Oct. 14, 1941.

L. W. DYER

2,259,300

CIRCUIT INTERRUPTER

Filed Sept. 30, 1939

2 Sheets-Sheet 1

Fig. 1.

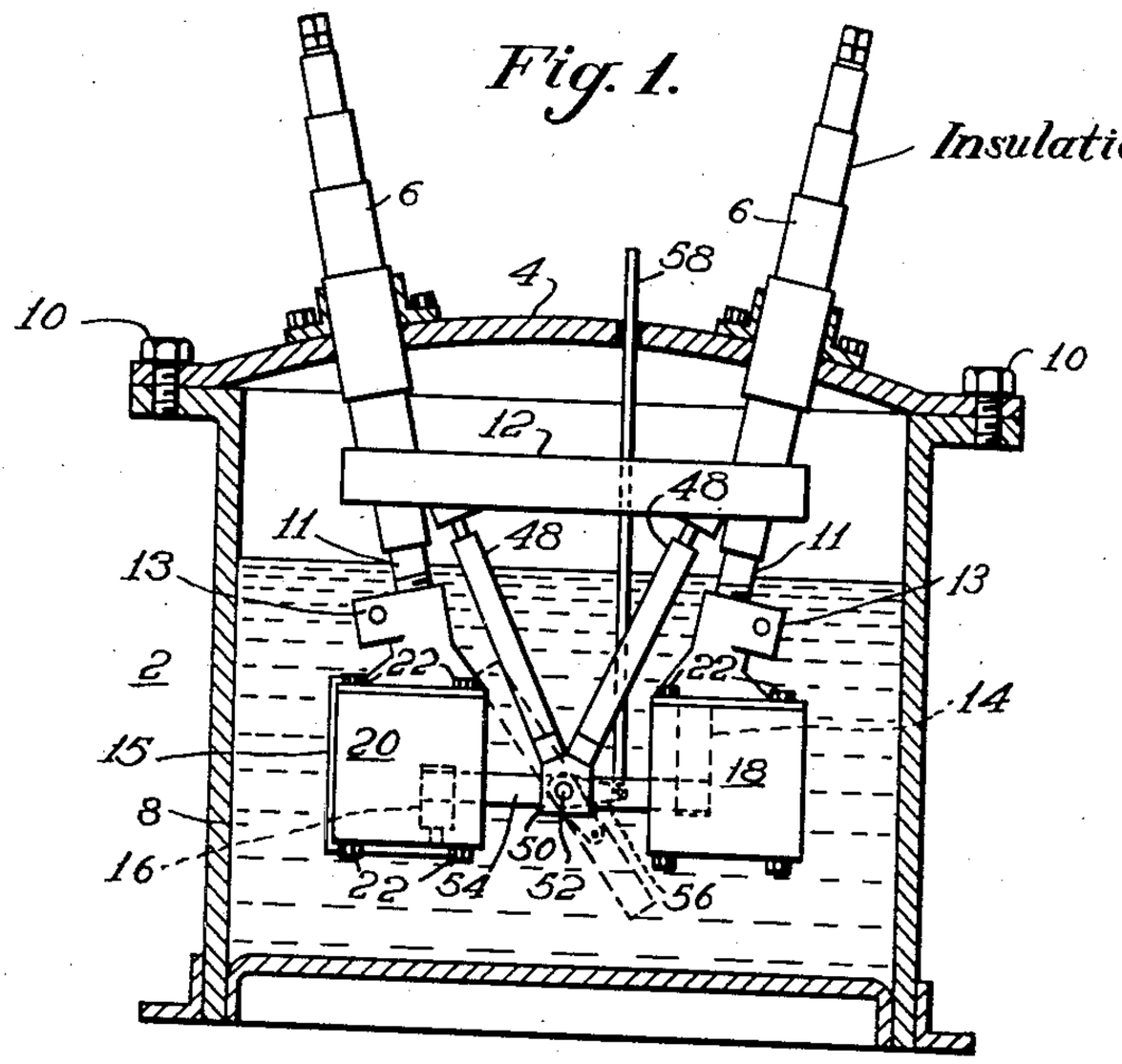

Fig. 2.

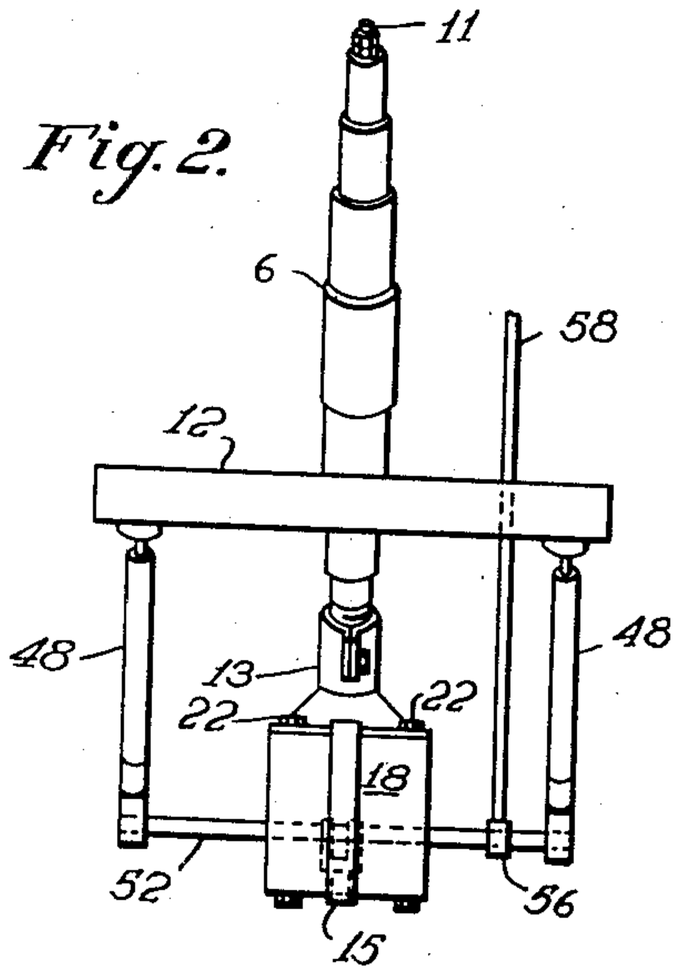

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Fig. 3.

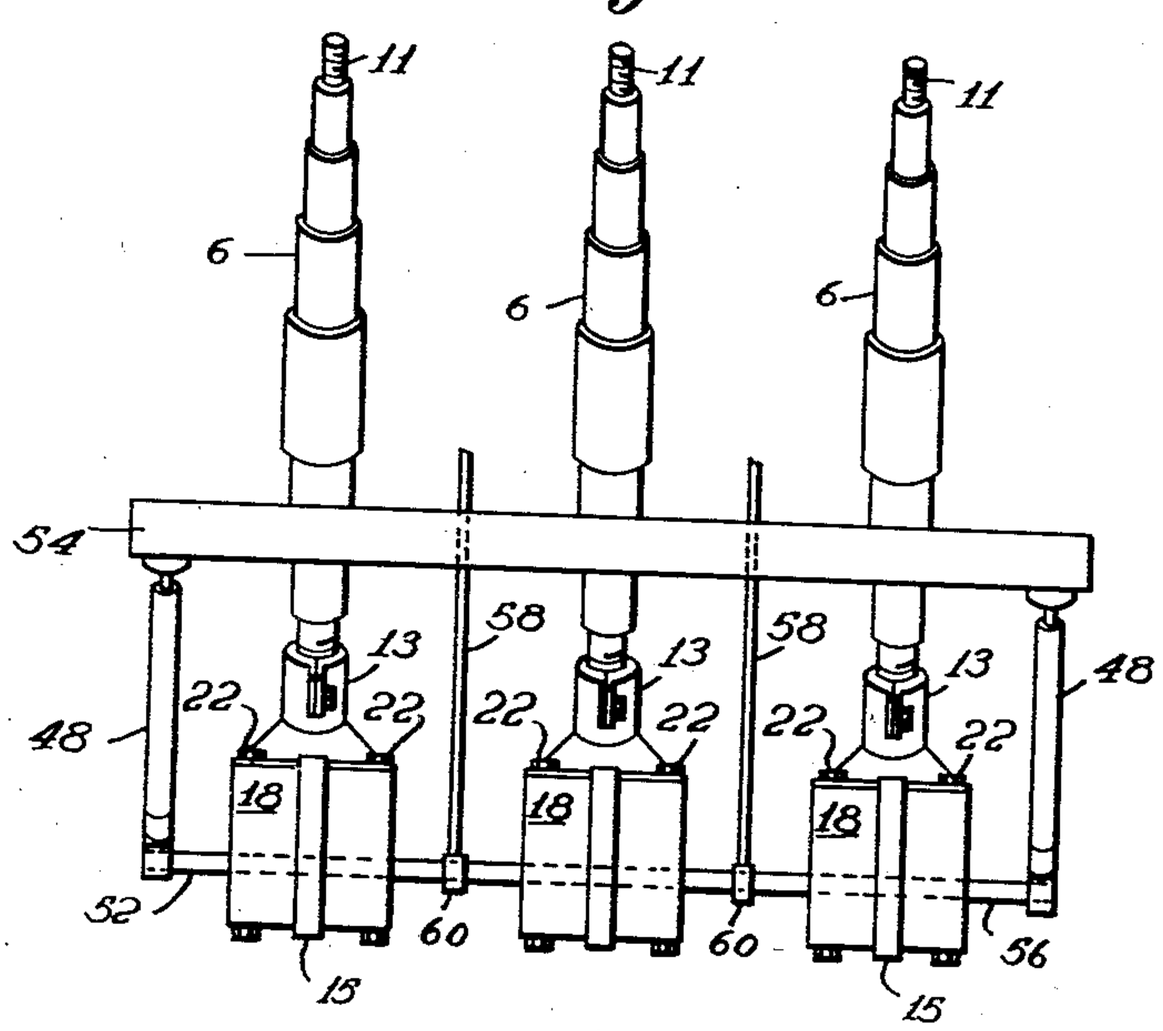
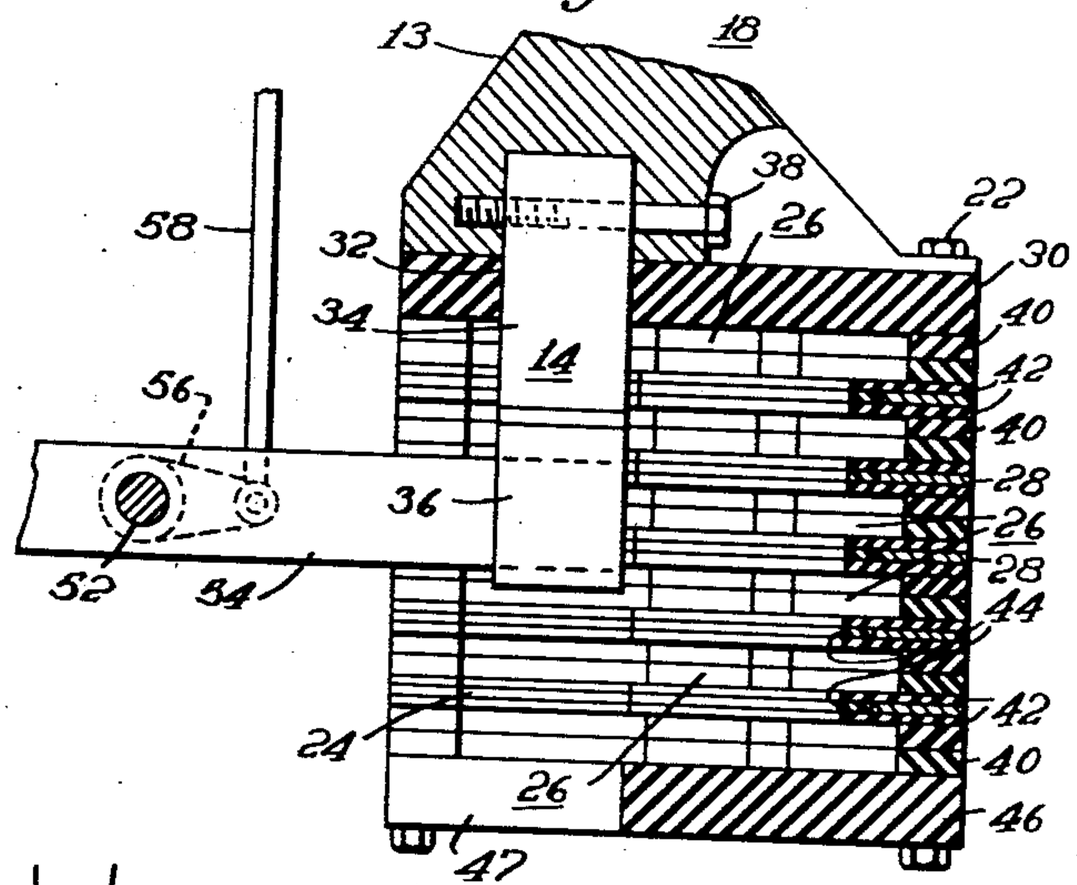


Fig. 4.



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UNITED STATES PATENT OFFICE

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CIRCUIT INTERRUPTER

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Application September 30, 1939, Serial No. 297,333

5 Claims. (Cl. 200—150)

My invention relates generally to electric circuit interrupting devices, and more particularly to high capacity interrupting devices.

In the closing of circuit breakers handling relatively large loads, the magnetic forces present tending to separate the breaker contacts are of a considerable value. Following the modern trend toward larger capacity electrical equipment of all types, the closing of circuit breaker contacts in a circuit having a large connected load is becoming increasingly difficult, especially where fast and positive operation is desirable.

Accordingly, it is an object of my invention to provide a novel form of circuit interrupting device in which substantially no magnetic force is encountered in opposition to operation of the interrupter.

Prior art double break interrupters are typified in the patent to L. W. Dyer, No. 2,109,211, issued February 22, 1938. In this type of device, the lines of force about the current carrying parts of the device are obviously concentrated, or crowded in the interior angles formed by the fixed and movable contacts, thus creating a force at these points which tends to open the contacts.

Another object of my invention is to provide a double break circuit interrupter in which the magnetic force at each break contact is substantially neutralized.

Another object of my invention is to provide a double break circuit breaker construction wherein movement of the movable contact at each break contact is in opposite directions to neutralize the electrical magnetic forces at these points.

Another object of my invention is to provide a novel circuit breaker construction which is relatively simple, yet efficient in operation.

These and other objects of my invention will become more apparent upon consideration of the following detailed description of preferred embodiments of my invention, taken in conjunction with the attached drawings, in which:

Figure 1 is a cross sectional view of a circuit breaker tank showing my novel contact structure in elevation;

Fig. 2 is an end elevational view of my novel contact arrangement per se;

Fig. 3 is a side elevational view of a three-pole circuit breaker utilizing the contact arrangement shown in Figs. 1 and 2; and

Fig. 4 is a cross sectional view of an arc extinguishing structure used in the structures of Figs. 1 to 3 with one contact and an end portion of a bridging contact in elevation.

Referring to the drawings, I have shown a circuit breaker tank **2** in Figure 1 of the drawings having a removable cover **4** secured to the tank by any desired removable securing means, such for example, as the bolts **10**. Secured in apertures in the cover **4** are a pair of insulating bushings **6**. These bushings may be made of any desired insulating material such, for example, as porcelain or a moulded insulation material. The bushings **6** have a central bore in which is carried conducting members **11**, respectively. Below the cover **4** the bushings are spanned by a supporting member **12** secured to the bushings in any desired manner. The supporting member **12** may be made of any desired material, preferably some insulating material such as fiber, porcelain or a moulded insulation material. The conductors **11** extend below the lower ends of the bushings to be connected to fixed contacts **14** and **16** respectively. Also secured to the conductors **11** by the split sleeve supporting members **13**, the split sleeve portions of which are securely bolted to conductors **11**, are arc extinguishing structures **18** and **20** respectively.

Each of the arc extinguishing structures **18** and **20** is of the side vented type and comprises essentially a plurality of superposed plates which are assembled upon suitable screw bolts **22**. These plates have centrally disposed openings therein which are aligned to form an arc passage, or slot **47**, the length of which is several times its width. Some of the plates also have cut out portions for defining oil pockets **26** along the arc passage, and at spaced intervals throughout the assembled stack are positioned U-shaped iron plates **28**. These iron plates are so arranged as to create a magnetic field about the arc which is established within the arc passage **47**, during the circuit interrupting operation so that the arc is caused to move in the direction of the closed end of the arc passage. During this movement, the arc is brought into contact with the fresh volumes of oil or other liquid retained in the pockets **26**, and the resulting gases are caused to flow laterally therethrough in venting. The combined result of the arc movement and the gas evolution is to cause a turbulent intermingling of the arc stream with the gaseous arc products and with some of the unvolatilized extinguishing liquid, thereby effecting a rapid cooling and extinguishing of the arc.

The arc extinguishing structure **18** is more particularly shown in Figure 4 and is in general of the type shown in the patent to S. H. Boden et al., No. 2,039,054, allowed April 28, 1936, and which

is assigned to the assignee of this invention. Specifically, the arc extinguisher comprises a rather thick upper plate 30 of insulating material, and has a slot 32 therein for receiving the stem 34 of a split contact member 36. The stem 34 of the split contact extends through the slot 32 in the insulating member 30 into a slot provided in the supporting member 13 and to which it is removably secured, as by the bolt 38 passing through an aperture in the contact stem 34. A pair of insulating plates 40 having cut out portions therein for defining the upper set of oil pockets 26 are disposed immediately beneath this upper plate 30. Next in the stack is one of the insulating plates 42 which is provided with a slotted opening for defining the outline of the arc passage itself. This insulating plate is followed by one of the iron plates 28 and an insulating liner plate 44, and the next element in the stack is a second insulating plate 42. Two more of the pocket defining plates 40 are positioned immediately beneath the second insulating plate 42, and these plates are followed by one of the groups comprising iron plate 28 with its insulating liner plate 44, and the next element in the stack is a second insulating plate 42. Two more of the pocket defining plates 40 are positioned immediately beneath the second insulating plate 42 and these plates are followed by one of the groups comprising an iron plate 28 with its insulating liner plate 44 sandwiched between two of the insulating plates 42. The remaining portion of the stack assembly, comprises successively two of the pocket defining plates 40, the third of the iron plate arc moving units and two more of the pocket defining plates 40. The lower unit in the stack structure comprises a thick insulating plate 46 somewhat similar in outline to the upper insulating plate 30. All of the plates are provided with suitable openings for accommodating the screw bolts 22 upon which they are mounted. The lower thick insulating plate 46 is provided with a slot 47 for accommodating movement of the movable breaker contact. The arc extinguishing structure 20 is identical with the structure 18 except that the bottom wall has no slot corresponding to slot 47 in arc extingusher 18 and the split fixed contact 16 is supported on the lower thick insulating plate instead of in the supporting member 13. The fixed contact 16 is electrically connected with the conductor 11 associated therewith by a conductor 15 extending outside of the arc extinguishing structure 20. Fixed to the supporting member 12 on the insulating bushings 6 at spaced points are spaced pairs of insulating supporting members 48 with each pair converging at their lower ends to support an integral bearing member 50. The bearing 50 rotatably supports a pivot shaft 52 secured substantially at the mid-portion of a bridging contact member 54. Also secured to the pivot shaft 52 is a crank 56 pivotally secured at its outer end to an operating rod member 58 which projects through an aperture in the tank cover 4 for connection with a suitable operating mechanism located outside of the tank.

It is obvious, that by longitudinal movement of the rod 58 the bridging contact 54 is caused to rotate about the pivot shaft 52 between the dotted and full line portions shown in Figure 1 into and out of engagement with the fixed contacts 14 and 16. It is apparent also, that the lines of force surrounding the conducting portions of this circuit breaker will be crowded together at the interior angles between the conductors 11 and the bridging contact 54. The crowding or concentration of flux at the interior angle between the contact 14 and the bridging member 54, for example, will exert a downward force on this end of the bridging contact which will tend to move it away from the fixed contact 14. This force, however, is counterbalanced by the force exerted on the other end of the bridging contact 54 which likewise will be in a downward direction and will, therefore, tend to move this end of the bridging contact into firmer engagement with the stationary contact 16.

It is thus seen that the magnetic forces present in the junctures of the line conductors and bridging contact in my switch are neutralized, thus permitting the same force to be used for closing circuit breakers of large capacity, as is commonly used in smaller capacity breakers. The elimination of these magnetic forces moreover enables the attainment of a greater closing speed while using relatively light moving parts.

Due to the fact that the electrical connection to the fixed contact 16 is by-passed around the arc extinguishing structure 20 by way of the conductor 15, a slight magnetic force may be established tending to move the adjacent end of the bridging contact 54 upwardly due to the crowding of lines of force in the interior angle between the fixed contact 16 and the bridging member. This force, however, is so slight as to be negligible, so that the magnetic forces are substantially balanced on each end of the bridging contact.

In Fig. 3 of the drawings, I have shown an arrangement whereby my structure may be utilized in a three-pole switch for three-phase circuits. Three switching units identical with the unit described in connection with Figures 1, 2 and 4 are mounted in side-by-side relation on an elongated supporting member 54. The arc extinguishing structures are supported from the bushing conductors and the bridging contact pivot shaft is supported from the elongated support 54 by insulating supporting members 48 at each end thereof. As shown in Fig. 3, a pair of operating cranks 60 are provided on the pivot shaft 56 for extension through the cover of a circuit breaker tank.

It should be apparent from the foregoing that I have provided a novel arrangement of circuit breaker contact structure wherein the magnetic forces usually encountered in opposition to the closing operation of the circuit breaker are substantially neutralized, thus providing a circuit breaker for large capacities which will require no more operating effort than small capacity circuit breakers while, at the same time, permitting a high speed operation with a relatively small mass of the moving parts.

Having described preferred embodiments of my invention in accordance with the patent statutes, I desire it to be understood that I do not wish to be limited to the particular embodiments disclosed herein inasmuch as it will be obvious, particularly to persons skilled in the art that many changes and modifications may be made in the particular structures disclosed herein without departing from the broad spirit and scope of my invention. Therefore, I desire that my invention be interpreted as broadly as possible and that it be limited only by what is expressly stated in the following claims.

I claim as my invention:

1. Circuit breaker construction including a tank having a removable cover, spaced insulating bushings extending through said cover, conduct-

ing means in said bushings and extending beyond the ends thereof to form terminals outside of said tank and contacts within said tank, and bracing means connecting said bushings intermediate said contacts and cover within said tank.

2. Circuit breaker construction including a tank having a removable cover, spaced insulating bushings extending through said cover, conducting means in said bushings and extending beyond the ends thereof to form terminals outside of said tank and contacts within said tank, bracing means connecting said bushings intermediate said contacts and cover within said tank, and a bridging contact mounted on said bracing means for movement into and out of engagement with said conductor contacts.

3. Circuit breaker construction including a tank having a removable cover, spaced insulating bushings extending through said cover, conducting means in said bushings and extending beyond the ends thereof to form terminals outside of said tank and contacts within said tank, bracing means connecting said bushings intermediate said contacts and cover within said tank, means secured to said bracing means and extending to a point intermediate said contacts, and bridging contact means pivotally supported on said last-mentioned means for movement into and out of bridging relation with respect to said contacts.

4. Circuit breaker construction including a tank having a removable cover, spaced insulating bushings extending through said cover, conducting means in said bushings and extending beyond the ends thereof to form terminals outside of said tank and contacts within said tank, bracing means connecting said bushings intermediate said contacts and cover within said tank, spaced means secured to said bracing means and converging to a point intermediate said contacts, and a bridging contact means pivotally supported by said spaced means for movement into and out of bridging relation with respect to said contacts.

5. Circuit breaker construction including a tank having a removable cover, spaced pairs of insulating bushings extending through said cover, conducting means in said bushings and extending beyond the ends thereof to form terminals outside of said tank and contacts within said tank, bracing means connecting said bushings intermediate said contacts and cover within said tank, and a bridging contact mounted on said bracing means for movement into and out of engagement with said conductor contacts.

LLOYD W. DYER.