July 21, 1942. E. A. iLEMAN 2,290,560

CIRCUIT BREAKER

Filed Oct. 5, 1939 2 Sheets-Sheet 1

Fig. 1.

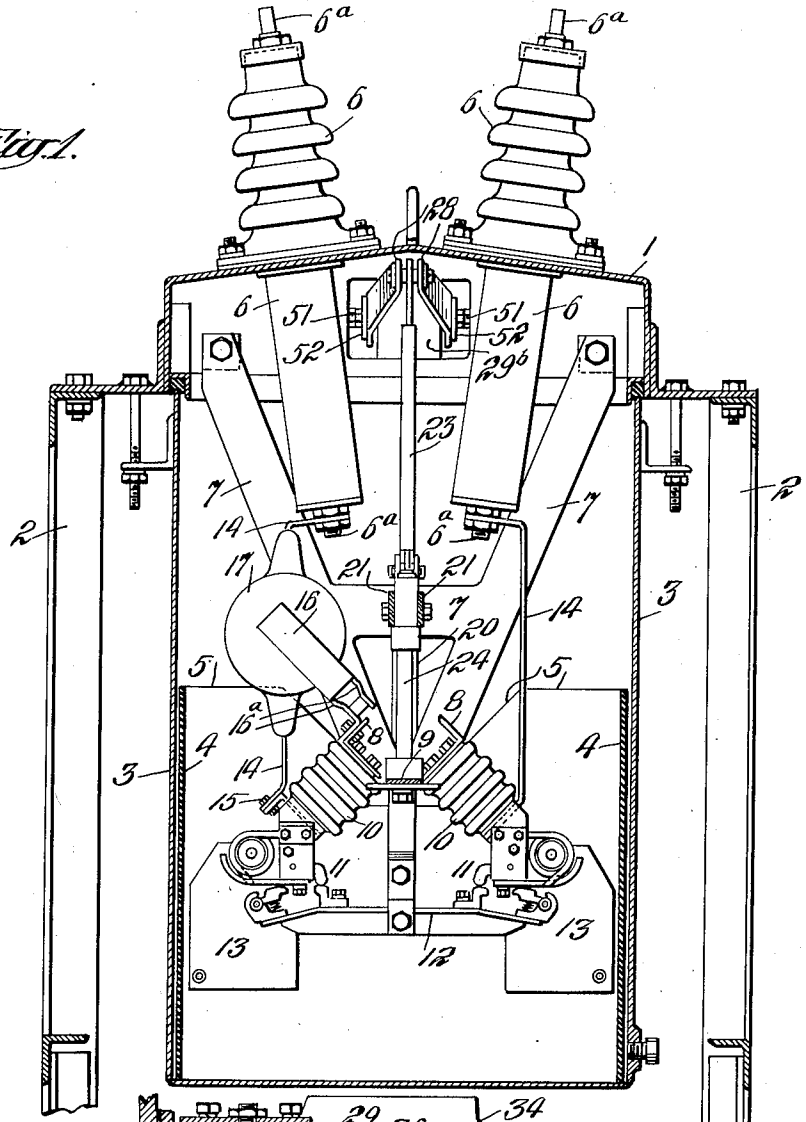
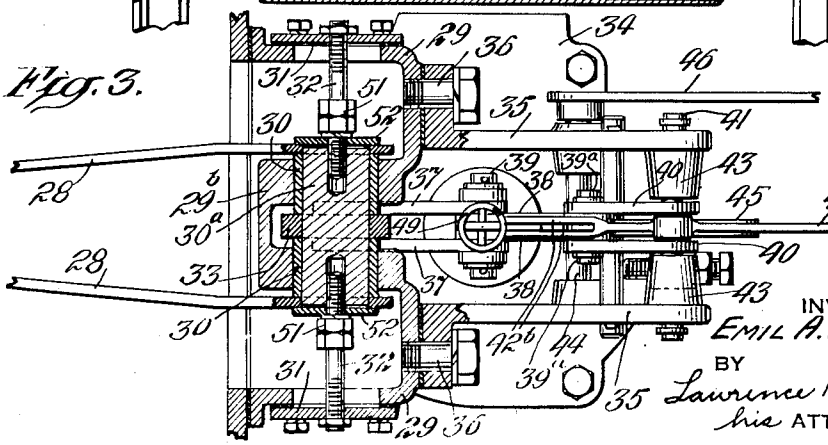


Fig. 3.



INVENTOR
EMIL A. ILEMAN
BY
Lawrence K. Sager
his ATTORNEY

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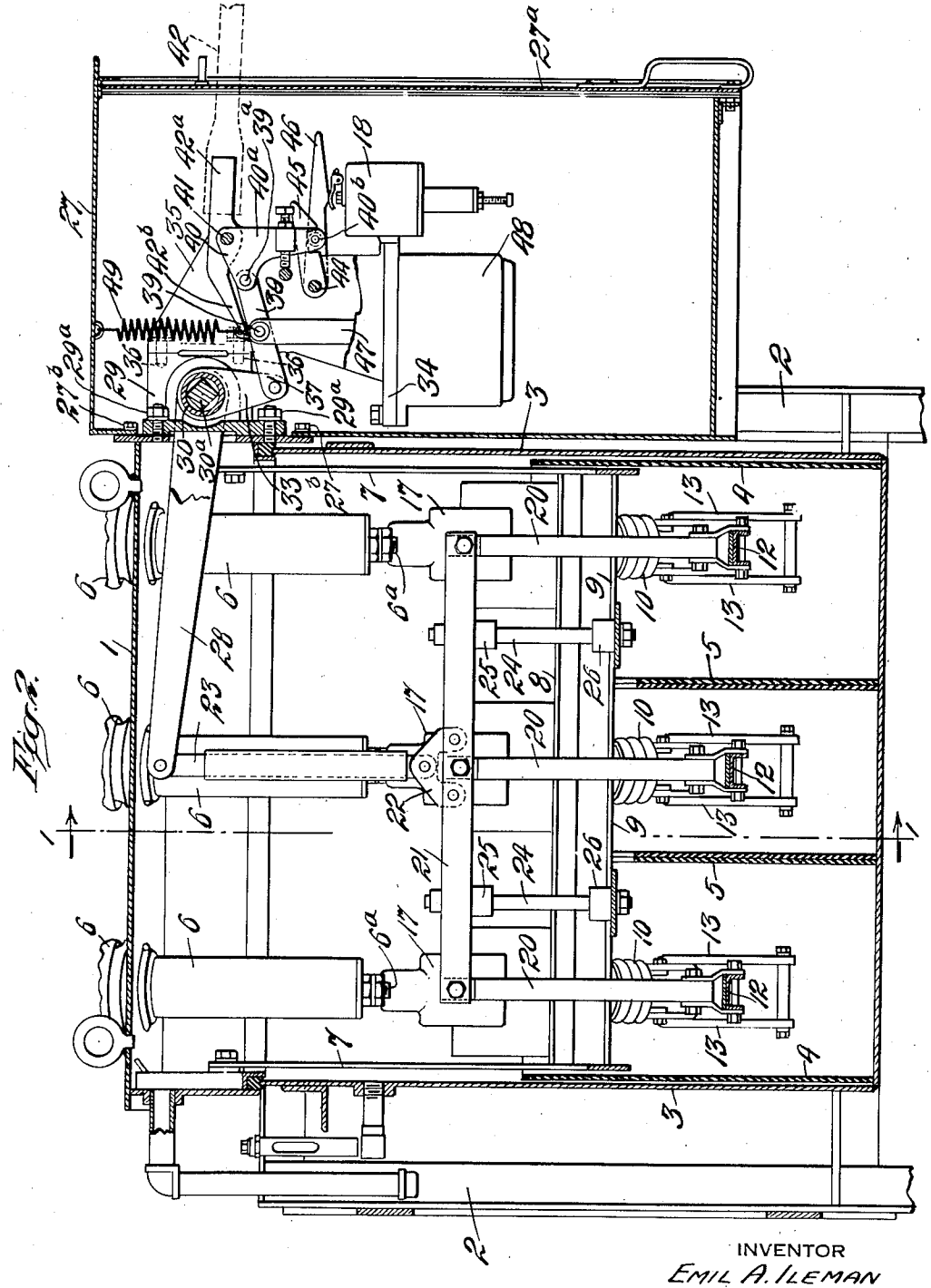

Fig. 2.

INVENTOR
EMIL A. ILEMAN
BY
Lawrence K. Sager
his ATTORNEY

UNITED STATES PATENT OFFICE

2,290,560

CIRCUIT BREAKER

Emil A. Ileman, Bethlehem, Pa., assignor, by mesne assignments, to The Pennsylvania Company for Insurances on Lives and Granting Annuities, Philadelphia, Pa., a corporation of Pennsylvania

Application October 5, 1939, Serial No. 298,011

8 Claims. (Cl. 200—150)

This invention relates to an improved form of construction of circuit breakers and new relationship of parts and is particularly applicable to oil circuit breakers.

The main object of the invention is to produce an improved structure that will be of sturdy and rugged form and dependable in long continued use. Another object is to relate the parts in such a manner as to afford convenient accessibility and removal and renewal of individual parts without the necessity of disturbing other parts. Another object is to provide opportunity for housing the current transformers within the enclosure of the breaker and to permit their convenient replacement by transformers of different capacity when desired without the necessity of disturbing the contacts. Another object is to provide opportunity for use of current transformers of a wide range of capacity. Another object is to permit convenient renewal of the main bushings without disturbing the contacts. Another object is to provide a form of construction which will permit the control mechanism to be assembled as a unit and detachable as a unit from the breaker. Other objects and advantages will be understood from the following description and accompanying drawings which illustrate a preferred embodiment of the invention.

Fig. 1 is a vertical section on the line 1—1 of Fig. 2; Fig. 2 is a vertical longitudinal section of the breaker and control mechanism; and Fig. 3 is an enlarged horizontal section of the control mechanism.

Referring to Figs. 1 and 2 the hollow steel top 1 is the main support for all the parts, it in turn being supported by the frame work 2. A downwardly removable tank 3 is supported from the top by intervening angle irons and is lined with insulating fibre board 4 and provided with fibre board partitions 5 located between the contacts of the three-pole breaker. The top also supports the three pairs of insulating bushings 6 which extend within the tank and contain the conducting leads 6a which serve to form the connections from the exterior to the interior of the tank.

At each end of the supporting top is an inverted A-shaped steel frame 7, the upper ends of which are bolted to the inside end portions of the top. Between the lower ends of these frames extend a pair of steel angle irons 8 longitudinally of the tank and parallel to each other and spaced apart. The ends of these angle irons are welded to the frames 7. A steel plate 9 likewise extends longitudinally of the tank and is centrally located below the angle irons 8 and is welded at its ends to the lower ends of the frames 7. The angle irons 8 serve as the main support for the fixed insulated contacts and other parts while the plate 9 serves to support the guides for the movable element of the breaker. The angle irons are positioned so that their lower faces converge toward each other and to these faces are bolted three pairs of post insulators 10. These insulators diverge outwardly and support the fixed contacts 11 of the breaker at their lower ends. These are shown of the magnetic blow-out type and cooperate with main butting contacts and auxiliary arcing contacts carried by the movable element but as they are not a part of the present invention, they are not described in detail. The movable contacts are carried by a bridging element 12, there being three of these bridging elements for cooperation with the three pairs of fixed contacts. The lower ends of the insulators 10 also support insulating fibre partitions 13 which extend downwardly on each side of the separable contacts for the purpose of further confining the arcing upon the opening of the breaker. A strap conductor 14 of copper extends from the lower end of each of the incoming conductors 6a to its respective fixed contact at the lower end of each bushing 10. The straps 14 are removably bolted to the lower ends of the conductors 6a and thereby permit the removal and renewal of the bushings 6 without disturbing other parts of the breaker.

Where current transformers are used, they are introduced in the connection between the lower ends of the conductors 6a and the lower ends of the terminal supporting bushings 10. The lower ends of the conductors 14 are removably bolted to the terminals at the lower ends of the bushings 10, as shown by the bolt 15 in Fig. 1. This figure shows a current transformer introduced in the lefthand connection between the conductor 6a and the lower end of its bushing 10. The laminated core 16 of the current transformer is shown provided with supporting extension plates 16a, the lower one of which engages the faces of the angle iron 8 and is bolted thereto and thereby forms the support for the current transformer. The strap 14 is connected to the ends of a formed primary winding 17 of the transformer which encircles one leg of the core 16. As this construction permits the use of a wound type of primary coil, it is possible to secure a transformer ratio which may trip the breaker at low primary currents. The secondary winding of the transformer is connected to

the overload trip coil 18 of the breaker. It is apparent that this form of structure permits the introduction of current transformers in any one or more of the connections 14, three such transformers being shown in the present case as illustrated in Fig. 2. The separate supports of the fixed contacts of the breaker by the post insulators 10 instead of being supported at the lower ends of the main bushings, provide ample space for these wound transformers and permit any desired capacity and ratio of transformation thereof to be utilized and to be replacable for obtaining different ratios of transformation without disturbing other parts of the breaker.

The movable portion of the breaker is provided with three downwardly extending insulating rods 20 which carry at their lower ends the bridging contact members 12. The upper ends of the rods are bolted between a pair of horizontally extending plates 21 which are supported by a central U-shaped frame piece 22 having pivotally connected to its middle upper portion an operating rod 23. Between the rods 20 are a pair of guide rods 24 which are supported at their lower ends on the plate 9. The upper ends of the rods pass through cylinders 25 which are supported between the plates 21. In the upward or downward movement of the movable portion of the breaker, the cylinders 25 pass along the guide rods 24 and serve to keep the parts in alignment. This plunger and cylinder guiding means also serve as a shock absorber which prevents rebounding of the movable portion of the breaker upon moving to the open position, the parts 26 serving as a cushion when engaged by the cylinders 25 at the end of the downward movement.

The unitary control mechanism is enclosed in a separate casing 27 having a removable side 27*a* and the casing is removably bolted to one end of the top portion 1 of the breaker as shown by the bolts 27*b*.

As shown in Figs. 2 and 3, a pair of arms 28 is connected to the upper end of the operating rod 23 and extends out through an opening in one end of the top portion of the main casing. This opening is covered by a casting 29 which seals the opening against the passage of oil and gases from the main casing of the breaker to the casing containing the control mechanism. The casting 29 provides a bearing support for the arms 28 of the breaker and is bolted to the top portion of the breaker casing by the bolts 29*a*. This casting has an inwardly projecting portion 29*b* which provides a bearing for cylindrical sleeves 30 mounted on a square shaft 30*a* to the opposite ends of which the outer ends of the arms 28 are fixed, being held in place by bolts 51 and plates 52. The casting 29 is provided with openings at its opposite ends, as shown in Fig. 3, which permit the introduction of the square shaft 30*a* and cylindrical sleeves 30, these openings being closed by cover plates 31. These cover plates serve to support bolts 32 which may be adjusted inwardly or outwardly for the purpose of centering the parts and for maintaining them in their proper position. The portion 29*b* of the casting 29 is slotted in its central outer portion for permitting the introduction of an arm 33 which is fixed to the shaft 30*a* and extends downwardly through the slot of the central portion 29*b* of the casting. It is evident that movement of the lower end of the arm 33 outwardly from the position shown in Fig. 2 will cause the breaker to open and movement of its lower end inwardly from open position will bring the parts to the closed position shown in the drawings.

The control mechanism is supported by a main casting having a horizontally extending portion 34 and plates 35 which are spaced apart from each other and extend upwardly from the horizontal portion 34. The plates 35 are provided with outwardly extending ears through which the bolts 36 pass for securing the frame to the outer part of the casting 29. The breaker is closed by a toggle mechanism made up of a pair of links 37 which are secured to the lower end of the arm 33 and in turn are pivotally connected to another pair of links 38 by a pin 39. The links 38 are in turn pivotally connected by a pin 39*a* between a pair of plates 40. The plates 40 are pivotally mounted upon a fixed pivot pin 41 which is supported by the plates 35 of the frame. A movable handle 42 is adapted to be inserted in one end of a lever 42*a* which is pivotally mounted on the pin 41 between the plates 40. The lever 42*a* is provided with forked arms 42*b* on its inner end which engage the inner ends of the links 38 for manual closing when desired. Portions 43 extending inwardly from the plates 35 serve to maintain the plates 40 in their proper position. As shown in Fig. 2 the plates 40 are provided with downwardly extending arms 40*a* which carry a pin at their lower ends on which is mounted a roller 40*b* between the lower ends of the arms. Fixed to a pin 44 pivotally supported by the plates 35 is an outwardly extending latch 45 which passes between the arms 40*a* and engages the roller 40*b* in the closed position of the breaker. Also fixed to the pin or shaft 44 is an outwardly extending arm 46 which is positioned above the trip coil 18. When the breaker is tripped, the plunger of the trip coil raises the arm 46 and thereby raises the latch 45 to release the breaker and permit it to assume its open position.

A rod or link 47 is pivotally connected to the pin 39 and extends downwardly and is adapted to be pulled downwardly by a closing coil contained within the casing 48 secured to the underside of the plate 34 of the frame. Also connected to the pin 39 is an upwardly extending spring 49 which is secured at its upper end to the top of the casing 27. Although a closing coil is indicated for operating the breaker, the breaker is adapted to be closed manually, if desired, by the manual closing handle 42.

It is evident that with the parts in the closed position shown, the latch 45 restrains the plates 40 so that the pin 39*a* forms a fixed pivot and that the breaker cannot be opened until the latch 45 releases the pin 40*b* which may be done automatically upon the occurrence of any abnormal circuit condition by the trip coil 18 or any other trip coils adapted to trip the latch upon the occurrence of any selected abnormal condition. For securing manual opening of the breaker it is merely necessary to raise the arm 46. There is considerable spring tension on the main contacts, which, in addition to the weight of the moving contact parts, exert a substantial downward pull on the arms 28, which is imparted to the arm 33 and, in turn, through links 37 and 38 against pivot 39*a*. When latch 45 is released this force compels the parts 40 to swing around pivot 41, permitting arm 33 to assume its open position, after which spring 49 retrieves the links and latch into the reset position.

After the opening of the breaker, the spring **49** will, by means of the links **38**, draw the plates **40** inwardly and reclose the latch. The pivot **39***a* is thus again made a fixed pivot so that when the closing coil is energized to draw the rod **47** downwardly, the arm **33** will be moved to the left to reclose the breaker. The links **37** and **38** will then be brought slightly beyond the dead center line and the breaker will remain closed after the closing coil is deenergized. If during the closing movement, any abnormal condition exists, the latch will be tripped by its trip coil or coils and the breaker cannot be closed even if the closing coil remains energized. Before the breaker can be closed again, the closing coil must be deenergized to permit the spring to raise the parts so that the parts may be relatched, after which the breaker may be closed if the abnormal condition no longer exists.

The control casing **27** is separately removable from the main casing by first opening the door **27***a*, unhooking the upper end of the spring **49** and then removing the bolts **27***b*. The control mechanism is separately removable as a unit from the main breaker by first removing the pivot pin holding the rod **23** and the arms **28** together, or by removing the cover plates **31** and plates **52**, thereby releasing the outer ends of the arms **28**, and then removing the bolts **29***a*. This convenient removal or replacement of the controlling means as a unit likewise permits the assembly of the controlling means as a complete unit by itself.

Although a particular embodiment of the invention has been disclosed, various changes and modifications may be made without departing from the scope of the invention.

I claim:

1. A circuit breaker comprising a casing, insulators containing the conducting leads extending through the casing, an inverted A-shaped supporting frame at each end of the casing and secured to the top portion thereof, a pair of bars extending between said frames, insulating means carried by said bars for supporting the fixed contacts, and removable connections between the inner ends of said conducting leads and said fixed contacts.

2. A circuit breaker comprising a casing, insulators containing the conducting leads extending through the casing, a supporting frame at each end of the casing, a pair of bars extending between and supported by said frames, post insulators carried by said bars and extending downwardly from the lower faces thereof for separately and individually supporting at their lower ends the fixed contacts of the breaker respectively, removable connections between the inner ends of said conducting leads and said fixed contacts, and a guide for the movable element of the breaker extending between and supported by said frames.

3. A circuit breaker comprising a casing, insulators containing the conducting leads extending through the casing, a supporting frame at each end of the casing, a pair of bars extending between and supported by said frames, post insulators carried by said bars and extending downwardly from the lower faces thereof for separately and individually supporting at their lower ends the fixed contacts of the breaker respectively, removable connections between the inner ends of said conducting leads and said fixed contacts, and a current transformer supported by one of said bars and connected in one of said connections.

4. A circuit breaker comprising a pair of fixed contacts and a bridging contact downwardly movable from the fixed contacts, a casing, insulators containing the conducting leads extending downwardly through the top of the casing, a metal frame supported from opposite top portions of the casing and having horizontally extending metal portions located below said insulators, post insulators carried by said horizontally extending portions and extending downwardly therefrom for separately and individually supporting at their lower ends the fixed contacts of the breaker respectively, and removable connections extending from the inner ends of said conducting leads and outside said post insulators to said fixed contacts at their lower ends, said fixed contacts being positioned by said post insulators above the bridging contact.

5. A circuit breaker comprising a pair of fixed contacts and a bridging contact downwardly movable from the fixed contacts, a casing, insulators containing the conducting leads extending downwardly through the top of the casing, a metal frame supported from opposite top portions of the casing and having metal portions located below said insulators and extending horizontally through the central portion of the casing between opposite sides of said casing, post insulators carried by said horizontally extending portions and extending downwardly therefrom for separately and individually supporting at their lower ends the fixed contacts of the breaker respectively, said post insulators diverging outwardly for positioning the fixed contacts opposite the ends of the bridging contact, and removable connections extending from the inner ends of said conducting leads and outside said post insulators to said fixed contacts at their lower ends.

6. A circuit breaker comprising a pair of fixed contacts and a bridging contact downwardly movable from the fixed contacts, a casing, insulators containing the conducting leads extending downwardly through the top of the casing, a metal frame supported from opposite top portions of the casing and having metal portions located below said insulators and extending horizontally through the central portion of the casing between opposite sides of said casing and the lower faces of said horizontally extending portions converging toward each other, post insulators mounted on said faces for separately and individually supporting at their lower ends the fixed contacts of the breaker respectively, said post insulators diverging outwardly for positioning the fixed contacts opposite the ends of the bridging contact, and removable connections extending from the inner ends of said conducting leads and outside said post insulators to said fixed contacts at their lower ends.

7. A circuit breaker comprising a pair of fixed contacts and a bridging contact downwardly movable from the fixed contacts, a casing, insulators containing the conducting leads extending downwardly through the top of the casing, a metal frame supported from opposite top portions of the casing and having extending metal portions located below said insulators and extending horizontally through the central portion of the casing between opposite sides of said casing, post insulators carried by said horizontally extending portions and extending downwardly therefrom for separately and individually supporting at their lower ends the fixed contacts of the breaker respectively, said post insulators diverging outwardly for positioning the fixed contacts op-

posite the ends of the bridging contact, removable connections extending from the inner ends of said conducting leads and outside said post insulators to said fixed contacts at their lower ends, and a current transformer included in the circuit of at least one of said connections.

8. An oil circuit breaker comprising a casing, fixed and movable contacts within the casing, a vertically movable lift rod for raising the movable contacts to engage the fixed contacts, an arm connected to the upper end of the lift rod and extending in a horizontal direction and outwardly through an opening in the casing, a bearing support removably secured to an outside portion of the casing and covering said opening and sealing the same against the outside passage of gases and oil, a shaft within said bearing support extending at right-angles to the direction of said arm and connected to said arm, toggle closing mechanism connected to said shaft and means for automatically opening the breaker, said mechanism and means being outside said casing, and a frame for supporting said mechanism and means, said frame being removably supported on said bearing support.

EMIL A. ILEMAN.