

May 26, 1942.

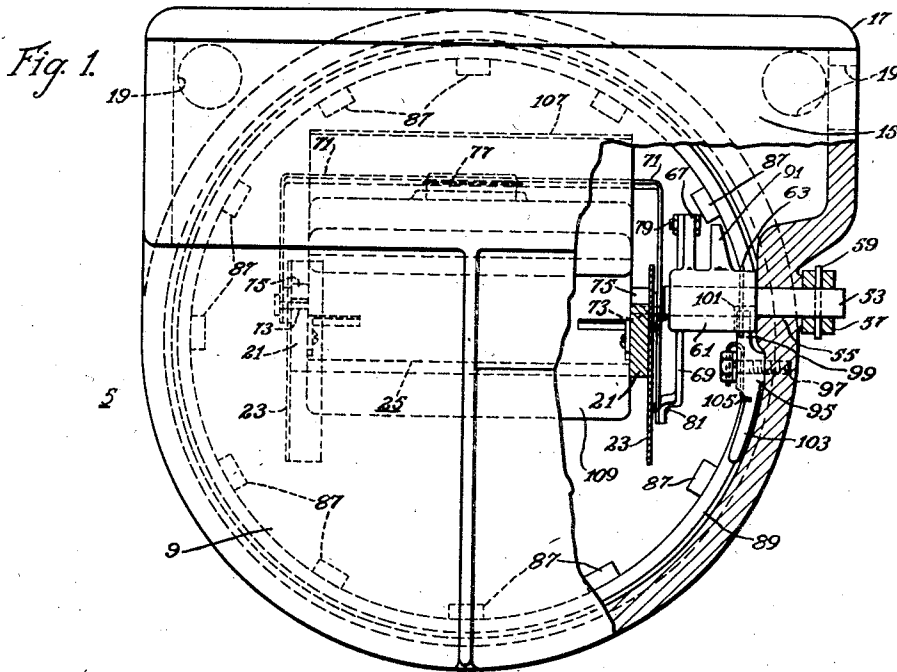
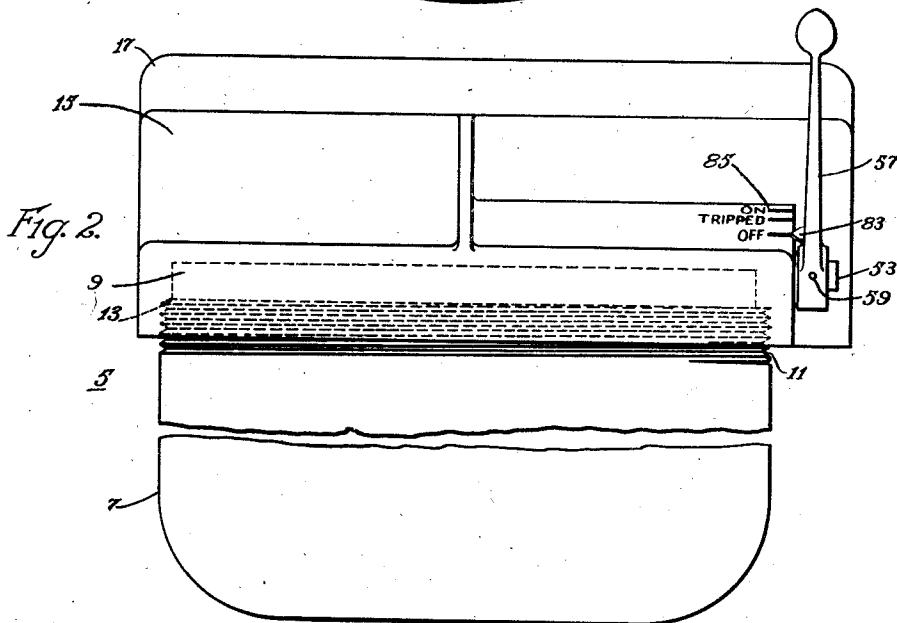
M. A. HYDE, JR

2,284,613

EXPLOSION PROOF CIRCUIT INTERRUPTING APPARATUS

Filed Jan. 5, 1940

2 Sheets-Sheet 1



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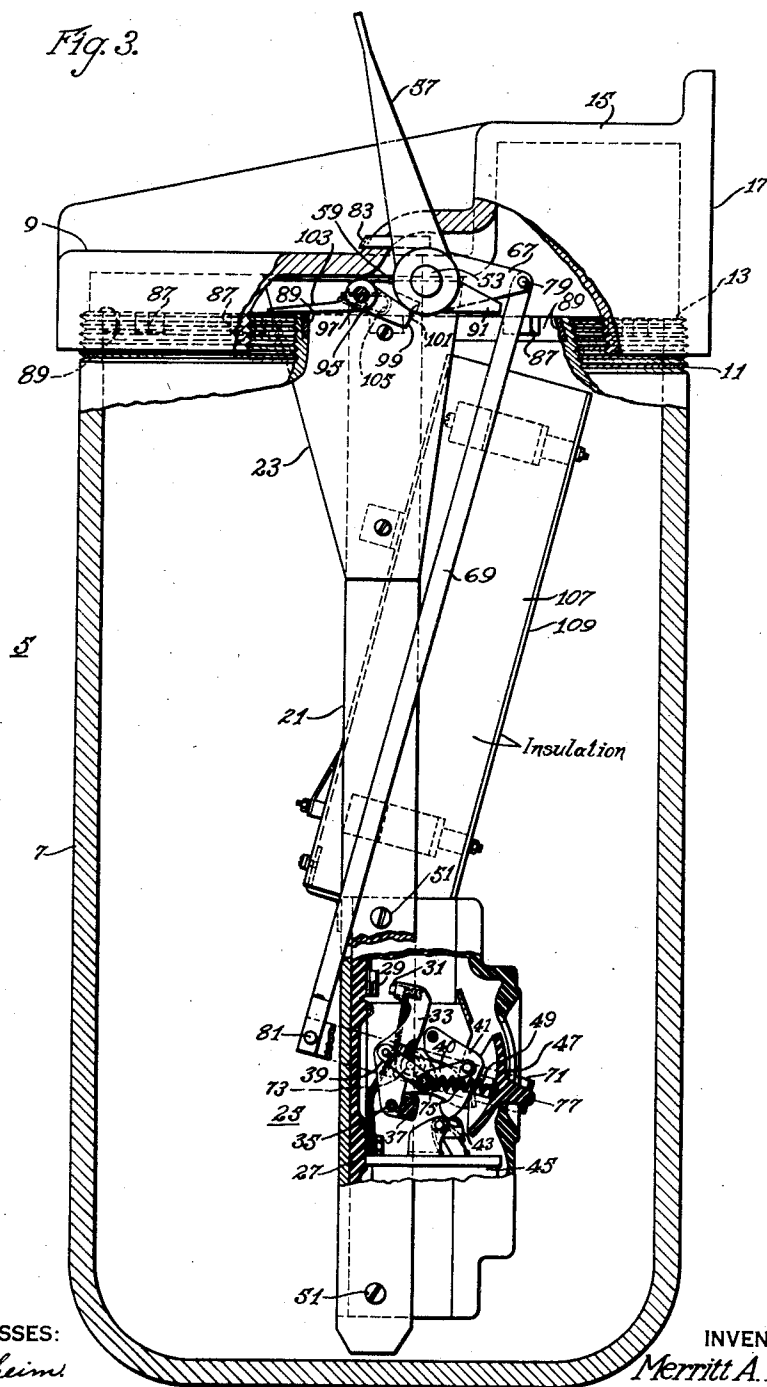
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UNITED STATES PATENT OFFICE

2,284,613

EXPLOSIONPROOF CIRCUIT INTERRUPTING APPARATUS

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Application January 5, 1940, Serial No. 312,503

31 Claims. (Cl. 200—50)

This application is a continuation-in-part of my copending application for Explosionproof control enclosures, Serial No. 245,639, filed December 14, 1938.

The invention relates to explosion-proof electrical control apparatus, and more particularly, to circuit interrupting apparatus mounted in explosion-proof housings for use in locations where the atmosphere is of an inflammable or explosive nature.

An object of the invention is the provision of an improved explosion-proof circuit interrupter housing having separable sections to permit access to the interrupter, which sections are detachably secured in flame-proof relation by relative rotation or screwing together of the sections, and embodying an interlock which prevents relative rotation or unscrewing of the sections except when the operating handle for the interrupter is in the "off" position.

Another object of the invention is the provision of an improved explosion-proof circuit interrupter housing comprising separable sections which screw together in flame-proof relation, and an interlock operable upon initial unscrewing of the sections to prevent movement of the operating handle for the interrupter to the "on" position.

Another object of the invention is the provision of an explosion-proof circuit interrupter housing comprising separable sections which screw together in flame-proof relation, a circuit interrupter and operating means therefor mounted on one of the sections, and interlocking means for preventing unscrewing of the sections while the contacts of the interrupter are closed and for preventing closing of the contacts when the sections are unscrewed and also when the sections are separated.

Another object of the invention is the provision of improved explosion-proof circuit interrupting apparatus as previously described in which the interlocks are disposed inside of the housing.

Another object of the invention is the provision of explosion-proof circuit interrupting apparatus of simple and improved construction which is safe and reliable in operation and inexpensive to manufacture.

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

following detailed description of one preferred embodiment thereof when read in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view, partly in section, of an explosion-proof circuit interrupting apparatus constructed in accordance with the invention;

Fig. 2 is a fragmentary elevational view of the apparatus shown in Fig. 1, a portion of the housing being broken away to shorten the figure; and

Fig. 3 is a side view of the apparatus, portions of the housing and circuit breaker within the housing being shown in section.

Referring to the drawings, the reference numeral 5 designates the explosion-proof housing which is preferably composed of cast metal such as iron, aluminum or a suitable alloy of either, and the housing is generally cylindrical in shape to provide maximum strength and minimum weight. The housing 5 comprises a cylindrical body section or tank 7 open at the top and having a rounded closed bottom, and a cover section or closure 9 which is secured to the top of the body section and closes the open end thereof.

The body section or tank 7 and the cover section 9 are detachably secured together in flame-proof or flame-tight relation by a screw-threaded connection comprising external screw threads 11 formed at the upper end of the body section 7 which engage complementary screw threads provided internally on the bottom portion of the cover section 9; the upper edge of the body section 7 engaging an internal shoulder 13 provided in the bottom portion of the cover section 9 when the sections are screwed tightly together.

The cover section 9 is of generally cylindrical cross-section and has an enlarged rectangular portion 15 provided with a flattened side 17 forming a base by which the housing may be secured to a support. The ends of the rectangular portion 15 are provided with one or more conduit receiving openings 19 for the ingress and egress of the electrical conductors (not shown) which lead to the circuit interrupting device within the housing 5.

The cover section 9 of the housing has a mounting frame for the circuit interrupting apparatus secured thereto which projects downwardly from the central portion thereof. This mounting frame comprises a pair of spaced vertical bars 21 each of which is bolted or otherwise secured to a triangular bracing gusset 23 which is, in turn, bolted to the cover section 9.

The circuit interrupting device in the embodiment of the invention shown comprises a multipole circuit breaker 25 which is manually op-

erable to open and close the circuit, and which is automatically operable to interrupt the circuit upon the occurrence of an overload or short circuit condition. The circuit breaker illustrated is of the same general construction as the circuit breaker fully described in Patent 2,047,739, of Harry J. Lingal, issued July 14, 1936, and assigned to the assignee of this invention. Briefly, the circuit breaker comprises a casing 27 of molded insulating material having therein a stationary contact 29 and a movable contact 31 for each of the three poles. The movable contacts 31 are carried by switch arms 33 which are mechanically connected for simultaneous movement together about a common pivot 35 by means of an insulating tie bar 37. The switch arms are actuated by a common overcenter spring mechanism comprising a pair of toggle links 39 and 40 connected to one of the switch arms 33 and to a pivoted releasable carrier 41. The free end of the carrier 41 is normally engaged and held by a latch 43 of a trip device 45. A pivoted actuating member 47 is connected by overcenter springs 49 to the knee of the toggle for manually actuating the breaker. The trip device 45 includes an electromagnetic trip element (not shown) for each pole energized by the current of its corresponding pole, each of the trip elements being operable on overload of its pole to release the carrier 41 and thus cause automatic opening of all of the contacts. When the breaker is tripped, the actuating member 47 is automatically moved to a "tripped" indicating position intermediate its "on" and "off" positions. The mechanism is reset by movement of the actuating member 47 to its "off" position.

The circuit breaker 25 is secured to the lower ends of the vertical bars 21, in a vertical position between the bars, by means of a plurality of fastening bolts 51.

An operating means is provided for manually operating the circuit breaker 25 from outside of the explosion-proof housing 5. The operating means comprises an operating shaft 53 which projects through a side of the cover section 9 and is rotatably mounted on the cover section in a bearing 55 provided therefor. An operating handle 57 is rigidly secured by a pin 59 to the portion of the operating shaft 53, which projects outside of the housing. A hub 61 is secured to the shaft 53 inside of the cover section 9 and this hub is retained in mounted position by means of a tapered pin 63. The shaft 53 has a close fit in the opening of its bearing 55, and the length of the engaged parts of the shaft and bearing is sufficient to make the shaft opening flame-proof or flame-tight.

The hub 61 which is secured to the shaft 53 for rotation therewith is provided with a crank arm 67 which is mechanically connected by a link 69 to one leg of an operating yoke 71 which is pivotally mounted at 73 (Fig. 1) on ears 75 provided on the vertical bars 21. The operating yoke 71 straddles the circuit breaker 25 and is provided with a slot which engages the breaker handle 77. The connecting link 69 is pivotally connected at 79 to the free end of the crank 67, and its other end is pivotally connected at 81 to one leg of the yoke 71 which extends beyond the pivot thereof.

The operating handle 57 is provided with a pointer 83 on its inner side which cooperates with indicia 85 marked on the cover section 9 to indicate the "on," "off" and "tripped" positions of the circuit breaker.

In order to prevent unscrewing of the sections 7 and 9 of the housing while the breaker contacts are closed, an interlocking means is provided which comprises a plurality of spaced lugs 87 secured to a ring 89 which is, in turn, secured to the upper end of the tank 7 at the internal periphery thereof. The hub 61 on the operating shaft 53 is provided with a cooperating locking element or projection 91 which is adapted to be moved into and out of the path of the locking lugs 87 upon operation of the operating shaft 53. When the operating handle 57 is in the "on" position the locking projection 91 is disposed in the path of the locking lugs 87 and thus prevents unscrewing of the housing sections 7 and 9 while the breaker contacts are closed. When the operating handle 57 is in the "off" position, the locking projection 91 is disposed above and clear of the path of the locking lugs 87 so as to permit unscrewing of the housing sections 7 and 9.

In order to prevent closing of the circuit breaker when the housing sections 7 and 9 are unscrewed or separated, an interlock is provided which comprises a locking lever 95 pivoted on a bolt 97 secured to the internal periphery of the cover section 9. The locking lever 95 has a projecting arm 99 on one side of its pivot which is adapted to engage a locking recess 101 formed in the hub 61 when the sections 7 and 9 of the housing are unscrewed a predetermined amount and also when the sections are separated. The locking lever 95 is also provided with an arm 103 projecting on the opposite side of the pivot 97 from the locking arm 99, and this arm 103 of the lever is adapted to be engaged by the internal ring 89 of the body section 7 of the housing when the sections are screwed tightly together. The locking lever is biased to locking position by means of a U-shaped spring 105, one end of which hooks over the top of the arm 103 of the locking lever, and the other end of which is secured to the head of the pivot bolt 97.

The locking lever 95 is normally held in inoperative position clear of the hub 61 when the sections 7 and 9 of the housing are screwed tightly together, so as to permit operation of the operating handle 57. However, when the sections are unscrewed a predetermined small amount, the ring 89 is lowered with the tank, thus allowing the locking lever 95 to rotate counter-clockwise by virtue of the bias of the spring 105 to engage its arm 99 in the locking recess 101 of the operating hub 61. Since the hub 61 is rigidly secured to the operating shaft 53, the locking lever 95 thus locks the operating handle 57 in the "off" position to prevent closing of the breaker contacts. The locking lever 95 is arranged to engage and lock the operating means upon an initial unscrewing movement of the housing sections 7 and 9 before the flame-proof joint between the housing sections is rendered inoperative, and the locking lever maintains the operating handle locked in the "off" position during further unscrewing of the sections and also when the housing sections are separated from one another.

The incoming and outgoing lead wires of the circuit breaker are enclosed in an insulating sheath comprising a U-shaped insulating barrier 107 on one side cooperating with a flat insulating barrier 109 on the other side, the barriers being supported by the vertical bars 21. This insulating sheath prevents contact with the lead wires when the tank section is lowered.

The operation of the apparatus is briefly as

follows. To close the circuit breaker the operating handle 57 is rotated in a clockwise direction to the "on" position. This movement of the operating handle is transmitted through the crank 67, link 69 and operating yoke 71 to cause movement of the breaker handle 77 upwardly to the "on" position, effecting closing of the breaker contacts. To open the circuit breaker, the operating handle is moved in a counter-clockwise direction to the "off" position. This movement is transmitted to the breaker handle 77 and causes movement of the breaker handle to the "off" position, as shown in Fig. 3.

When the circuit breaker is tripped open in response to an overload or short circuit condition, the contacts thereof are automatically opened and the breaker handle 77 is moved to a tripped position intermediate the open and closed positions. This movement of the breaker handle 77 to the tripped position causes corresponding movement of the operating handle 57 outside of the housing to a tripped indicated position, thus indicating externally that the circuit breaker has been tripped. To reset the circuit breaker, the operating handle 57 is moved to the "off" position.

The sections 7 and 9 of the housing cannot be unscrewed while the breaker contacts are closed, due to the fact that the locking projection 91 is disposed in the path of the locking lugs 87. In order to unscrew and separate the housing sections 7 and 9 to obtain access to the breaker, it is necessary to move the operating handle 57 to the "off" position to effect opening of the circuit breaker. When the operating handle 57 is in the "off" position, the locking element 91 is disposed in a position clear of the path of the lugs 87, so that the tank 7 may be unscrewed and lowered from the cover section 9.

Upon initial unscrewing movement of the housing sections 7 and 9, the locking lever 95 moves into locking engagement in the recess 101 of the hub 61 to effect locking of the operating handle 57 in the "off" position. The locking lever 95 maintains the operating handle locked in the "off" position as long as the sections are unscrewed or separated. It is possible, however, for an authorized person familiar with the interlock mechanism to move the operating handle to the "on" position by deliberately rotating the locking lever 95 to released position.

After the tank section 7 is replaced and completely screwed to the cover section 9, the internal ring 89 of the tank will have come into contact with and moved the locking lever 95 in a clockwise direction to inoperative position clear of the operating hub 61, thereby permitting movement of the operating handle to the "on" and "off" positions.

If desired, the biasing spring 105 for the locking lever may be omitted and the arm 103 thereof weighted so as to bias the locking lever to its locking position. Also, the breaker 25 and its operating means may be secured to the body section 7 and the locking lugs 87 attached to the cover section 9.

Although the circuit interrupting device has been shown as a multipole circuit breaker, it is to be understood that other types of circuit interrupting devices, such as switches, motor starters, or circuit breakers of any type, may be enclosed by the explosion-proof housing. Also, control mechanism in addition to the circuit interrupting device may be disposed within the explosion-proof housing 5.

If desired, a body of oil or other insulating liquid may be disposed in the tank section 7 to cover the circuit interrupting device and protect the equipment against corrosion. The flame-proof joint between the body section 7 and the cover section 9 is relied upon to confine any explosion that might occur within the housing even with the oil in the enclosure.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details thereof may be made without departing from the spirit of the invention.

I claim as my invention:

1. In combination, a housing comprising two sections having annular portions which are threadedly engaged, locking means disposed adjacent one of said annular portions, movable operating means on one of said sections, said operating means having a part movable thereby engageable with said locking means when said operating means is in one position to prevent unscrewing of said sections, said part being clear of said locking means in a second position of said operating means to permit unscrewing of said sections, and means operable upon unscrewing movement of said sections to effect locking of said operating means in said second position, said last-named means comprising a locking element mounted for movement relative to said sections which element clears said operating means when the sections are screwed together but which is effective to engage and lock said operating means in said second position as a result of unscrewing movement of said sections.

2. In combination, a housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, locking means for said sections disposed inside said housing adjacent the periphery of one of said annular portions, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, said operating means having a part on the inside of said one section movable thereby which in the "on" position of said operating means causes locking of said locking means to prevent unscrewing of said sections, and which in the "off" position of said operating means releases said locking means to permit unscrewing of said sections, and means operable upon unscrewing movement of said sections to effect locking of said operating means in the "off" position, said last-named means comprising a locking element mounted for movement relative to said sections which element normally clears said operating means when said sections are screwed tightly together and which is caused to engage and lock said operating means upon unscrewing of said sections.

3. In combination, a housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, locking means for said sections disposed inside said housing adjacent the periphery of one of said annular portions, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, said operating means having a part on the inside of said one section movable thereby which in the "on" position of said operating means causes locking of said locking means to prevent unscrewing of said sections, and which in the "off" position of said operating means releases said

locking means to permit unscrewing of said sections, and means operable upon unscrewing movement of said sections to effect locking of said operating means in the "off" position after said sections have been unscrewed a predetermined amount and also when said sections are separated from one another.

4. In combination, a housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, locking means disposed inside said housing at the periphery of one of said annular portions, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, a part inside said one section movable by said operating means perpendicular to the screwing movement of said sections, said part in the "on" position of said operating means causing locking of said locking means to prevent unscrewing of said sections, and in the "off" position of said operating means releasing said locking means to permit unscrewing of said sections.

5. In combination, a housing comprising two sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, and means comprising a movable locking element held in released position when said sections are screwed together and biased to move to locking position to lock said operating means in the "off" position upon unscrewing of said sections.

6. In combination, a housing comprising two sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, and means operable upon unscrewing movement of said sections to effect locking of said operating means in the "off" position, said last-named means comprising a movable locking element biased to move into locking engagement with a part of said operating means and held clear of said part when said sections are screwed together a predetermined amount.

7. In combination, a housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, locking means for said sections disposed inside of said sections, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, a part inside of said one section and movable by said operating means which in the "on" position of said operating means will cause locking of said locking means to prevent unscrewing of said sections, and which in the "off" position of said operating means will release said locking means to permit unscrewing of said sections, and means operable upon unscrewing movement of said sections to effect locking of said operating means in the "off" position, said last-named means being effective to lock said operating means in the "off" position after said sections have been unscrewed a predetermined amount and also when said sections are separated.

8. In combination, a housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupter in said housing actuable to "on" and "off" positions, operating means on one of said sections movable to "on" and "off" positions to actuate said interrupter, locking means for said sections operable

to prevent unscrewing of said sections when said operating means is in the "on" position and to permit unscrewing of said sections when said operating means is in the "off" position, and means operable upon unscrewing movement of said sections to effect locking of said interrupter in the "off" position, said last-named means comprising a movable locking element biased to locking position and held in released position only when said sections are screwed together a sufficient amount to make the threaded joint explosion-proof.

9. In combination, a housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupter in said housing, operating means on one of said sections movable to "on" and "off" positions for actuating said interrupter, locking means for said sections effective to prevent complete unscrewing of said sections when said operating means is in the "on" position and to permit complete unscrewing of said sections when said operating means is in the "off" position, and means operable upon unscrewing movement of said sections to effect locking of said operating means in the "off" position, said last-named means comprising a movable locking element biased to move into locking engagement with a part of said operating means and held in released position clear of said part only when said sections are screwed together more than a predetermined amount.

10. In combination, a housing comprising separable sections secured together by a screw threaded connection, a circuit interrupter in said housing, operating means for actuating said interrupter, a locking member movably mounted inside one of said sections movable into engagement with a part of said operating means upon unscrewing movement of said sections to lock said interrupter against closing thereof, and interlocking means for preventing complete unscrewing of said sections when the interrupter is in circuit closed position.

11. In combination, a housing comprising separable sections secured together by a screw threaded connection, a circuit interrupter in said housing, operating means for actuating said interrupter, interlocking means comprising a locking element inside one of said sections which is relatively rotated into engagement with a part of said operating means by the initial unscrewing movement of said sections only when said interrupter is in circuit closed position for preventing further unscrewing of said sections.

12. In combination, a housing comprising a casing and cover secured together by a screw threaded connection, a circuit interrupter in said housing, operating means movable to "on" and "off" positions to actuate said interrupter, a locking element movably mounted inside one of said sections movable into locking engagement with a part of said operating means upon unscrewing movement of said casing or cover to lock said interrupter against closing thereof.

13. An explosion-proof circuit interrupter housing comprising a generally cylindrical body section provided with an opening at one end, a closure section for closing said opening detachably secured to said body section in flame-tight relation therewith by relative turning movement of said sections, a circuit interrupting device in said housing secured to one of said sections only, operating means having a handle portion outside said housing and a portion extending into said housing for actuating the interrupting device,

and interlocking means disposed inside said housing and operable by said operating means to prevent inoperativeness of the flame-tight joint between said sections while the contacts of the interrupting device are closed.

14. An explosion-proof circuit interrupter housing comprising a generally cylindrical body section provided with an opening at one end, a closure section for closing said opening detachably secured to said body section in flame-tight relation therewith by relative turning movement of said sections, a circuit interrupting device in said housing secured to one of said sections only, operating means having a handle portion outside said housing and a portion extending into said housing for actuating the interrupting device, interlocking means disposed inside said housing and operable by said operating means to prevent inoperativeness of the flame-tight joint between said sections while the contacts of the interrupting device are closed, and a locking element in said housing held in an inoperative position when the sections are secured in flame-tight relation and biased to a locking position to effect locking of said operating means in the "off" position when said sections are turned relative to one another a sufficient amount to render the flame-proof joint inoperative and when said sections are separated.

15. An explosion-proof circuit interrupter housing comprising a generally cylindrical body section provided with an opening at one end, a closure portion for closing said opening having a screw-threaded flame-proof connection with said body section, a circuit interrupting device inside said housing and secured to one of said sections only, operating means on said last-mentioned section having a handle outside said housing and a portion extending into said housing for actuating the interrupting device, and interlocking means inside said housing operable by said operating means to prevent unscrewing of said sections while the contacts of the interrupting device are closed.

16. An explosion-proof circuit interrupter housing comprising separable sections having annular portions which are threadedly engaged, locking means for said sections disposed inside said housing adjacent the periphery of one of said sections, operating means on one of said sections movable to the "on" and "off" positions, said operating means having a part on the inside of said section movable thereby which in the "on" position of said operating means causes locking of said locking means to prevent unscrewing of said sections, and which in the "off" position of said operating means releases said locking means to permit unscrewing of said sections, and means operable upon unscrewing movement of said sections to effect locking of said operating means in "off" position after said sections have been unscrewed a predetermined amount and also when said sections are separated from one another.

17. An explosion-proof circuit interrupter housing comprising two separable sections having annular portions which are threadedly engaged, a circuit interrupting device in said housing mounted on one of said sections only, operating means on said one section including a handle outside said housing and a portion inside said housing for actuating said circuit interrupting device, interlocking means disposed inside said housing and operable by said operating means to prevent unscrewing of said sections

while the contacts of said circuit interrupting device are closed, and means operable upon unscrewing of said sections to effect locking of said operating means in "circuit open" position.

18. An explosion-proof circuit interrupter housing comprising at least two separable sections having annular portions which are threadedly engaged, a circuit interrupting device in said housing mounted in its entirety on one of said sections, operating means on said one section having a handle outside said section and a portion projecting inside said housing for actuating said circuit interrupting device, interlocking means operable to prevent unscrewing of said sections while the contacts of said circuit interrupting device are closed, and operable to permit unscrewing of said sections when the contacts of the interrupting device are open, and means comprising a locking element held in an inoperative position when said sections are screwed together and biased to a locking position to effect locking of said operating means in the "circuit open" position when said sections are unscrewed.

19. An explosion-proof circuit interrupter housing comprising a body section and a cover section having annular portions which are threadedly engaged, a circuit interrupting device in said housing mounted on said cover section only, operating means on said cover section having a handle outside said section and a portion inside said section connected to said circuit interrupting device, to actuate said interrupting device, interlocking means operable to prevent unscrewing of said sections while the contacts of the circuit interrupting device are closed, and a second interlocking means operable upon unscrewing of said sections to prevent closing of the contacts of said interrupting device while said sections are unscrewed.

20. A container comprising, in combination, a substantially cylindrical body portion and a top portion which are secured together by a screw-threaded connection, locking means disposed internally at the periphery of said body portion, an operating member mounted on said top portion having an external handle and a part projecting inside of said container which is laterally engageable at any one of a plurality of points with said locking means when said handle is in one position, thereby effecting locking of said body portion and said top portion to prevent unscrewing thereof, and which clears said locking means when said handle is in another position to allow unscrewing of said body portion and said top portion.

21. A container comprising, in combination, a substantially cylindrical body portion and a top portion which are secured together by a screw-threaded connection, a plurality of lugs disposed internally about the periphery of said body portion, a lever mounted on said top portion having an exposed handle portion and a concealed portion, which concealed portion projects inside of said container and into the peripheral path of said lugs when said handle is in one position, thereby effecting locking of said body portion and said top portion to prevent unscrewing thereof, and which concealed portion is moved out of the peripheral path of said lugs when said handle is in another position to allow unscrewing of said body portion and said top portion, a rim inside said body portion, a movable locking element mounted inside said top portion engaged by said rim when said body portion and top portion are screwed together, said element being

biased to engage and lock said lever against movement from said other position only when said body portion is unscrewed from said top portion.

22. A container comprising, in combination, a substantially cylindrical body portion and a top portion which are secured together by a screw-threaded connection, a plurality of lugs disposed internally about the periphery of said body portion, a lever mounted on said top portion having an exposed handle portion and a concealed portion, which concealed portion projects inside of said container and into the peripheral path of said lugs when said handle is in one position, thereby effecting locking of said body portion and said top portion to prevent unscrewing thereof, and which concealed portion is moved out of the peripheral path of said lugs when said handle is in another position to allow unscrewing of said body portion and said top portion, a rim on said body portion, a movable locking element mounted on said top portion and engaged and held in released position by said rim when said body portion and top portion are screwed together, a spring biasing said locking element to cause said locking element to lock said lever against movement from said other position when said body portion is unscrewed from said top portion.

23. A circuit breaker comprising, in combination, a top frame, a tank having a cylindrical portion, which portion is screw-threaded to said top frame, a plurality of lugs disposed internally about the periphery of said cylindrical portion, a circuit make and break mechanism within said tank, an operating member mounted on said top frame for opening and closing said make and break mechanism, an element connected to said operating member but which is contained within said tank and which projects within the peripheral path of said lugs when said operating member is in the "circuit closed" position and which clears said peripheral path when said operating member is in the "circuit open" position, effecting locking of said cylindrical portion and top frame to prevent unscrewing, in the former instance, and unlocking thereof to permit unscrewing in the latter instance.

24. A circuit breaker comprising, in combination, a top frame, a tank having a cylindrical portion, which portion is screw-threaded to said top frame, a plurality of lugs disposed internally about the periphery of said cylindrical portion, a circuit make and break mechanism within said tank, an operating handle which effects opening and closing of said make and break mechanism, which handle is mounted on said top frame, a member integrally connected to said handle but which is contained within said tank and which projects within the peripheral path of said lugs when said handle is in the "circuit closed" position and which clears said peripheral path when said handle is in the "circuit open" position, effecting locking of said cylindrical portion and top frame to prevent unscrewing, in the former instance, and unlocking thereof to permit unscrewing in the latter instance, a rim on said cylindrical tank portion, a movable locking element mounted on said top frame and engaged and held in released position by said rim when said tank and top frame are screwed together, said locking element being biased to lock said operating handle against movement from its "circuit open" position when said tank is unscrewed from said top frame.

25. A circuit breaker comprising, in combina-

tion, a top frame, a tank having a cylindrical portion, which portion is screw-threaded to said top frame, a plurality of lugs disposed internally about the periphery of said cylindrical portion, a circuit make and break mechanism within said tank, an operating handle which effects opening and closing of said make and break mechanism, which handle is mounted on and above said top frame, a member integrally connected to said handle but which is contained within said tank and which projects within the peripheral path of said lugs when said handle is in the "circuit closed" position and which clears said peripheral path when said handle is in the "circuit open" position, effecting locking of said cylindrical portion and top frame to prevent unscrewing, in the former instance, and unlocking thereof to permit unscrewing in the latter instance, a rim inside said cylindrical tank portion, a locking element pivoted inside said top frame and engaged and held in released position by said rim when said tank and top frame are screwed together, a spring biasing said locking element to cause said locking element to lock said operating handle against movement from its "circuit open" position when said tank is unscrewed from said top frame.

26. A circuit breaker comprising, in combination, a top frame, a tank having a cylindrical portion, which portion is screw-threaded to said top frame, a plurality of lugs disposed internally about the periphery of said cylindrical portion, a circuit breaking mechanism within said tank, an operating shaft which projects into said top frame, means connecting said operating shaft to said circuit breaking mechanism such that rotation of said shaft in one direction effects closing of said mechanism whereas rotation in an opposite direction effects opening thereof, a handle rigidly mounted on said shaft externally of said top frame for rotating said shaft, a member rigidly connected to said operating shaft in a manner such that it will project into the peripheral path of said lugs when said handle is in the "closed" position of said circuit breaking mechanism, effecting locking of said cylindrical portion and top frame to prevent unscrewing thereof, and which member will clear said peripheral path when said handle is in the "open" position of said circuit breaking mechanism to permit unscrewing of said cylindrical portion from said top frame.

27. A circuit breaker comprising, in combination, a top frame, a tank having a cylindrical portion, which portion is screw-threaded to said top frame, a plurality of lugs disposed internally about the periphery of said cylindrical portion, a circuit breaking mechanism within said tank, an operating shaft which projects into said top frame, means connecting said operating shaft to said circuit breaking mechanism such that rotation of said shaft in one direction effects closing of said mechanism whereas rotation in an opposite direction effects opening thereof, a handle rigidly mounted on said shaft externally of said top frame for rotating said shaft, a member rigidly connected to said operating shaft in a manner such that it will project into the peripheral path of said lugs when said handle is in the "closed" position of said circuit breaking mechanism, effecting locking of said cylindrical portion and top frame to prevent unscrewing thereof, and which member will clear said peripheral path when said handle is in the "open" position of said circuit breaking mechanism to permit un-

screwing of said cylindrical portion from said top frame, a rim inside said cylindrical tank portion, a locking element pivoted inside said top frame engaged and held in released position by said rim when said tank and top frame are screwed together, said locking element being biased to cause locking of said operating handle against movement from its "circuit open" position when said tank is unscrewed from said top frame.

28. A circuit breaker comprising, in combination, a top frame, a tank having a cylindrical portion, which portion is screw-threaded to said top frame, a plurality of lugs disposed internally about the periphery of said cylindrical portion, a circuit breaking mechanism within said tank, an operating shaft which projects into said top frame, means connecting said operating shaft to said circuit breaking mechanism such that rotation of said shaft in one direction effects closing of said mechanism whereas rotation in an opposite direction effects opening thereof, a handle rigidly mounted on said shaft externally of said top frame for rotating said shaft, a member rigidly connected to said operating shaft in a manner such that it will project into the peripheral path of said lugs when said handle is in the "closed" position of said circuit breaking mechanism, effecting locking of said cylindrical portion and top frame to prevent unscrewing thereof, and which member will clear said peripheral path when said handle is in the "open" position of said circuit breaking mechanism to permit unscrewing of said cylindrical portion from said top frame, a rim inside said cylindrical tank portion, a lever pivoted inside said top frame, a spring which presses one end of said lever into engagement with said rim when said tank and top frame are practically screwed home, the other end of said lever being adapted to lock said operating handle against movement from its "circuit open" position only when said spring-pressed end has dropped as the result of lowering of said rim as the tank is unscrewed from said top frame.

29. In combination, two cylindrical, threadedly engaged members, lug means disposed about the periphery of one of said members, a lever mounted on the other of said members, said lever hav-

ing a portion which, in one position of the lever, will abut said lug means and prevent unscrewing of said members, and in a different position of the lever will clear said lug means so as to permit unscrewing of said members, and means responsive to the unscrewing operation of said members to effect locking of said lever in said different position, said last-named means comprising a second lever which normally clears said first lever but which is effective as the result of unscrewing of said members to lock said first lever in said different position.

30. In combination, two cylindrical, threadedly engaged members, lug means disposed about the periphery of one of said members, a lever mounted on the other of said members, said lever having a portion which, in one position of the lever, will abut said lug means and prevent unscrewing of said members, and in a different position of the lever will clear said lug means so as to permit unscrewing of said members, and means responsive to the unscrewing operation of said members to effect locking of said lever in said different position, said last-named means comprising a second lever, supporting means on one of said members which supporting means normally supports an arm of said second lever thereby keeping the other arm thereof clear of said first lever, said other arm being adapted to lock said first lever as the result of withdrawal of said supporting means, which withdrawal is effected by unscrewing of said members.

31. An explosion proof circuit interrupter housing comprising a supporting body section having an opening at one end, and a cup shaped section having a screw threaded connection to said body section at the open end, said cup shaped section being completely removable from said body section when the sections are unscrewed, operating means on said body section having a handle on the side of said body section and a portion extending inside said section adapted to operate the circuit interrupter, and interlocking means effective to prevent unscrewing of the sections when the handle is in the "on" position and effective to prevent movement of the handle to the "on" position when the sections are unscrewed and separated.

MERRITT A. HYDE, JR.