July 12, 1949. B. E. SPIRO 2,476,071

CIRCUIT INTERRUPTING DEVICE

Filed July 15, 1944

Fig. 1.

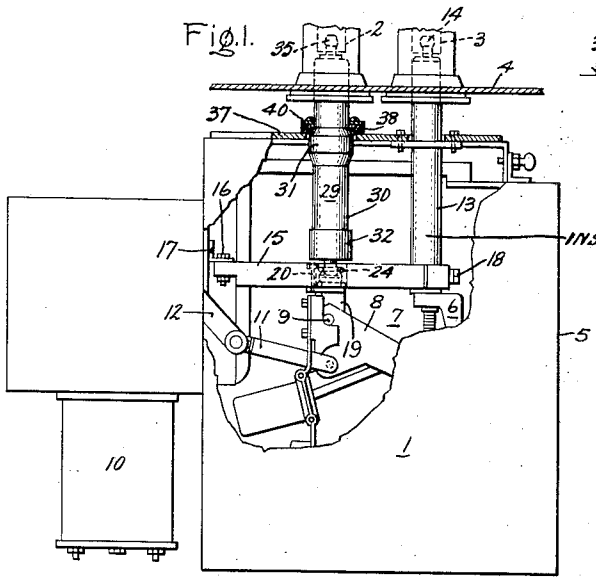


Fig. 2.

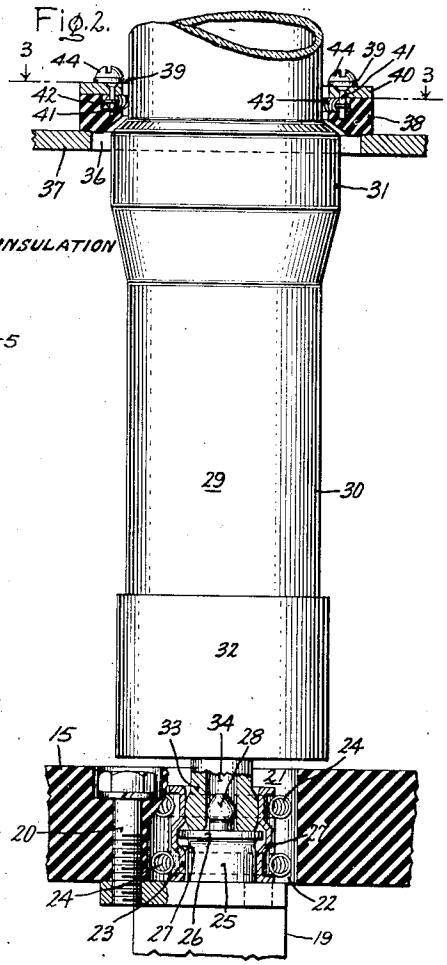


Fig. 5.

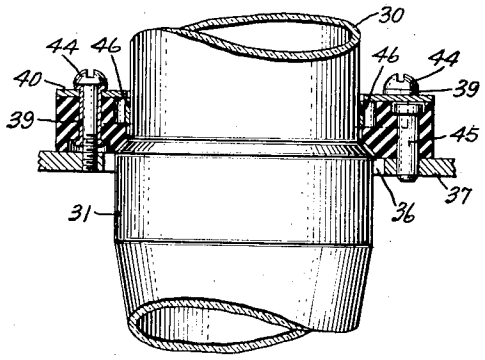
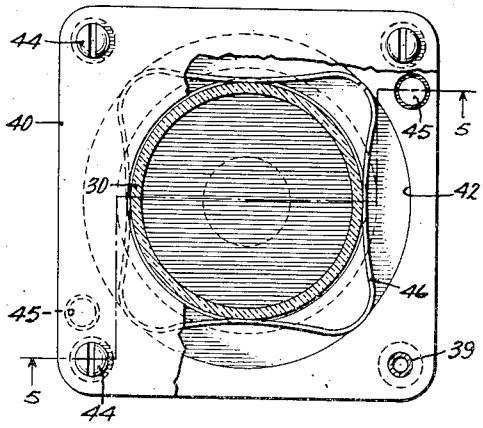
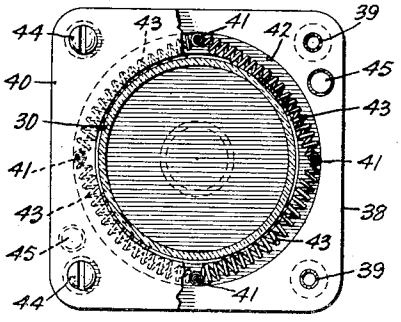


Fig. 3.

Fig. 4.





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Patented July 12, 1949

2,476,071

UNITED STATES PATENT OFFICE

2,476,071

CIRCUIT INTERRUPTING DEVICE

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Application July 15, 1944, Serial No. 545,100

6 Claims. (Cl. 200—168)

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My invention relates to circuit interrupting devices, and more particularly to a circuit interrupter which includes as a part of its physical structure a second circuit interrupter preferably of the type including a fusible element. Specifically, my invention is an improvement on Patent No. 2,427,181 to Baskerville and Bush, issued September 9, 1947, and assigned to the same assignee as the present application.

It is an object of my invention to provide a new and improved circuit interrupting device in which a circuit interrupter includes as a part of its physical structure a second circuit interrupter electrically in series with the first mentioned circuit interrupter.

It is another object of my invention to provide a new and improved conductor stud for an electric circuit breaker.

Further objects and advantages of my invention will become apparent as the following description proceeds, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this application.

For a better understanding of my invention, reference may be had to the accompanying drawing in which Fig. 1 is a side elevational view with a cutaway portion of a well-known type of standard air circuit breaker embodying my invention, constructed for use with metal clad switchgear of the vertical lift type; Fig. 2 is an enlarged view partly in section of a portion of Fig. 1 embodying my invention; Fig. 3 is a view of a portion of Fig. 2 taken on line 3—3 of Fig. 2; Fig. 4 is a view similar to Fig. 3 showing a modified resilient supporting means; and Fig. 5 is a view taken on line 5—5 of Fig. 4.

As is also true of the above mentioned Baskerville and Bush patent, it will be obvious that my invention is applicable to many different types of circuit breakers. It is, however, particularly applicable to switchgear commonly referred to as metal clad switchgear which comprises a stationary housing into which electric power circuits are connected, which power circuits are controlled by a cooperating electric circuit breaker mounted on a removable unit which may be of the vertical lift or the horizontal draw-out type. Movement of the unit including the circuit breaker into position in the stationary housing connects the circuit breaker or circuit interrupting device with an

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associated power circuit through primary disconnecting devices which usually comprise stationary portions in the housing and cooperating conductor studs on the removable unit including the circuit breaker.

In the drawings, and particularly with reference to Fig. 1, I have illustrated my invention as applied to a circuit breaker of the vertical lift type which is also referred to as of the "drop-down" type, wherein disconnection of the circuit breaker from the associated circuit is effected merely by bodily lowering the removable unit and associated circuit breaker. The circuit breaker illustrated in the drawings is in some respects very similar to the circuit breaker disclosed and claimed in United States Letters Patent 2,335,068, granted November 23, 1943, on an application of Leonard J. Linde, and assigned to the same assignee as the present application.

The circuit breaker unit shown in Fig. 1 and generally indicated as 1 is in a form that is particularly adaptable for central stations and substations wherein the unit can be bodily disconnected with respect to stationary circuits comprising the stationary portions 2 and 3 of the primary disconnecting contacts by a simple plugging operation. These stationary portions 2 and 3 of the primary disconnecting contacts are suitably mounted in a metal-clad housing 4 only a very small portion of which is shown in Fig. 1. The removable unit 1, including the circuit breaker, enclosed in box barrier 5 is housed in the grounded metal enclosure, or housing 4, when in position to control an associated electric circuit. More specifically, the circuit breaker unit 1 of Fig. 1 comprises a main supporting frame for the movable contact structure which comprises a fixed or stationary contact structure 6, and a movable contact structure 7. The movable contact structure comprises a pivotally mounted contact supporting arm 8 pivotally mounted at 9. Arm 8 supports current carrying and arcing contacts (not shown) for engagement with cooperating stationary current carrying and arcing contacts (also not shown) forming a part of the stationary contact structure 6.

Relative movement between the contacts associated with the contact structures 6 and 7 is obtained through the operation of any suitable actuating mechanism, which may be of the solenoid type for example, such as 10 in Fig. 1, car-

ried by the supporting frame. The actuating mechanism 10 is interconnected in any suitable manner with movable contact supporting arm 8, as for example by a link 11 and a crank 12. Upon relative separation of the movable and stationary contact structures the arc drawn is interrupted in a suitable arc extinguishing structure (not shown).

The stationary contact structure 6 is electrically connected by suitable means to the lower end of a conductor stud 13, which is suitably supported by the framework of the metal-clad unit 1. The upper end of conductor stud 13 comprises a male contact portion or plug contact 14, which forms the movable portion of the primary disconnecting devices or contacts adapted to electrically engage the stationary portion 3 thereof suitably mounted in metal-clad housing 4. It should be understood that the major portion of the exterior of conductor stud 13 is constructed of insulating material to insulate the electrical conductor interconnecting contact 14 and the stationary contact structure 6 from the housing or enclosure 5.

In order to support the pivot 9 for movable contact arm 8 an insulating brace or support 15 is provided having one portion or end thereof suitably fastened as by bolts 16 to an angle member 17 suitable fastened to the vertical framework of removable unit 1. The other end of insulating brace or support 15 is supported by being clamped to the lower end of conductor stud 13 which preferably has a portion of reduced cross section (not shown). The clamping means for the end of brace 15 is indicated at 18 in Fig. 1.

The arrangement described thus far is not my invention but is disclosed and claimed in the above mentioned Baskerville and Bush patent.

Insulating brace 15 supports pivot 9 and this is accomplished by means of a conducting member 19 which supports pivot 9 and is in turn bolted to insulating base 15 intermediate the ends thereof as by bolts or other suitable fastening means 20. A flexible terminal generally indicated at 21 and electrically connected to member 19 is mounted within an opening 22 formed in insulating brace 15. Flexible terminal 21 is preferably constructed in accordance with the terminal disclosed and claimed in Linde Patent 2,243,567, assigned to the same assignee as the present application, and comprises a plurality of segments 23 which are held in position to form a socket type contact by means of garter springs 24. The segments 23 of flexible terminal 21 are positioned on an extension 25 of member 19 which is provided with a disk or collar member 26. The extension 25 is preferably integrally formed with member 19. The segments 23 are recessed at 27 to receive the peripheral extension or collar member 26 of extension 25 so that the garter springs 24 lock the segments to the member 12 without in any way interfering with the flexibility of operation of terminal 21. Cylindrical member 25 is also provided with an upwardly extending guide pin 28 having a tapered end, the purpose of which will become apparent from the ensuing description.

Flexible terminal 21 is adapted to be removably electrically connected to the lower end of a conductor stud 29 which not only serves as a conductor stud but actually comprises a current limiting fuse which may be similar in form and construction to the current limiting fuse disclosed and claimed in the patent to Strang et al., dated June 3, 1947, and assigned to the same assignee as the present application. This current limiting fuse comprises an insulating casing 30 having intermediate the ends thereof a shoulder or enlargement 31. The lower end of casing 30 is provided with a terminal or ferrule 32 including a conducting extension 33 which is annular in form and acts as a plug type contact for making contacting engagement with flexible terminal 21, as is clearly obvious in Fig. 2. The central passageway, or recess 34 in conducting extension 33, is adapted to receive guide pin 28 which is tapered to facilitate the ready insertion and proper seating of extension 33 in flexible terminal 21. The upper end of current limiting fuse 29 terminates in a contact 35 very similar to the contact 14 of conductor stud 13 and forms the movable portion of the particular primary disconnecting contact, the stationary portion of which is indicated at 2.

Current limiting fuse and conductor stud 29 is flexibly attached to the circuit breaker 1 in that it is supported only at its lower end by the flexible terminal 21. The upper end of the conductor stud 29 is therefore free to center itself in the stationary portion 2 of the primary disconnecting contact of the metal-clad housing 4. In this way strain is avoided on the conductor stud which is very desirable if the current limiting fuse has a glass or other breakable housing, as is generally the case. The conductor stud and current limiting fuse 29 extends through an opening 36 in a top plate 37 of the removable unit 1 including the circuit breaker.

A certain amount of friction is involved between the movable portion 35 and the stationary portion 2 of the primary disconnecting contacts associated with conductor stud 29 in order to assure good electrical contact. With the arrangement described thus far it is possible that upon lowering of the metal-clad unit 1 so as to cause disengagement of the primary disconnecting contacts, that conductor stud 29 might be disengaged from flexible terminal 21 instead of from the stationary portion 2 of the primary disconnecting contacts. This would be very undesirable and in accordance with my invention I provide an arrangement which not only maintains the conductor stud in engagement with flexible terminal 21, but which furthermore resiliently supports housing 30 of fuse 29 with respect to top plate 37. This means comprises a rectangular counterbored flange 38 formed of insulating material. Riveted to the top of flange 38 by means of hollow rivets 39 is a cover plate 40. Affixed to the bottom side of cover plate 40 are four spring posts 41 equally spaced around a central opening in both flange 38 and plate 40, which opening is sufficiently large to permit conductor stud 29 to extend therethrough. Cover plate 40 and the counterbore in flange 38 define a recess 42 within which are mounted four coiled springs 43 supported from either end by spring posts 41 as is clearly shown in Fig. 3. These springs resiliently engage the housing 30 of conductor stud 29 so that jarring or vibration will not cause damage thereto. It should be noted that the spring posts 41 riveted or otherwise suitably fastened to cover plate 40 extend into cooperating openings in flange 38.

The lower edge of the opening through flange 38 for accommodating conductor stud 29 is cut at an angle to fit against the angular portion of shoulder 31 which is too large to pass through the opening in flange 38. When the unitary arrangement comprising cover plate 40 and flange 38 is fastened to top plate 37, as by bolts 44 pass-

ing through the hollow rivets 39, the conductor stud and current limiting fuse 29 is effectively latched into conducting engagement with flexible terminal 21 so that it is maintained in the position indicated in Fig. 2 during the interval when the removable unit or circuit breaker is lowered and the primary disconnecting devices or contacts are disengaged in the metal-clad equipment. In order to aid in positioning flange 38 on top plate 37 prior to fastening it thereto, I provide a pair of pins 45 which are mounted in flange 38 as is best shown in Fig. 3 and also in Fig. 5.

In Figs. 4 and 5 I have illustrated substantially the same combined resilient supporting and latching means except that the coiled springs 43 have been omitted and instead a flat spring 46 has been provided, which functions in substantially the same manner as coiled springs 43. The corresponding parts of Figs. 4 and 5 are designated by the same reference numerals as in the preceding figures. The construction of the hollow rivets 39 and the centering pins 45 is clearly shown in Fig. 5.

Although I have disclosed my invention as applied to a circuit breaker in which only two conductor studs are visible, which might be a single-phase circuit breaker, it will be obvious that it might equally well be applied to a polyphase circuit breaker, such as a three-phase circuit breaker in which case six conductor studs will be provided.

From the above discussion it will be obvious that I have provided a circuit interrupting device including as a physical part thereof a second circuit interrupting device serially arranged therewith insofar as the electrical circuit is concerned. The main circuit interrupting device operates as a conventional circuit breaker unit, but in the event of faulty currents greater than those which the circuit breaker can satisfactorily interrupt, the second circuit interrupter becomes effective to interrupt the current. By this arrangement a very compact structure is provided having all the advantages of a current limiting fuse and circuit interrupting device. Also with my invention the current limiting fuse is maintained in position when the primary disconnecting contacts are disengaged. The resilient supporting means comprising the springs 43 or 46 prevent damage to the current limiting fuse, both during normal operation of the apparatus and also while being transported.

While I have disclosed certain specific embodiments of my invention, it should be understood that my invention is not limited to the specific details and construction thereof herein illustrated, and I intend in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric circuit breaker of the removable type having a pair of relatively movable contacts disposed within an enclosing housing and adapted to be connected to an associated electric circuit through primary disconnecting devices, a conductor stud disposed within an opening in the housing and connected to one of the contacts to form one terminal of said circuit breaker, a shoulder on said conductor stud, a flange on said circuit breaker housing for engaging said shoulder to prevent withdrawal of said conductor stud from said circuit breaker through the opening in the housing when said circuit breaker is moved out of engagement with said primary disconnecting devices, a groove in said flange, and resilient means for supporting said conductor stud including a flexible terminal for engaging the end of said conductor stud connected to one of the contacts and spring means mounted in said groove for engaging and resiliently supporting said conductor stud against lateral movement within the opening in the housing.

2. An arrangement for flexibly attaching a conductor stud to a circuit breaker having an enclosing housing comprising an apertured brace member secured within the circuit breaker, means disposed within the aperture of said brace member for slidably connecting the conductor stud to one of the contacts of the circuit breaker, an opening in the enclosing housing of the circuit breaker through which the conductor stud extends, an apertured flanged member secured to the housing with its aperture substantially coinciding with said opening, a shoulder on the conductor stud for engaging said flanged member to limit longitudinal outward movement of the stud with respect to the circuit breaker, and spring means mounted within the aperture of said flanged member for engaging and resiliently supporting the conductor stud against lateral movement.

3. An arrangement for yieldably attaching a conductor stud to a circuit breaker having a pair of relatively movable contacts and an enclosing housing comprising means for connecting the inner end of the stud to one of the contacts of the circuit breaker, an opening in the enclosing housing through which the stud extends, an apertured flanged member secured to the housing with its aperture substantially coinciding with said opening, a shoulder on the conductor stud for engaging said flanged member to limit longitudinal outward movement of the stud, and spring means mounted within the aperture of said flanged member for engaging and resiliently supporting the conductor stud against lateral movement.

4. An arrangement for yieldably attaching a conductor stud to a circuit breaker having a pair of relatively movable contacts and an enclosing housing comprising means for connecting the inner end of the stud to one of the contacts of the circuit breaker so as to secure the inner end of the stud against lateral and inward longitudinal movement, an opening in the enclosing housing through which the stud extends, an apertured flanged member, an apertured plate member secured to said flanged member in substantially coincidental relationship with respect to the opening in the enclosing housing, means for securing said flanged member and said plate member to the housing, a shoulder on the conducting stud for engaging said flanged member to prevent outward longitudinal movement of the conductor stud, and resilient means disposed between said plate member and the flanged portion of said flanged member for engaging and resiliently supporting the conductor stud against lateral movement.

5. An arrangement for yieldably attaching a conductor stud to a circuit breaker having a pair of relatively movable contacts and an enclosing housing comprising a supporting brace member, a tapered pin electrically connected to one of said contacts and supported by said brace member, a recess within the inner end of the conductor stud for engaging said pin to secure the inner end of said stud against lateral movement, an opening in the enclosing housing through which the stud extends, an apertured flanged member secured to the housing with its aperture substantially

coinciding with said opening, a shoulder on the conductor stud for engaging said flanged member to limit longitudinal outward movement of the stud and spring means mounted within the aperture of said flanged member for engaging and resiliently supporting the conductor stud against lateral movement.

6. An arrangement for yieldably attaching a conductor stud to a circuit breaker having a pair of relatively movable contacts and an enclosing housing comprising means forming a slidable connection between one of the contacts and the inner end of the conductor stud, an opening in the enclosing housing through which the stud extends, an apertured flanged member secured to the housing with its aperture substantially coinciding with said opening, a shoulder on the conductor stud for engaging said flanged member to limit longitudinal outward movement of the stud and

a plurality of spring posts disposed about the aperture in said flanged member, and a plurality of springs secured to said spring posts for engaging and resiliently supporting the conductor stud against lateral movement.

BENJAMIN E. SPIRO.

REFERENCES CITED

The following references are of record in the file of this patent:

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1,936,469	Hill	Nov. 21, 1933
2,243,567	Linde	May 27, 1941
2,300,893	Hayford	Nov. 3, 1942
2,385,658	Strang et al.	Sept. 25, 1945