boss **27**. The spring **22** acts on the lever **25**, of course, in such a way as to ensure that the lug **28** is always in contact with the boss **27**.

From FIGS. **10**, **11** and **12** it will be seen that the boss **27** comprises a body **29** having a slot **30** there-through, ribs **31**, **32** being provided at each end of the body **29**

and in alignment with the longitudinal centre line of the slot **30**. To one side of the slot **30** is a counterbored fixing hole **33**.

As can be seen from FIGS. **3** to **6**, the boss **27** is secured to a knob **34** which, as will be evident from FIGS. **2** and **3**, is accessible from outside the circuit breaker so as to be manually rotatable about an axis provided by a pivot bolt **35**. The configuration of the knob **34** is shown in FIGS. **7**, **8** and **9**. It comprises an approximately semi-circular back plate **36** having a flange portion **37** extending therearound so as to define a recess, and formed with a bush **38** by which it fits over the bolt **35**. Two shallow grooves **39**, **40** are provided at opposite sides of the bush **38** ao as to be substantially diametrically disposed relative thereto and spaced to one side of these grooves **39**, **40** and the bush **38**, so as to be substantially parallel to the grooves **39**, **40** is a fixing slot **41**. The boss **27** is located on the knob **34** by its ribs **31**, **32** engaging into the respective grooves **40**, **39** and is fixed in position by a screw **42** through the fixing slot **41** and the counterbored fixing hole **33**. FIGS. **4** to **6** show the boss **27** fixed in its position of maximum eccentricity so that rotation of the knob **34** provides maximum variation of the loading applied to the pivoted armature **13** by the spring **22**. Thus, for example, a circuit breaker may be adjusted to trip at selected currents in the range of 3000 amperes to 10,000 amperes.

The extent of adjustment achieved by rotating the knob **34**, however, is variable by varying the eccentricity of the boss **27** and this is achieved by slackening off the screw **42** and displacing the boss **27** appropriately in the direction dictated by the interengagement of the ribs **31**, **32** into the grooves **40**, **39**, it being possible to bring the boss **27** to a position wherein the centre of its body **29** nearly coincides with the axis of rotation of the knob **34** and only minimal or very fine adjustment is achieved by rotation of the knob **34**.

It will be appreciated that adjustment of the boss eccentricity when the combination is in the maximum set positionas shown in FIG. **4** does not affect the tension of the spring **22** and the tripping performance of the breaker pole can be set at its upper limit when the combination is in this FIG. **4** position by adjustment of the bolt **23** only. This is because the direction of movement of the boss **27** to alter its eccentricity is substantially parallel to the lug **28** of the lever **25**. When this has been done, the combination can be set to its minimum position and the tripping performance correspondingly set by adjustment of the eccentricity of the boss **27** alone. This latter adjustment will have no effect on the upper setting, which is substantially independent of the degree of eccentricity of the boss **27**.

The described arrangement conforming to the invention accordingly provides, in a very simple and convenient manner, for the instantaneous tripping current of the circuit breaker to be adjusted and also for the available range of such adjustment to be varied.

In the illustrated case, a thermal element in the form of a respective bimetal strip **43** is provided for each of the poles A, B and C. This bimetal strip is arranged so as to be heated by current passing through the respective pole of the circuit breaker and, upon overload (i.e. passage of a sustained current in excess of a predetermined overload current rating of the breaker for a continuous period of time) to deflect sufficiently to engage a respective contact point, provided by a respective calibration screw **44**, on the trip bar **10** to pivot the latter and cause tripping of the circuit breaker. It is not essential to the invention, however, that such thermal elements should be present.

We claim:

1. An electric circuit breaker of the type which includes a pivoted armature forming part of an electromagnetic circuit through which a conductor extends so that a short circuit current passing through the conductor causes pivoting of the armature by reason of magnetism induced in the electromagnetic circuit by such current, the armature's movement serving to cause movement of a trip bar of the circuit breaker, whereby the latter is tripped, and in which pivoting movement of the pivoted armature occurs against the action of a resilient member loading the armature, characterized in that the load applied by said resilient member is variable by adjustment of an eccentric boss rotatable manually by means of a knob accessible externally of the circuit breaker, the knob being shaped to provide a recess in which the boss is secured, and wherein the securement of the boss to the knob is adjustable for the eccentricity of the boss to be varied thereby to vary the extent of adjustment which is achieved by rotating the knob.

2. An electric circuit breaker as claimed in claim **1**, wherein the boss and knob are formed the one with a groove and the other with a complementary rib engaging with the groove, said rib and groove extending diametrically relative to the axis of rotation of the knob and providing for corresponding diametral adjustment of the boss.

3. An electric circuit breaker as claimed in claim **2**, wherein a pivoted lever, having the resilient member connected thereto, abuts the eccentric boss and is adapted to be adjusted in its pivotal position by rotation of the boss, thereby to vary the loading applied to the armature by the resilient member.

4. An electric circuit breaker as claimed in claim **3**, wherein the resilient member is a spring connected by one end to the lever and by the other end to the pivoted armature.

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