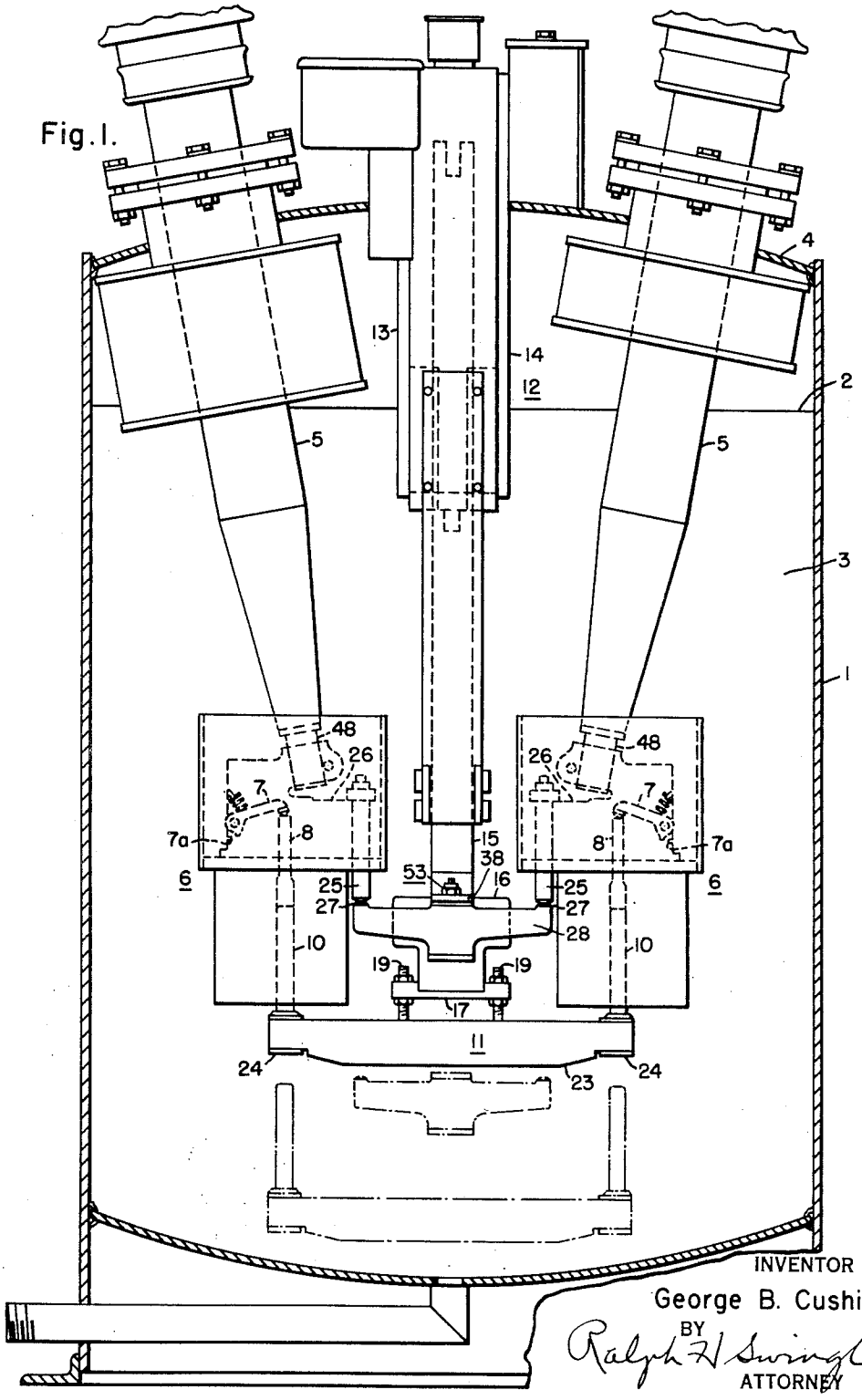
May 14, 1957 G. B. CUSHING 2,792,476

CIRCUIT INTERRUPTER

Filed June 30, 1953 5 Sheets-Sheet 1

Fig. 1.



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CIRCUIT INTERRUPTER

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Fig. 8.

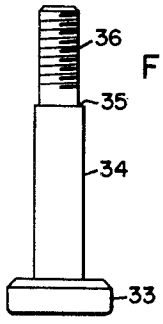


Fig. 2.

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CIRCUIT INTERRUPTER

Filed June 30, 1953 5 Sheets-Sheet 3

Fig. 3.

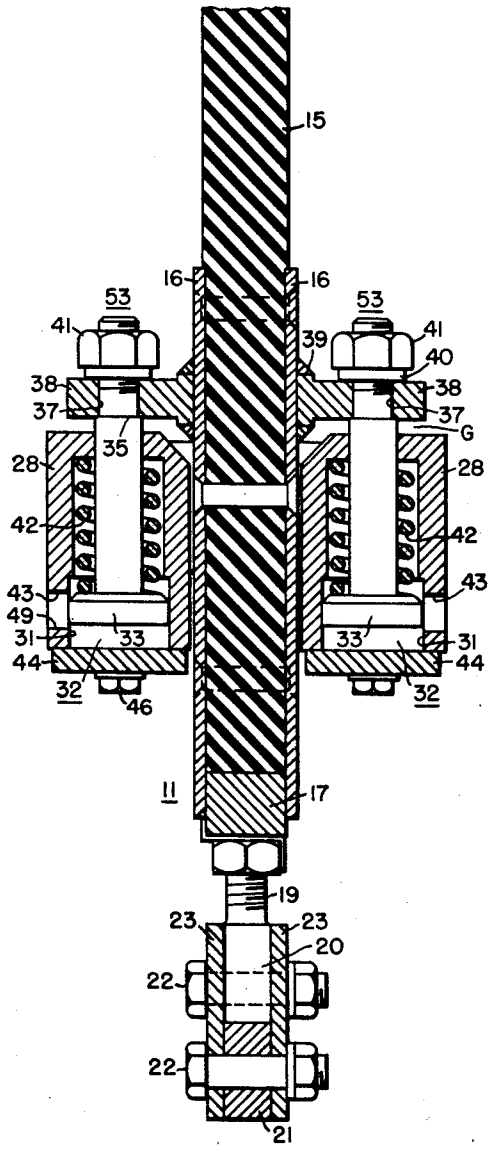
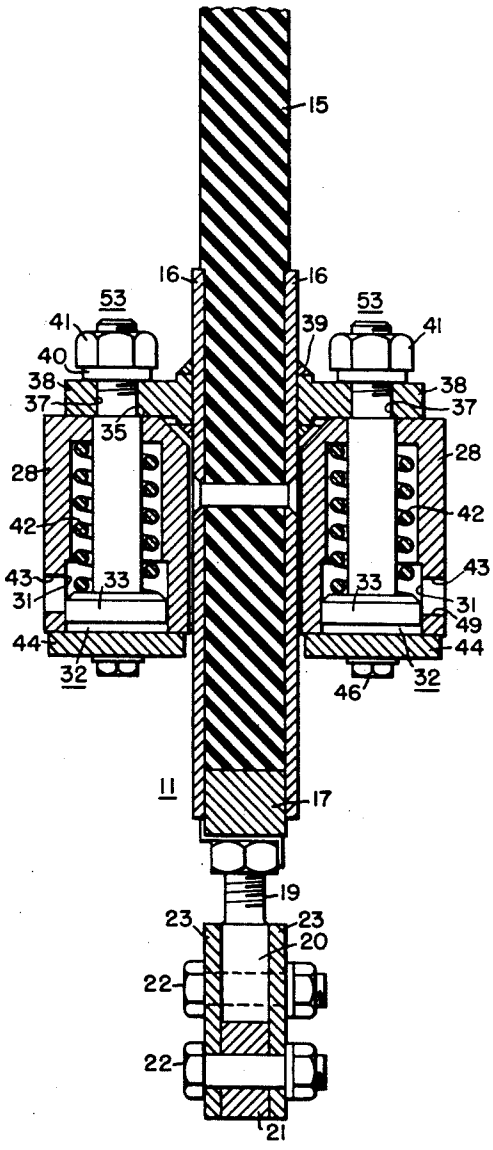


Fig. 4.



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CIRCUIT INTERRUPTER

Filed June 30, 1953 5 Sheets-Sheet 4

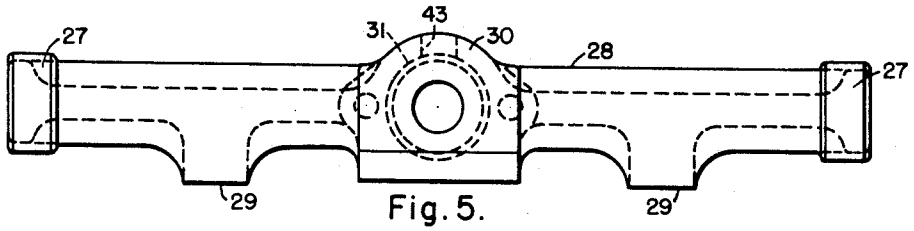


Fig. 5.

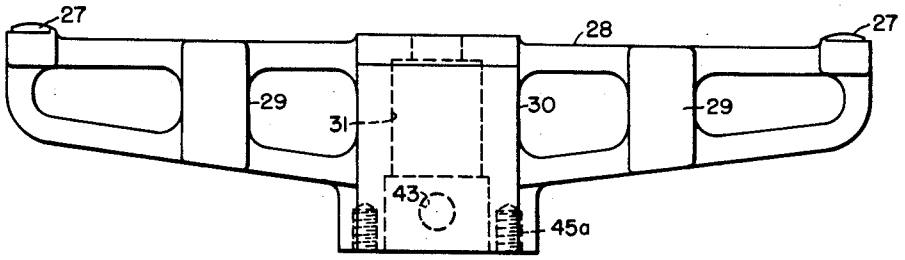


Fig. 6.

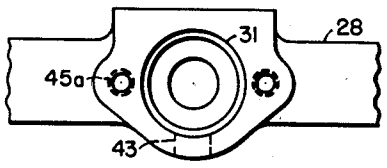


Fig. 7.

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CIRCUIT INTERRUPTER

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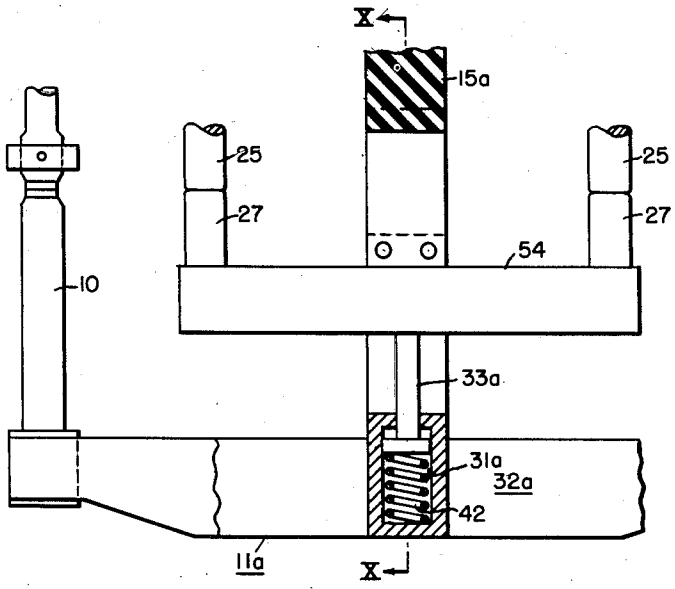


Fig. 9.

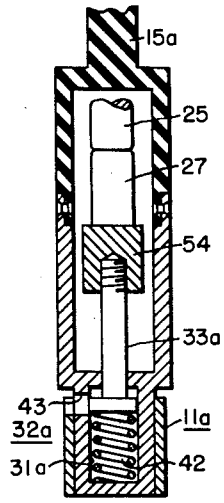


Fig. 10.

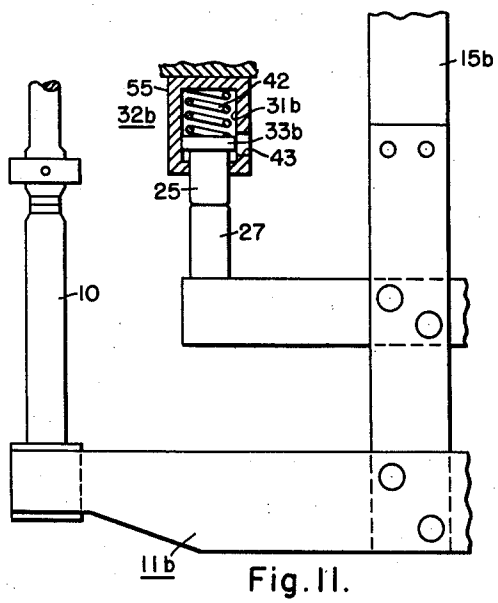


Fig. 11.

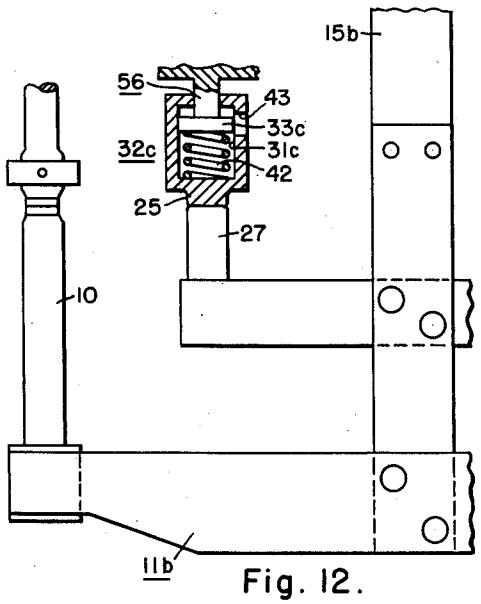


Fig. 12.

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United States Patent Office 2,792,476 Patented May 14, 1957

2,792,476

CIRCUIT INTERRUPTER

George B. Cushing, Turtle Creek, Pa., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application June 30, 1953, Serial No. 365,209

18 Claims. (Cl. 200—146)

This invention relates to circuit interrupters in general, and, more particularly, to contact structures and operating arrangements therefor.

A general object of my invention is to provide a more effective arc-extinguishing structure than has been provided heretofore.

A more specific object is to provide an improved and more effective contact arrangement for a circuit interrupter, which will render its operation more efficient in use.

Still another object of my invention is to provide a more effective arc-extinguishing structure utilizing a plurality of arcing contacts and a cooperating shunting pair of main contacts with improved means for actuating the contact structure in a highly effective manner.

My invention has particular value as applied to a high-voltage type of circuit interrupter, especially one of the liquid break type, in which a pair of arc-extinguishing units are submerged within liquid in a tank structure, and the contact arrangement involves a movable bridging contact assemblage. Such interrupters are frequently called upon to carry considerable load current, for example, 2000 amperes, and, if arcing contacts were to carry this value of current continuously, it would necessitate their being of considerable size, which would decrease their efficiency during the interrupting operation. It has been, therefore, common practice to provide externally of the extinguishing units cooperating pairs of main contacts shunting the arcing contacts, which, in the closed-circuit position of the device, carry practically all of the current.

When the interrupter is to be opened, the main current-carrying contacts are arranged, usually by a lost-motion connection with the actuating means, to separate prior to the separation of the arcing contacts. Thus, the current is caused to flow through the arcing contacts upon the separation of the main contacts. Subsequently, when the arcing contacts separate, the arc is drawn thereon, and the arcing contacts have the sole function of interrupting the circuit, usually in a suitable arc-extinguishing device. As a result, the main contacts are never called upon to break the arc; their surfaces, therefore, remain clean and unpitted, with the result that they are in good condition to carry the full-load current when the interrupter is closed. With such arrangements considerable dead time in parting main contacts, contact shock on opening and contact bounce on closing have, in the past, been prevalent. It is, therefore, a further object of my invention to provide structure which will solve such problems.

Although I shall illustrate and describe features of my invention as applied to a commercial type of liquid break circuit interrupter adapted for 69 kv., 2000 amperes continuous current, it is to be clearly understood that certain features of my invention have ready application to other circuit interrupters of widely different types for either low-voltage or high-voltage service.

Further objects and advantages will readily become apparent upon reading the following specification, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a side elevational view, partially in section, of a tank-type, liquid-break circuit interrupter embodying my invention, the contact structure being shown in the closed-circuit position;

Fig. 2 is an enlarged view of a portion of the bridging contact structure of the interrupter of Fig. 1, with a portion of the actuating mechanism therefor, the contact structure being shown in the closed-circuit position;

Fig. 3 is a vertical sectional view taken through the bridging contact structure of Fig. 2 along the line III—III thereof;

Fig. 4 is a view similar to Fig. 3, but illustrating the position of the several parts in the fully open-circuit position of the interrupter;

Fig. 5 is a top plan view of one of the two main contact bridging members;

Fig. 6 is a side elevational view of the main contact bridging member of Fig. 5;

Fig. 7 is a bottom plan view of a portion of the main contact bridging member shown in Fig. 6;

Fig. 8 is an elevational view of the piston or plunger utilized in the dash-pot device of my invention, as shown in Fig. 2;

Fig. 9 is a somewhat diagrammatic view of a modification of my invention in which the plunger piston is secured to the main movable contact structure directly, the contacts being illustrated in the closed circuit position;

Fig. 10 is a vertical sectional view taken along the line X—X of Fig. 9;

Fig. 11 illustrates a further modification of my invention in which the dash-pot device is associated with the relatively stationary main contact structure and the support therefor, the contact structure being illustrated in the closed circuit position; and

Fig. 12 illustrates still a further modification of my invention in which the dash-pot device is associated with the relatively stationary main contact structure, the contacts being shown in the closed circuit position.

Referring to the drawings, and more particularly to Fig. 1 thereof, the reference numeral **1** designates a tank filled to the level **2** with a suitable arc-extinguishing fluid, such as circuit breaker oil **3**. Extending downwardly through the top cover **4** of the tank **1** are a pair of identical terminal bushings **5**, preferably of the condenser type. Secured to the lower end of each terminal bushing **5** is an arc-extinguishing unit, generally designated by the reference numeral **6**.

Generally, each arc-extinguishing unit **6** is of the type which establishes a pressure-generating arc and an interrupting arc. The contact structure for each unit **6** includes a pivotally-mounted, pressure-generating contact **7**, an intermediate contact **8**, spring-biased downwardly to a limited extent by a battery of coil compression springs **9** (Fig. 2), and a lower movable interrupting contact **10**. The two interrupting contacts **10** for the two units **6** are positioned at opposite extremities of a movable main bridging contact assemblage **11**, which is actuated reciprocally in a vertical direction by an actuating means **12**. In the particular interrupter shown in Fig. 1, the actuating means **12** is a straight-line lever mechanism disposed between a pair of support plates **13**, **14** welded to the top cover **4**. The aforesaid lever mechanism is operated by a horizontally extending pull rod (not shown), which extends across the tops of a plurality of tanks **1** for a three-phase installation, as will be well understood by those skilled in the art.

The actuating means **12** includes an insulating lift rod **15**, which moves up and down, and to which is secured at its lower end a pair of metal plates **16**, between which

is welded a metallic bar 17. As shown more clearly in Fig. 2 of the drawings, the metallic bar 17 has a pair of apertures 18 provided therethrough adjacent its outer ends, through which pass threaded support studs 19. The studs 19 are integrally formed with base-block portions 20, in turn welded to a horizontally extending metallic brace 21. The brace 21, as well as the block portions 20, are bolted by bolts 22 between a pair of conducting bridging plates 23. The lower base-block portion 24 of each interrupting contact 10 is secured between the outer ends of the two bridging plates 23, as more clearly shown in Fig. 2. Thus the insulating lift rod 15 is rigidly secured to the interrupting contacts 10 and positively effects their opening and closing movements.

As mentioned previously, for interrupters carrying a large continuous current, it is desirable to provide shunting main contacts. As shown in Fig. 1, in the present instance, such main contacts include a relatively stationary main contact 25, of substantially post form, the upper end of which is adjustably threadedly secured to the upper support casting 26, which is in electrical contact with the upper pressure-generating contact 7 of the arc-extinguishing unit 6.

Cooperating with the lower end of the post-like stationary contact 25 is a movable main contact 27, which is situated at the outer extremity of a main contact bridging member 28. There are two such main contact bridging members 28, which operate independently of each other. As more clearly shown in Figs. 5–7, each of the two main contact bridging members 28 is cast into the desired form with bosses 29 to prevent rotation thereof, and having a central body portion 30, which is machined to form a piston chamber 31 of a dashpot device, generally designated by the reference numeral 32 in Figs. 3 and 4. Movable within each piston chamber 31 is a plunger, or piston 33, more clearly shown in detail in Fig. 8 of the drawings. The support 53 for the movable main contacts 27 includes the piston 33.

As set out in Fig. 8, the piston 33 has a piston-rod portion 34 with a shoulder 35 and a threaded upper end 36. The threaded end 36 passes through apertures 37 provided in a pair of horizontally extending support plates 38, which are welded, as at 39, to the vertical clamping plates 16.

As shown in Figs. 3 and 4, the shoulder 35 of the piston rod 34 bears against the lower surface of the support plates 38, and is maintained there by a lock washer 40 and a nut 41. Thus, the piston 33 is secured to, and movable with, the insulating lift rod 15 forming the support 53 for the movable main contacts 27.

Disposed interiorly within the upper end of each piston chamber 31, and bearing downwardly against the head of the piston 33, is a coiled compression spring 42, as shown more clearly in Figs. 3 and 4 of the drawings. The springs 42 tend to force each main contact bridging member 28 upwardly against the support plates 38, as shown in Fig. 4 of the drawings. Fig. 4 indicates the position of the several parts in the fully open-circuit position of the interrupter, where each main contact bridging member 28 is moved upwardly by its compression spring 42 against the lower surface of its laterally extending support plate 38.

It will be noted that each piston chamber 31 has a vent passage 43 provided in its side wall, as more clearly shown in Figs. 3, 4 and 6 of the drawings. The vent passage 43 is provided to permit the passage of fluid, in this instance oil 3, out of the piston chamber 31 from under the piston 33 during the opening operation, and from on top of the piston 33 during the closing operation, as more fully explained hereinafter.

The lower end of each piston chamber 31 is closed by a closure plate 44, which has a pair of apertures 45 adjacent its outer ends, as more clearly shown in Fig. 2 of the drawings. A pair of machine bolts 46 pass through the apertures 45, and are threadedly secured into interiorly threaded holes 45*a* provided in the lower portion of the central body portion 30 of each movable main contact bridging member 28, as more clearly shown in Fig. 6 of the drawings. Thus, each piston chamber 31 is completely closed with the exception of a single vent passage 43 heretofore referred to.

The operation of the circuit interrupter will now be explained. In the closed-circuit position of the interrupter, as shown in Figs. 1, 2 and 3 of the drawings, the electrical circuit therethrough passes downwardly through the terminal stud 48, passing interiorly through the terminal bushing 5, through the pressure-generating contact 7, intermediate contact 8 and lower interrupting contact 10 of the unit 6. The circuit may then pass through the bridging plates 23 and in a similar manner through the other arc-extinguishing unit 6 of the interrupter.

Another more conductive path for the current flow through the interrupter, that is, with lower impedance therethrough, is the path which directly leads from the terminal stud 48 through the conducting support 26 to stationary main contact posts 25, movable main contacts 27, through the two main contact bridging members 28, and through the other two pairs of main contacts 25, 27 and conducting supports 26 to the other terminal stud 48. Since the latter path is shorter and has fewer contact surfaces it consequently has a lower resistance, and a major portion of the current flow will take place through the main contacts which shunt the arcing contacts. A gap "G" (Fig. 3) of approximately ¼ inch exists between the main bridging members 28 and the lower surfaces of the plates 38 due to slight compression of the springs 42. This compression of the springs 42 provides the requisite contact pressure between the contacts 25, 27.

When it is desired to open the interrupter, or when there exists overload current conditions in the circuit controlled by the interrupter, suitable mechanism (not shown) causes operation of the actuating means 12 to cause downward opening movement of the insulating operating rod 15. Since the piston plungers 33 are rigidly secured to the lift rod 15, they move downwardly approximately one-sixteenth of an inch to seal the ports, or vent passages 43, in the piston chambers 31 from the space beneath the piston to cause practically immediate downward opening motion of the movable main contact bridging members 28. This occurs, of course, by the oil which is trapped below the two pistons 33. At this point it may be pointed out that, although Fig. 3 indicates superficially a relatively large opening for the oil to pass out of the port 43 below the piston 33 prior to the time that the piston 33 passes below the lower edge 49 of the port 43, actually the sectional view of Fig. 3 is taken through the vertical diameter of the port 43 and consequently the segmental opening is actually very small.

The picking up of the movable main bridging members 28 by the lift rod 15 in its downward opening movement causes the current to flow through the arcing contacts 7, 8 and 10 upon the separation of the four pairs of main contacts 25, 27. This occurs, of course, by the overtravel permitted in the main extinguishing units 6. In other words, during closing, the interrupting contacts 10 have moved the intermediate contacts 8 upwardly into engagement with the pressure-generating contacts 7 to an upward closed position, as indicated in Fig. 1. During the opening operation, the interrupting contacts 10 can move a short distance downwardly before the pressure-generating contact 7 is stopped by a lug 7*a* to provide thereby a separation between the pressure-generating and intermediate contacts 7, 8.

The intermediate contact 8 maintains contacting engagement with the interrupting contact 10 for a short distance, as caused by the compression springs 9 (Fig. 2). When it reaches its stop 50, as diagrammatically indicated in Fig. 2, an interrupting arc will be drawn

between the separating intermediate and interrupting arcing contacts **8, 10**. The pressure-generating arc will send oil under pressure into the interrupting arc, established between the contacts **8, 10**, through suitable passage structure (not shown) to effect extinction of the interrupting arc.

The details of the extinguishing units **6** have not been minutely illustrated since reference may be had to United States Patent 2,619,356, issued November 25, 1952 to Robert E. Friedrich and Joseph Sucha, and assigned to the assignee of the instant application. This patent minutely describes the particular manner of arc extinction, and may be referred to for the details of arc interruption. For the purposes of the present invention, it is only necessary to know that arc interruption occurs generally in the aforesaid manner, and that the arcing contacts **7, 8** and **10** open subsequently to the main contacts **25, 27**.

My invention is an improvement over constructions such as exemplified in United States Patent 2,100,102, issued November 23, 1937 to Lloyd W. Dyer and Gayne D. Gamel and in United States Patent 2,109,211, issued February 22, 1938 to Lloyd W. Dyer, in which there is lost motion between the main movable contacts and the lift rod, because with my construction it is not necessary to take up the entire amount of lost motion between the lift rod and the main movable bridging contact member before any opening motion of the main movable bridging contact member takes place. Thus, for a particular commercial assembly, involving a 69 kv., 2000 ampere prior art interrupter, the main movable bridging contact members were resiliently supported bars and made contact with the stationary main contacts during the final one-fourth inch of lift-rod travel when approaching the fully closed position. This gave a positive contact between the main contacts, with some latitude for wear. In opening, the main contacts separated after one-fourth inch of travel, and the arcing contacts within the extinguishing unit separated after ⅞ inch of travel. The interposed ⅝ inch travel was provided to allow time for the transfer of current from the main contacts into the arcing contacts of the arc-extinguishing unit.

The introduction of a dash-pot device **32**, as illustrated in the present application, substantially eliminates any delay in opening the main contacts **25, 27** when the breaker is tripped. The first 1/16 inch of opening lift-rod travel seals off the ports **43** in the dash-pot **32** (with attention being directed to the above statements regarding the exaggerated conditions of affairs in the sectional view of Fig. 3), and traps the volume of oil below the piston **33**. Continued downward travel of the lift rod **15** and pistons **33** imparts motion to the movable main contacts **27** through the trapped oil. By this means the main contacts **25, 27** are separated earlier, allowing more time for the transfer of current into the grids **6** prior to interruption, or with the same time for transfer permitting earlier separation of the arcing contacts **7, 8** and **10** within the extinguishing units, or grids, **6** and earlier interruption of the circuit.

A second benefit to be derived from the use of this dash-pot **32** is a reduction of mechanical shock to the breaker in opening. Without the dashpot, during the first part of the downward lift-rod travel in opening, the springs associated with the main movable bridging contacts, assisted the interrupter mechanism accelerating springs in accelerating the pole unit lever system. In other words, the main accelerating spring for the interrupter, not shown, but which biases the horizontal pull rod, previously referred to, which actuates the actuating means **12**, biases the lift rod **15** downwardly during the opening operation. Prior to the picking up of the main movable bridging contacts in prior art interrupters, the movable main contact springs assisted such accelerating spring action. However, in such breakers of the prior art, after the lost motion was taken up, the lift rod abruptly picked up the mass of the main bridging contact members and lost the accelerating force of the main contact pressure springs. Transient mechanical oscillations in the moving contact assembly originating at this time were detrimental to the maintenance of good contact within the arc-extinguishing units.

The introduction of the dash-pot **32** eliminates shock to the mechanical system. Main contacts **25, 27** and lift rod assembly **15** are smoothly accelerated as a single mass when the breaker opens. Also, the momentary kickoff given to the lift rod **15** by the main contact pressure springs is largely eliminated, their force being opposed by the dashpot **32**.

It will also be noted that as designed, the dashpot **32** is to some extent double acting. Oil trapped above the piston **33** is throttled through the restricted opening **43** during the closing operation. This feature serves as a buffer to restrict excessive bounce of main contacts **27** when the breaker is closed. Thus, during a closing operation, the lift rod **15** is moved upwardly by the actuating mechanism **12**. Prior to the contact of the main contacts **25, 27**, the movable main bridging contact assemblage **11** assumes the situation as shown in Fig. 4, with the pistons **33** at the lower ends of the piston chambers **31**.

When the upward travel of the lift rod **15** is sufficient to cause engagement between the main contacts **25, 27**, the fact that oil is trapped on the upper side of the piston **33** and is only permitted to leak in a restricted manner out through the ports **43**, gives rise to a state of affairs where considerable force is directly exerted on the two main movable bridging members **28** directly by the lift rod **15**, the lost motion therebetween being retarded because of the trapped oil within the upper end of the piston chamber **31**. As a result, no bounce of the movable main contacts **27** is permitted because of this direct upward force exerted positively on the main movable contacts **27** by the lift rod **15** itself. Any bounce of the main contacts **25, 27** during closing would cause arcing therebetween because of the low resistance path afforded by the main contacts.

From the foregoing description, it will be apparent that I have associated a novel type of lost-motion connection between the actuating means **12** and the movable main contacts **27**. This lost-motion connection is so arranged that means are provided to retard the taking up of the lost motion during the opening operation, with the result that the movable main contacts **27** move substantially simultaneously with initial opening movement of the lift rod **15**. During the closing operation, the arrangement is such that the giving up of the lost motion during the closing operation is retarded to eliminate main contact bounce.

Consequently, my invention has the advantage of bringing earlier opening of the main contacts thereby permitting earlier interruption of the circuit. It also has the advantage of providing earlier opening of the main contacts **25, 27** allowing more time for transfer of current into the arcing contacts associated with the extinguishing units **6**. A third advantage of my invention is that of eliminating mechanical shock to the moving contact assembly during the opening operation. Further, a fourth advantage is the provision of a buffering action to prevent excessive bounce of the main contacts **27** during the closing operation.

The foregoing four advantages are provided by structure, which, it will be apparent, is simple in arrangement and trouble-free in operation. The fluid, such as oil, for the dashpot **32** is taken directly from the liquid **3** provided in the main tank **1**. Moreover, it will be noted that the contact operating arrangement is compact, taking up little space, and, in fact, takes up little more space than would be required by the usual provision of a pair of movable main contact bridging members, as employed by the prior art.

The result of an application of the invention is a circuit interrupter rendering smooth, more rapid and more effective performance, with a minimizing of arcing and wear on the main contacts due to the elimination of bounce therebetween during the closing stroke.

It will be obvious to those skilled in the art that it is not necessary to utilize the precise dashpot arrangement described heretofore in connection with the interrupter of Figs. 1–8 of the drawings. Rearrangement of the several parts is readily possible without departing from the essential law of action of my invention. For example, Figs. 9–12 somewhat diagrammatically indicate alternate constructions involving a rearrangement of the parts, without in any way departing from the advantages of an application of my invention, as heretofore described.

It is not necessary, for example, to provide a support for the movable main contacts **27** by means of the piston plungers **33**. Instead, a piston plunger **33***a* may be rigidly connected to the movable main contacts **27**, as shown in Fig. 9, the dashpot cylinder **31***a* being fixed to the movable main bridging contact assemblage **11***a*. This merely involves interchanging of the piston and piston chamber, heretofore described in connection with the first embodiment of my invention, as set out in Figs. 1–8, and in no manner changes the operation.

As shown in Fig. 10, the lift rod **15***a* is slightly modified to straddle the bridging member **54** electrically and mechanically interconnecting the two movable main contacts **27**. Since the operation is the same as heretofore described in connection with Figs. 1–8, it will not be repeated.

Instead of associating a dashpot device, or means providing a lost-motion connection between the movable main contacts and the support therefor, it is readily possible to associate the lost-motion connection, or the dashpot device, between the relatively stationary main contact **25** and its associated support. Thus, in Fig. 11, the movable main contact **27** is rigidly secured to, and movable with, the lift rod **15***b* as is also the bridging member **11***b*. A dashpot device **32***b* is associated between the relatively stationary main contact **25** and the support **55** therefor. In this instance, the support **55** provides the piston chamber **31***b* within which moves the piston or plunger **33***b* attached to the relatively stationary contact **25**. The opening **43** is again provided, and the device has the same manner of operation as heretofore described. A further description, therefore, is not deemed necessary.

Fig. 12 shows a modification of the invention, similar to that set out in Fig. 11, but in this embodiment the relatively stationary main contact **25** forms the piston chamber **31***c*, and the piston plunger **33***c* provides the support **56** for the relatively stationary main contact **25**. Again the opening **43** is provided and the contact structure has the same manner of operation, and has the same advantages as heretofore described in connection with Figs. 1–8 of the drawings.

These alternative arrangements show how it is possible to obtain the advantages of my invention by departing slightly from the specific arrangement set out in Figs. 1–8 of the drawings.

Although I have shown and described specific structures, it is to be clearly understood that the same were merely for the purpose of illustration, and that changes and modifications may readily be made therein by those skilled in the art without departing from the spirit and scope of the invention.

I claim as my invention:

1. A circuit interrupter including a relatively stationary contact, a cooperating movable contact, actuating means for moving the movable contact to the open and closed-circuit positions, means providing a lost-motion connection between said movable contact and said actuating means after the movable contact has engaged the stationary contact during the closing operation, and means retarding the giving up of this lost motion during the closing operation subsequent to contact engagement.

2. A circuit interrupter including a relatively stationary contact, a cooperating movable contact, actuating means for moving the movable contact to the open and closed-circuit positions, means providing a lost-motion connection between said movable contact and said actuating means after the movable contact has engaged the stationary contact during the closing operation, and a dashpot device retarding the giving up of this lost motion during the closing operation subsequent to contact engagement.

3. A circuit interrupter including a relatively stationary contact, a cooperating movable contact, actuating means for moving the movable contact to the open and closed-circuit positions, means providing a lost-motion connection between said movable contact and said actuating means after the movable contact has engaged the stationary contact during the closing operation, and means retarding the taking up of the lost motion during the opening operation and also the giving up of lost motion during the closing operation subsequent to contact engagement.

4. A circuit interrupter including a relatively stationary contact, a cooperating movable contact, actuating means for moving the movable contact to the open and closed-circuit positions, means providing a lost-motion connection between said movable contact and said actuating means after the movable contact has engaged the stationary contact during the closing operation, and a dashpot device retarding the taking up of the lost motion during the opening operation and also the giving up of lost motion during the closing operation subsequent to contact engagement.

5. A circuit interrupter including a pair of arcing contacts and a shunting pair of main contacts including a movable main contact, actuating means for first opening the main contacts during the opening operation and subsequently the arcing contacts so that the latter always interrupt the circuit, a lost-motion connection between the actuating means and said movable main contact after the movable main contact has engaged the other main contact during the closing operation, and means retarding the taking up of the lost-motion during the opening operation.

6. A circuit interrupter including a pair of arcing contacts and a shunting pair of main contacts including a movable main contact, actuating means for first opening the main contacts during the opening operation and subsequently the arcing contacts so that the latter always interrupt the circuit, a lost-motion connection between the actuating means and said movable main contact after the movable main contact has engaged the other main contact during the closing operation, and a dashpot device retarding the taking up of the lost motion during the opening operation.

7. A circuit interrupter including a pair of arcing contacts and a shunting pair of main contacts including a movable main contact, actuating means for first opening the main contacts during the opening operation and subsequently the arcing contacts so that the latter always interrupt the circuit, a lost-motion connection between the actuating means and said movable main contact after the movable main contact has engaged the other main contact during the closing operation, and means retarding the taking up of the lost-motion during the opening operation and the giving up of lost motion during the closing operation.

8. A circuit interrupter including a pair of arcing contacts and a shunting pair of main contacts including a movable main contact, actuating means for first opening the main contacts during the opening operation and subsequently the arcing contacts so that the latter always interrupt the circuit, a lost-motion connection between the actuating mans and said movablee main contact after the movable main contact has engaged the other main contact during the closing operation, and a double acting dashpot device retarding the taking up of the lost motion

during the opening operation and the giving up of lost motion during the opening operation and the giving up of lost motion during the closing operation.

9. A circuit interrupter including a pair of arcing contacts and a shunting pair of main contacts including a movable main contact, actuating means for first opening the main contacts during the opening operation and subsequently the arcing contacts so that the latter always interrupt the circuit, a lost-motion connection between the actuating means and said movable main contact after the movable main contact has engaged the other main contact during the closing operation, and means retarding the giving up of lost-motion during the closing operation subsequent to main contact engagement.

10. A circuit interrupter including a pair of arcing contacts and a shunting pair of main contacts including a movable main contact, actuating means for first opening the main contacts during the opening operation and subsequently the arcing contacts so that the latter always interrupt the circuit, a lost-motion connection between the actuating means and said movable main contact after the movable main contact has engaged the other main contact during the closing operation, and a dashpot retarding the giving up of lost-motion during the closing operation subsequent to main contact engagement.

11. A circuit interrupter including a pair of serially related arc-extinguishing units, each arc-extinguishing unit having one or more relatively stationary main and arcing contacts, a movable bridging assemblage for electrically interconnecting the units in the closed-circuit position, actuating means for effecting opening and closing motion of the movable bridging assemblage, the movable bridging assemblage having at least a pair of movable main contacts and a pair of movable arcing contacts, a lost-motion connection between the actuating means and the movable main contacts after the movable main contacts have engaged the relatively stationary main contacts during the closing operation, and means retarding the taking up of the lost-motion during the opening operation.

12. A circuit interrupter including a pair of serially related arc-extinguishing units, each arc-extinguishing unit having one or more relatively stationary main and arcing contacts, a movable bridging assemblage for electrically interconnecting the units in the closed-circuit position, actuating means for effecting opening and closing motion of the movable bridging assemblage, the movable bridging assemblage having at least a pair of movable main contacts and a pair of movable arcing contacts, a lost-motion connection between the actuating means and the movable main contacts, after the movable main contacts have engaged the relatively stationary main contacts during the closing operation, and a dashpot retarding the taking up of the lost-motion during the opening operation.

13. A circuit interrupter including a relatively stationary main contact, means defining a support therefor, a cooperating movable main contact, means defining a support for the movable main contact, actuating means for moving the movable main contact to the open and closed-circuit positions, a cooperable pair of arcing contacts electrically shunting the main contacts, means providing a lost-motion connection between one of the main contacts and its support subsequent to main contact engagement during the closing operation, and means retarding the taking up of the lost motion during the opening operation.

14. A circuit interrupter including a relatively stationary main contact, means defining a support therefor, a cooperating movable main contact, means defining a support for the movable main contact, actuating means for moving the movable main contact to the open and closed-circuit positions, a cooperable pair of arcing contacts electrically shunting the main contacts, means providing a lost-motion connection between one of the main contacts and its support subsequent to main contact engagement during the closing operation, and a dashpot device retarding the taking up of the lost motion during the opening operation.

15. A circuit interrupter including a relatively stationary main contact, a cooperating movable main contact, a cooperable pair of arcing contacts electrically shunting the main contacts, a dashpot piston chamber secured to and movable with the movable main contact, means comprising a piston plunger for supporting the movable main contact and actuating the same, and a lost motion connection between the piston plunger and the dashpot piston chamber following main contact engagement during the closing operation.

16. A circuit interrupter including a relatively stationary main contact, a cooperating movable main contact, a cooperable pair of arcing contacts electrically shunting the main contacts, a piston plunger secured to and movable with the movable main contact, a dashpot piston chamber, within which the piston moves, for actuating the movable main contact, and a lost motion connection between the piston plunger and the dashpot piston chamber following main contact engagement during the closing operation.

17. A circuit interrupter including a relatively stationary main contact having a piston plunger secured thereto, a support for the relatively stationary main contact comprising a dashpot piston chamber within which the piston plunger operates, a movable main contact cooperable with the relatively stationary main contact, a cooperable pair of relatively movable arcing contacts electrically shunting the main contacts, said piston plunger being movable within the dashpot piston chamber following engagement of the main contacts during the closing operation so as to provide thereby a lost-motion connection between the relatively stationary main contact and the support therefor following main contact closure, and means retarding the giving up of this lost-motion during the closing operation subsequent to closure of the main contacts.

18. A circuit interrupter including a relatively stationary main contact having a dashpot cylinder secured thereto and movable therewith, a support for the relatively stationary main contact including a dashpot piston plunger, a relatively movable main contact cooperable with the relatively stationary main contact, a cooperable pair of relatively movable arcing contacts electrically shunting the main contacts, said dashpot piston plunger being movable within the dashpot cylinder following engagement of the main contacts during the closing operation so as to provide thereby a lost-motion connection between the relatively stationary main contact and the support therefor following main contact closure, and means retarding the giving up of this lost-motion during the closing operation subsequent to closure of the main contacts.

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