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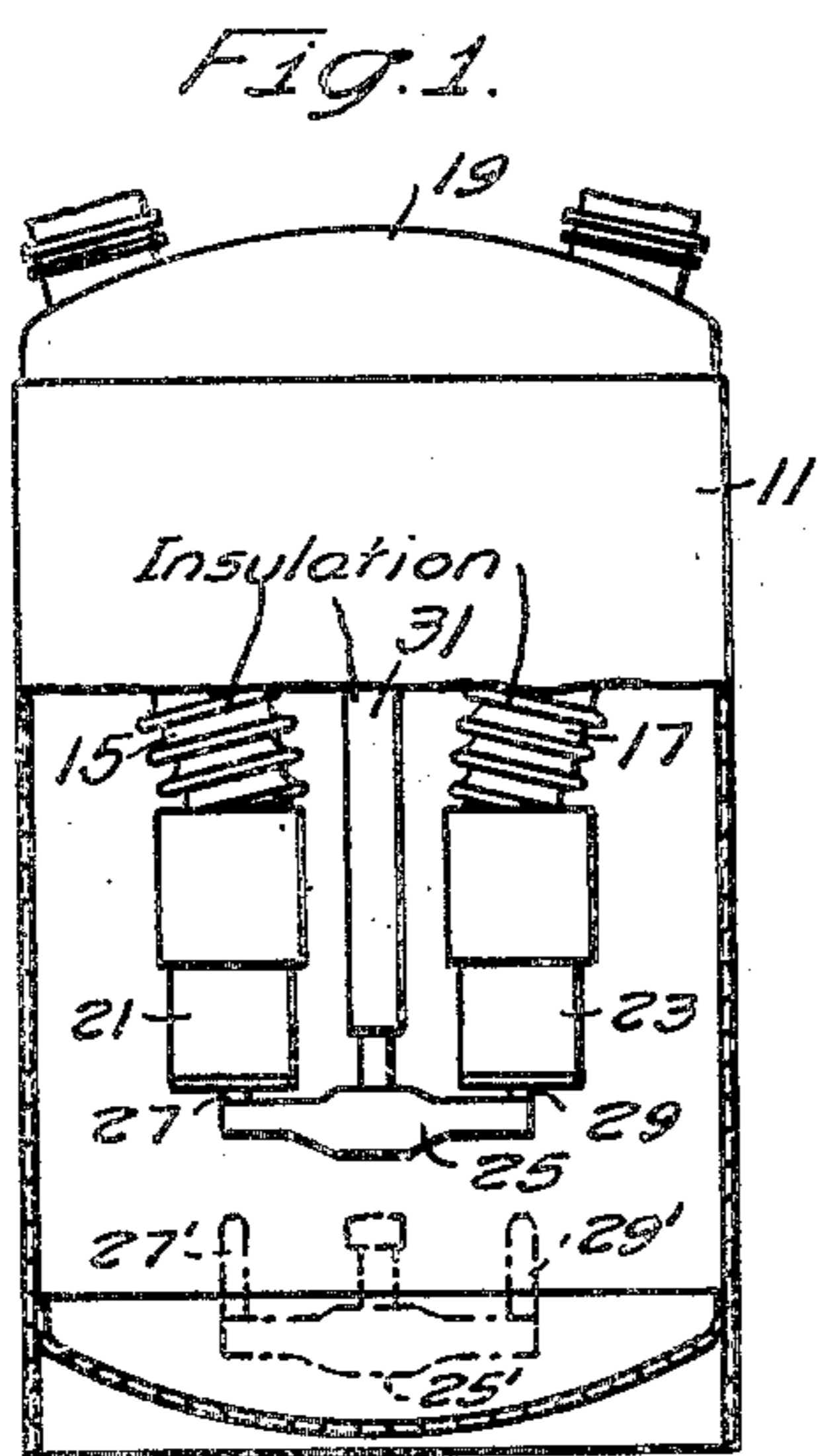
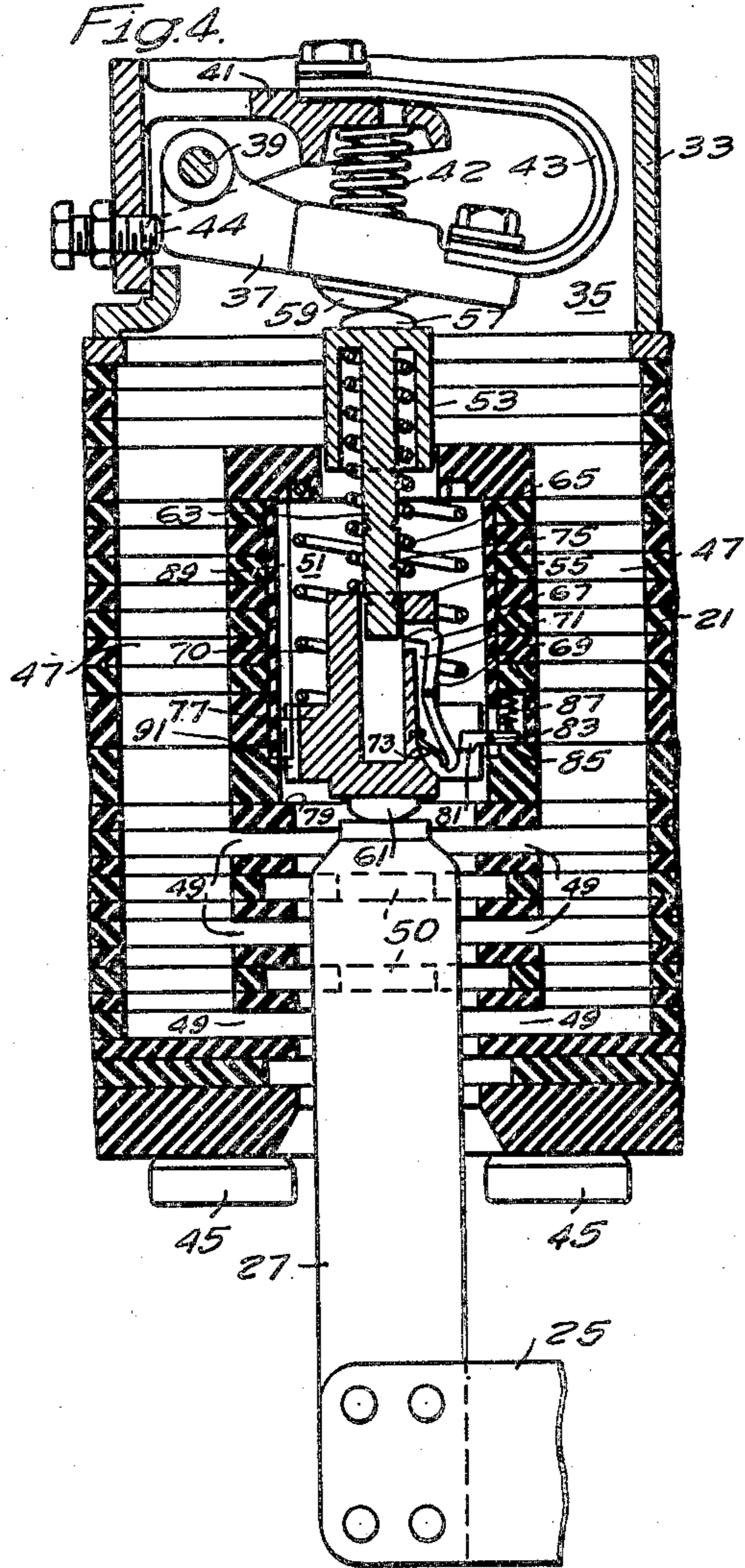
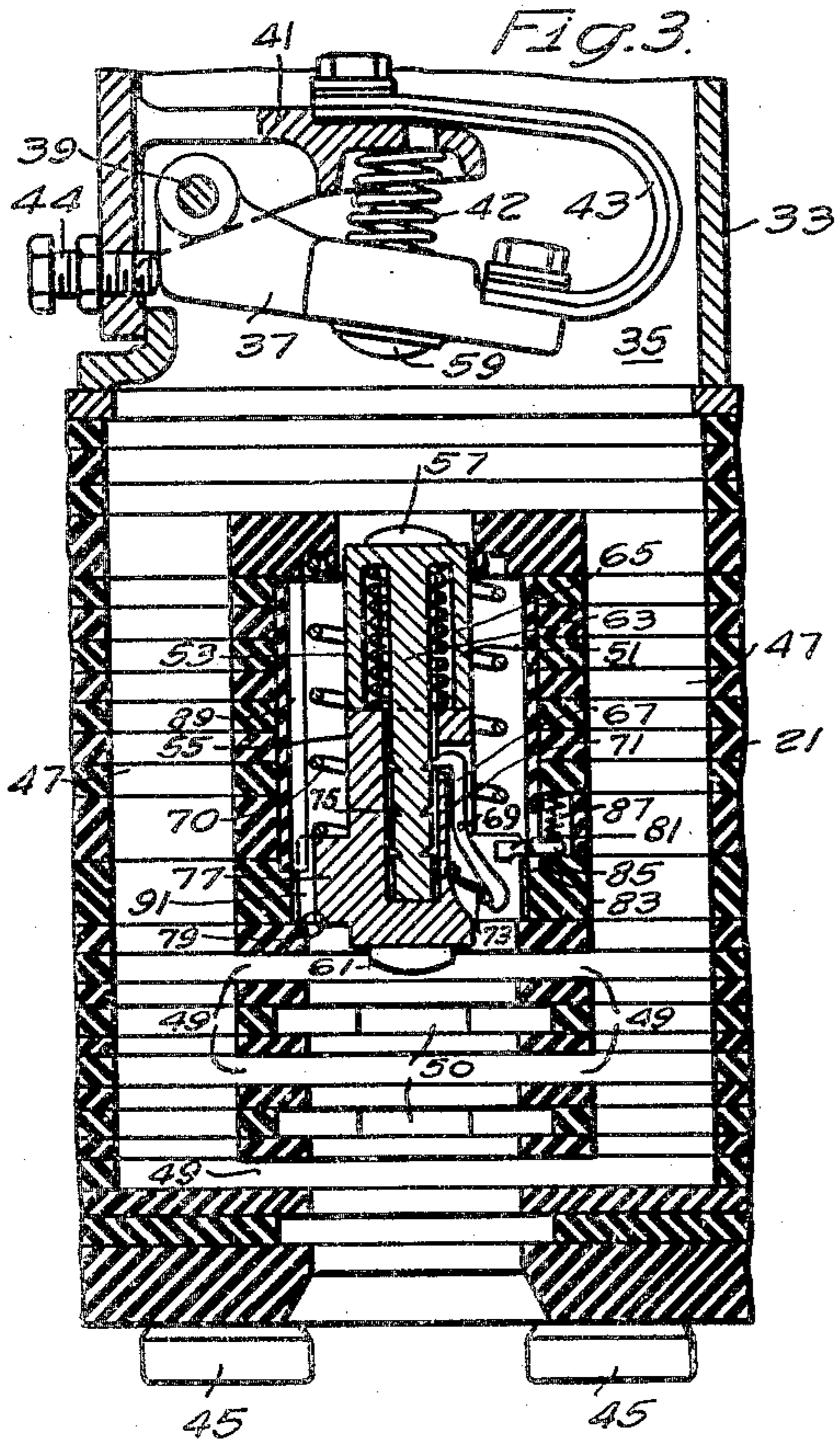
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2,495,192

SNAP ACTION CIRCUIT CLOSER

Filed Nov. 8, 1945

2 Sheets-Sheet 1



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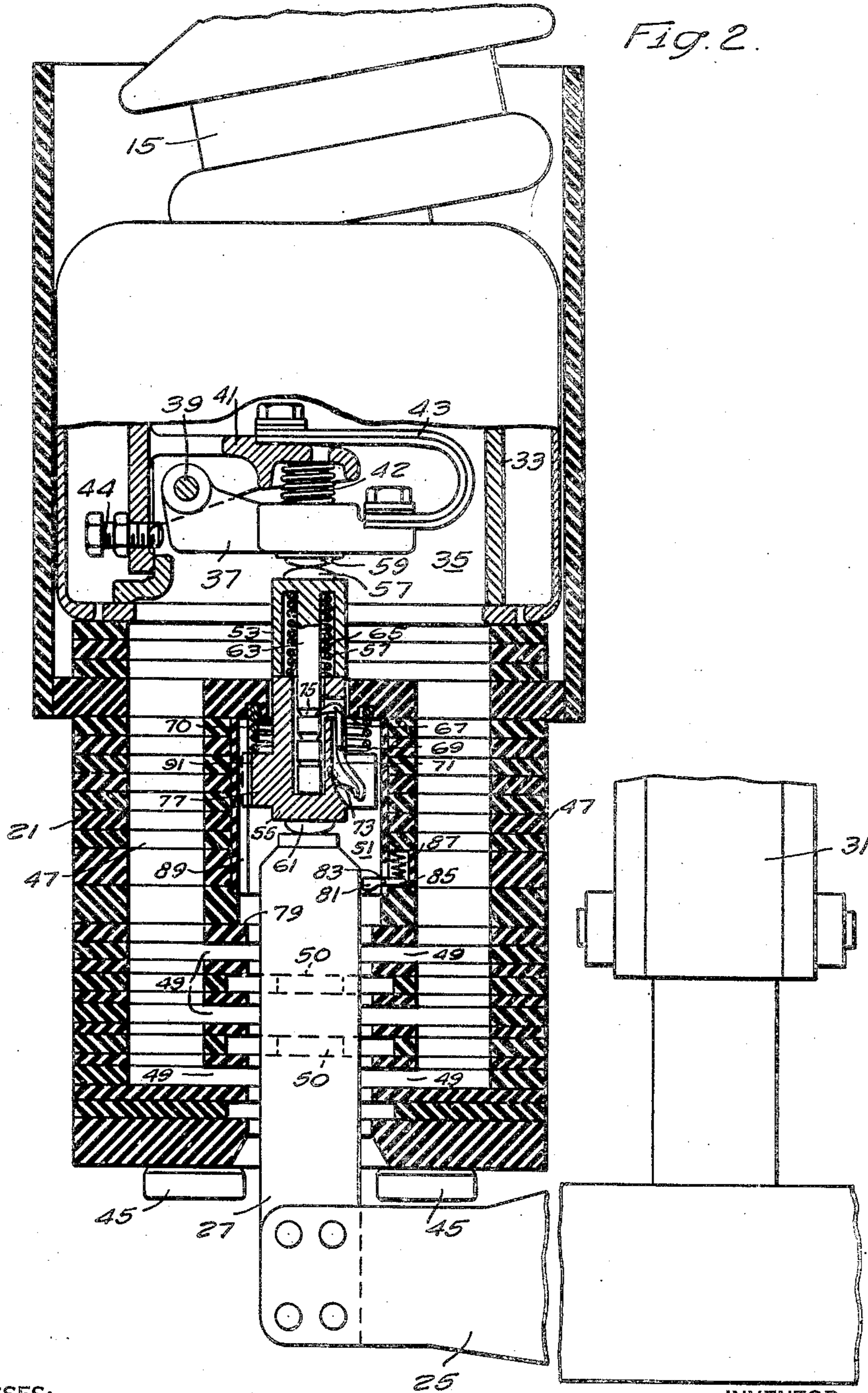
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Fig. 2.



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# UNITED STATES PATENT OFFICE

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## SNAP ACTION CIRCUIT CLOSER

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14 Claims. (Cl. 200—78)

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This invention relates to circuit interrupters, and more particularly, to contact structures therefor.

An object of this invention is to provide a circuit interrupter having stationary contact means, cooperating movable contact means and means for operating the movable contact means to close the contacts, with means for closing the contacts at a rate of speed greater than the speed of the operating means.

Another object of the invention is to provide a circuit interrupter having separable contact and operating mechanism therefor with means for increasing the closing speed of the contacts without increasing the speed of the breaker operating mechanism.

Another object of the invention is to provide a circuit interrupter having stationary and movable contact means with extensible contact means capable of effecting contact closure at a speed greater than the speed of the movable contact means.

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 best be understood from the following detailed description of one embodiment thereof when read in conjunction with the accompanying drawings, in which:

Figure 1 is an elevational view partly in section, of a circuit interrupter embodying the principles of the invention and shown in the closed position;

Fig. 2 is an enlarged elevational view, in vertical section, taken through one of the interrupting units of Fig. 1, the parts being shown in the closed circuit position;

Fig. 3 is a fragmentary sectional view of the interrupter shown in Fig. 2, the parts being shown in the circuit open position;

Fig. 4 is a sectional view similar to Fig. 3 but showing the parts at the instant the intermediate contact was tripped and before the movable contact has completed its closing movement.

Referring to Fig. 1 of the drawings, the circuit interrupter comprises, generally, a tank 11 substantially filled with an arc extinguishing fluid such, for instance, as oil, insulating bushings 15 and 17 mounted in the dome shaped cover 19 of the tank, arc extinguishing units 21 and 23 mounted on the inner ends of the bushings

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15 and 17, respectively, and a bridging contact member 25.

The bridging contact member 25 is provided with contact members 27 and 29 for cooperating with contact means within the arc extinguishing units 21 and 23, respectively. The bridging contact member 25 is operated by means of an insulating operating rod 31 which is actuated by suitable operating mechanism of known construction, none being shown.

The construction of arc extinguishing units and the contact structure of the two poles of the breaker are the same for which reason the mechanism of only one pole is illustrated in detail and will be described herein.

Referring to Fig. 2, a hollow casting 33, securely mounted on the inner end of the insulating bushing 15, forms a pressure chamber 35 in which is mounted a pressure contact member 37. The contact member 37 is pivotally mounted on a pin 39 supported in an integral projection 41 of the casting 33. The contact member 37 is biased in contact closing direction by a spring 42 and is electrically connected by means of a flexible shunt connection 43 to the projection 41. A stop 44 is provided to limit clockwise movement of the contact member 37.

The arc extinguishing unit 21 comprises generally a plurality of suitably shaped insulating plates held together by tie rods 45. Certain features of the arc extinguishing unit are described and claimed in patent application Serial No. 465,244, filed November 11, 1942, by Leon R. Ludwig, Benjamin P. Baker and Winthrop M. Leeds, now Patent No. 2,406,469, issued August 27, 1946, and assigned to the assignee of the instant application.

The insulating plates of the arc extinguishing unit form vertical flow passages indicated generally at 47, which at their upper ends communicate with the pressure chamber 35 and their lower ends with a plurality of arc extinguishing passages 49. Pressure is generated in the upper chamber during an opening operation causing oil to flow from the pressure chamber 35 down through the passages 47, through the arc extinguishing passages 49 and forces ionized gases out through vents 50. For a complete understanding of the principles of the arc extinguishing unit reference may be had to the aforementioned patent.

Cooperating with the pressure contact 37 is an extensible, telescopic intermediate contact designated generally by the reference numeral 51. This intermediate contact, in the closed position

of the interrupter, also cooperates with the movable contact 27 to complete the electrical circuit through the interrupter. The intermediate contact 51 comprises an upper member 53 and a lower member 55. The upper contact member 53 carries a contact 57 which cooperates with a contact 59 on the pressure contact member 37. The lower contact member of the intermediate contact is provided with a contact 61 for cooperating with the movable contact 27.

The two contact members 53 and 55 are generally cylindrical and the upper member 53 has a guide rod 63 formed integral with or otherwise suitably secured to the center portion thereof, which rod telescopes into the lower member 55. The two parts 53 and 55 of the intermediate contact 51 are biased apart by means of a strong compression spring 65 coiled about the guide rod 63, but are normally releasably latched together against the force of the spring 65 by means of a latch 67 pivoted on a pin 69 supported in a recess 71 formed in the side of the lower member 55. The latch 67 is biased by a spring 73 into latching engagement with an annular groove or notch 75 in the guide rod 63.

In the closed position of the interrupter, the spring 65 is compressed and the two parts 53 and 55 abut against each other as shown in Figure 2, being restrained in this position by the latch 67.

When the operating rod 31 (Fig. 1) is released and moved downwardly by accelerating springs (not shown), the bridging contact member 25 is moved to the position shown by dotted lines at 25' in Figure 1. During this downward movement of the bridging contact member, the movable contacts 27, 29 are withdrawn from the arc extinguishing units 21, 23 to cause separation of the contacts. The contacts 57, 59 are the first to separate and the intermediate contact 51, biased by a spring 70, moves downwardly with the movable contact 27 until it is arrested by a flange 77 on the lower part 55 of the intermediate contact engaging an annular shoulder 79 on the arc extinguishing unit. The contacts 27-61 now separate and the movable contact continues its downward movement to the full open position indicated at 27' in Figure 1. The parts of the contact structure are now in the positions in which they appear in Figure 3.

During the downward movement of the intermediate contact 51, the tail of the latch 67 wiped by a latch operating pawl 81 pivoted on a pin 83 and biased in a clockwise direction against a stop 85 by means of a relatively light spring 87. It will be observed that the pawl 81 is free to rotate in a counterclockwise direction from the position shown against the force of the light biasing spring but its clockwise movement is limited by the stop 85. Consequently, when the tail of the latch 67 engages the pawl 81 during its downward travel, the pawl is rotated counterclockwise thus permitting the latch to pass without unlatching the intermediate contact. The intermediate contact 51, therefore, arrives at the position shown in Figure 3 in its contracted and latched condition.

One of the important features of the invention is to close the contacts and re-establish the circuit at a higher rate of speed than is provided by the fixed rate of movement of the operating mechanism and the movable contact member. The purpose of such high speed contact closing operation is to prevent prestriking of the arc before the contacts touch. This new and important

result is obtained by the provision of the extensible intermediate contact 51 which is released during the closing movement and permitted to expand or elongate at a high rate of speed and close the contacts much quicker than they would be closed by the regular operation of the movable contact structure.

When the operating mechanism (not shown) is energized and caused to move the operating rod upwardly to close the contacts, the moving contact 27 is drawn upwardly into the arc extinguishing unit and engages the intermediate contact 51. Continuing its upward travel the movable contact 27 carries the intermediate contact therewith and, during the early part of this movement, the tail of the latch 67 engages the pawl 81 and, since the pawl is prevented from rotating clockwise from its normal position, it cams the latch 67 in a clockwise direction to disengage the latch from the notch 75 in the guide rod 63 thus freeing the upper part 53 of the contact 51 from the lower part 55 thereof. The spring 65 immediately expands and snaps the contact member 53 upwardly at high speed to close the contacts 57-59. The parts are shown in Figure 4 at the instant, after the latch 67 was actuated and the part 53 of the contact 51 has been moved by the spring 65 to close the contacts 57-59.

Continuing upward or closing movement of the movable contact, following operation of the expansible contact 51, compresses the spring 65 and causes the two parts 53 and 55 to telescope together in which position they are retained by the latch 67 which is actuated to latching position by the spring 73. The last part of the closing movement compresses the spring 42 to provide contact pressure.

The member 55 of the intermediate contact is guided in its operation by means of a vertically disposed guide bar 89 of insulating material which is engaged by a slot 91 in the flange 77 of the member 55. In this manner the member 55 is prevented from rotating and the latch 67 is maintained in alignment with the pawl 81.

By the instant invention, there is provided an expansible telescopic contact which is released during the closing operation of the circuit interrupter to effect high speed closure of the circuit at a speed greater than the speed of the operating member and the moving contact and which is reset and relatched automatically during the latter portion of the closing stroke.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made therein without departing from some of the essential features of the invention.

I claim as my invention:

1. In a circuit interrupter, relatively movable contact means comprising a pressure contact, a movable contact operable to effect closure of said contact means, extensible contact means disposed for longitudinal movement between said pressure contact and said movable contact, means for operating said movable contact to close said contact means, and means releasable during closing movement of said movable contact for effecting high speed elongation of said extensible contact means to effect closure of said contact means at a speed independent of the closing speed of the movable contact.

2. In a circuit interrupter, relatively movable contact means comprising a pressure contact, a

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movable contact operable to effect closure of said contact means, extensible contact means longitudinally movable between said pressure contact and said movable contact, means for moving said movable contact to close said contact means, and spring means associated with said extensible contact and releasable during closing movement of said movable contact to effect high speed elongation of said extensible contact means to effect closure of said contact means at a speed greater than the closing speed of the movable contact.

3. In a circuit interrupter, relatively movable contact means comprising a first contact, a movable contact and telescopic contact means disposed between said first contact and said movable contact, spring means for causing high speed elongation of said telescopic contact means, means normally preventing elongation of said telescopic contact means, operating mechanism for moving said movable contact to effect closing of said contact means, and means operable during a contact closing operation to actuate said preventing means to permit said spring to elongate said telescopic contact means.

4. In a circuit interrupter, relatively movable contact means comprising a first contact, a movable contact and a telescopic contact means disposed between said first contact and said movable contact, spring means for causing high speed elongation of said telescopic contact means, means normally preventing elongation of said telescopic contact means, operating mechanism for moving said movable contact to effect closing of said contact means, and means operable during a contact closing operation to actuate said preventing means to permit said spring to elongate said telescopic contact means, said movable contact near the end of the closing operation effecting resetting and relatching of said telescopic contact means.

5. In a circuit interrupter, separable contact means, a first contact and a movable contact, means for operating said movable contact to close said contact means, extensible contact means disposed between said first contact and said movable contact and operable by said movable contact, said extensible contact means comprising a pair of telescopic members, spring means biasing said members apart to effect elongation of said extensible contact means, latch means for releasably holding said members together against the force of said spring, and means operable during a closing operation for actuating said latch to permit said spring to separate said members to thereby effect high-speed elongation of said extensible contact means.

6. In a circuit interrupter, relatively movable contact means comprising a pressure contact, a movable contact and an extensible contact means disposed between said pressure contact and said movable contact, operating mechanism for moving said contact means to open and closed positions, said extensible contact means comprising a pair of telescopic contact members biased apart, means for causing unitary movement of said pair of members in opening direction, said means being operable during a closing operation to cause high speed separation of said pair of members to effect closing of said contact means before said contact means would be closed by said movable contact.

7. In a circuit interrupter, separable contact means and operating mechanism for causing opening and closing of said contact means, said

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contact means comprising a first contact member, a reciprocally movable contact member and extensible telescopic contact means for bridging the gap between said first contact and said movable contact, means for causing said telescopic contact to move in opening direction in contracted condition, said means being operable during a closing operation to effect high speed elongation of said telescopic contact means to quickly bridge the gap between said first contact and said movable contact.

8. In a circuit interrupter, a pressure contact, a movable contact, intermediate contact means disposed between said pressure contact and said movable contact and operable by said movable contact to close the circuit, operating mechanism for said movable contact, said intermediate contact means comprising a pair of telescopic contact members, means biasing said contact members apart, means on one of said contact members for releasably holding said contact members together, means for engaging and actuating said holding means during a closing operation to permit said biasing means to move the other contact member into circuit closing engagement with said pressure contact while said one contact member remains in circuit closing engagement with said movable contact.

9. In a circuit interrupter, relatively movable contact means comprising a first contact, a movable contact and intermediate extensible contact means for bridging the gap between said first contact and said movable contact, operating mechanism for said contact means, spring means for causing elongation of said extensible contact means to effect bridging of the gap between said first contact and said movable contact at a speed greater than the speed of the operating mechanism.

10. In a circuit interrupter, comprising relatively movable contact means and operating mechanism therefor, said relatively movable contact means comprising a first contact, a movable contact operable by said operating mechanism to open and close said contact means and intermediate contact means, said intermediate contact means being disposed between said first contact and said movable contact and comprising a pair of relatively movable members each having a contact thereon, a compression spring disposed between said relatively movable members for biasing said members apart to effect elongation of said intermediate contact means, latch means on one of said relatively movable members engageable with the other relatively movable member to releasably couple said members together, and means engageable by said latch during a closing operation for actuating said latch to release said other relatively movable member and permit said spring to effect elongation of said intermediate contact means and closing of said contact means at a speed greater than the speed of the movable contact.

11. In a circuit interrupter, comprising relatively movable contact means and operating mechanism therefor, said relatively movable contact means comprising a first contact, a movable contact operable by said operating mechanism to open and close the circuit and an extensible intermediate contact means, said extensible contact means being disposed in the path of movement of said movable contact between said first contact and said movable contact and comprising a pair of contact members each having a contact thereon, a compression spring disposed

between said contact members for biasing said members apart to effect elongation of said intermediate contact means, latch means on one of said contact members engageable with the other contact member to releasably couple said contact member together, and means engageable by said latch during a closing operation for actuating said latch to release said other contact member and permit said spring to effect high-speed elongation of said intermediate contact means and closing of said contact means at a speed greater than the speed of the movable contact, and said movable contact near the end of said closing operation effecting compression of said spring and recoupling of said contact members.

12. In a circuit interrupter, pressure contact means, cooperating movable contact means including an extensible intermediate contact structure, operating mechanism for moving said movable contact means to close said contacts, and spring means operable during a closing movement of said movable contact means for effecting high-speed elongation of said intermediate contact structure to thereby effect closure of said contact means at a speed independent of the speed of the operating mechanism.

13. In a circuit interrupter, a first contact means, a cooperating movable contact means, intermediate contact means comprising an extensible contact structure disposed between said first contact means and said movable contact means, operating mechanism for effecting closure of said contact means, and spring means operable during a closing operation of said movable contact for causing high-speed elongation of said extensible

contact structure to effect closure of said contact means at a speed greater than the speed of the movable contact means.

14. In a circuit interrupter, relatively movable contact means comprising a first contact, a movable contact and an intermediate telescopic contact structure disposed to bridge the gap between said first contact and said movable contact, spring means for causing high-speed elongation of said telescopic contact structure, means normally preventing elongation of said telescopic contact structure, operating means for moving said movable contact and said telescopic contact structure to effect closing of said contact means, and means operable during a contact closing operation to actuate said preventing means and permit said spring to quickly elongate said intermediate telescopic contact structure to effect closure of said contact means at a speed greater than the closing speed of said movable contact.

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