Jan. 5, 1960 A. S. CASWELL 2,920,170

PNEUMATICALLY OPERATED CIRCUIT BREAKER HAVING PNEUMATICALLY ASSISTED ARC INTERRUPTING MEANS

Filed Oct. 11, 1957 2 Sheets-Sheet 1

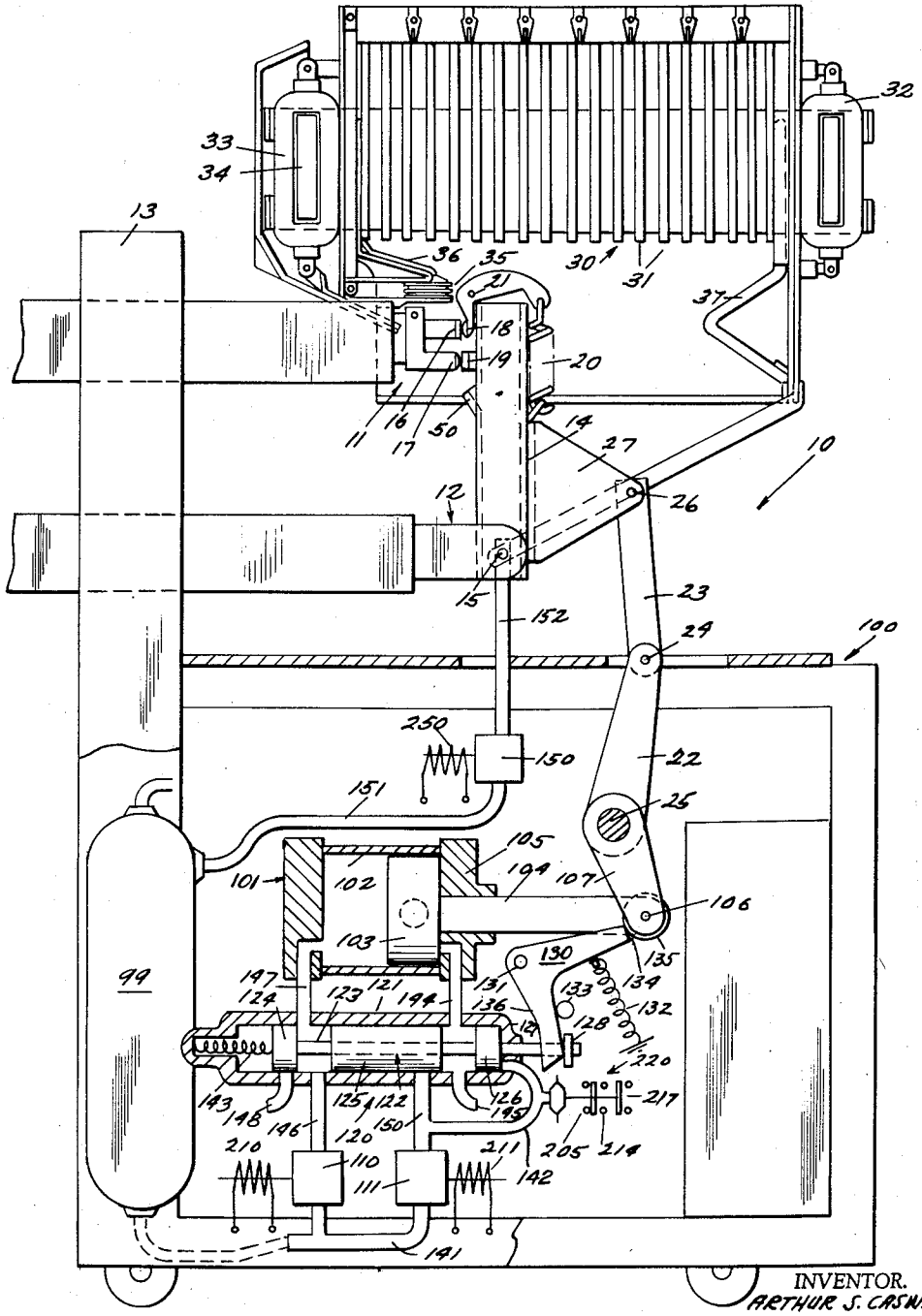


FIG. 1

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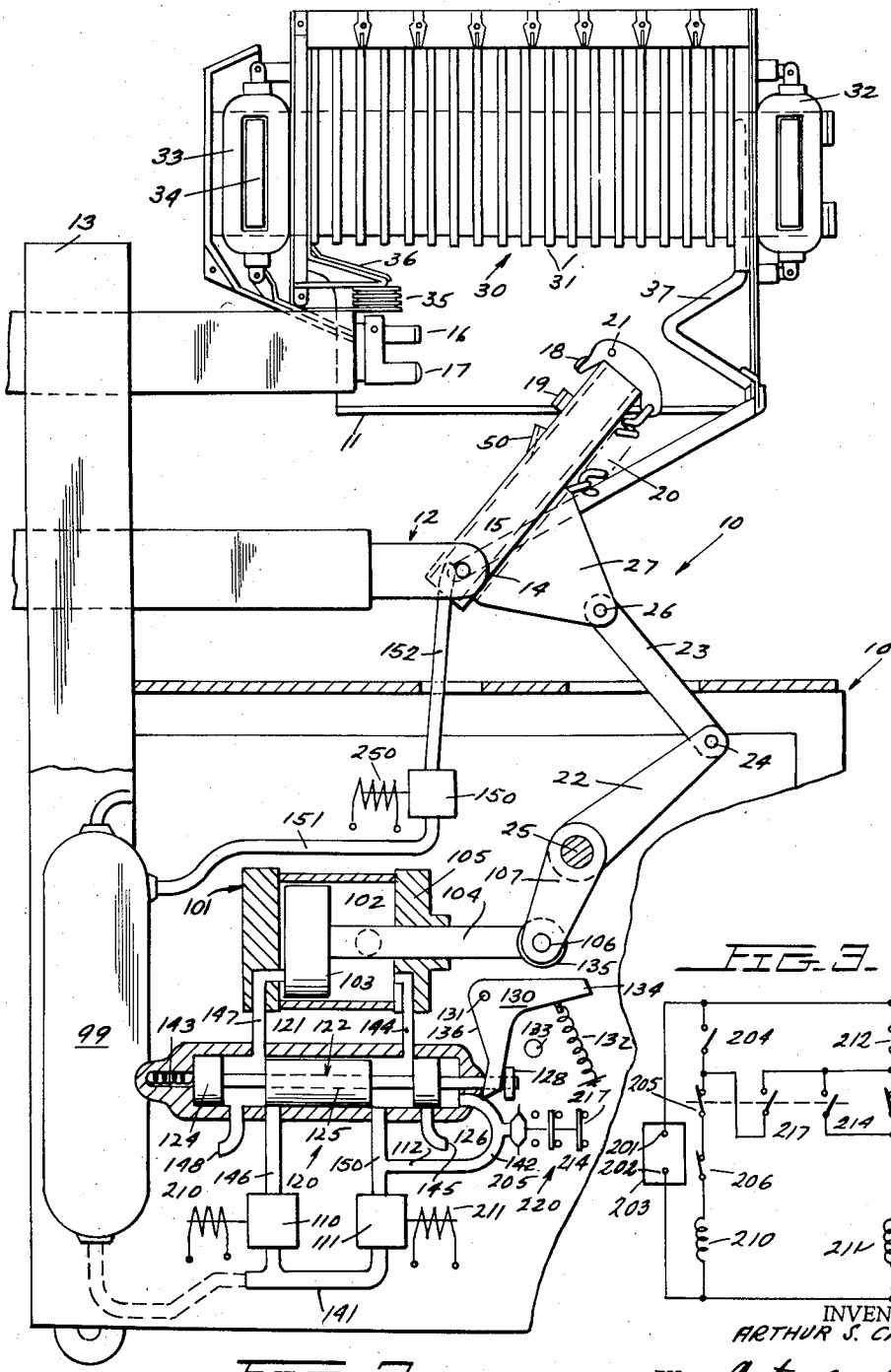


FIG. 2

FIG. 3

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United States Patent Office 2,920,170
Patented Jan. 5, 1960

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PNEUMATICALLY OPERATED CIRCUIT BREAKER HAVING PNEUMATICALLY ASSISTED ARC INTERRUPTING MEANS

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Application October 11, 1957, Serial No. 689,691

10 Claims. (Cl. 200—148)

This application relates to circuit breakers in general and more particularly to an air magnetic type circuit breaker which is pneumatically operated between its open and closed positions and in which a pneumatic assist is added to the conventional magnetic type arc interrupting means.

Attempts have been made to improve the interrupting characteristics of air magnetic type circuit breakers by utilizing a puffer device which directed a mere puff of air toward the breaker contacts as they were parted. This puff of air acted merely to transfer the arc from the stationary contacts to a runner of the arc chute. The puff was relatively small, being generated by the opening motion of the bridge, and diminished rapidly as the distance between the parted contacts increased.

At high current interruption the effect of the puff was negligible since a strong magnetic field of the current served to rapidly draw the arc into the chute and transfer the arc to the runners. It was at relatively low currents that the puffer was of value in transferring the arc to the runner.

However, the gas generated by the puffer device was ineffective to drive the arc deeply into the arc chute or cool the arc after it had been driven there.

The novel circuit breaker of the instant invention is of the air magnetic type which is provided with a pneumatic system. This pneumatic system furnishes both the opening and closing power for the circuit breaker contacts and in addition furnishes a blast of gas which assists the magnetic arc interrupting means and thereby increases the interrupting rating of the circuit breaker. The pneumatic system referred to is gas stored in a tank at a high pressure of approximately 100 p.s.i. and is utilized for complete operation of the circuit breaker, that is, closing, opening, trip free operation and arc interruption. Arc interruption is assisted by subjecting the arc to a high pressure air blast for the entire opening motion of the bridge so that the gas will drive the arc more deeply into the chute and also cool the arc in the process.

My novel interrupting arrangement results in a shortening of arcing time especially at low currents thereby enabling the rating of the interrupter to be increased. The pneumatic assist also permits a reduction in the size of the conventional type arc chute employing a plurality of parallel plates and a magnetic means. Further, the pneumatic system enables the circuit breaker bridge to be of a simple construction and also increases the current carrying capacity thereof.

Accordingly, a primary object of the instant invention is to provide a novel air magnetic type circuit breaker which is pneumatically operated and in which an air blast is utilized for arc interruption.

Another object is to provide a novel circuit breaker which is pneumatically operated between its open and closed positions as well as being pneumatically operated trip free.

Still another object is to provide a pneumatic means,

as an assist to the conventional arc interrupting means of an air magnetic breaker, which acts on the arc while it is in the arc chute.

A further object is to provide a novel circuit breaker utilizing a source of high pressure gas for operation of the circuit breaker contacts as well as to provide a blast directed at the arc formed during current interruption while the arc is in the arc chute of the magnetic arc interrupting means.

A still further object is to provide a novel circuit breaker construction which eliminates the necessity for opening or closing springs as well as costly and critical latches for trip free operation.

Yet another object is to provide a hollow light weight current carrying bridge whereon the movable circuit breaker contacts are mounted and direct a gas blast through the bridge during circuit interruption to play on the portion of the arc in the arc chute.

These as well as other objects of the instant invention will become readily apparent after reading the following description of the accompanying drawings in which:

Figures 1 and 2 are schematic representations of my novel circuit breaker shown in a partially sectioned side elevation. In Figure 1 the circuit breaker contacts are in engagement while in Figure 2 the circuit breaker contacts are disengaged.

Figure 3 is a wiring diagram of the control circuits for the novel circuit breaker of Figures 1 and 2.

Referring to the figures, circuit breaker **10** comprises an upper **11** and a lower **12** stationary contact both secured to and suitably insulated from circuit breaker frame **13**. Bridge **14** is a hollow member pivotally mounted at **15** to lower stationary contact **12**. Upper stationary contact **11** includes stationary arcing contact **16** and pivotally mounted main carrying contact **17**. Bridge **14** carries movable main contact **19** and movable arcing contact **18** which is biased in a clockwise direction about pin **21** by means of spring **20** so that on circuit closing arcing contacts **16, 18** will engage before main contacts **17, 19** and on circuit opening arcing contacts **16, 18** will disengage after main contacts **17, 19** have parted. Contact pressure is maintained in accordance with magnetic blow-on principles well known in the circuit breaker art.

Bridge **14** is operated between the closed and opened positions of Figures 1 and 2 respectively by means of operating mechanism **100** through toggle links **22, 23** which are interconnected by pin **24** at one of their respective ends to form the knee of a toggle. The other end of link **22** is keyed to stationary operating shaft **25** while the other end of insulating link **23** is pivotally secured at **26** to insulating bracket **27** which is affixed to bridge **14** in a suitable manner.

Arc extinguishing means **30** is of the conventional air magnetic type fully described in copending application Serial No. 545,956, filed November 9, 1955, and assigned to the assignee of the instant invention. Means **30** includes a plurality of spaced parallel arc plates, which form arc chute **31**, and coils **32, 33** wound around core **34** which establishes a magnetic field in association with arc chute **31**. Jump gap **35** is provided to transfer the arc drawn between contacts **16, 18** to arc runners **36, 37** where the arc may be effectively acted upon by the magnetic field established by coils **32, 33** which drives the arc upward in arc chute **31** where the arc is required to follow a tortuous path and is thereby elongated and cooled until it is finally distinguished.

Operating mechanism **100** includes operating valve or fluid motor **101** comprising cylinder **102** and piston **103** slidably disposed in cylinder **102**. Rod **104** is secured to piston **103** and extends through end **105** of cylinder **102**

and is pivotally secured at 106 to crank 107 which in turn is keyed to main operating shaft 25. Operating valve 101 is pneumatically controlled by means of gas stored at high pressure in tank 99.

Closing 110 and opening 111 valves control the flow of high pressure gas to operating valve 101 with control valve 120 being interposed therebetween for the purpose of directing the high pressure gas to the proper end of cylinder 102. Closing and opening valves 110, 111 respectively are of the conventional solenoid operated type and are both biased to closed positions.

Control valve 120 comprises an elongated cylinder 121 wherein operator 122 is slidably disposed. Operator 122 includes rod 123 having secured thereto in spaced relationship spindles 124–126 which are closely fitted to the inside diameter of cylinder 121.

Rod 123 extends through end 127 of cylinder 121 and has secured thereto protrusion 128 which is operatively positioned to engage prop latch 130 in order to permit circuit breaker 10 to be opened. Prop latch 130 is pivotally secured to stationary pin 131 and is biased thereabout in a counterclockwise direction by means of a compression spring 132. Stop 133 is suitably positioned to limit the counterclockwise rotation of prop latch 130 and thereby establish its latching position wherein end 134 thereof is in engagement with latch roller 135 which is freely mounted at pin 106.

With circuit breaker 10 in its closed position of Figure 1 operation thereof to its open position of Figure 2 is initiated by opening or trip valve 111. High pressure gas from tank 99 now finds a clear passage through gas line 141, trip valve 111, and gas line 142 to end 127 of cylinder 121 where the gas acts on the right surface of spindle 126 thereby forcing operator 122 to the left against biasing spring 143 to the position indicated in Figure 2.

Operator 122 in moving to the left causes protrusion 128 to engage leg 136 of prop latch 130 thereby rotating it in a clockwise direction whereby end 134 thereof is free of latch roller 135. In the position of Figure 2 spindle 126 blocks closing exhaust port 145 and spindle 125 blocks closing inlet port 146. The high pressure gas flowing through trip valve 111 is now conducted through gas line 150, laterally through cylinder 121, and through gas line 144 to the right hand end of operating valve piston 103. This will force piston 103 to the left with gases on the left side of piston 103 being forced through gas line 147, laterally through cylinder 121, and finally being discharged through opening exhaust port 148.

As piston 103 moves to the left it carries with it rod 104 causing crank 107 to rotate main operating shaft 25 in a clockwise direction. This in turn will rotate toggle link 22 in a clockwise direction with the knee 24 of the toggle moving to the right and carrying with it toggle link 23 thereby rotating bridge 14 about its lower end to bring about disengagement of cooperating main contacts 17, 19 and cooperating arcing contacts 16, 18 in the proper sequence. Simultaneously with the operation of trip valve 111, solenoid operated arc interrupter valve 150 is opened to provide a clear gas passage through gas lines 151 and 152 to the lower end of hollow bridge 14. Gas line 152 is comprised of a suitable insulating material. A portion of the gas passing through line 152 will exit at struck out opening 50 at an intermediate point between the ends of bridge 14 and being directed to the gaps formed between cooperating contacts 17, 19 and 16, 18 to scavenge the contact area and assist jump gap 35 in transferring the arc to runner 36.

The major portion of the gas entering bridge 14 will exit through the upper end thereof and flow from the lower to the upper end of arc chute 31 and act directly upon the arc formed between the arc runners 36, 37. In this manner the conventional air magnetic interrupter means 30 is assisted in extinguishing the arc by a strong gas blast acting directly on the portion of the arc in chute 31. This will cause the arc to rise more rapidly in the chute 31 thereby bringing about a more rapid distinction thereof.

Operation of circuit breaker 10 to the closed position is initiated by the operation of closing valve 110 which provides a gas passage from gas line 141 through closing valve inlet port 146. With opening or trip valve 111 deenergized biasing spring 143 is effective to move operator 122 to its rightmost position. Now spindle 124 blocks opening exhaust port 148 and spindle 125 blocks opening inlet port 150 so that high pressure gas flows laterally through cylinder 121, through gas line 147, to the left hand side of piston 103 thereby forcing piston 103 to the right. Gases on the right side of piston 103 are exhausted through gas line 144, laterally through cylinder 121, and finally through closing exhaust port 145.

As piston 103 moves to the right, rod 104 causes rotation of crank 107 thereby rotating main operating shaft 25 in a counterclockwise direction which in turn rotates toggle link 22 counterclockwise. Knee 24 moves to the left carrying with it one end of link 23 and forcing the other end thereof upward so that bridge 14 will rotate counterclockwise about pivot 15 thereby closing the circuit breaker 10. As rod 104 is being moved to the right, roller 135 engages surface 151 thereby rotating prop latch 130 in a clockwise direction against its bias 132 until roller 135 clears end 134 at which time biasing spring 132 rotates latch 130 to its latching positions thereby maintaining circuit breaker 10 closed.

Referring more particularly to Figure 3, control circuit 200 comprises a first and second parallel path extending between terminals 201, 202 of control voltage source 203. The first series path begins at terminals 201 and extends through normally open switch contact 204 connected to one end of solenoid coil 210 which operates closing valve 110. The other end of solenoid coil 210 is connected to terminal 202 through the series combination of normally closed contacts 205, 206. The second series path commences at terminal 201 and proceeds through normally open switch 212 to one end of solenoid coil 211 which operates trip valve 111. The other end of coil 211 is connected to terminal 202 through the parallel combination of normally closed contacts 213 and normally open contacts 214. Normally open switch contacts 212 are paralleled by the normally open contacts 215 of a conventional type overcurrent device (not shown) commonly associated with circuit breakers of this type.

A series circuit comprising normally open contacts 216 and solenoid coil 250, which controls the operation of valve 150, is connected from terminal 202 to the juncture between solenoid coil 211 and opening switch 212.

Another pair of normally open contacts 217 are connected between the last named juncture and the juncture between closing switch contacts 204 and solenoid coil 210. Contacts 205, 214 and 217 are associated with air operated switch 220 connected to gas line 142. Contacts 213, 216 are associated with an auxiliary switch (not shown) of well known type. Contacts 206 are associated with another switch (not shown) which is operated when the circuit breaker reaches its closed position so that closing coil 210 will not be continuously energized even though the contacts of closing switch 204 are engaged.

With the circuit breaker 10 in the open position of Figure 2 the operation of closing switch 204 will energize closing solenoid coil 210 so that piston 103 is operated to the right as hereinbefore explained. When the circiut breaker reaches its fully closed position contacts 206 will open thereby deenergizing coil 210.

Should an attempt be made to close circuit breaker 10 on a fault the overcurrent will cause contacts 215 to close thereby providing an energizing path for trip

coil 211 through auxiliary switch contacts 213. With trip valve 111 in the open position high pressure gas in line 142 will operate switch 220 thereby simultaneously closing contacts 214 and 217 and opening contacts 205. This will immediately deenergize closing coil 210 with tripping valve 111 assuming complete control. Pressure released through line 142 drives operator 122 to the left against the bias of spring 143 with spindle 125 mechanically blocking the high pressure gas supply to the L.H. end of cylinder 121 and fully venting it to the atmosphere through opening exhaust port 148 so that the opening of circuit breaker 10 may proceed in the manner previously set forth. If closing switch 204 continues to remain closed a continuous current path extends from the terminal 201 through switch 204, contacts 217, trip coil 211, and contacts 214 to terminal 202 but the current path through closing coil 210 is broken to prevent pumping.

The auxiliary switch (not shown) with which contacts 213 and 216 are associated is operatively connected to operating shaft 25, in a manner well known to the art, such that contacts 216 are closed when circuit breaker 10 is in the closed position of Figure 1. With circuit breaker 11 closed and trip coil 211 energized, valve 150 is opened since solenoid 250 and closed contacts 213 are in parallel with trip coil 211 and closed contacts 213. Contacts 216 are adjusted to open at approximately the ⅔ point of the breaker opening stroke with the exact adjustment being determined by tests and the dictates of economy. Contact 213 of the auxiliary switch open when circuit breaker 10 is in the open position of Figure 2.

Thus, I have provided a novel air magnetic type circuit breaker which is pneumatically operated and in which an air blast is utilized for arc interruption. This construction eliminates the necessity for providing opening springs and costly critical latches characteristic of most trip free operating mechanisms. The pneumatic operation also eliminates the necessity for a puffer device yet achieves efficient arc transfer to the runners of the arc extinguishing means.

In the foregoing, I have described my invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of my invention within the scope of the description herein are obvious. Accordingly, I prefer not to be bound by the specific disclosure herein but only by the appending claims.

I claim:

1. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; pneumatic means operatively connected to said operating mechanism and operatively positioned to subject said arc to a gas blast from said pneumatic means while said arc is received by said magnetic arc interrupting means; a hollow movable bridge having a first of said cooperating contacts secured thereto near a first end thereof; said pneumatic means being operatively connected to said bridge near a second end thereof with said gas blast being directed by said bridge into said magnetic arc interrupting means; and opening in said bridge intermediate the ends thereof; said gas blast having an intensity which is independent of the speed of movement of said bridge; means at the edge of said opening constructed to direct a small portion of said gas blast at the area occupied by said cooperating contacts when in said engaged position.

2. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; one of said pair of cooperating contacts being fixedly mounted; pneumatic means operatively connected to said operating mechanism and operatively positioned to subject said arc to a gas blast from said pneumatic means while said arc is received by said magnetic arc interrupting means; said pneumatic means including a pneumatically operated control means, a pneumatically operated operating means, and means providing fluid guide means between said control means and said operating means; said control means operatively connected through said operating mechanism to said operating mechanism for operation thereof between a first position wherein said cooperating contacts are disengaged and a second position wherein said contacts are engaged; said control mechanism being pneumatically operated to said first position when said circuit breaker is being closed on a fault for trip free operation of said operating mechanism.

3. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; one of said pair of cooperating contacts being fixedly mounted; a gas operated means operatively connected to said operating mechanism; said gas operated means including a gas operated control means operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated control means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated control means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated control means to said second position wherein said cooperating contacts are engaged only when said first valve is closed whereby said operating mechanism is operated trip free when closing on a fault.

4. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas operated means comprising a single operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an un-

obstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed.

5. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas operated means comprising an operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an unobstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed; said operating valve including a first cylinder and a piston closely fitted to said first cylinder; said first and second gas passages communicating with a first and a second end respectively of said cylinder; said cooperating contacts being disengaged when said piston is at said second end and being engaged when said piston is at said first end.

6. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas operated means comprising an operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an unobstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed; said operating valve including a first cylinder and a piston closely fitted to said first cylinder; said first and second gas passages communicating with a first and a second end respectively of said cylinder; said cooperating contacts being disengaged when said piston is at said second end and being engaged when said piston is at said first end; said operating valve including a second cylinder and an operator; said operator being disposed within said second cylinder and biased in a first direction to a first position when said first gas passage is blocked; said operator being operated against the bias to a second position by gas from said source when said first valve is open; said first gas passage being unobstructed when said operator is in its said second position.

7. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas operated means comprising an operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an unobstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed; said operating valve including a first cylinder and a piston closely fitted to said first cylinder; said first and second gas passages communicating with a first and a second end respectively of said cylinder; said cooperating contacts being disengaged when said piston is at said second end and being engaged when said piston is at said first end; said operating valve including a second cylinder and an operator; said operator being disposed within said second cylinder and biased in a first direction to a first position when said first gas passage is blocked; said operator being operated against the bias to a second position by gas from said source when said first valve is open; said first gas passage being unobstructed when said operator is in its said second position; said second cylinder including a first and a second port; said first port being connected to the first end of said first cylinder when said operator is in its said first position and said second port being connected to the second end of said first cylinder when said operator is in its said second position.

8. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas

operated means comprising an operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an unobstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed; said operating valve including a first cylinder and a piston closely fitted to said first cylinder; said first and second gas passages communicating with a first and a second end respectively of said cylinder; said cooperating contacts being disengaged when said piston is at said second end and being engaged when said piston is at said first end; said operating valve including a second cylinder and an operator; said operator being disposed within said second cylinder and biased in a first direction to a first position when said first gas passage is blocked; said operator being operated against the bias to a second position by gas from said source when said first valve is open; said first gas passage being unobstructed when said operator is in its said second position; said second cylinder including a first and a second port; said first port being connected to the first end of said first cylinder when said operator is in its said first position and said second port being connected to the second end of said first cylinder when said operator is in its said second position; said operator including a first, a second, and a third spindle; said spindles being displaced along the axis of said operator and operatively connected to move in unison; said second spindle blocking said first gas passage and said third spindle blocking said second port when said operator is in its said first position; said first spindle blocking said first port and said second spindle blocking said second gas passage when said operator is in its said second position.

9. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas operated means comprising an operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an unobstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed; a third valve operatively connected between said source and said magnetic arc interrupting means; said magnetic arc interrupting means being subjected to a gas blast from said source while said third valve is open.

10. An air magnetic type circuit breaker being comprised of a pair of cooperating contacts, an operating mechanism operatively connected to move said cooperating contacts between an engaged and a disengaged position, and magnetic arc interrupting means operatively positioned to receive and extinguish an arc drawn between said cooperating contacts as they are moved from said engaged to said disengaged position; a gas operated means operatively connected to said operating mechanism and operable between a first and a second position; a first valve and a second valve operatively connected between said gas operated means and a source of high pressure gas; said first valve when open permitting gas from said source to operate said gas operated means to said first position wherein said cooperating contacts are disengaged; said second valve when open permitting gas from said source to operate said gas operated means to said second position wherein said cooperating contacts are engaged only when said first valve is closed; said gas operated means comprising an operating valve and a control valve operatively connected between said operating valve and said first and said second valves; said operating valve also being operatively connected to said operating mechanism; said control valve providing a portion of an unobstructed first gas passage between said source and said operating valve when said first valve is open; said control valve providing a portion of an unobstructed second gas passage between said source and said operating valve only when said second valve is open and said first valve is closed; a third valve operatively connected between said source and said magnetic arc interrupting means; said magnetic arc interrupting means being subjected to a gas blast from said source while said third valve is open; a hollow movable bridge having a first of said cooperating contacts secured thereto near a first end thereof; said third valve being operatively connected to said bridge near a second end thereof with said gas blast being directed by said bridge into said magnetic arc interrupting means; said third valve being open for substantially all of the time interval during which said cooperating contacts are being moved from said engaged to said disengaged positions.

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