Nov. 26, 1935. J. KOPELIOWITSCH 2,022,241

CIRCUIT INTERRUPTING DEVICE

Filed May 19, 1933 2 Sheets-Sheet 1

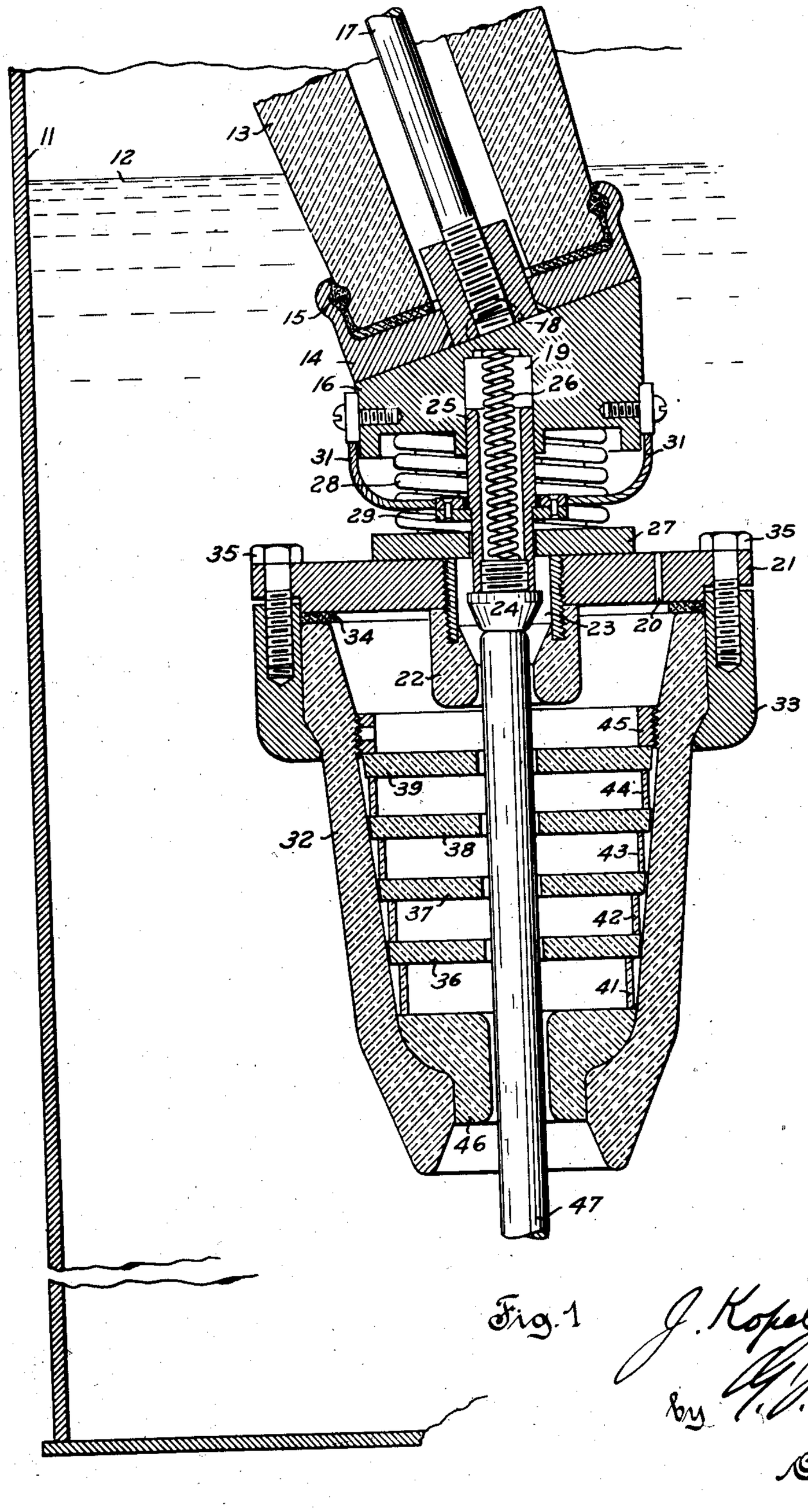

Fig. 1

Inventor
J. Kopeliowitsch
by G. F. Kelly
Attorney

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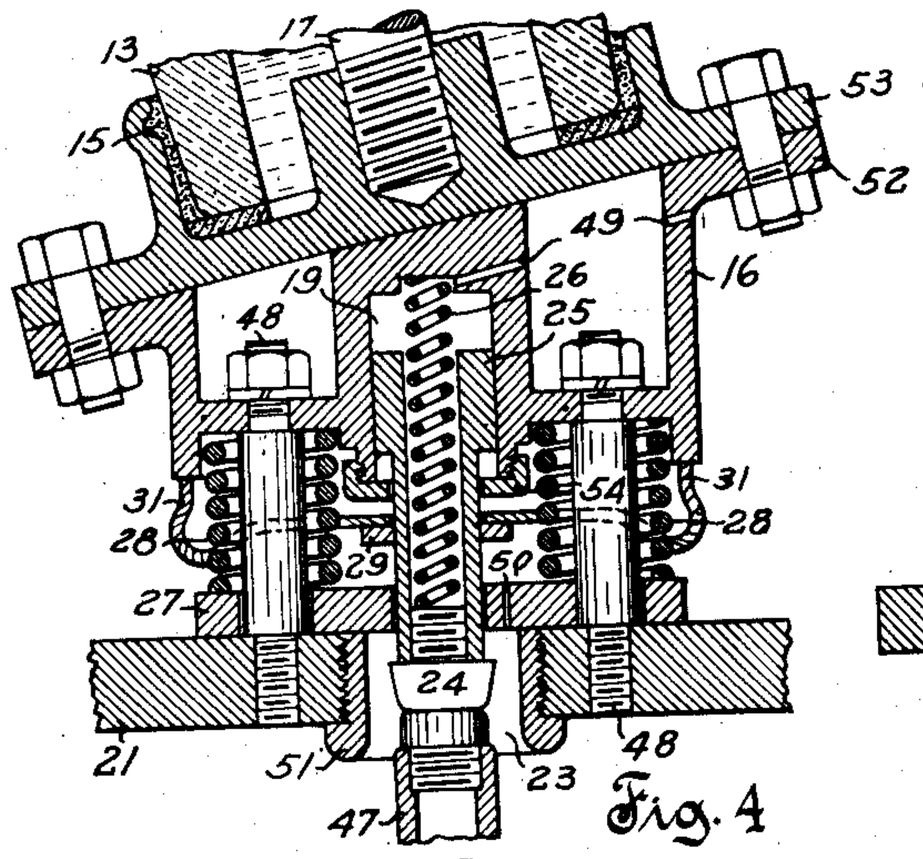

Fig. 4

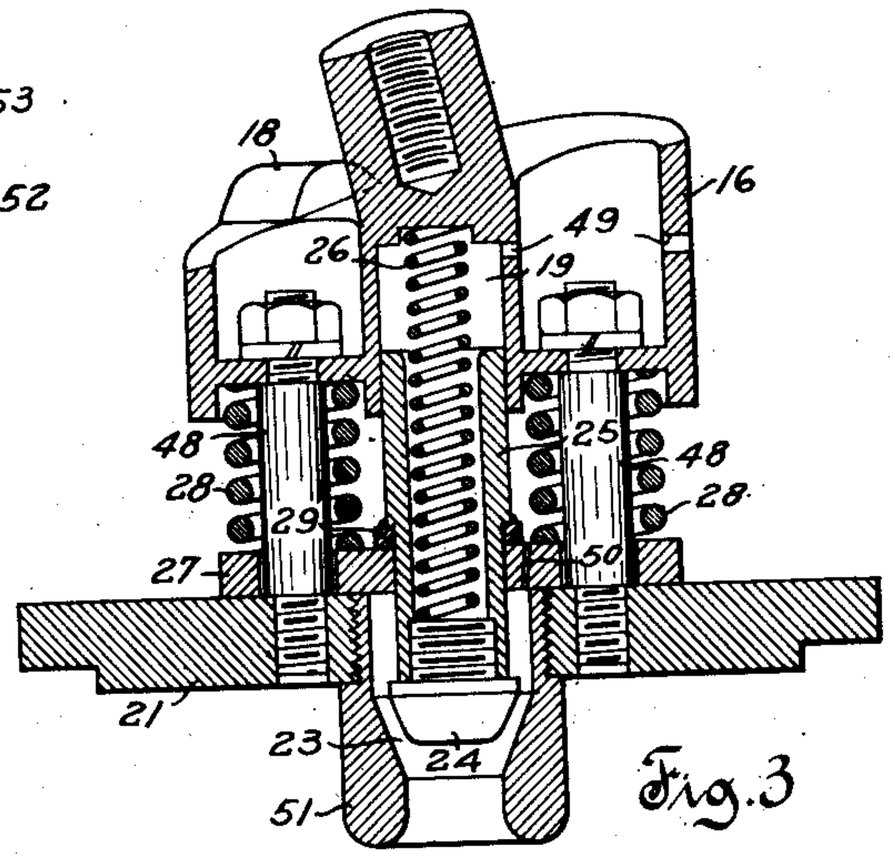

Fig. 3

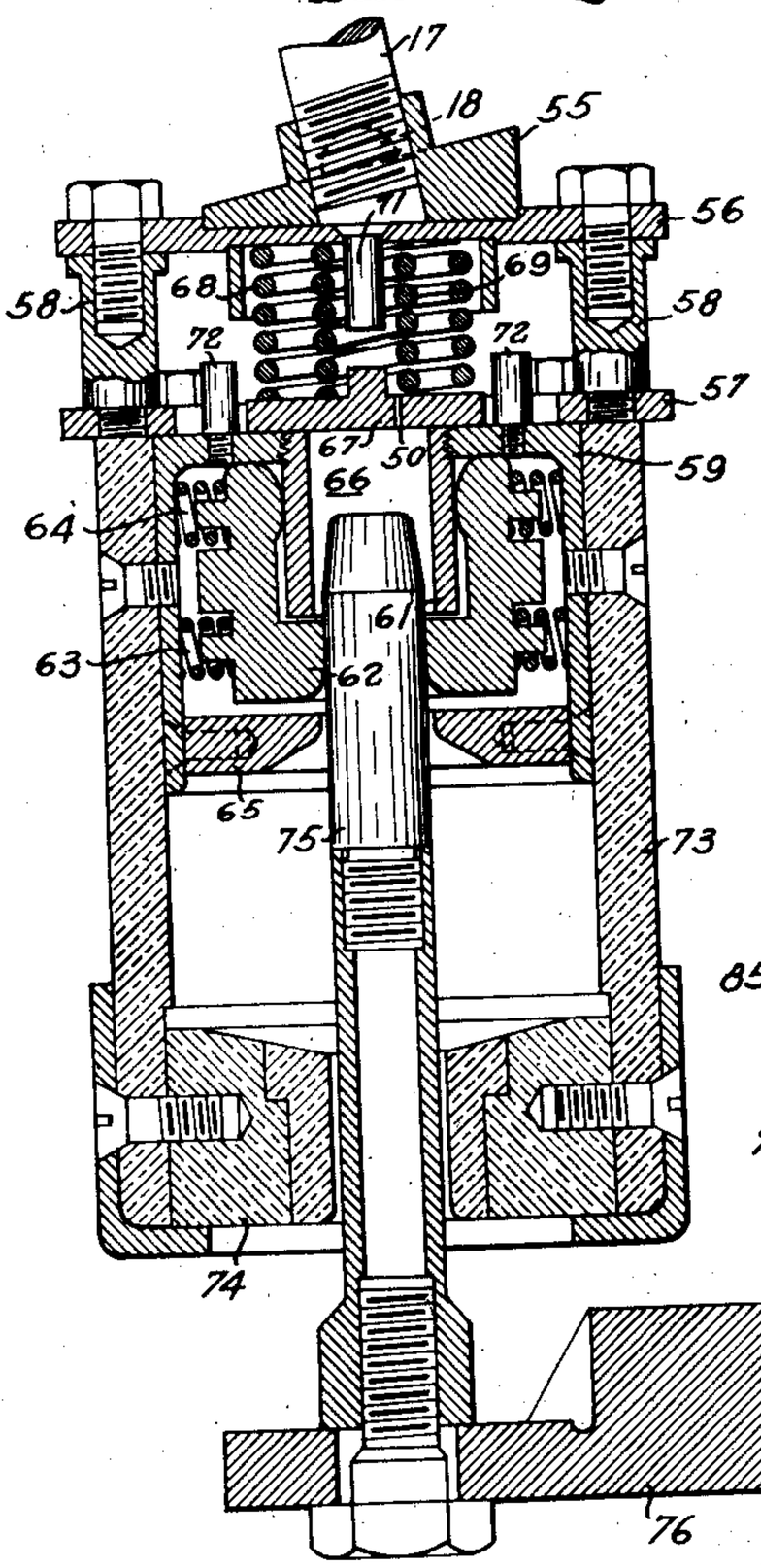

Fig. 5

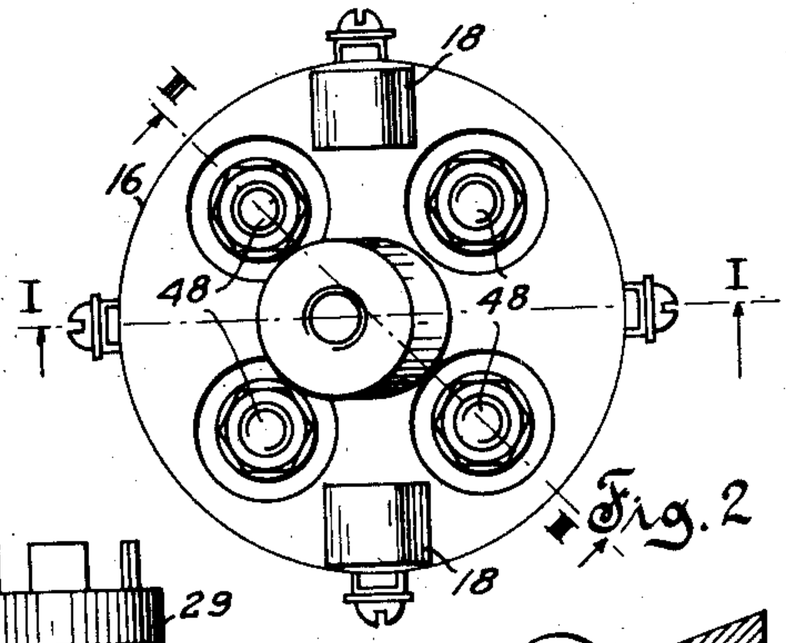

Fig. 2

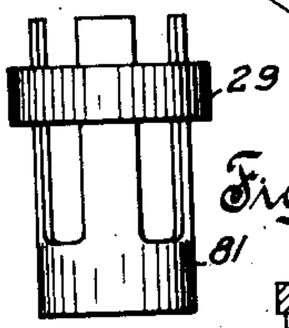

Fig. 7

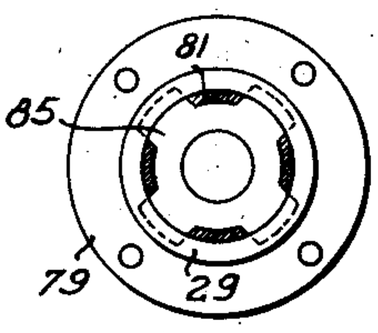

Fig. 8

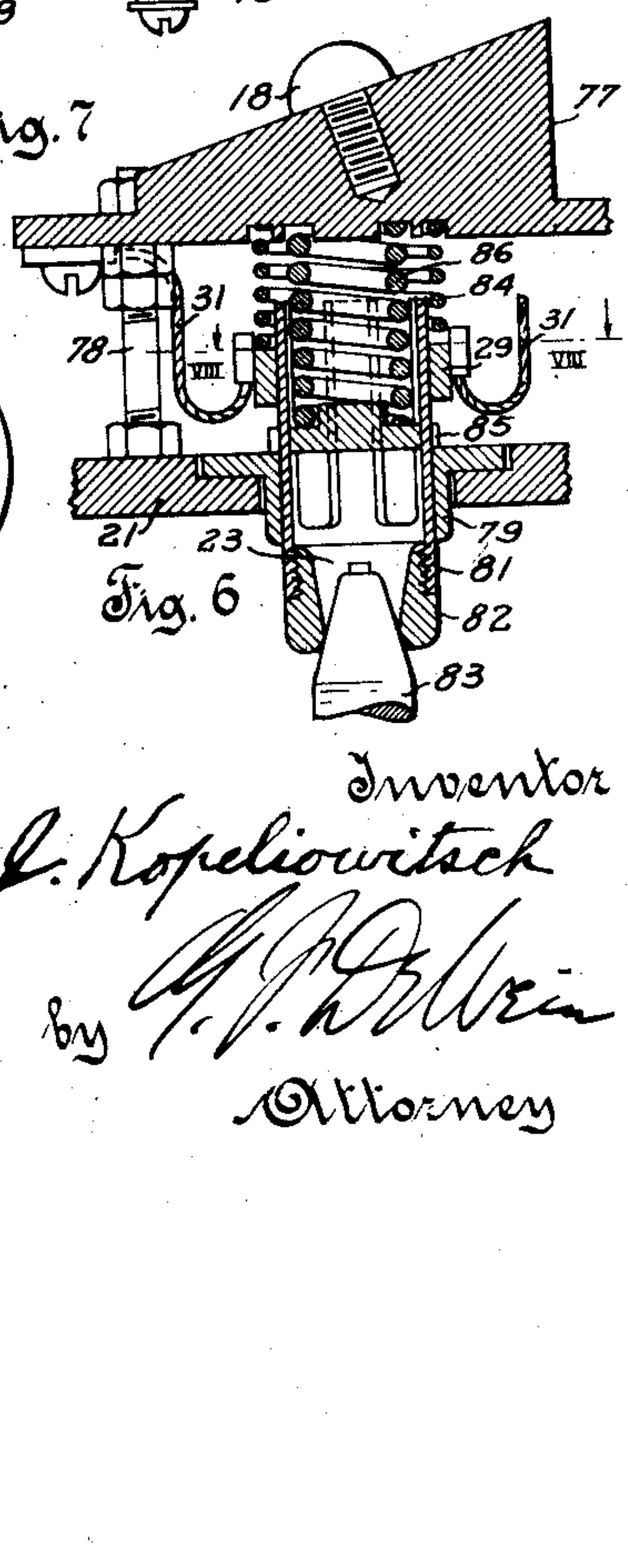

Fig. 6

Inventor
J. Kopeliowitsch
by
Attorney

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2,022,241

UNITED STATES PATENT OFFICE

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CIRCUIT INTERRUPTING DEVICE

Jakob Kopeliowitsch, Baden, Switzerland, assignor to Aktiengesellschaft Brown Boveri & Cie., Baden, Switzerland, a joint-stock company of Switzerland

Application May 19, 1933, Serial No. 671,823
In Germany June 1, 1932

11 Claims. (Cl. 200—150)

This invention relates in general to circuit interrupters having pressure pots provided with means for regulating the discharge of arc extinguishing fluid across the arc in accordance with the pressure generated within the pot, and more particularly to circuit interrupters in which such regulated discharge action commences during the initial circuit interrupting action.

To accelerate the interruption of alternating current arcs in heavy duty circuit breakers the so-called explosion pots as well as other devices have been used. Heretofore these explosion pots generally have been provided with only one nozzle opening through which the movable contact rod may move. As long as the movable contact rod is within the chamber the nozzle opening is so restricted that it is difficult to design the walls of the pressure chamber sufficiently strong to hold the pressures generated by the arc within the pot.

To overcome this difficulty explosion pots containing a certain volume of air have been proposed, the air being compressed by the pressure generating arc, however, such arrangements have not proven to be practical because the turbulence of the liquid within the pot causes most of the air to be ejected from the pot. Pressure chambers having additional fixed openings for the discharge of gas have also been proposed, however, such arrangements are not effective to produce a vigorous blast of arc extinguishing liquid through the arc when the current to be interrupted is of small magnitude. Pressure chambers having valve controlled openings for the discharge of gas have also been proposed, however, in such arrangements the energy of the gas escaping through these openings is wasted inasmuch as it is not caused to flow through the arc.

It is therefore an object of this invention to provide a circuit interrupter with a pressure pot having a pressure controlled discharge opening which utilizes the energy of the discharged fluid to cause a blast of arc extinguishing fluid to flow across the arc before leaving the pressure pot.

Another object of the invention is to provide a circuit interrupter with a pressure pot having a restricted passageway for a movable contact and a valve controlled discharge opening in communication with an annular arcing contact member for causing the fluid discharged through said opening to flow across the points of attachment of the arc on the arcing contact member.

It is an object of the invention to provide a circuit interrupter with a pressure pot having a passageway for the movable contact sufficiently restricted so as to efficiently extinguish an arc at smaller currents and pot pressures and to provide a means controlled by excessive pot pressures caused by greater currents for relieving the excess pressure and utilizing such excess pressure in extinguishing the arc.

A further object of the invention is to provide a circuit interrupter of the pressure pot type with a bushing supported bearing member and a pressure pot supporting member having cooperating sockets and projections for preventing the rotation of the pressure pot relative to the insulating bushing.

A still further object of the invention is to provide improved details of construction of a circuit interrupter of the pressure pot type various novel features of which will be apparent from the description and drawing herein, and will be more particularly pointed out in the claims.

Various illustrative examples of this invention are shown in the accompanying drawings in which:

Fig. 1 is a sectional side view of a circuit breaker of the pressure pot type embodying features of the invention.

Fig. 2 is a top view of the supporting member shown in Fig. 1 detached from the insulating bushing.

Fig. 3 is a sectional side view of the supporting member, valve and contact assembly taken along line III—III of Fig. 2.

Fig. 4 is a sectional side view of a structure similar to Fig. 3 and within the scope of the invention.

Fig. 5 is a sectional side view of another form of pressure pot assembly embodying the invention.

Fig. 6 is a sectional view of a modified form of supporting member, valve, and contact structure embodying the invention.

Fig. 7 is a side view of the contact sleeve shown in Fig. 6.

Fig. 8 is a top sectional view of contact and valve structure shown in Fig. 6 taken along the line VIII—VIII.

Referring now to Fig. 1, circuit breaker tank 11 contains an arc extinguishing fluid 12 and has an insulating bushing 13 projecting thereinto at an angle to the vertical. The lower end of bushing 13 is provided with a bearing plate 14 secured thereto by suitable means such as cement 15. A truncated supporting member 16 is held in engagement with bearing plate 14 by means of an

assembly conductor rod 17 and is prevented from turning relative to plate 14 by means of projections 18 thereon which cooperate with corresponding recesses in bearing plate 14. Supporting member 16 is provided with an axial bore 19 in which the stationary contact structure is mounted as will be described hereinafter.

Ring member 21 is secured to supporting member 16 in spaced relation thereto by a plurality of stud bolts 48 in a manner better shown in Figs. 2 and 3. The opening through ring member 21 is provided with a nozzle member 22 here shown as of insulating material defining an axial discharge passageway 23. Ring member 21 is also provided with a bleeder vent 20 which permits the pressure pot to refill with arc extinguishing fluid by discharging the gas remaining in the top of the pressure pot after a circuit interrupting operation. An upper contact structure is provided with a butt contact 24 detachably secured to contact tube 25 which is slidable in axial bore 19 and is biased downwardly by spring 26. An annular valve plate 27 preferably of metal closely surrounds contact tube 25 and is biased into engagement with plate 21 by means of springs 28 in such a manner that discharge passageway 23 is normally closed. A conducting ring 29 is welded or otherwise secured to contact tube 25 and connected to this ring are a plurality of pigtail conductors 31 which are connected to supporting member 16.

A pot member 32 preferably of insulating material is secured to ring member 21 by suitable clamping means such as clamping ring 33 and bolts 35, noting that a gasket 34 is interposed between the upper edge of the pot member 32 and ring 21. Within the pot member perforate baffle plates 36, 37, 38 and 39 may be secured in spaced relation by means of a plurality of spacers 41, 42, 43 and 44 and retaining ring 45. In some instances it is desirable that the above described baffle plates be omitted. The lower end of pot member 41 is provided with a throat bushing 46 preferably of insulating material adapted to withstand the heat of arc currents. A movable contact rod 47 is adapted to be moved by conventional mechanism (not shown) through the contact openings in throat bushing 46 and the perforations in baffle plates 36 to 39, inclusive, into engagement with butt contact 24, noting that these baffle plates preferably closely surround contact rod 47 so that the movement of arc extinguishing fluid in a downward direction is limited while the contact rod 47 is within the pressure pot.

Figs. 2 and 3 show more in detail the manner in which ring member 21 is secured to supporting member 16 by means of stud bolts 48. It is to be noted that valve plate 27 is provided with a plurality of holes through which stud bolts 48 pass thus serving to guide the movement of valve plate 27. As shown in Fig. 3 the downward movement of contact tube 25 is limited by conducting ring 29 abutting against the upper face of valve plate 27. A vent passageway 49 from axial bore 19 permits fluid within this bore to be displaced when contact 24 is moved upwardly. Valve plate 27 may be provded with a small vent opening 50 to permit gases from passageway 23 to escape from the pot after the circuit breaker has operated.

As to the operation of the circuit breaker disclosed in connection with Figs. 1, 2 and 3, upon downward movement of contact rod 47 an arc will be drawn between butt contact 24 and the top of contact rod 47. This arc will generate pressure noting that while contact rod 47 is moving through the openings in baffle plates 36 to 39, inclusive, and through throat bushing 46 valve control passageway 23 is substantially the only exit for arc extinguishing fluid and gas. When the pressure has built up sufficiently to raise valve plate 27 against compression springs 28 a discharge of arc extinguishing fluid will flow from the interior of pot member 32 through the arc and out of the pot through discharge passageway 23. As the pressure increases or decreases valve plate 27 will raise or lower to control or regulate the effective cross section of the discharge passageway thereby maintaining sufficient pressure within the pressure pot to cause a vigorous blast of arc extinguishing fluid through the arc. If the arc persists or is reignited after passing through a zero current condition the arc extinguishing fluid between the various baffle plates will flow into the arc stream thereby causing an additional arc extinguishing action. If the arc still persists after movable contact member 47 is completely withdrawn from throat bushing 46 a downward blast of arc extinguishing fluid will flow through the throat of bushing 46 and will extinguish the arc in a manner accomplished by the conventional explosion pot construction. It is to be noted that in Fig. 1 the arc will attach to butt contact 24 and will pass through insulating nozzle 22 whereas in a structure such as shown in Fig. 3 the arc will attach to the metal arcing ring 51 after the contacts have separated a predetermined amount and this arc will be acted upon by arc extinguishing fluid flowing into passageway 23.

Fig. 4 shows a structure substantially the same as Fig. 3 except that the truncated supporting member 16 is bolted to a bearing plate 53 by means of a flanged portion 52. This construction is particularly useful where it is desired to use an oil filled insulating bushing such as shown by 13. Downward movement of contact tube 25 is prevented by a retaining ring 54 which cooperates with a shoulder on contact tube 25.

In Fig. 5 truncated supporting member 55 is provided with projections 18 and a threaded hole for assembly rod 17 so that the pressure pot shown in this figure may be secured to and removed from a bearing plate such as shown by 14 in Fig. 1. Supporting member 55 is welded or otherwise secured to a supporting plate 56. A ring member 57 is secured to supporting plate 56 in spaced relation thereto by means of a plurality of circumferentially spaced stud bolts 58. An annular cage member 59 is bolted or otherwise secured to the bottom face of ring member 57 and is provided with an opening in the upper end thereof in which tubular contact member 61 is secured. The inner walls of contact member 61 define a portion of a discharge passageway 66. A plurality of contact segments 62 are circumferentially arranged around tubular contact member 61 and are biased into contacting engagement therewith by means of upper springs 64. The lower portions of contact segments 62 are biased laterally into passageway 66 by means of lower springs 63. An annular ring member 65 preferably of metal is secured to cage member 59 and serves as an arcing contact member, however, it is to be noted that in some instances it is desirable that this member be made of insulating material in which event it serves as a baffle plate. Passageway 66 is normally closed by valve plate 67 by means of springs 68 and 69 noting that

stop member 71 serves to limit the upward movement of valve plate 67. A plurality of guide pins 72 are circumferentially spaced around valve plate 67 and serve to guide the movement of this valve plate.

A shell member 73 as here shown is secured to cage member 59. For low voltages this member may be of metal, however, for high voltages it is preferable that insulating material be used. A throat bushing 74 is secured to shell member 73 by suitable means and is provided with a contact passageway therethrough for the movement of movable contact member 75 with small clearances therebetween. Contact rod 75 is secured to bridging member 76 which is operated by conventional mechanism (not shown).

As to the operation of the apparatus shown in Fig. 5, upon initial separation of contact rod 75 and contact segments 62 an arc will be drawn therebetween which generates pressure. When this pressure exceeds a predetermined value contact plate 67 will raise and permit a blast of arc extinguishing fluid to flow across the arc and through passageway 66 to the exterior of the pressure pot. As the pressure within the pressure pot increases or decreases valve plate 67 will raise or lower to regulate the discharge of fluid from the pot by controlling the effective cross sectional area of the discharge blast. When contact rod 75 is withdrawn from throat member 74 an additional blast downwardly through the contact passageway in throat member 74 is available for extinguishing any arc that may persist. It is to be noted that the above described stationary contact structure affords a novel means for conducting current from a movable member to a stationary member without the use of pigtail connections inasmuch as upper springs 64 bias the upper portion of contact segments 62 into contacting engagement with tubular contact member 61.

In Fig. 6, a truncated supporting member 77 is adapted to be secured to an insulating bushing as shown in Fig. 1. Ring member 21 is secured to supporting member 77 in spaced relation thereto by means of stud bolts 78. The opening in ring member 21 is provided with a bushing 79 through which slotted contact tube 81 (more clearly shown in Fig. 7) is adapted to slide. Contact tube 81 has a conducting ring 29 secured thereto and is biased in a downward direction by contact spring 84. Annular contact 82 is removably secured to contact tube 81 and is adapted to cooperate with movable contact 83 which is provided with an arcing tip. A valve member 85 is provided with a plurality of projections adapted to extend through the slotted portions of contact tube 81 and these projections normally rest upon bushing member 79. Valve spring 86 normally biases valve member 85 to the position shown in which passageway 23 through the tubular contact is closed.

By referring to Figs. 6, 7 and 8 it will be seen that upon occurrence of excessive pressure generated by an arc drawn between contacts 82 and 83 valve member 85 will raise against the pressure of springs 84 and 86 inasmuch as conducting ring 29 rests upon the projecting portions of valve 85 after contact rod 83 has been withdrawn, thereby opening a plurality of vents for the discharge of arc extinguishing fluid through the arc and through passageway 23 and out of the pot through the slots in contact tube 81. It is thus seen that valve 85 is capable of regulating the effective cross sectional area of the fluid discharged from the pressure pot in accordance with the pressure within the pot.

Although but a few embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A circuit interrupter comprising a pressure pot containing an arc extinguishing fluid and having a movable contact passageway through one end thereof, a contact structure mounted adjacent the other end of said pot in axial alinement with said passageway, a contact member of substantially the same cross sectional size as said passageway movable through said passageway to draw a pressure generating arc between said contacts and within said pot, means including a second discharge passageway surrounding said contact structure whereby said arc extinguishing fluid flows across the points of attachment of said arc on said contact structure and to the exterior of said pot, and valve means surrounding a portion of said contact structure and normally closing said discharge passageway, said valve means being operable to open said discharge passageway only when the pressure within said pot exceeds a predetermined magnitude.

2. A circuit interrupter comprising a pressure pot having alined openings in the top and bottom thereof and containing an arc extinguishing fluid therein, an arcing contact structure secured to said pot and having an aperture in alinement with the alined openings in said pot, a spring biased stationary contact structure mounted on said pot adjacent the top opening in said pot, a movable contact member normally extending through the opening in the bottom of said pot and the aperture in said arcing contact structure into engagement with said stationary contact structure and withdrawable to establish a pressure generating arc which attaches to said arcing contact structure, valve means normally closing the opening in the top of said pot and openable upon generation of a predetermined pressure within said pot to permit arc extinguishing fluid to flow across said arc and through the aperture in said arcing contact structure and through the opening in the top of said pot.

3. A circuit interrupter comprising a pressure pot containing an arc extinguishing fluid, said pressure pot having axially alined openings in the top and bottom of said pot, at least one baffle plate within said pot having a hole therein in alinement with said openings, an arcing contact member secured in the top opening in said pot and provided with an axial passageway therethrough, a resiliently mounted contact member arranged in said axial passageway so as to define a discharge vent therebetween, a contact rod normally extending through the bottom opening in said pot into engagement with said resiliently mounted contact member and withdrawable through the opening in the bottom of said pot to draw a pressure generating arc which attaches to said arcing contact member and causes a pressure blast of arc extinguishing fluid to flow across the points of attachment of said arc on said arcing contact and out of said pot through said discharge vent, and valve means surrounding said resiliently mounted contact member for preventing the flow of arc extinguishing fluid

out of said discharge vent until the pressure within said pot exceeds a predetermined value.

4. A circuit interrupter comprising a supporting member, an annular ring member secured to said supporting member in spaced relation thereto, a valve member covering the opening in said annular ring member, spring biasing means arranged between said supporting member and said valve member, a pressure pot member secured to said annular ring member and having a contact passageway therein, a stationary contact structure arranged within said pot member concentrically of said annular ring member, a contact member movable through said contact passageway for connection and disconnection with said stationary contact structure.

5. A circuit interrupter comprising a supporting member, an annular plate member bolted to said supporting member in spaced relation thereto, a valve member covering the opening in said annular plate member, spring biasing means arranged between said supporting member and said valve member, a pressure pot member of insulating material secured to said plate member and having a contact passageway therethrough, a stationary contact assembly secured within said pot member to said plate member, said assembly comprising a plurality of spring biased contact segments annularly arranged to form a passageway communicating with the opening in said annular plate and comprising an annular arcing plate forming a portion of said passageway and a contact rod movable through said contact passageway and through the opening in said annular arcing plate into engagement with said contact segments.

6. A circuit interrupter comprising a supporting member, a ring member secured to said supporting member in spaced relation thereto and having a centrally located opening therethrough, a spring biased contact member slidably mounted in said supporting member and arranged to project into said opening, a valve member surrounding said contact member and normally closing said opening, spring biasing means arranged between said supporting member and said valve member, a pressure pot member secured to said ring member and having a contact passageway therethrough, and a contact rod movable through said contact passageway into engagement with said spring biased contact.

7. A circuit interrupter comprising a supporting member, a ring member secured to said supporting member in spaced relation thereto and having a centrally located opening therethrough, an annular arcing contact member secured to said ring member and having a passageway therethrough, a spring biased contact member slidably mounted in said supporting member and arranged to project into the passageway in said arcing contact member, a valve member surrounding said contact member and normally closing said opening, spring biasing means arranged between said supporting member and said valve member, a pressure pot member secured to said ring member and having a contact passageway therethrough, and a contact rod movable through the contact passageway in said pot member into engagement with said spring biased contact.

8. A circuit interrupter comprising a supporting member, an annular ring member secured to said supporting member in spaced relation thereto, a tubular contact member extending through the opening in said annular ring member and having a plurality of discharge openings therein, a valve member slidable within said tubular contact member, a spring abutting against said supporting member and arranged to normally bias said valve member to a position wherein said discharge openings are closed, a pressure pot member secured to said ring member and having a contact opening therein, and a contact rod movable through said contact opening to draw an arc within said pressure pot member.

9. A circuit interrupter comprising a supporting member, an annular ring member secured to said supporting member in spaced relation thereto, a tubular contact member slidable through the opening in said annular ring member and having a discharge passageway therethrough, a spring for biasing said tubular contact to a limit position, a valve member slidable within said tubular contact member, a spring abutting against said supporting member and arranged to normally bias said valve member to a position wherein said discharge passageway is closed, a pressure pot member secured to said ring member and having a contact opening therein, arc extinguishing liquid within said pressure pot member, and a contact rod movable through said contact opening to draw a pressure generating arc within said pressure pot member.

10. A circuit interrupter comprising a truncated supporting member, a ring member secured to said supporting member in spaced relation thereto and having a centrally located opening therethrough, a spring biased contact member slidably mounted in said supporting member for limited axial movement into the opening in said ring member, flexible current carrying conductors connected between said contact member and said supporting member, an annular valve member surrounding said contact member and normally closing the opening in said ring member, spring biasing means abutting against said supporting member for biasing said valve member to its closed position, a pressure pot member secured to said ring member and having a contact passageway therethrough and a contact rod movable through said contact passageway into engagement with said spring biased contact member.

11. A circuit interrupter comprising a pressure pot having openings in the top and bottom thereof and containing an arc extinguishing fluid therein, an arcing contact structure secured to said pot and having an aperture, a spring biased stationary contact structure mounted on said pot adjacent the top opening in said pot, a movable contact member normally extending through the opening in the bottom of said pot and the aperture in said arcing contact structure into engagement with said stationary contact structure and withdrawable to establish a pressure generating arc which attaches to said arcing contact structure, valve means normally closing the opening in the top of said pot and openable upon generation of a predetermined pressure within said pot to permit arc extinguishing fluid to flow across said arc and through the aperture in said arcing contact structure and through the opening in the top of said pot.

JAKOB KOPELIOWITSCH.