May 16, 1950 T. LINDSTROM ET AL 2,508,178

CIRCUIT INTERRUPTER

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Fig. 1.

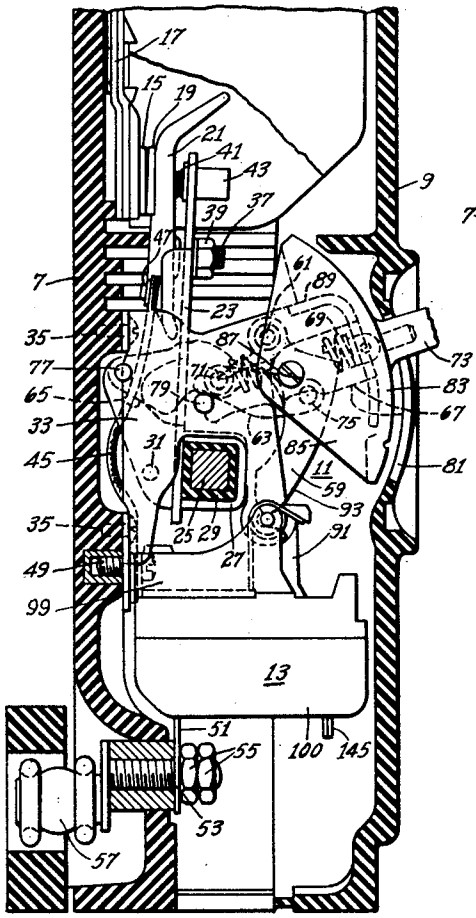


Fig. 2.

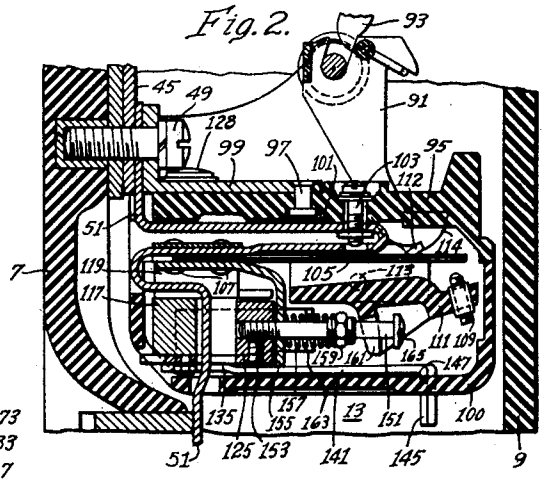


Fig. 3.

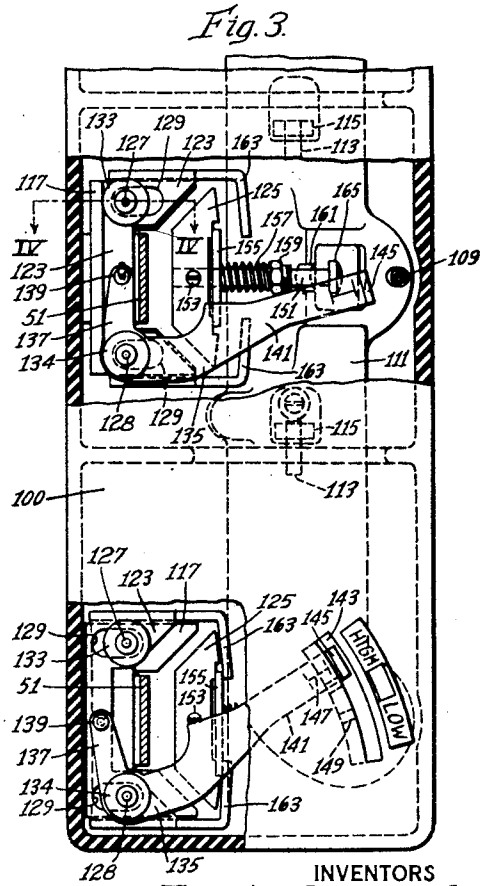
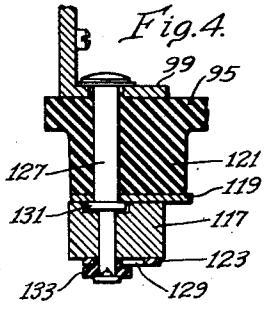


Fig. 4.



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CIRCUIT INTERRUPTER

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12 Claims. (Cl. 200—106)

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This invention relates to circuit interrupters and more particularly to circuit interrupters embodying electromagnetic tripping means for tripping the interrupter in response to overloads above a predetermined value.

An object of the invention is to provide a circuit interrupter having instantaneous and time delay trip mechanism with improved means for adjusting the instantaneous tripping characteristics of the interrupter.

Another object of the invention is to provide a circuit interrupter with an improved electromagnetic trip means having an armature and a fixed core wherein a portion of the magnetic core is adjustable relative to the armature to vary the tripping characteristic of the electromagnet.

Another object of the invention is to provide an improved circuit interrupter with a novel electromagnetic trip device, the electromagnet having an armature and two magnetic flux circuits and corresponding air gaps disposed to produce a differential pull on the armature, the minimum tripping current required to instantaneously trip the interrupter being determined by varying the differential pull of the magnet.

Another object of the invention is the provision of a circuit interrupter with a novel electromagnetic trip means comprising an armature and fixed and movable core members for producing a differential pull on the armature, said movable core member being manually adjustable to vary the differential pull of the electromagnet.

Another object of the invention is the provision of a circuit interrupter with an improved electromagnet and trip device comprising an armature and a fixed core structure disposed to produce a differential pull on said armature, at least a part of the fixed core structure being adjustable relative to said armature to vary the differential pull of the electromagnet to thereby adjust the tripping characteristic of the device.

Another object of the invention is the provision of a circuit interrupter with an electromagnetic trip device having a plurality of parallel magnetic flux circuits and adjustable means to vary the minimum current value for instantaneously tripping the interrupter.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description thereof when read in

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conjunction with the accompanying drawings, in which:

Figure 1 is a vertical sectional view of a circuit breaker embodying the invention;

Fig. 2 is a vertical sectional view on an enlarged scale of the trip device;

Fig. 3 is a bottom view of the electromagnetic trip devices for two adjacent poles of the interrupter with the trip device cover partly broken away to show the adjustment of the adjustable core member; and

Fig. 4 is a detailed sectional view taken on the line IV—IV of Fig. 3 and showing the method of mounting the fixed and adjustable core members.

Referring to Fig. 1 of the drawing, the circuit interrupter is of the three pole type and comprises a base 7 of molded insulating material, a cover 9 also of molded insulating material secured to the base by means of bolts (not shown), operating mechanism indicated generally at 11 and a trip device indicated generally at 13 having a separate electroresponsive tripping means for each of at least two of the poles of the interrupter. Each pole of the breaker is provided with a stationary contact 15 mounted on the lower end of a conductor 17 of the corresponding pole of the breaker, the conductor being suitably secured to the base 7.

The movable contact structures of the several poles are the same, for which reason only the movable contact structure for the center pole has been shown and will be described. The movable contact 19 for the center pole is secured to a contact arm 21 which is loosely supported on a channel-shaped switch arm 23. The three channel-shaped switch arms of the three poles are rigidly fastened for unitary movement by means of a metal tie bar 25 which extends transversely across all of the poles of the breaker. The tie bar 25 is fastened to the switch arms 23 adjacent the pivoted ends thereof by means of metal straps 27 looped about the tie bar and clinched thereagainst. The tie bar is surrounded by an insulating tube 29 in order to insulate and prevent short circuiting of the poles of the interrupter. By means of the tie bar 25, all of the switch arms 23 are mechanically interconnected so that all three of the switch arms are operated by a single operating mechanism, which is hereinafter described. The channel-shaped switch arm 23 for the center pole is pivotally supported on a pin 31 mounted in a U-shaped main frame 33 secured to the base 7 by means of screws 35. The pivot pin 31 forms the common pivot for the three mechanically connected switch arms 23.

Each of the contact arms 21, to which the movable contacts 19 are secured, is attached to its corresponding channel-shaped switch arm 23 by means of a headed adjusting bolt 37 which threadedly engages the switch arm and is locked in adjusted position by a lock nut 39. The head (not shown) of the bolt 37 loosely engages in a recess in the contact arm and is retained therein by an inwardly flanged portion of the contact arm. Contact pressure is provided by a compression spring 41 having one end seated in a cup-shaped spring seat 43 mounted on the switch arm 23 near its upper end and the other end bearing against the contact arm 21. The spring 41, in the open contact position of the switch arm 23, biases the contact arm 21 counterclockwise about the head of the bolt 37, the movement being limited by a tail portion of the contact arm 21 striking the channel-shaped switch arm 23.

The upper end of a flexible conductor 45 is electrically and mechanically connected to the lower end of the contact arm 21 by means of a clamp 47 and the lower end of the flexible conductor is connected by means of a screw 49 to a conductor 51 (Figs. 2, 3 and 4) which forms the energizing means for the corresponding pole of the trip device 13. The conductor 51 has its lower end connected by means of a bolt 53 and nuts 55 to a terminal connector 57. The upper end of the conductor 17 is similarly connected to a terminal connection (not shown) but similar to the connector 57. The circuits for the two outer poles are the same as the circuit for the center pole, consequently, only the circuit for the center pole will be traced. This circuit extends from the upper terminal (not shown) through the conductor 17, stationary contact 15, movable contact 19, contact arm 21, flexible conductor 45, the trip device 13 energizing conductor 51 and the bolt 53 to the terminal connector 57.

The movable contact structure comprising the channel-shaped switch arms 23, the tie bar 25 and the contact arms 21 for all three poles of the breaker, is adapted to be operated to open and closed positions to open and close the circuit of the interrupter by the single operating mechanism 11. This operating mechanism comprises a carrier or support member 59 pivotally mounted by means of a pin 61 on the main frame 33, a pair of toggle links 63 and 65 interconnecting the carrier 59 and the center pole switch arm 23, a U-shaped operating lever 67, overcenter springs 69 for connecting the operating lever 67 to the knee pivot pin 71 of the toggle links 63 and 65, and an insulating operating handle 73 for the operating lever.

The toggle link 63 is pivotally connected by means of a pin 75 to the carrier 59, while the toggle link 65 is pivotally connected by means of a pin 77 to the channel-shaped switch arm 23 for the center pole of the interrupter. The two legs of the operating lever 67 are disposed adjacent the inner sides of the main frame 33 and are pivotally supported on pins 79 projecting inwardly from the sides of the frame. The operating handle 73 projects through an opening 81 in the cover 9 and has an arcuate protective portion 83 having side portions 85 integral with the portion 83. The side portions 85 of the operating handle straddle the main frame 33 and are secured to the two legs of the operating lever 67 by means of screws 87 which threadedly engage the respective legs of the operating lever 67. The connecting

portion of the operating lever is provided with a formed over portion 89. The portion 89 of the operating lever is for the purpose of engaging and resetting the carrier 59 to its latched position by movement of the operating handle as far as it will go in opening direction, in order to reset the mechanism following a tripping operation of the interrupter. The carrier 59 is normally restrained in latched position as shown in Fig. 1 by a latch 91 of the trip device, which engages a latching portion 93 of the carrier.

The operation of the circuit interrupter operating mechanism is as follows: with the parts in the position shown in Fig. 1, in which position all of the contact means are closed and the carrier 59 is held in latched position; if the operating handle 73 is moved in a clockwise direction from the position shown to the opposite end of the slot 81 thus rotating the operating lever 67 in a clockwise direction, the overcenter spring 69 will snap overcenter below the line 71—75 and cause the toggle links 63—65 to collapse, thereby causing simultaneous movement of all of the channel-shaped switch arms 23 and the movable contacts 19 to the open-circuit position with a snap action. To reclose the interrupter, the operating handle is moved in the opposite direction back to the position shown in Fig. 1. This movement of the handle causes the overcenter springs to snap overcenter in the opposite direction and move the toggle to the in-toggle position to simultaneously close all of the contact means with a snap action.

The circuit interrupter is opened automatically in response to overload currents occurring in the circuit of any pole of the breaker, by operation of the trip device 13. When the latch 91 is released by the trip device in response to an overload current, it frees the carrier 59 and permits the springs 69 to rotate the carrier in a counter-clockwise direction, thus causing collapse of the toggle 63—65 and movement of the channel shaped switch arms and the movable contacts for all three poles of the breaker to the open circuit position. The breaker cannot be closed after a tripping operation until the handle is moved to the fully opened position in order to reset and relatch the carrier 59 with the latch 91. After the carrier has been relatched, the operating handle may then be moved to the closed circuit position to effect closing of the contacts.

The trip device comprises an insulating base or support member 95 (Fig. 2) secured by means of rivets 97 or other suitable means to an angle bracket 99 which is, in turn, secured to the base 7 of the interrupter by means of the screws 49. A cover 100 of insulating material encloses the trip device. The electroresponsive tripping means for the three poles are the same, therefore only the one for the center pole will be described. The energizing conductor 51 of each pole has a loop 101 therein, the upper leg of the loop being disposed adjacent to the base 95 and secured by means of a screw 103 to the underside of the base 95. A bimetal element 105 has one end secured by means of rivets 107 or other suitable means to the lower leg of the loop near the base of the loop. The rivets 107 also serve to rigidly secure both the lower loop of the heater element 51 and the bimetal element 105 to a support bracket 119 to which is also secured the electromagnetic trip means to be later described. The bimetal element 105 extends toward the right (Fig. 2) substantially parallel to and adjacent the lower leg of the loop 101. The free end of the bimetal is disposed adjacent an adjusting screw

109 mounted in an insulating trip bar 111. The trip bar is pivotally mounted by pins 113 supported in the trip bar engaging bearing projections 115 (Fig. 3) extending downwardly from the bracket 99 through openings (not shown) in the base 95. In the normal position of the trip bar 111, a latch member 112 (Fig. 2) thereon engages a latch portion 114 of the latch member 91 to restrain this latch in latching position. When the bimetal element 105 is heated a predetermined amount in response to overload currents, it deflects downwardly to engage the adjusting screw 109 and rocks the trip bar clockwise about its pivot 113. This movement of the trip bar disengages the latch 112 from the latch 91 thus freeing the carrier 59 and causing an opening operation of the breaker mechanism in the previously described manner.

The trip device is also provided with electromagnetic means for each of at least two of the poles of the breaker operable in response to overloads above a predetermined value, or in response to short circuits to instantaneously actuate the trip bar 111 to trip the interrupter. Each electromagnet comprises a fixed U-shaped core member 117 (Figs. 2 and 3) fixedly mounted on the bracket 119, a movable U-shaped core member 123, and an armature 125. The bracket 119 is of non-magnetic material and is secured to spaced projections 121 (Fig. 4) integral with the base 95.

The fixed core member 117 and the bracket 119 are rigidly mounted on the projections 121 by means of a pair of rivets 127 and 128 which extend through openings in the bracket 99, the base 95, the bracket 119, the fixed core member 117 and elongated slots 129 in a movable core member 123 hereinafter described. The rivets 127 and 128 have centrally located heads 131 which abut against the lower face of the bracket 119, and the upper ends of the rivets are peened over to rigidly secure the brackets 99 and 119 to the base 95 of the trip device. The lower ends of the rivets 127 and 128 are provided with spacers 133 (Fig. 4) and 134, respectively, having reduced portions abutting against the fixed core member 117 and firmly held thereagainst. The spacers 133 and 134 are also provided with flanged portions of a larger diameter than the width of the slots 129 of the adjustable core member to retain the movable core member 123 in place but which permit adjusting movement of the core member 123. The reduced portion of the spacer 134 on the rivet (Fig. 3) is made longer than the reduced portion of the spacer 133 to accommodate a bell crank lever 135 which is pivotally mounted thereon. One arm 137 of the bell crank lever carries a pin 139 which projects into an elongated slot in the movable core member 123 whereby movement of the lever 135 is transmitted to the movable core member 123 to move it relative to the fixed core member 117 and also relative to the armature 125. The other arm 141 of the bell crank lever extends parallel to and just inside the bottom of the cover 100 of the trip device. The free end of the arm 141 is formed at right angles to the arm and projects downwardly (Fig. 2) through an arcuate opening 143 (Fig. 3) in the cover to form a convenient handle 145 whereby the bell crank lever may be operated to adjust the position of the movable core member 123. A projection 147 (Figs. 2 and 3) on the arm 141 is held in engagement with serrations indicated at 149 formed on the inside of the cover 100, by means of the inherent resiliency of the arm 141 to retain the bell crank 135 and the movable core member 123 in the adjusted position.

The armature 125 is threadedly mounted on one end of a horizontally disposed trip rod 151 and is locked in place by a set screw 153. The rod 151 is slidably mounted in a formed over portion 155 of the non-magnetic bracket 119 and the armature is held in retracted position against the bracket by means of a spring 157 compressed between the portion 155 of the bracket and a nut 159 threadedly engaging an enlarged and threaded mid portion of the rod 151. At its right-hand end (Figs. 2 and 3) the rod 151 projects through an open slot 161 in the trip bar 111 and is provided with a head 165 which, upon movement of the armature to attracted position engages and operates the trip bar to trip the interrupter.

The movable core member 123 is of the same general U-shape as the fixed core member 117 and lies flat against the lower face of the fixed core member. When the movable core member 123 is in its position closest to the armature 125, the pole faces of the two core members are substantially in line. The movable core member provides a path for a portion of the magnetic flux parallel to the magnetic flux path through the fixed core member. The magnetic flux through the armature 125 and both the fixed and movable core members produces a pull on the armature tending to move it in tripping direction. The initial air gap between the armature 125 and the core member 117 is fixed but the air gap between the movable core member 123 and the armature may be varied by adjusting the position of the movable core member in the previously described manner. This varies the over-all pull on the armature produced by both core members.

The ends of the movable core member 123 are formed over at right angles and lie adjacent the ends of the fixed core member. Each formed-over portion of the movable or adjustable core member 123 is provided with an arm 163 which arms extend to the right (Fig. 3) and are formed inwardly toward each other. The purpose of the arms 163 is to provide a limited path for at least a portion of the magnetic flux and thereby provide a differential pull on the armature 125 which may be varied according to the adjustment of the core member 123. The ends of the armature 125 and of the core means 117—123 are slanted inwardly along a line extending toward the center of U of the core means. This not only increases the pole face area and thereby provides for maximum pull on the low trip setting where the current is low but also provides a corner on the armature of relatively small area facing the parallel extensions of the core member 123 so that the lateral flux leakage to the parallel extensions is reduced and there is a strong back pull between the inturned arms 163 on the extensions and the back of the armature 125.

Referring to the lower portion of Fig. 3, it may be seen that the instantaneous magnetic tripping means for the right-hand pole of the interrupter is adjusted to trip in response to overload currents of high value. In this adjusted position the adjustable core member 123 has been moved to the left away from the armature and way from the pole faces of the fixed core member 117, thus differentially increasing the air gap of the magnet and decreasing the pull of the magnet for a given amount of current. Movement of the adjustable core member 123 also moves the bent arms 163 thereof closer to the outer side of the

armature, the movement of the member 123 in this direction being limited by the arms 163 engaging the portion 155 of the non-magnetic bracket 119 (Fig. 2). In this position there is a slight air gap between the arms 163 and the right-hand face of the armature 125. In the adjustment of the trip device just described, the inward pull of the magnetic core members 117 and 123 on the armature in tripping direction is differentially decreased and the back pull of the arms 163 is increased for a given value of overload current. When the bell crank lever 135 is rotated clockwise from the "high" position toward the "low" position, the adjustable core member 123 is moved toward the armature 125 and the arms 163 are moved away from the armature. This has the effect of decreasing the magnetic air gap and increasing the pull of the magnet on the armature in tripping direction. Also, as the arms 163 move away from the armature, the back pull on the armature opposing tripping movement thereof decreases so that when the device is set at a position below the highest position which it is capable of adjustment, the trip device will be actuated in response to overloads of lesser magnitude to trip the interrupter.

By way of example, assuming that the breaker is rated to carry a normal load indefinitely without actuating the trip device, the bimetal may be calibrated to trip the breaker with an inverse time delay in response to overloads of say between 100% and 300% of the normal rated current. The electromagnetic trip device may be calibrated and adjusted to instantaneously trip the breaker on overloads of, for instance, between 300% and 1100% of rated current depending on the setting of the lever 135 and the corresponding adjustment of the movable core member 123. Assuming that the trip device is calibrated to the above arbitrary values, then with the device set to the "low" position, as shown in the upper part of Fig. 3, the electromagnet will operate to instantaneously trip the breaker upon the occurrence of an overload current of 300% or more of normal. If the lever 135 is moved to the "high" position to correspondingly adjust the movable core member 123, the armature will not be attracted until the occurrence of an overload current of 1100% of normal. By adjusting the lever 135 to any point between the maximum and minimum settings, the magnet will function to instantaneously trip the breaker in response to an overload current of a minimum value corresponding to the particular setting of the device. Thus the device may be set to cause instantaneous tripping of the breaker in response to a minimum overload of, for instance, 300%, 500% or 700%, etc., up to 1100% of normal rated current. It will be understood that if the device is adjusted to instantaneously trip out at a minimum overload of, for instance, 700% of normal, the bimetal element 105 will function to trip the breaker after a time delay upon the occurrence of overload currents of any value between 100% and 700%, or between 100% and the particular minimum current value between 300% and 1100% to which the magnet is adjusted.

The time delay tripping may be adjusted by rotating the screw 109 in the trip bar 111 to vary the distance of the end of the screw from the bimetal element.

The high instantaneous trip setting is determined by the small air gap between the armature 125 and the arms 163 of the movable core member, and by the air gap between the movable core member 123 and the armature. The low instantaneous trip setting is determined by the initial force of the spring 157. The initial tension of the spring 157 may be varied by turning the nut 159 on the threaded portion of the rod 151 to increase or decrease the tension of the spring. This varies the low instantaneous tripping current required to trip the breaker when the adjustable magnet core is set to the "low" position.

From the foregoing description, it will be seen that the invention provides a circuit breaker having an improved trip device wherein the electromagnetic trip means is provided with two parallel magnetic flux circuits and corresponding air gaps disposed to produce a differential pull on the armature so that a wide range of adjustment is obtained, the minimum current value required to trip the breaker being selectively determined by varying the air gaps to thereby vary the differential magnetic pull on the armature.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details and arrangement of parts thereof may be made without departing from some of the essential features of the invention. It is desired, therefore, that the language of the appended claims be given as reasonably broad interpretation as the prior art permits.

We claim as our invention:

1. In a circuit interrupter, tripping means including electromagnetic means comprising an armature and fixedly mounted magnetic core means, a unitary movable magnetic core means movable relative to said armature and having portions disposed on each side of said armature to cause said electromagnet to produce a differential pull on said armature, and means for adjusting said movable core means relative to said armature to vary the differential pull of said electromagnet to thereby selectively determine the minimum value of overload current required to operate said armature.

2. In a circuit interrupter the combination of an armature operable to effect automatic operation of said interrupter, electromagnetic means comprising a fixed main pole structure cooperating with said armature to define a main air gap an auxiliary pole structure disposed adjacent said fixed pole structure and movable relative to said fixed pole structure and said armature to vary the main magnetic air gap between said armature and said pole structure, means integral with said auxiliary pole structure providing a back drag on said armature, said integral means being movable with said auxiliary pole structure to vary the back drag on said armature, and means for adjusting said auxiliary pole structure and said integral means to selectively determine the tripping characteristic of said electromagnetic means.

3. In a circuit interrupter, the combination of a tripping armature, an energizing winding traversed by the current of the circuit of the interrupter, a main pole structure comprising a fixedly mounted main pole member and a unitary auxiliary pole member cooperating with said main pole member to produce a forward pull on said armature and movable relative to said main pole member and said armature, said auxiliary pole member having a part disposed to cause said pole structure to produce a back pull on said armature, and manual means for moving said auxiliary

pole member relative to said main pole member and said armature to vary the magnetic air gap between the armature and said main pole structure and to simultaneously vary the back pull of said pole structure.

4. In a circuit interrupter, an armature, electroresponsive means comprising a pole structure including a main pole member fixedly mounted in front of said armature defining a main air gap, a unitary auxiliary pole member slidably mounted in front of said armature adjacent to said main pole member and movable relative thereto to vary the main air gap of said electromagnet, said auxiliary pole member having portions integral therewith disposed to cause said pole structure to produce a back pull on said armature, said pole structure being effective when energized in response to overload currents above a predetermined magnitude to operate said armature, and means for adjustably positioning said auxiliary pole member and said integral portions relative to said main pole member and said armature to selectively determine the magnitude of the current required to instantaneously operate said armature.

5. In a circuit interrupter, an armature, electromagnetic means energized in response to the current in the circuit of the interrupter for operating said armature, said electromagnetic means comprising a fixedly mounted main pole member disposed in front of said armature defining a main air gap, an auxiliary pole member disposed in front of said armature and movable relative to said main pole member to vary the main air gap of the electromagnetic means, means integral with said auxiliary pole member disposed back of said armature to produce a back drag on said armature, said integral means being movable with said auxiliary pole member to vary the back drag on said armature.

6. An electroresponsive device comprising an energizing winding, an armature cooperating therewith, a fixedly mounted pole member cooperating with said armature to define a main air gap, a movably mounted auxiliary pole member cooperating with said fixedly mounted pole member to produce a forward pull on said armature, means on said auxiliary pole member disposed to produce a back drag on said armature, said auxiliary pole member and said means together being movable to vary the main air gap of the electroresponsive device and to vary the back drag on said armature.

7. The combination of an energizing winding, an armature cooperating therewith, a pole structure comprising a main fixedly mounted pole structure and an auxiliary pole structure movable relative to said main pole structure, said main pole structure and said auxiliary pole structure cooperating to produce a forward pull on said armature, means mounted on and movable with said auxiliary pole structure for causing said pole structure to produce a differential pull on said armature, and means for selectively adjusting said auxiliary pole structure.

8. An electromagnet comprising an energizing winding, a movable armature, a fixedly mounted main pole member disposed adjacent one side of said armature, a movable pole member mounted adjacent said fixedly mounted pole member and movable relative thereto, said pole members producing a forward pull on said armature, means on said movable pole member and disposed adjacent the opposite side of said armature for producing a back drag on said armature, said pole members overcoming said back drag and operating said armature when energized in response to current of a predetermined magnitude traversing said winding, and manual means for adjusting said movable pole member to selectively determine the magnitude of current required to operate said armature.

9. An electroresponsive device comprising an energizing winding, an armature cooperating therewith, a U-shaped pole member mounted on a fixed support and cooperating with said armature to define a main air gap, a slidably mounted U-shaped auxiliary pole member disposed adjacent to said fixedly mounted pole member and cooperating therewith to produce a forward pull on said armature, projections on said auxiliary pole member cooperating with said armature to produce a back drag thereon, said auxiliary pole member and said projections being movable relative to said fixedly mounted pole member and said armature to vary the main air gap of said electroresponsive device and to vary the back drag on said armature.

10. In a circuit interrupter, an electromagnet comprising an armature, a U-shaped magnetic core operable in response to overload currents to effect operation of said armature, said core having a portion disposed in front of said armature, said U-shaped core having pole faces at the ends thereof slanting inwardly toward the center of the U and having substantially parallel extensions at the outer edges of the U extending beyond said slanting pole faces, said extensions having at the outer ends thereof inwardly directed portions extending in back of the end portions of the armature, said armature having slanting faces adjacent to and cooperating with the slanting pole faces on the core, and said slanting faces of the armature terminating in a corner at each end of the armature of small area for reducing the lateral flux leakage to said extensions and enhancing the back pull and a portion disposed back of said armature to produce a differential pull on said armature, and manual means for effecting relative movement between said armature and both portions of said core to vary the differential pull of said electromagnet.

11. In a circuit interrupter comprising operating means for causing automatic operation of said interrupter, an electromagnet comprising an armature, a core member having portions arranged in relation to said armature to provide a main air gap on one side of said armature and a secondary air gap on the opposite side of said armature, a core having an extension beyond the end of the armature and having pole portions positioned oppositely on each side of the armature to provide a main air gap on one side of the armature and a secondary air gap on the other side of the armature producing a differential pull on the armature, the pole portion for one of said air gaps being slanted at an angle relative to the pole portion of the other air gap, said armature having a slanting end portion facing said slanting pole portion and providing an end of reduced section for reducing the lateral flux leakage to said extension of the core, producing a differential pull on said armature, and manual means for effecting relative movement between said armature and said core member to vary both of said air gaps to thereby vary the differential pull on said armature.

12. A circuit interrupter comprising relatively movable contact means, a trip device comprising electromagnetic means operable in response to

overload currents to effect automatic opening of said contact means, said electromagnetic means including an armature, a fixed core member, a movable core member cooperative with said fixed core member to produce a forward pull on said armature to operate said armature, a portion integral with said movable core member disposed and arranged to cause said electromagnetic means to produce a differential pull on said armature, and adjusting means for selectively positioning said movable core member and said integral portion relative to said armature to vary the differential pull to thereby selectively determine the minimum overload current value required to operate said armature.

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