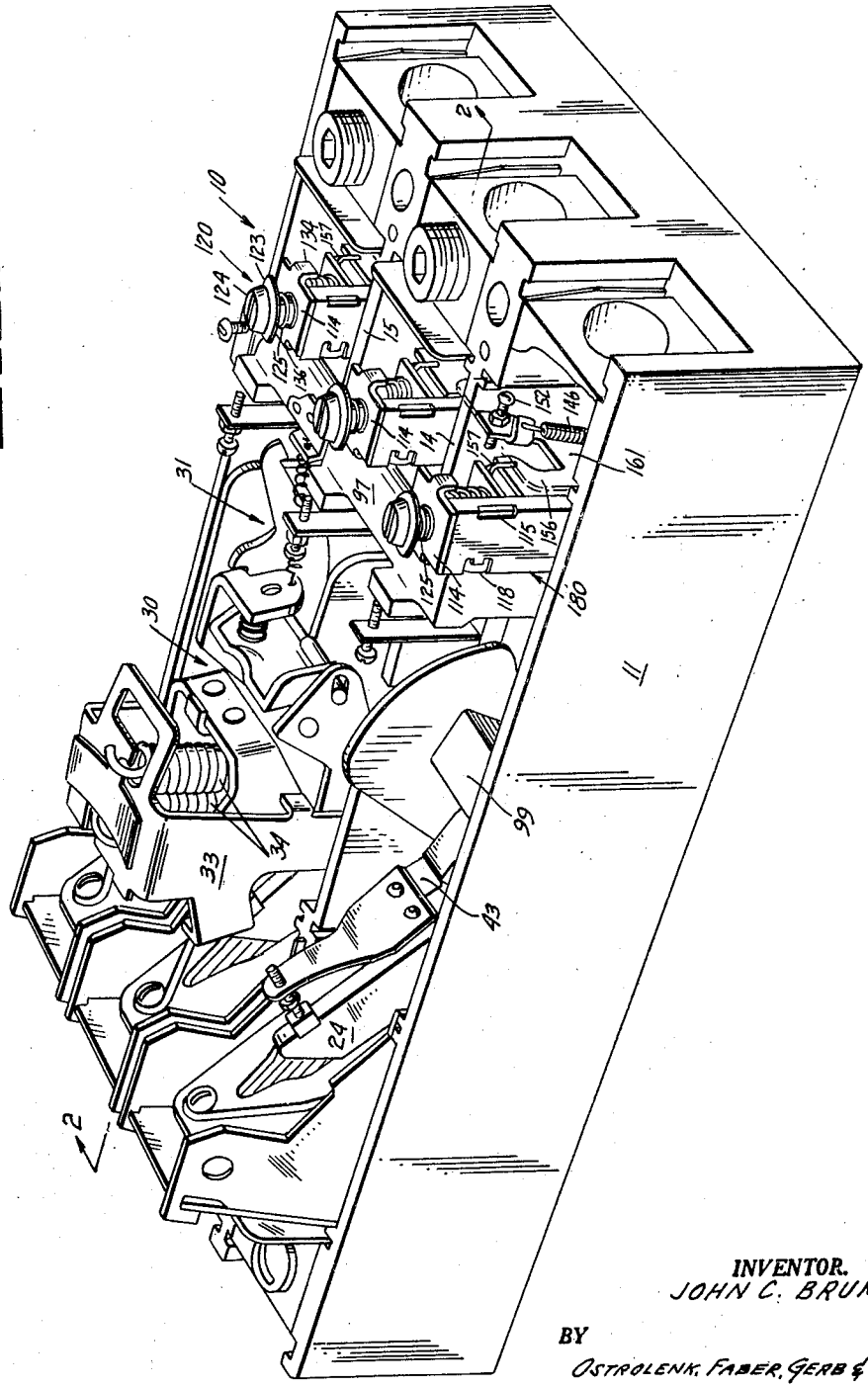
March 17, 1964 J. C. BRUMFIELD 3,125,651

MAGNETIC TRIP MEANS

Filed June 15, 1961 4 Sheets-Sheet 1

FIG. 1.



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MAGNETIC TRIP MEANS

Filed June 15, 1961 4 Sheets-Sheet 2

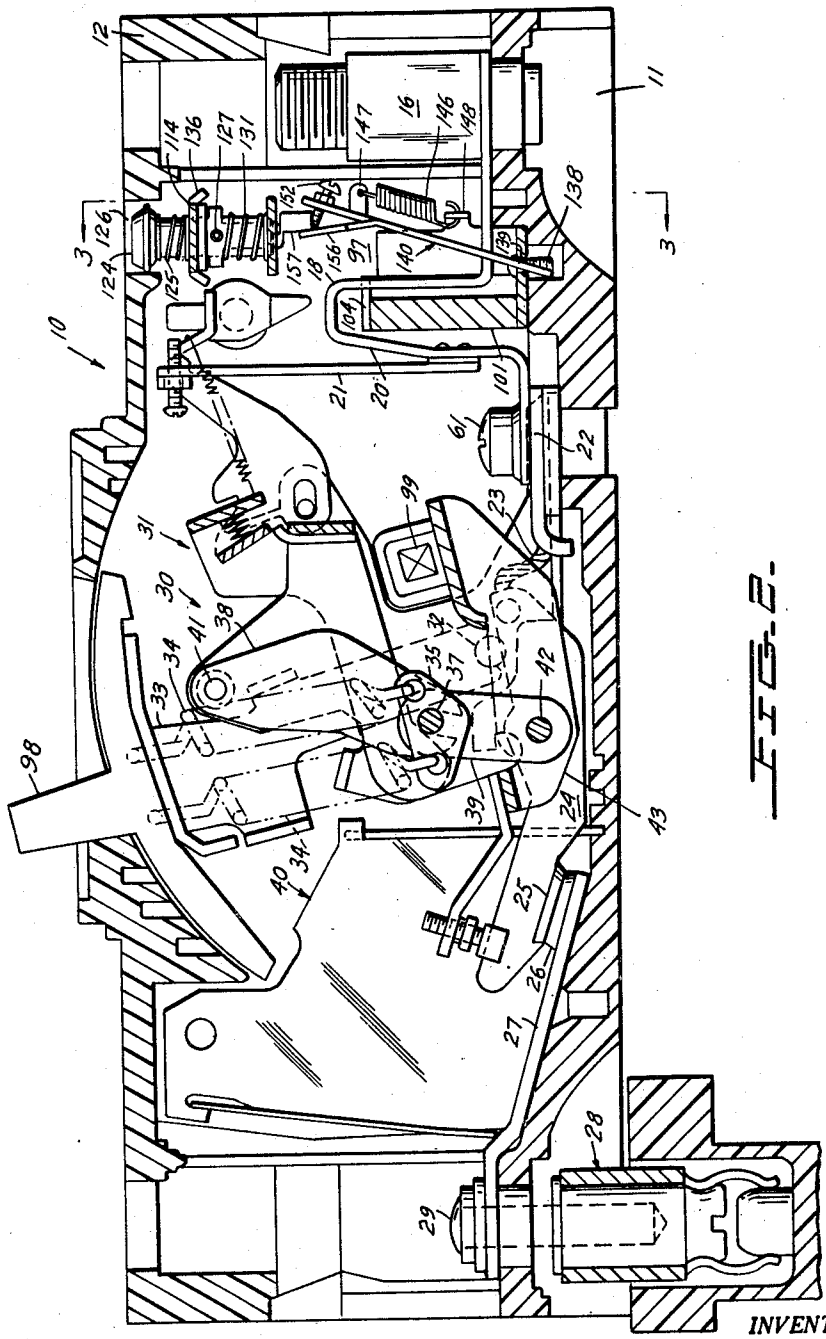


FIG. 2.

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MAGNETIC TRIP MEANS

Filed June 15, 1961 4 Sheets-Sheet 3

FIG. 3.

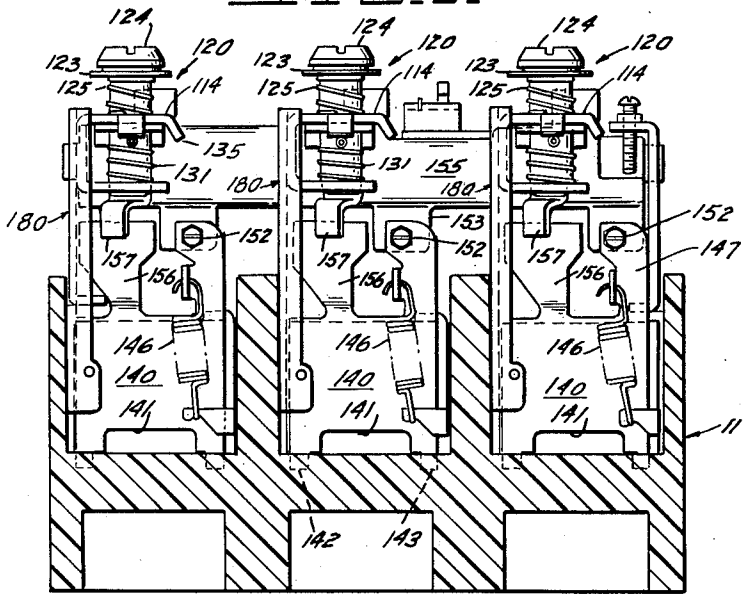


FIG. 5.

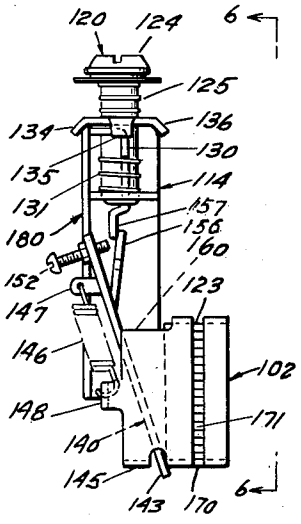


FIG. 6.

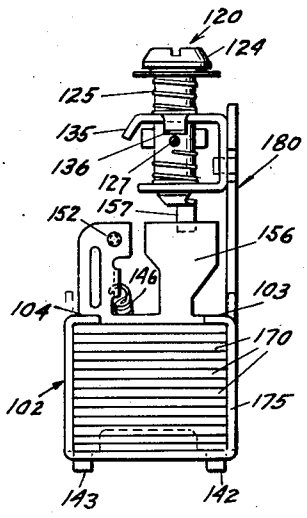


FIG. 7.

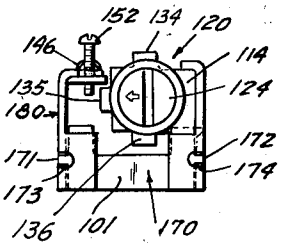
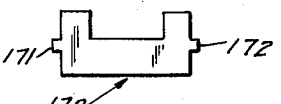


FIG. 8.



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March 17, 1964 J. C. BRUMFIELD 3,125,651

MAGNETIC TRIP MEANS

Filed June 15, 1961 4 Sheets-Sheet 4

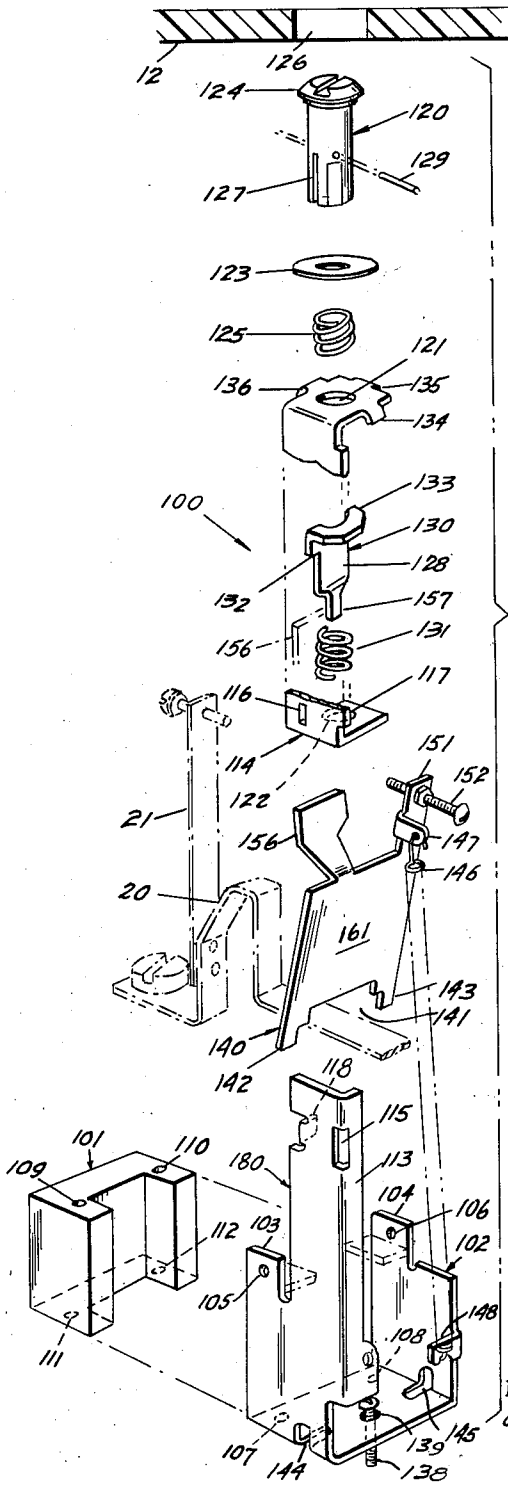


FIG. 4.

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United States Patent Office 3,125,651 Patented Mar. 17, 1964

3,125,651
MAGNETIC TRIP MEANS

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Filed June 15, 1961, Ser. No. 117,464
11 Claims. (Cl. 200—88)

This invention relates to molded case circuit breakers in general and more particularly to a novel construction for the instantaneous trip means thereof.

In the manufacture of molded case circuit breakers it is desirable from the standpoint of ease and speed of manufacture to mount as many components as possible by fastening means operable from the front of the base. It is also desirable to assemble as many of the components as possible externally of the case and in this manner limit the number of fasteners securing the components to the base.

In this connection the instant invention provides a novel construction for the instantaneous or magnetic trip means wherein most of the elements thereof are assembled externally of the base. This construction comprises a frame to which the pole piece of the magnet and the air gap adjusting means are mounted prior to mounting of the frame to the base. A single screw is then utilized to mount the frame to the base. Thereafter, extensions of the armature are inserted into slots in the frame to cooperate therewith in providing a pivotal guide for the armature relative to the frame. Following this a tension spring is secured between the armature and the frame in operative position to bias one end of the armature away from the magnet pole faces while firmly seating the other end of the armature against the frame.

The frame is a generally U-shaped member whose arms may be provided with elongated slots which serve as a positioning means for the laminations of a pole piece required for high frequency work. The slots receive ears projecting from the laminations to cooperate therewith in positioning the laminations. The laminations are maintained in a tightly packed stack by means of inwardly turned formations extending from the frame arms.

With this construction the need for riveting the laminations together to form a stack is eliminated. It is to be remembered that space is very limited in molded case circuit breakers as they are constructed today so that the magnet pole pieces are small. Thus, if it were necessary to punch rivet holes in the laminations the structure would be mechanically weakened and the flux path would be adversely affected.

Accordingly, a primary object of this invention is to provide a novel construction for a circuit breaker magnetic trip means.

Another object is to provide a novel construction for a magnetic trip sub-assembly.

Still another object is to provide a magnetic trip subassembly including a U-shaped frame having a U-shaped magnet pole piece mounted thereto with the arms of the pole piece extending at right angles to the arms of the frame.

A further object is to provide a slotted frame construction for securing magnetic pole piece laminations in a stack without the necessity of rivets.

These as well as other objects of this invention shall become readily apparent after reading the following description of the accompanying drawings in which:

FIGURE 1 is a perspective of a molded case circuit breaker embodying the teachings of the instant invention. In this view, the circuit breaker cover has been removed to reveal the operating mechanism of the circuit breaker.

FIGURE 2 is a cross section taken through line 2—2 of FIGURE 1 looking in the direction of arrows 2—2.

FIGURE 3 is a cross section taken through line 3—3 of FIGURE 2 looking in the direction of arrows 3—3.

FIGURE 4 is an exploded perspective of the circuit breaker magnetic trip device.

FIGURE 5 is a side elevation of a magnetic trip device with a laminated pole piece.

FIGURE 6 is a rear elevation of the magnetic trip device of FIGURE 5 looking in the direction of arrows 6—6.

FIGURE 7 is a plan view of the magnetic trip device of FIGURES 5 and 6.

FIGURE 8 is a plan view of one of the laminations comprising the pole piece of FIGURES 5–7.

Now referring to the figures and more particularly to FIGURES 1–4, circuit breaker 10 comprises a molded housing having base 11 and removable cover 12. Base 11 is provided with longitudinal partitions 14, 15 which divide base 11 into three elongated compartments, one for each phase of circuit breaker 10. Similar longitudinal partitions (not shown) are provided for cover 12.

The current path through each phase of circuit breaker 10 comprises load terminal connector 16, load terminal strap, including loop portion 18 having portion 20 of reduced cross sections which serves as a heater for bimetal trip element 21, connecting member 22, flexible member 23 to one end of movable contact arm 24. Movable contact 25 is mounted to the other end of contact arm 24 and is engageable with stationary contact 26 mounted to one end of line terminal strip 27 which is connected by screw means 29 to tulip connector 28 forming the line terminal connection.

Trip free operating mechanism 30 is provided to pivot movable tie bar 99 about pin 36. All three contact arms 24 are carried by tie bar 99 for simultaneously operating movable contacts 25 of all three phases into and out of engagement with their associated stationary contacts 26. Operating mechanism 30 is of an overcenter toggle type well known to the art and is fully described in copending application, Serial No. 108,812, filed May 9, 1961, entitled "U-Shaped Cradle for Circuit Breaker," invented by Ernest R. Wortmann, and assigned to the assignee of the instant invention. Handle 98 is provided for manual operation of mechanism 30 while overload device 97 is provided for automatic tripping of mechanism 30.

Arc extinguishing means in the form of arc chute 40 is operatively positioned by suitable formations in base 11 to receive electric current arcs drawn between cooperating contacts 25, 26 upon separation thereof. Since the theory of arc interruption is well understood to those skilled in the art elaboration of this point will not be undertaken at this time.

Overload device 97, in addition to comprising a time delay tripping means comprising bimetal 21 also comprises instantaneous trip means 100. The latter comprises a generally U-shaped magnet pole piece 101 energized by current passing through loop 18. Pole piece 101 is mounted to generally U-shaped frame 102 with the arms of pole piece 101 extending at right angles to the arms of frame 102. Securement is accomplished by inwardly bending ears 103, 104 to overlap pole piece 101 and thereafter deforming ears 103—104 at 105, 106, respectively, and the web of frame at 107, 108 with these deformations being received in recesses 109—112, respectively, of pole piece 101.

One of the arms of frame 102 is provided with upward extension 113 with U-shaped bracket 114 mounted at the upper end thereof by means of slots 115, 116 of frame 102 and bracket 114, respectively, which receive ears 117, 118 of bracket 114 and frame 102, respectively. Bracket 114 carries rotatable air gap adjusting member 120 which

is received by aligned apertures 121, 122 in the arms of bracket 114. Fiber washer 123 is disposed adjacent to head 124 of member 120 and is biased upward by compression spring 125 wihch rests against the upper arm of bracket 114. Washer 123 serves as a closure member for aperture 126 of cover 12 into which head 124 projects.

Member 120 includes longitudinal slot 127 which reveices the body portion 128 of member 130. Members 120 and 130 are secured to one another by means of roll pin 129 which extends through aligned apertures (not shown) in members 120 and 130. Compression spring 131, interposed between the lower arm of bracket 114 and seating portion 132 of member 130, biases member 130 hence member 120 upwardly. In the upward position, portion 133 of member 130 positioned at right angles to portion 128 is in a plane with extensions 134—136 which project downward from the top leg of bracket 114. In this position one of the flat edge surfaces of portion 133 cooperates with one of the extensions 134—136 to maintain members 120—130 in a fixed angular position with respect to bracket 114. Members 120—130 may be rotated after depressing same until portion 133 is below the lower ends of extensions 134—136.

The elements of instantaneous trip device 100 hereinbefore described are assembled as a unit prior to insertion and securement to base 11. Securement is accomplished by a single screw 138 which passes through frame 139 and is received by a suitable threaded insert mounted to base 11. After the sub-assembly is mounted to base 11 current carrying loop 18 is secured in place and thereafter magnetic armature 140 is mounted to frame 102.

Armature 140 comprises a plate-like member whose lower end is provided with notch 141 for the passage of loop member 18. Notch 141 is defined by projections whose lower ends are narrowed at 142, 143. The narrowed projection portions 142, 143 are received by frame slots 144, 145, respectively, in the web of frame member 102. The cooperation of projection portions 142, 143 and slots 144, 145 provides a pivotal connection between armature 140 and frame 102.

Tension spring 146 is secured between armature ear 147 and frame ear 148 with these ears being operatively positioned so that the upper end of armature 140 is biased away from pole faces of pole piece 101 and the lower end of 140 is firmly seated against the web of frame 102. It is to be noted that frame slots 144, 145 are so positioned that even when armature 140 is not attracted to pole piece 101, armature 140 rests against the lower end of the pole piece faces so that no air gap exists at this region.

The upper end of armature 140 includes extension 151 which carries adjusting screw 152 engageable with ear 153 of common trip bar 155. As is well known to the art, rotation of common trip bar 155 by the armature of the instantaneous trip device is effective to bring about automatic tripping of the circuit breaker mechanism.

Armature 140 also carries another upwardly extending ear 156 which is engaged by downward extension 157 of member 130. As member 120 is rotated so too is member 130. This moves portion 157 thereof in relation to the plane of the pole piece pole faces. The engagement between portions 157 and armature extension 156 causes the size of the V-shaped air gap 160 between armature 140 and the faces of pole piece 101 to change. A fine adjustment, made at the factory, is achieved by bending extension 156 relative to the main portion of armature 140 along line 161.

The embodiment of FIGURES 5–7 is substantially the same as the embodiment previously described except that the pole piece is comprised of a stack of thin laminations 170. In order to obviate the necessity for riveting laminations 170 together to form a stack each of the laminations 170 is provided with outwardly extending ears 171, 172 which are disposed within elongated slots 173, 174 of generally U-shaped frame 175. In all other respects frames 102 and 175 are identical as are the other elements of instantaneous trip devices 100 and 180.

Thus, it is seen that this invention provides a novel construction for a magnetic trip device utilized in a molded case circuit breaker. Most of the elements in the magnetic trip device are assembled prior to insertion into the base. Only two members, armature 140 and spring 146 are assembled to the frame of the magnetic trip device after the frame is mounted to the base. This materially simplifies assembly and as a result reduces the overall cost of the circuit breaker. Further, the frame of the magnetic trip device is constructed in a manner such that the magnet pole piece may be constructed of laminations which are required for high frequency operation without an adverse affect on the flux path or mechanical weakening of the pole piece structure.

Although I have here described preferred embodiments of my novel invention, many variations and modifications will now be apparent to those skilled in the art, and I therefore prefer to be limited not by the specific disclosure herein but only by the appending claims.

I claim:

1. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame adjacent said pole piece and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism.

2. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; said pole piece being retained in operative position upon said frame by inwardly turned formations of the frame arms.

3. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; said other end having a notch therein for the passage of a conductor carrying current for the energization of said pole piece.

4. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; said biasing means compris-

ing a tension spring one end of which is tied to said frame and the other end of which is tied to said armature.

5. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; said armature other end having extensions at each side thereof disposed within guide apertures of said frame.

6. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; one of the arms of the frame being longer than the other arm thereof; means carried by said one arm and in operative engagement with said armature one end for adjusting said air gap.

7. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; one of the arms of the frame being longer than the other arm thereof; means carried by said one arm and in operative engagement with said armature one end for adjusting said air gap; said last recited means comprising a rotatable member movable to a plurality of discrete positions.

8. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces, and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; said pole piece being positioned between the arms of the frame; one of the arms of the frame being longer than the other arm thereof; means carried by said one arm and in operative engagement with said armature one end for adjusting said air gap; said armature other end having extensions at each side thereof disposed within guide apertures of said frame.

9. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; each arm of the frame having a longitudinal slot; said pole piece comprising a stack of sheet like U-shaped members having outboard projections which extend into said slots to operatively position said members with respect to each other and to said frame.

10. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; each arm of the frame having a longitudinal slot; said pole piece comprising a stack of sheet like U-shaped members having outboard projections which extend into said slots to operatively position said members with respect to each other and to said frame; the member at one end of said stack abutting said frame at the web thereof; said frame arms having inwardly turned formations abutting the member at the other end of the stack to retain the pole piece operatively mounted to the frame.

11. A magnetic trip means for a circuit breaker, said means comprising a generally U-shaped frame, a U-shaped magnetizable pole piece mounted to said frame with the pole piece extending at right angles to the arms of the frame, a plate-like armature pivotally mounted to said frame and operatively positioned to form a V-shaped air gap with respect to the pole piece, pole faces and biasing means urging one end of said armature away from said pole faces and urging the other end of said armature toward said frame at the web thereof, means carried by said armature at said one end thereof for tripping of a circuit breaker operating mechanism; each arm of the frame having a longitudinal slot; said pole piece comprising a stack of sheet like U-shaped members having outboard projections which extend into said slots to operatively position said members with respect to each other and to said frame; the member at one end of said stack abutting said frame at the web thereof; said frame arms having inwardly turned formations abutting the member at the other end of the stack to retain the pole piece operatively mounted to the frame; one of the arms of the frame being longer than the other arm thereof; means carried by said one arm and in operative engagement with said armature one end for adjusting said air gap; said armature other end having extensions at each side thereof disposed within guide apertures of said frame.

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