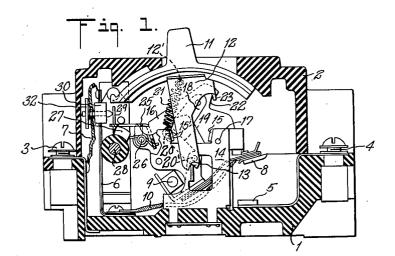
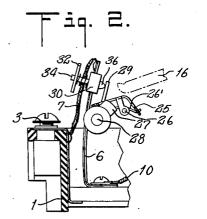
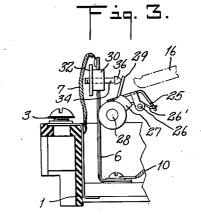
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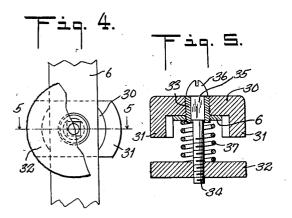
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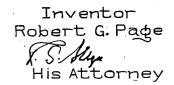
R. G. PAGE ELECTRIC CIRCUIT BREAKER Filed April 19, 1951











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# UNITED STATES PATENT OFFICE

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#### ELECTRIC CIRCUIT BREAKER

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7 Claims. (Cl. 200-88)

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My invention relates particularly to a circuit breaker of the type which employs means for automatically opening a circuit upon either a prolonged small overload or a sudden heavier overload, and means for adjusting the point of automatic release in case of an overload.

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One object is to provide a circuit breaker of simple construction combining thermal and magnetic tripping means.

Another object is to provide a simple and ef-<sup>10</sup> fective means for calibrating the breaker to the point at which a sudden heavy overload will open a circuit.

Another object is to provide tripping means in which the thermal tripping point and the mag- <sup>15</sup> netic tripping point are independently adjustable.

Fig. 1 is a side view and partial section of a construction embodying one form of my invention, the contacts being shown in the manually <sup>20</sup> opened circuit position.

Fig. 2 is a fragmentary side view showing the releasing device and the position its parts take when the circuit is opened automatically upon a gradual overload in the circuit. 25

Fig. 3 is a similar fragmentary view showing the parts released upon application of a sudden heavy overload.

Fig. 4 is a fragmentary view showing parts of the magnetic release device on an enlarged scale. 30 Fig. 5 is a sectional view on the plane of the line 5-5 of Fig. 4.

In Fig. 1, I have shown an insulating sectional housing consisting of a base part 1 with a cover part 2 and having circuit terminals 3 and 4.

A stationary switch contact 5 is supported on the base and is connected to the terminal 4, and a bimetal 6 has its lower end secured on the base and its upper end movable and connected to terminal 3 by a flexible conductor 7.

The movable switch member 8 is hinged to a shaft 9 and connected by a flexible conductor 10 to the foot of the bimetal strip 6.

The breaker is provided with a manually operable handle or finger piece 11 mounted on the 45 outer end of a lever 12 which is hinged at 13 in a frame 14 and movable between abutments 15, 15.

A cradle or tripping lever 16 is hinged at 17 to the frame 14 and is normally held stationary.

The manual operation as shown for instance in the Getchell Patent 2,455,753, is effected by a toggle joint action including hinged links 18 and 19 which connect the tripping member 16 with the movable switch member 8 at 20'. The snap 55 cuit. action is effected in any convenient manner, such By 2

as by a throwing spring 21 connecting the lever 12 at 12' with the hinge pin 20 of the toggle joint action. The tripping member 16 is provided with a shoulder 22 against which the shoulder 23 on the lever 12 acts to reset the tripping member manually when it has been automatically released.

In the normal circuit condition of the breaker, the tripping member 16 is restrained by a springpressed latch 25 hinged at 26. This latch is held in its latching position by an abutment 27 on the shaft 28, constituting a second latch, upon which a part of the latch is pressed by a spring 26'. This shaft also has a tripping projection 29 interposed in the path of movement of a part of the overload actuating mechanism.

This mechanism has the U-shaped magnetic field piece 30 which is carried by the bimetal strip  $\mathfrak{s}$  near its upper end. This field piece has pole pieces 31, 31 and an armature 32, and supports or guides the plunger 34 which has a noncircular portion 35 slidable but not rotatable in bushing 33. The bushing 33 is threaded and mounted in a threaded aperture in the base of the field piece 30.

One end of this plunger is provided with a head 36 for engaging projection 29 and actuating shaft 28 and is slotted whereby the plunger, and therefore bushing 33, may be rotated to adjust calibration as described below. A spring 37 is interposed between the armature 32 and the field piece 30 and normally holds the armature spaced apart from the field piece.

By rotating the armature **32** on the plunger to move it toward and from the field piece, the effect of an overload in the circuit may be varied and the breaker readily calibrated.

The head 36 of the plunger normally stands close to the projection 29 on the shaft 28 so that 40 when a gradual small overload occurs, the upper end of the bimetal strip 6 warps and moves to the right (as seen in Fig. 2), turns the shaft 23 and moves the abutment 27 out of contact with the latch 25 and into a slot in said latch. The spring 45 26' then moves the latch 25 counterclockwise breaking the connection between the latch and lever 16 thereby releasing said lever and permitting the spring 21 to throw the parts to open circuit position.

Upon a heavy overload, the field piece 30 draws the armature 32 toward it and forces the plunger 34 outwardly of the member 30 against the projection 29 thereby turning the shaft 28 and releasing the tripping member 16 to break the circuit.

By adjusting the armature by rotation along

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the plunger 34, the air gap may be adjusted and the effect of a heavy overload in the circuit accordingly varied and the breaker readily calibrated.

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By adjusting the bushing in the bimetal strip 5 the normal position of the plunger head and the thermal action may be adjusted independently of the magnetic action.

The supporting plunger is slidable in the field piece and provides for adjustable positioning of 10 the armature along the plunger. It is the end of the plunger which causes tripping, therefore, rather than the armature. Once the position of the plunger is determined, as for instance, by adjusting sleeve 33, the point at which thermal tripping will occur is determined. Thereafter, the position of the armature along the plunger may be adjusted without affecting the position of the plunger end. This means that the point of magnetic tripping may be adjusted without affecting 20 the point of thermal tripping.

If the armature **32** is held while the stud **36** and sleeve **33** are rotated, the point of thermal tripping may be adjusted without affecting the magnetic air-gap and, therefore, the magnetic trip- 25 ping point.

The provision of a circular armature permits the above adjustment easily and makes it unnecessary to provide guiding means to keep the armature in position.

I claim:

1. In a circuit breaker having manually operable mechanism for opening and closing a circuit, tripping mechanism for opening a circuit automatically upon either a prolonged small over-  $^{35}$ load or a sudden greater overload, said mechanism including a thermally actuated member, a magnetically actuated member carried by said thermally actuated member, a bushing carried by said thermally actuated member, a springbiased plunger movable in said bushing, means for adjusting the tripping point of the thermally actuated member, and means for adjusting the tripping point of the magnetically actuated mem-45 ber independently of the adjustment of the thermally actuated member including means for adjusting said bushing.

2. In a circuit breaker having contact means for opening and closing an electric circuit, a trip member biased to an open circuit position and  $^{50}$ latch means for holding said trip member in a closed circuit position, means for tripping said latch means to release said trip member comprising a warpable bimetal member, means for heat-55 ing said bimetal member in response to the current in said circuit, a magnet field piece mounted on a movable portion of said bimetal member, plunger means mounted on said field piece for movement to trip said latch means, an armature 60 connected to said plunger means so as to be attracted by said field piece and move said plunger means to trip said latch means in response to a large overload current in said circuit, a spring for biasing said armature away from said field piece, 65 said plunger means being moved with said field piece by said bimetal member to trip said latch means in response to a small overload current in said circuit.

3. In a circuit breaker having contact means for opening and closing an electric circuit, a trip member biased to an open circuit position and latch means for holding said contact means in closed circuit position, means for tripping said latch means to release said trip member comprising a warpable bimetal member, means for 75

heating said bimetal member in response to the current in said circuit so that a portion of said bimetal member moves toward said latch means, a magnet field piece mounted on said movable portion of said bimetal member on the side adjacent said latch means, a plunger slidably mounted on said field piece for movement toward said latch means, an armature secured to said plunger on the opposite side of said bimetal member so as to be attracted by said field piece and move said plunger to trip said latch means in response to a large overload current in said circuit, and a spring for biasing said armature away from said field piece, said plunger being moved with said field piece by said bimetal member to trip said latch means in response to a small overload current in said circuit.

4. In a circuit breaker having contact means for opening and closing an electric circuit, a trip member biased to an open circuit position and latch means for holding said contact means in closed circuit position, means for tripping said latch means to release said trip member comprising a warpable bimetal member, means for heating said bimetal member in response to the current in said circuit, a magnet field piece mounted on a movable portion of said bimetal member, a plunger slidably mounted on said field piece for movement in one direction to trip said latch 30 means, means for limiting the movement of the plunger in the opposite direction, an armature secured to said plunger by a screw threaded connection so as to be attracted by said field piece and move said plunger to trip said latch means in response to a large overload current in said circuit, a spring for biasing said armature away from said field piece, said plunger being moved with said field piece by said bimetal member to trip said latch means in response to a small overload current in said circuit and said screw threaded connection providing for adjustment of said armature relative to said field piece to vary the effect of a large overload current in said circuit.

5. In a circuit breaker having contact means for opening and closing an electric circuit, a trip member biased to an open circuit position and latch means for holding said trip member in a closed circuit position, means for tripping said latch means to release said trip member comprising a bimetal strip fixed at one end, electric connections for including said strip in said circuit so that said strip is heated and bends toward said latch means in response to the current in said circuit, a U-shaped magnet field piece mounted on the free end of said bimetal strip so as partially to surround said strip and with its base on the side adjacent said latch means, said field piece being provided with an aperture in its base, a plunger slidably mounted in said aperture, a head on the end of said plunger on the outer side of said base, an armature mounted on said plunger opposite the ends of said field piece so as to be attracted to said field piece and move said plunger to trip said latch means in response to a large overload current in said circuit, a spring for biasing said armature away from said field piece with said head in engagement with said base, said plunger being moved with said field piece by said bimetal strip to trip said latch means in response to a small overload current in said circuit.

6. A circuit breaker comprising manually operated contact means for opening and closing a circuit, a trip member biased to an open circuit position, latch means for holding said trip member in closed circuit position, a warpable bimetal

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member, means for heating said bimetal member in response to the current in said circuit, a magnet field piece mounted on a movable portion of said bimetal member on the side adjacent said latch means, said field piece being provided with 5 a screw threaded aperture, a threaded bushing mounted in said aperture, a plunger slidably mounted in said bushing, a head on the end of said plunger on the outer side of said base, the opposite end portion of said plunger being 10 threaded, a circular armature mounted on said threaded portion opposite the ends of said field piece so as to be attracted to said field piece and move said plunger to trip said latch means and release said trip member in response to a prede- 15 circuit. termined large overload current in said circuit, a spring surrounding said plunger for biasing said armature away from said field piece with said head in engagement with said bushing, said plunger being moved with said field piece by said 20 file of this patent: strip to trip said latch means in response to a small overload current in said circuit.

7. A circuit breaker comprising manually operated contact means for opening and closing a circuit, a trip member biased to an open circuit 25 position, latch means for holding said trip member in closed circuit position, a bimetal strip fixed at one end, electric connections for including said strip in said circuit so that said strip is heated and bends toward said latch in response to the  $_{30}$ current in said circuit, a U-shaped magnet field piece mounted on the free end of said strip so as partially to surround said strip and with its base on the side adjacent said latch means, said field piece being provided with a screw threaded aper-ture in its base, a threaded bushing mounted in <sup>35</sup> Number said aperture, a plunger slidably mounted in said bushing but secured against rotation in said

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bushing, a head on the end of said plunger on the outer side of said base, the opposite end portion of said plunger being threaded, a circular armature mounted on said threaded portion of said plunger opposite the ends of said field piece so as to be attracted to said field piece and move said plunger to trip said latch means and release said trip member in response to a large overload current in said circuit, a spring surrounding said plunger for biasing said armature away from said field piece with said head in engagement with said bushing, said plunger being moved with said field piece by said strip to trip said latch means in response to a small overload current in said

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