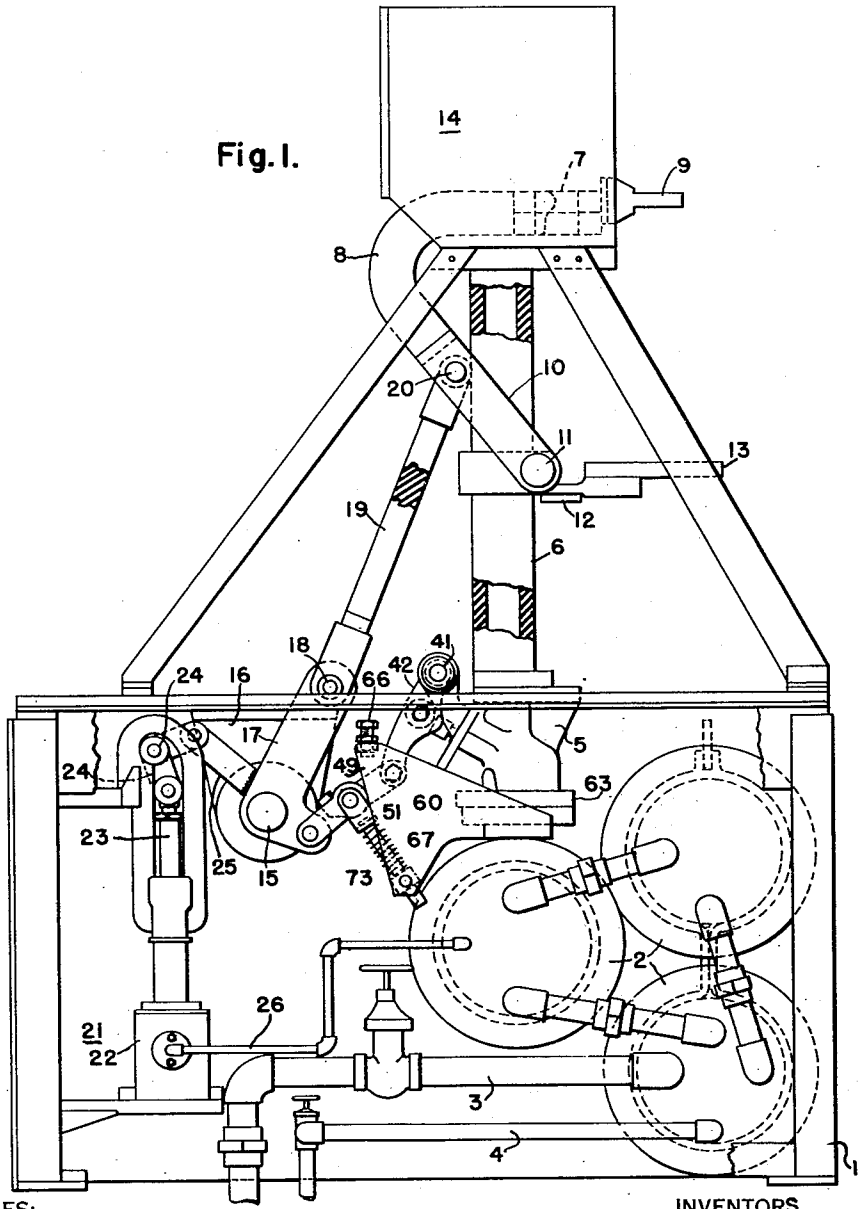
Aug. 24, 1948. B. P. BAKER ET AL 2,447,627

COMPRESSED GAS CIRCUIT INTERRUPTER

Filed Jan. 12, 1946 3 Sheets-Sheet 1

Fig. 1.



WITNESSES:

W. R. Crocket

INVENTORS
Benjamin P. Baker and
Raymond H. Leitzel.
BY
Ralph W. Swengle
ATTORNEY

Aug. 24, 1948. B. P. BAKER ET AL 2,447,627

COMPRESSED GAS CIRCUIT INTERRUPTER

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Fig. 2.

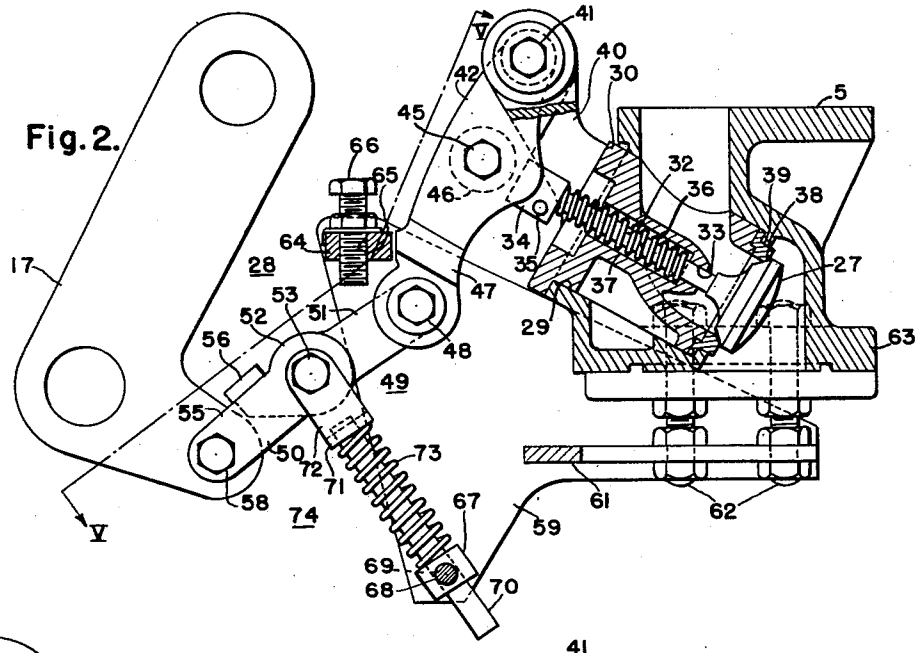
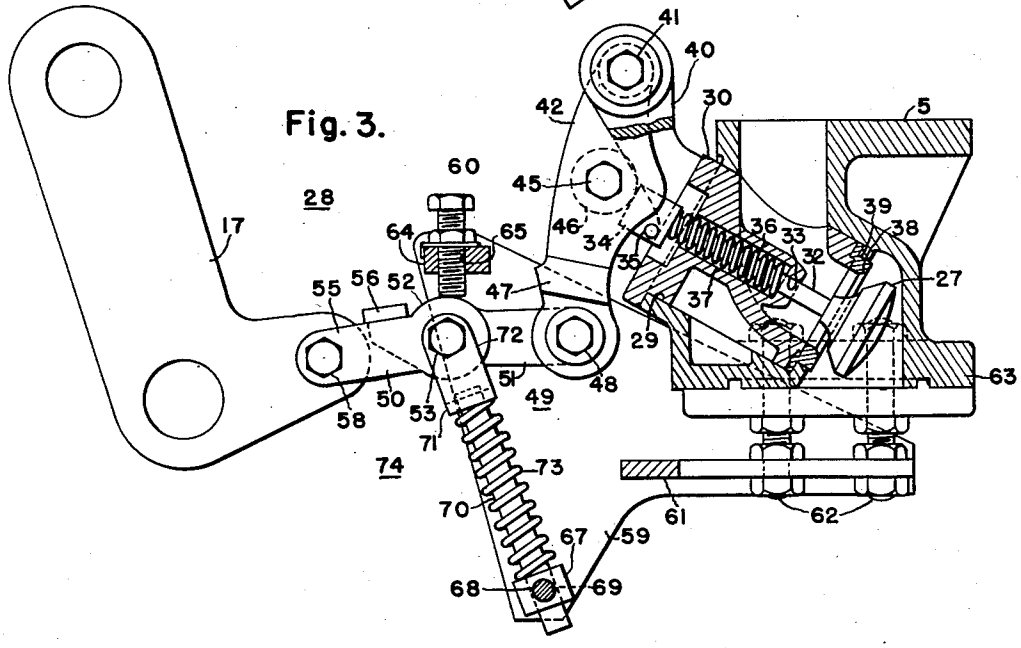


Fig. 3.



WITNESSES:
Fred C. McKenna
W. R. Crouse

INVENTORS
Benjamin P. Baker and
Raymond H. Leitzel.
BY
Ralph H. Swaugh
ATTORNEY

Aug. 24, 1948. B. P. BAKER ET AL 2,447,627

COMPRESSED GAS CIRCUIT INTERRUPTER

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Fig.4.

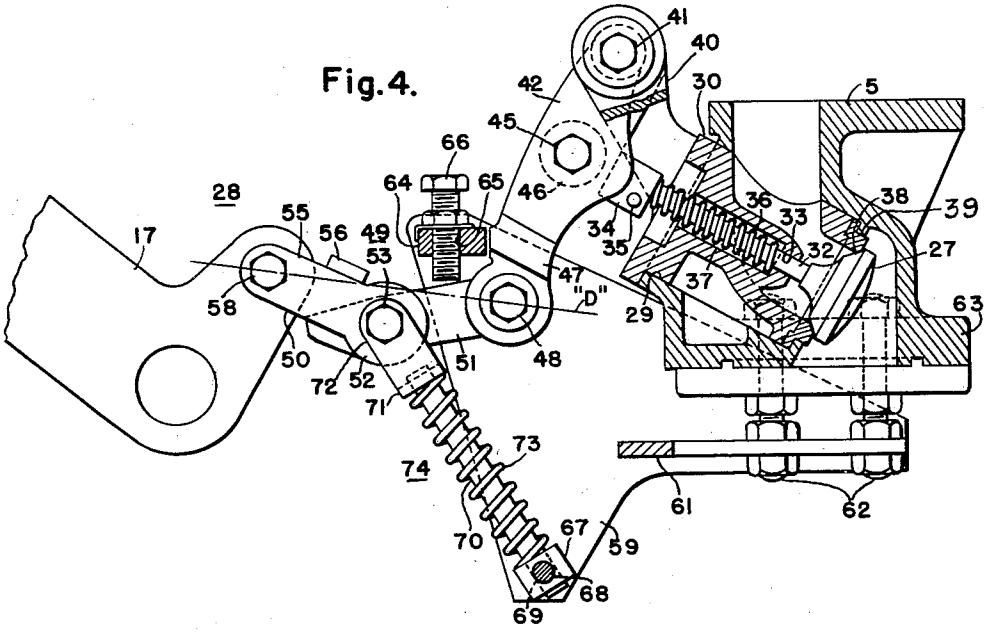
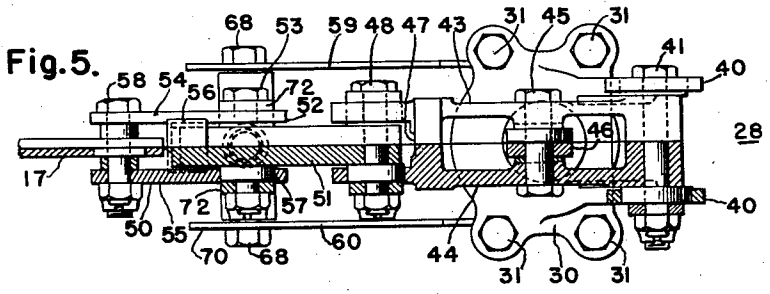


Fig.5.



WITNESSES:
Fred C. Miller
W. R. Crocet

INVENTORS
Benjamin P. Baker and
Raymond H. Leitzel.
BY
Ralph W. Swingle
ATTORNEY

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UNITED STATES PATENT OFFICE

2,447,627

COMPRESSED GAS CIRCUIT INTERRUPTER

Benjamin P. Baker, Turtle Creek, and Raymond H. Leitzel, Wilkinsburg, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application January 12, 1946, Serial No. 640,826

9 Claims. (Cl. 200—148)

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This invention relates to circuit interrupters in general, and, in particular, to gas blast type circuit interrupters.

More specifically, it is an object of our invention to provide an improved operating mechanism for actuating the gas blast valve of a gas blast type of circuit interrupter.

Another object is to provide an improved valve mechanism which opens the blast valve only during a portion of the opening operation, and which maintains the blast valve closed during the entire closing operation to conserve the supply of compressed gas.

Another object is to provide an improved blast valve mechanism for a compressed gas circuit interrupter which is suitable for long operational life.

Another object is to provide an improved blast valve mechanism which consists of few parts which are readily adjustable and which upon operation insure positive operation of the blast valve.

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

Figure 1 is a side elevational view, partly in section, of a gas blast type of circuit interrupter embodying our invention and shown in the closed circuit position;

Fig. 2 is an enlarged fragmentary side elevational view, partly in section, of the improved blast valve mechanism of our invention, the parts being shown in the closed circuit position of the interrupter;

Fig. 3 is a view similar to Fig. 2 but illustrating the disposition of the parts during an intermediate point in the opening operation at which time the toggle means is just about to be collapsed by an engagement with the stop means to cause thereby closure of the blast valve;

Fig. 4 is a view similar to Fig. 3 but showing the disposition of the parts in the fully open circuit position of the interrupter; and

Fig. 5 is a plan view, with portions of the parts shown in section, taken substantially along the line V—V of Fig. 2.

Referring to the drawings, and more particularly to Fig. 1 thereof, the reference numeral 1 designates a frame which supports a plurality of gas reservoirs 2 which collectively serve as a storage space for compressed gas which is supplied to the interrupter by means of the conduits 3, 4 which lead to suitable compressor equipment not shown.

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Supported by the framework 1 is a valve casing 5 which supports a tubular insulating blast conduit 6, the upper end of which terminates adjacent the conduits which comprise a stationary contact 7 and a movable hook-shaped contact 8. The stationary contact 7 is electrically connected to the line terminal 9 and the movable contact 8 has a bifurcated portion 10 straddling the insulating blast tube 6 and pivotally mounted at 11 to a conducting bracket 12 which leads to the other line terminal 13 of the interrupter.

Consequently, in the closed circuit position of the interrupter, as shown in Fig. 1, the electrical circuit therethrough comprises the line terminal 9, stationary contact 7, movable contact 8, conducting bracket 12 to the other line terminal 13 of the interrupter. The contacts 7, 8 are separated within an arc chute, generally designated by the reference numeral 14, and which forms no part of our invention. Preferably, the arc chute 14 assumes a construction as set forth in U. S. Patent 2,272,380, which issued February 10, 1942, to Leon R. Ludwig, Herbert L. Rawlins and Benjamin P. Baker, and which was assigned to the assignee of the instant invention.

The movable contact 8 is moved to the opened and closed circuit positions by the rotation of an operating shaft 15 which is journalled at its ends in suitable bearings supported in brackets 16, the latter having their upper ends secured to the frame 1. The operating shaft 15 has welded thereto an operating part or bell crank 17, the upper end of which is pivotally connected at 20 to the movable contact 8. Thus, counterclockwise rotation of the operating shaft 15 causes through the medium of the insulating rod 19 opening separating motion of the movable contact 8 from the stationary contact 7. The rotation of the operating shaft 15 is caused by the actuation of a pneumatic mechanism, generally designated by the reference numeral 21 and comprising an operating cylinder 22 in which reciprocally operates a piston, not shown, which is connected to the piston rod 23. The upper end of the piston rod 23 is connected by means of the links 24 to a crank arm 25, the latter being welded to the operating shaft 15.

Thus, to cause the opening operation of the interrupter suitable valves, well known in the art, are actuated to admit compressed gas through the conduit 26 from the gas reservoirs 2 to the upper end of the operating cylinder 22 wherein this compressed gas forces the piston therein positioned downwardly to cause downward open-

ing movement of the piston rod 23. The downward opening movement of the piston rod 23 causes through the links 24 and crank arm 25 counterclockwise rotation of the operating shaft 15. The counterclockwise rotation of the operating shaft 15 simultaneously causes counterclockwise rotation of the bell crank 17 or operating part to effect downward movement of the operating rod 19 to effect thereby separation of the movable contact 8 from the stationary contact 7 within the arc shute 14 and adjacent the upper end of the blast tube 6.

Simultaneously with the contact separation during the opening stroke, the blast valve 27 (Fig. 2) is actuated by a blast valve mechanism, generally designated by the reference numeral 28, to permit compressed gas to pass upwardly from the gas reservoir 2 through the valve casing 5 and upwardly through the blast tube 6 to effect extinction of the arc drawn between the separated contacts 7, 8. The blast valve mechanism 28 is more clearly shown in Figs. 2 through 5, inclusive. Referring more particularly to Fig. 2, it will be observed that the valve casing 5 has a bore 29 formed therein into which snugly fits a valve body section 30. The valve body section 30 is secured within the valve casing 5 by bolts 31 clearly shown in Fig. 5. Thus, by removing the bolts 31, the valve body section 30 may be removed from the valve casing 5 to permit inspection, repair and replacement of the parts. This construction involving a removable valve body section is more fully described and claimed in U. S. patent application, Serial No. 566,725, filed December 5, 1944, by Raymond H. Leitzel, and assigned to the assignee of the instant invention.

As more clearly shown in Fig. 2, the blast valve 27 has a valve stem 32 which slides within a bore 33 provided in the valve body section 30. At the outer end of the valve stem 32 is threadedly secured and clamped thereto an adjustable nut 34. A bolt 35 spans two leg portions of the adjustable nut 34 to clamp the nut 34 securely to the threaded end of the valve stem 32 after adjustment has been made. A compression spring 36 disposed within a bore 37 provided in the valve body section 30 biases the blast valve 27 to its normally closed position as shown in Fig. 2. An annular valve seat 38 rests against an inwardly extending flange portion 39 formed integrally with the valve casing 5.

The valve body section 30 has integrally formed therewith two offstanding lugs 40, more clearly shown in Fig. 5, which have apertures extending therethrough through which is mounted a bolt 41. Pivotally mounted on the pivot bolt 41 is an actuating lever, generally designated by the reference numeral 42, and consisting of a bifurcated member having spaced side portions 43, 44. A pivot bolt 45 spans the side portions 43, 44 and mounts a roller 46, the later making engagement with the adjustable nut 34 to actuate the blast valve 27 during the opening operation.

The side portions 43, 44 are spanned by an integrally formed brace 47, the purpose for which will appear more clearly hereinafter. Adjacent the left-hand end of the actuating lever 42 is mounted through suitably formed apertures in the side portions 43, 44, a pivot bolt 48 which pivotally connects the actuating lever 42 with toggle means, generally designated by the reference numeral 49 and comprising two toggle links 50, 51. The toggle link 51 has its right-hand end, as viewed in Fig. 5, pivotally mounted on the pivot bolt 48 and has its middle portion 52 pivotally mounted on the knee pin bolt 53. The toggle link 50 comprises two spaced plates 54, 55 which have a cross-plate 56 welded thereacross, as shown more clearly in Figs. 4 and 5. The two plates 54 and 55 have their right-hand ends mounted by means of bearings 57 to the knee-pin bolt 53. The left-hand ends of the plates 54, 55 are pivotally mounted by means of a pivot bolt 58 to the arm or operating part 17 welded to the operating shaft 15 and movable therewith.

Two spaced support plates 59, 60 have a U-shaped bracket 61 welded thereacross. The U-shaped bracket 61 has 4 apertures provided therein through which extend 4 bolts 62, only two of which are shown. The upper ends of the bolts 62 extend through a flange portion 63 integrally formed with the valve casing 5. Thus, the two spaced support plates 59, 60 are stationarily mounted with respect to the valve casing 5. The space support plates 59, 60 are spanned by a braced 64 welded at its ends to the support plates 59, 60. An aperture 65 is provided at the center of the brace 64 which threadedly mounts stop means, in this instance, comprising an adjustable stop bolt 66.

A rotatable bar 67 is pivotally supported between the support plates 59, 60 by pivot screws 68, more clearly shown in Fig. 5. At the center of the rotatable bar 67 is provided an aperture 69 through which extends a tubular guide 70 having the upper end thereof welded to a yoke-shaped member 71. The legs 72 of the yoke-shaped member 71 are pivotally mounted on the knee-pin bolt 53. A compression spring 73 encircles the tubular guide 70 and is positioned between the rotatable bar 67 and the yoke-shaped member 71.

It will consequently be apparent that the guide 70, yoke-shaped member 71 and compression spring 73 collectively form a toggle over-center biasing means, generally designated by the reference numeral 74 and serving in the closed circuit position of the interrupter to force the toggle means 49 to its over-center position, as shown in Fig. 2 of the drawings.

The operation of our improved gas blast valve operating mechanism will now be explained. During the opening operation, when the operating shaft 15 rotates in a counterclockwise direction as viewed in all the drawings, the movable contact 8 separates from the stationary contact 7 in a manner previously described to draw an arc at the upper end of the insulating blast tube 6. Simultaneously the operating part or arm 17 also rotates in a counterclockwise direction about the operating shaft 15 to force the toggle means 49 to rotate the actuating lever 42 in a counterclockwise direction about the pivot bolt 41. This causes the roller 46 to engage the adjustable nut 34 into contacting engagement to force the valve stem 32 downwardly to cause opening of the blast valve 27 in opposition to the force exerted by the compression spring 36. The opening of the blast valve 27 from its seat 38, permits compressed gas to flow upwardly from the gas reservoir 2 through the valve casing 5 and upwardly through the blast tube 6 to effect extinction of the arc drawn between the movable contact 8 and the stationary contact 7.

The counterclockwise rotative motion of the operating part or bell crank 17 continues and the stop means or stop bolt 66 is struck by the toggle link 51. Further counterclockwise rotation of the operating part 17 forces the toggle center

53 down over the centerline D, Fig. 4, thus breaking the toggle and allowing the toggle links 50, 51 to collapse or fold up. The collapse of the toggle means 49 permits the compression spring 36 to force the actuating lever 42 back to its original position, as shown in Fig. 2, at which time the brace 47 strikes the brace or stop 64. Further counterclockwise rotation of the operating shaft 15 and operating part 17 continues to effect thereby continued separation between the contacts 7, 8. However, throughout this continued opening rotative movement of the operating shaft 15, the blast valve 27 remains closed inasmuch as the toggle means 49 remains collapsed. The fully open circuit position of the interrupter is shown in Fig. 4. It will be observed that in this fully open circuit position of the interrupter, the blast valve 27 is closed and the toggle means 49 is in its collapsed or folded-up position.

During the closing operation, suitable valve means, not shown but well known in the art, are operated to permit a blast of closing air to pass to the lower end of the operating cylinder 22 to force the piston positioned therein to move upwardly to thereby cause upward movement of the piston rod 23. The upward movement of the piston rod 23 causes, through the action of the links 24, clockwise rotative movement of the crank 16 to effect clockwise rotative movement of the operating shaft 15. The clockwise rotative movement of the operating shaft 15 effects corresponding clockwise rotative movement of the bell crank or operating part 17 to simultaneously effect contact closure through the medium of the insulating operating rod 19 and straightening of the toggle means 49. Near the end of the closing stroke, the toggle overcenter biasing means 74 causes the toggle means 49 to assume its overcenter position, as shown in Fig. 2 of the drawings. Throughout the entire closing operation, the toggle means 49 is collapsed and the blast valve 27 remains in its closed position. It is only near the end of the closing stroke that the toggle means 49 assumes a position in which it is capable of being pushed to its overcenter or toggle set position as caused by the biasing action exerted by the compression spring 73 associated with the toggle overcenter biasing means 74.

From the foregoing description, it will be apparent that we have provided an extremely simple mechanism for operating the blast valve of a compressed gas circuit interrupter in which few parts are employed, and in which positive action is assured due to the positive pivotally linking of the several parts together. The mechanism which we have provided is suitable for long operational life in which the breaker operations may total 25,000 to 50,000 per year. By the adjustment of the stop means or stop bolt 66, the time at which the blast valve 27 may be closed during the opening operation may be regulated. Also, it will be observed that the point and amount of valve opening can be set by adjusting the clamp nut 34. The design consists of a minimum number of parts and is suitable for operation under severe service with a minimum amount of adjustment and attention. The point of valve closing can be set by adjusting bolt 66 and the construction is such that a rigid and secure mounting of the several parts is obtained.

Although we have shown and described a specific structure, it is clearly to be understood that the same was merely for the purpose of illustration and that changes and modifications may readily be made therein by those skilled in the art

without departing from the spirit and scope of the appended claims.

We claim as our invention:

1. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, means normally biasing said valve closed, a linkage operable by the operating part and operable during the opening operation of the interrupter to cause opening of the valve and means operative at a predetermined point during the opening operation of said interrupter to cause collapse of said linkage to permit closing of said valve.

2. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, spring means biasing said valve closed, a pivoted actuating lever for actuating the valve, a linkage connected to the operating part and the actuating lever and operable by said operating part to open said valve, and means causing collapse of said linkage to permit said spring to close said valve.

3. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, a linkage operable by said operating part during the opening operation of the interrupter to cause opening of the valve, and means engageable by said linkage at a predetermined point during the opening operation to effect collapse of said linkage and closing of the valve.

4. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, a pivoted actuating lever for actuating the valve, toggle means pivotally connecting the operating part to the actuating lever, and means engageable by the toggle means at a predetermined point during the opening operation to cause collapse of said toggle to thereby permit closing of the valve.

5. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, and toggle means pivotally connecting the operating part and operable during the opening operation of the interrupter to cause opening of the valve, means engageable by the toggle means at a predetermined point during the opening operation to effect collapse of said toggle to thereby permit closing of the valve, and biasing means for biasing the toggle means to the over center position in the closed circuit position of the interrupter.

6. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, means biasing said valve closed, an actuating lever for actuating the valve to open position, means pivotally mounting the actuating lever adjacent one end thereof, toggle means pivotally connecting the operating part to the other end of the actuating lever, means engageable by the

toggle means at a predetermined point during the opening operation to cause collapse of said toggle and closing of the valve, and spring means biasing the toggle means to the over center position in the closed circuit position of the interrupter.

7. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, spring means biasing said valve closed, a valve stem for operating the valve, an actuating lever, an actuating lever operable to engage and operate the valve stem during the opening operation, toggle means interrelating the operating part and the actuating lever for positively actuating said lever to open position, and means for effecting collapse of said toggle during an opening operation to permit said spring means to close said valve.

8. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, means biasing said valve in closing direction, a valve stem for operating the valve, an actuating lever, means pivotally mounting the actuating lever adjacent one end thereof, means intermediate the ends of said actuating lever for engaging and operating the valve stem during the opening operation, toggle means interrelating the operating part and the other end of the actuating lever for positively actuating said lever to open said valve, and means for effecting collapse of said toggle means at a predetermined point during the opening operation to permit said biasing means to close said valve.

9. In a circuit interrupter of the gas blast type, contact means for establishing an arc, an operating part movable in accordance with contact movement, a valve operable to cause an arc extinguishing blast of gas to extinguish the arc, a valve stem for operating the valve, a pivoted actuating lever, means carried intermediate the ends of said actuating lever for engaging and operating the valve stem during the opening operation, toggle means interrelating the operating part and the actuating lever, means engageable by said toggle means at a predetermined point during the opening operation to effect collapse of said toggle and closing of said valve, and biasing means for biasing the toggle to the over center position.

BENJAMIN P. BAKER.
RAYMOND H. LEITZEL.

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