April 18, 1950 A. P. STROM ET AL 2,504,901

CIRCUIT INTERRUPTER

Filed March 17, 1944

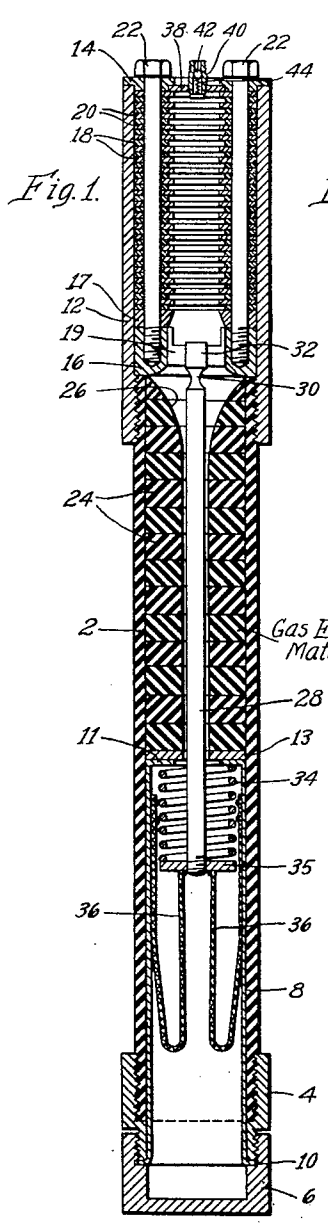


Fig. 1.

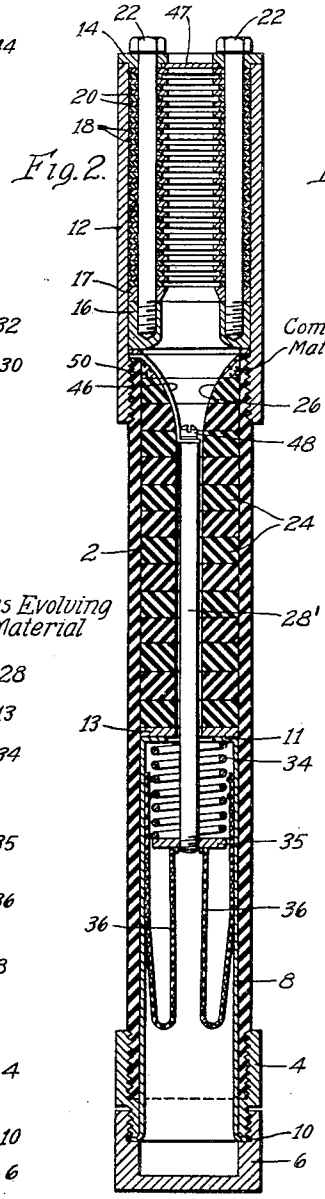


Fig. 2.

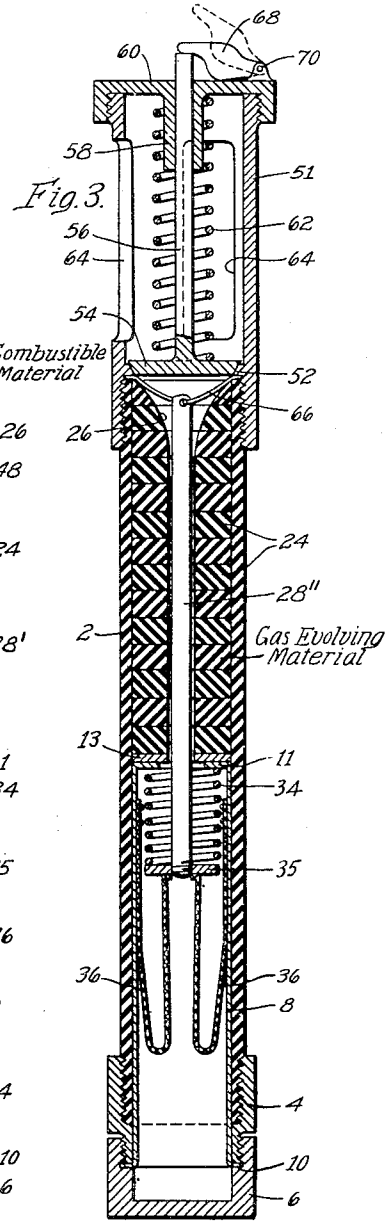


Fig. 3.

WITNESSES:

E. J. Weller.

A. T. Stratton

INVENTORS

Albert P. Strom and

Thomas E. Browne, Jr.

BY

Ralph W. Swingle

ATTORNEY

Patented Apr. 18, 1950

2,504,901

UNITED STATES PATENT OFFICE

2,504,901

CIRCUIT INTERRUPTER

Albert P. Strom and Thomas E. Browne, Jr., Forest Hills, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application March 17, 1944, Serial No. 526,848

16 Claims. (Cl. 200—120)

1

This invention relates, in general, to electric circuit interrupters, and more particularly to means providing for interruption of high-voltage circuits at elevated pressures.

Although this invention is disclosed as incorporated in high-voltage fuses wherein it has certain novel features of cooperation, it will become apparent as the invention is described, that it may also find use in other types of circuit interrupters.

One characteristic of circuit interrupters of the self-generated gas-blast type, is the marked dependence of the volts per unit length of arc channel which can be interrupted, upon the magnitude of current interrupted. As a matter of fact, the volts per unit of length which can be interrupted increase rapidly with increases in current, except for very small currents. This means that the length of the arc passage will be determined by the performance of the interrupter at some low value of current.

The principal object of this invention is to provide in a circuit interrupter, novel means for increasing the volts per unit length of arc channel which can be interrupted at least for low values of current, by the provision of a predetermined minimum pressure condition in the arc passage.

Another object of this invention is to provide in a circuit interrupter of the self-generated gas-blast type, a predetermined gas pressure in the arc passage independent of the gas generated by the interrupter, at least for low values of current.

Another object of this invention is to provide, in a circuit interrupter of the type having an arc passage in which gas pressure is built up during a circuit interrupting operation to a value dependent upon the magnitude of current interrupted, novel means for maintaining an elevated pressure in the arc passage at all times.

Another object of this invention is to provide in an expulsion type circuit interrupter, means for preventing the expulsion of gases from the arc path until a predetermined pressure is built up in the arc path.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of preferred embodiments thereof, when taken in connection with the attached drawing, in which:

Figure 1 is a longitudinal section of a fuse constructed in accordance with this invention,

Fig. 2 is a longitudinal section of a modified form of fuse, and

Fig. 3 is a longitudinal section of still another modification of a fuse embodying this invention.

2

Referring to Fig. 1 of the drawing, the invention is therein disclosed as incorporated in a high-voltage fuse contained within a fuse tube 2 of insulating material, such, for example, as fiber or the like. Fuse tube 2 is threaded at its opposite ends for receiving at one end a terminal ferrule 4, which, in turn, has a reduced threaded extension for threadedly receiving a closure cap 6. A relatively thin walled tube 8 of good electrical conducting material, such, for example, as copper or the like, extends into fuse tube 2 from terminal ferrule 4. Conducting tube 8 has the outer end thereof provided with an outwardly extending flange 10 adapted to be clamped between the outer end of terminal ferrule 4 and a shoulder provided on end cap 6. The inner end of tubular conductor 8 is provided with an inwardly extending flange 11 on which is seated a washer 13, for a purpose to be described.

A tubular terminal 12 is threadedly engaged at its inner end with the other end of fuse tube 2, and condensing means is supported within tubular terminal 12 between supporting collar 16 therein and cover disk 14. Supporting collar 16 is secured within the tubular terminal in any desired manner, such, for example, as by welding or the like. The condensing structure within the tubular terminal comprises a plurality of disks 18 and 20 of a good heat conducting material, such, for example, as copper, brass or the like, with disks 18 provided with a larger aperture than disks 20 and being arranged alternately therewith, so as to present a condensing passage having spaced annular grooves defined by the apertures in disks 18. Condensing disks 18 and 20 are secured in position within tubular terminal 12 between supporting collar 16, having washer 17 interposed between it and the condenser disks, and outer end disk 14, by through bolts 22 which extend through the condenser disks and washer 17 to be threadedly engaged in supporting collar 16. A spider 19 which may be integral with or rigidly secured to supporting collar 16 in any desired manner, is provided within the supporting collar, and has at the center thereof a hub 32, for a purpose to be described.

A plurality of blocks 24 of an insulating material which is capable of evolving an arc extinguishing gas when in proximity to an electric arc, preferably boric acid or the like, are supported within fuse tube 2 and extend from washer 13 at about the mid-portion of the tube to tubular terminal 12. Each block 24 is provided with a central aperture, with the outer end blocks having progressively outwardly flared apertures so

that when the blocks are assembled, the apertures therein form a tubular bore having a flared outer end 26. An elongated rod 28 of conducting material, such as copper or the like, is normally positioned within the bore through blocks 24, and is held at this position by a fusible section 30, suitably secured to the outer end of the rod and hub 32 of spider 19, for example as by soldering or the like. Conductor rod 28 is biased for movement toward end cap 6, by a coil compression spring 34 reacting between flange 11 on conductor tube 8, and a supporting disk 35 threadedly mounted on the other end of conductor rod 28. Conductor rod 28 is electrically connected to terminal ferrule 4 by flexible conductors 36 connected with the supporting disk 35 and conductor tube 8.

The electrical circuit through the fuse illustrated in Fig. 1 extends from lower terminal ferrule 4 through tubular conductor 8, flexible shunts 36, rod 28 and fusible section 30 to tubular terminal 12. In the operation of this fuse, the fusible section 30 will melt on overloads, thus releasing rod 28 for movement by spring 34 through the bore formed by blocks 24. If the current is of a high value, rod 28 will not move very far before the arc will be extinguished, because high-current arcs have a correspondingly large amount of energy and relatively large cross section, so that when they are drawn within flared portion 26 of the passage through blocks 24, sufficient arc extinguishing gas will be evolved from the blocks to readily extinguish these arcs at a current zero, before rod 28 has time to move very far into the small portion of the bore through blocks 24. It is preferred that blocks 24 be of a gas evolving material which evolves a gas, a major portion of which is condensable, so that such gas passing into tubular terminal 12 and into contact with condenser disks 18 and 20 will be cooled and condensed thereby, and thus prevent an excessive pressure rise within the fuse. Boric acid is preferred because the major part of the gas it evolves is water vapor, which is easily condensed.

If the current at which fusible section 30 melts is relatively low, that is, but little higher than the minimum melting current for the fusible section, the arc will correspondingly have but little energy, and be of such small cross section as not to cause substantial evolution gas from blocks 24 in the flared portion 26 of the bore through these blocks. Consequently, the rod 28 will move into the cylindrical portion of the bore through blocks 24 and may have to move substantially entirely through this bore in order to expose a great length of the arc to gas evolving material 24, to obtain evolution of sufficient gas to extinguish these arcs. As in the interruption of high-current arcs, gases evolved from blocks 24 on low currents will also pass into tubular terminal 12 and be condensed by condenser disks 18 and 20 therein.

Since a fuse of the type shown in Fig. 1 must draw out low-current arcs to a greater distance than higher-current arcs, it follows that the design of such fuses is determined by their operation on such low currents. It has been found that the volts per unit length of arc channel which can be interrupted, that is, at which the current can be successfully interrupted, generally speaking, increases rapidly with an increase in the magnitude of current being interrupted. Consequently, if the voltage interrupting ability of this type of interrupter on high currents, could be extended throughout the current range, interrupters of this type could be designed much smaller and simpler in form. Tests indicate that the voltage per unit length of arc channel which can be interrupted may be raised at low-current values by entirely enclosing the interrupter and providing an initial elevated gas pressure therein. This would indicate that the better performance of these interrupters on high currents is probably due to the fact that more gas is evolved by high-current arcs, and this creates a higher pressure in the region of the arc. On the other hand, since much less gas is generated by low-current arcs, at least until they are drawn out to a relatively great length, it is probable that relatively low pressures exist in the region of the arc.

In order to provide an initial gas pressure in the fuse shown in Fig. 1, tubular closure 12 is closed by a disk 38 secured between end disk 14 and end condenser disk 20, and is provided with a central threaded opening for receiving a threaded sleeve 40 having a valve seat therein on which a ball valve 42 may be seated under the influence of a compression spring 44, to form a one-way inlet valve. With this structure, any suitable gas under pressure, such as air, may be admitted to the fuse tube 2, and will be retained therein by the automatic seating of ball valve 42. With gas provided in tubular fuse holder 2 under predetermined pressure, the arc will always be subjected to at least this predetermined pressure, and in the case of small current arcs will be extinguished in much shorter travel of rod 28 than is possible where no pressure condition initially exists within the fuse holder. Where the fuse holder contains gas under pressure, the design of the condensing means should be such that it has enough capacity to condense the gas evolved from blocks 24 without permitting an excessive pressure rise within the fuse holder. While the initial gas pressure may be of any desired magnitude, dependent upon the strength of the materials employed for the fuse tube 2, tests have shown that the improvement in results obtained are substantially directly proportional to the pressure. Thus at currents of 100 amperes, which is the current value at which the particular fuse tested at atmospheric pressure was least effective in terms of voltage per unit length of arc channel that could be interrupted, the voltage which it was possible to interrupt was approximately doubled by raising the initial pressure within the fuse holder from atmospheric to about 150 pounds per square inch.

Another way in which a predetermined minimum gas pressure may be provided within a fuse holder is illustrated in Fig. 2, in a fuse structure similar to that shown in Fig. 1. Since most of the parts of the fuse shown in Fig. 2 are identical with the parts of the fuse shown in Fig. 1, like reference numerals are employed to designate such like parts. In the embodiment of the invention shown in Fig. 2, the space within the fuse holder is normally at atmospheric pressure, and a solid closure disk 47 is provided for tubular terminal 12 to completely close the fuse holder to the atmosphere. A strip 46 of fusible material joins the outer end of conductor rod 28' to tubular terminal 12, being clamped between supporting collar 16 on the terminal and the adjacent end of fuse tube 2, and being secured to conductor rod 28, for example, as by a screw 48. The outer end block of gas evolving material 50 is made of a highly combustible material, such as gun powder or the like, so that when ignited it will produce a predetermined quantity of gas substantially instantaneously.

It will be noted that fusible strip **46** overlies the combustible block **50**, so that when the fusible strip melts an arc will be struck in proximity to block **50** to ignite it. When ignited, the material **50** is substantially instantaneously consumed, and produces a predetermined quantity of gas to thereby build up a predetermined gas pressure within the fuse holder at about the same instant that the fusible strip **46** melts, so that the conditions within the fuse holder at that time will be the same as in the fuse holder shown in Fig. 1 having a gas already provided under pressure. Consequently, the operation of the fuse shown in Fig. 2 will be much like the operation of the fuse shown in Fig. 1, so that it will not be specified in detail in order to avoid repetition. However, the fuse of Fig. 2, by providing a predetermined gas pressure within the fuse enclosure when the fuse blows, will also be effective to increase the volts per unit length of the arc channel which can be interrupted at low currents, for example on the order of 100 amperes. Although the gases which may be generated by combustible material **50** are generally not condensable, this is to be desired in order that the pressure built up by these gases may be maintained for the extinction of low-current arcs.

The fuse shown in Fig. 3 utilizes the same principle as the fuse of Figs. 1 and 2, that is, the provision of at least a predetermined pressure within the arcing space when the fuse blows, to raise the arc volts per unit length of the arc channel which may be interrupted, at least on low currents. In this embodiment of the invention, many parts are identical with corresponding parts of the fuses illustrated in Figs. 1 and 2, and, accordingly, like reference numerals will be used to identify such like parts. The fuse shown in Fig. 3, however, differs from the embodiments previously disclosed in that a tubular terminal sleeve **51** is provided at the end of fuse tube **2** opposite terminal cap **6**, and this terminal sleeve is provided with an annular internal flange **52** adapted to engage the adjacent end of fuse tube **2**, and having its edge bevelled to provide an annular valve seat, for a valve head **54**. A valve stem **56** is provided integral with valve head **54**, and extends through a bearing portion **58** provided integral with end cap **60** which is threadedly mounted on the outer end of terminal sleeve **51**. A coil compression spring **62** normally biases valve head **54** into engagement with a seat formed on a flange **52**, with a predetermined pressure. Terminal sleeve **51** is provided with a plurality of relatively large openings **64** therein, for the purpose of venting the fuse holder, as will be described. A fuse wire **66** is provided for normally holding conductor rod **28''** at the position shown, and this fuse wire preferably has its ends soldered, or otherwise secured to flange **52** of the terminal sleeve, and is passed through an aperture in the outer end of rod **28''**.

In the operation of the fuse shown in Fig. 3, it will be observed that the arc space is completely enclosed, since valve head **54** is normally engaged with its seat **52**. Consequently, when fuse wire **66** melts and an arc is formed within the bore through blocks **24**, evolution of gas from the blocks will be initiated, and this gas will be confined to the bore through the blocks, and consequently will build up pressure therein in the region of the arc. Furthermore, this will continue until a predetermined pressure is built up within the bore through blocks **24**, which is of a value predetermined by the force exerted by valve

spring **62**, and may be any desired value corresponding to the improvement in interruption of volts per unit length of arc channel which is desired, for obtaining corresponding improvement in low-current circuit interruption. As soon as the gases evolved from blocks **24** has proceeded to build up a pressure of this predetermined value, valve **54** will be moved upwardly when the pressure within the arc passage exceeds the pressure exerted by spring **62**. Since the amount valve **54** will move will depend upon the pressure within the arc passage, spring **62** will operate to maintain a reasonably constant pressure within the arc passage, which will correspond to the previously mentioned predetermined pressure at which best interruption occurs. On the interruption of extremely heavy currents, valve **54** may be forced against the stop formed by bearing **58** on cap **60**, thereby permitting free escape of gases through the large vent apertures **64**.

The opening of valve **54** may be utilized to operate an indicator **68** pivotally mounted on cap **60**, for example, as by a frictional pivot **70**. Indicator **68** has a nose which normally overlies the outer end of a valve stem **56**, and it is normally maintained in this position by the friction in pivot **70**. When valve **54** opens upon operation of the fuse to relieve the excess pressure within the arc passage, indicator **68** will be moved to the dotted line position shown in Fig. 3, to thereby give a readily visible indication of the operation of the fuse. If desired, movement of indicator **68** may be utilized for operating other devices, such, for example as a switch, latch, or the like.

In each of the embodiments of invention disclosed herein, it will be observed that provision is made for the improvement in voltage per unit length of arc channel which may be interrupted at least at low currents, by the provision of a predetermined elevated pressure at least within the arc passage. Three different methods of accomplishing this are disclosed, (1) by the provision of a totally enclosed fuse provided with a gas under pressure, (2) the provision of a totally enclosed fuse with combustible means therein for evolving a predetermined quantity of gas irrespective of the value of current interrupted to thereby establish a predetermined gas pressure in the interrupter, and (3) the provision of an enclosure for the arc passage so that arc extinguishing gas evolved from the passage walls will be confined therein to build up a pressure within the passage to a value determined by a vent valve, in the nature of a pressure regulating valve. While in each embodiment of the invention there is shown to be considerable clearance between the movable rod **28** and the cylindrical part of the bore through blocks **24** for the purposes of illustration, actually the clearance should be as small as possible so that in the embodiments of invention of Figs. 2 and 3, relatively little, if any, of the gas pressure built up within the arc bore will escape into the lower end of the fuse tube.

Having described preferred embodiments of the invention in accordance with the patent statutes, it is desired that the invention be not limited to the particular embodiments disclosed, inasmuch as it will be obvious, particularly to persons skilled in the art, that many changes and modifications may be made in these particular embodiments without departing from the broad spirit and scope of the invention. Accordingly, it is desired that the invention be interpreted as

broadly as possible and that it be limited only as required by the prior art.

We claim as our invention:

1. In a circuit interrupter, means forming an arcing space in which an arc is struck in a circuit interrupting operation, means independent of the current value of said arc providing a predetermined fluid pressure above atmospheric pressure in said arcing space, said arcing space forming means entirely enclosing said interrupter, and separate means dependent upon the current value of said arc for causing a blast of fluid to flow through said arc.

2. In a circuit interrupter, means forming an enclosed arcing space, means for striking an arc in said space, a one-way inlet valve for said enclosure means to permit the supply of a quantity of fluid under predetermined pressure in said space so as to increase the voltage which may be interrupted in said space, and means for generating fluid dependent on the current value of said arc for causing a blast of fluid to flow through the arc.

3. In a circuit interrupter, means of insulating material forming an arc passage, means for striking an arc in said passage, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, a substantial portion of said arc extinguishing gas being condensable, means closing the opposite ends of said arc passage including condensing means communicating with one end of said passage for receiving and condensing said arc extinguishing gas, and a quantity of non-condensable gas under pressure above atmospheric pressure in said passage.

4. In a circuit interrupter, means of insulating material forming an arc passage, means for striking an arc in said passage, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, a substantial portion of said arc extinguishing gas being condensable, means closing the opposite ends of said arc passage including condensing means communicating with one end of said passage for receiving and condensing said arc extinguishing gas, a one-way inlet valve for said enclosure means, and a quantity of non-condensable fluid introduced under predetermined pressure into said space by means of said valve so as to increase the voltage which may be interrupted in said space.

5. In a circuit interrupter, means of insulating material forming an arc passage, means for striking an arc in said passage, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc in a quantity dependent on the current value of the arc, and means directly responsive to the striking of an arc in said space to generate a predetermined quantity of gas independent of the current magnitude of the arc to cause the pressure in said space to attain a predetermined magnitude sufficient to substantially increase the voltage per unit length of said passage which can be interrupted.

6. In a circuit interrupter, means of insulating material forming an arc passage, means for striking an arc in said passage, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc in a quantity dependent on the current value of the arc, a substantial portion of said arc extinguishing gas being condensable, means closing the opposite ends of said arc passage including condensing means communicating with one end of said passage for receiving and condensing said arc extinguishing gas, and means directly responsive to the striking of an arc in said space to generate a predetermined quantity of relatively non-condensable gas independent of the current magnitude of the arc to cause the pressure in said space to attain a predetermined magnitude sufficient to substantially increase the voltage per unit length of said passage which can be interrupted.

7. In a circuit interrupter, means of insulating material forming an arc passage, means for striking an arc in said passage, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, a substantial portion of said arc extinguishing gas being condensable, means closing the opposite ends of said arc passage including condensing means communicating with one end of said passage for receiving and condensing said arc extinguishing gas, and means directly responsive to the striking of an arc in said space to generate a predetermined quantity of gas independent of the current magnitude of the arc, at least the major part of the gas produced by said arc-responsive means being non-condensable to cause the pressure in said space to attain a predetermined magnitude sufficient to substantially increase the voltage per unit length of said passage which can be interrupted.

8. In a high-voltage fuse, a tubular fuse holder of insulating material, terminals on said holder adjacent opposite ends thereof, means of insulating material forming an arc passage in said holder, at least inner walls of said passage including a material which is capable of evolving an arc extinguishing gas when in proximity to an electric arc, conducting means in said holder connected between said terminals and including a fusible section for striking an arc in said passage, said passage having one end adjacent one end of said holder and said one end of said passage being open during a circuit interrupting operation, the other end of said holder being closed, a substantial portion of said arc extinguishing gas being condensable, a closed condenser secured to said one end of said holder in communication with said one end of said passage during a circuit interrupting operation, and means in said holder adjacent said one end thereof for generating a predetermined quantity of non-condensable gas in direct response to fusion of said fusible section and independent of the current magnitude of the arc to build up pressure in said arc passage, at least to a predetermined value.

9. In a circuit interrupter, tubular means of insulating material forming an elongated arc passage restricted in cross section area, means for striking an arc in said passage at one end thereof and extending the arc through said passage toward the other end thereof, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, means closing opposite ends of said passage including closure means located directly at said one end of the passage to cause said gas to build up a predetermined pressure restricted to said passage for all values of current, said closure means including pressure-responsive valve means responsive to pressures

above said predetermined pressure for venting said passage, and biasing means for holding said valve means closed at pressures below said predetermined pressure and for automatically closing said valve means during a venting operation when the pressure in said passage falls below said predetermined pressure.

10. Circuit interrupting apparatus comprising, in combination, condensable gas blast action arc extinguishing means, means comprising a non-condensing normally closed gas and pressure-conserving chamber for defining a complete enclosure for an arcing zone so that said arc extinguishing means is capable of substantially instantaneously causing a pressure rise in said arcing zone upon initiation of operation of said arc extinguishing means, said chamber having a vent opening, and resiliently biased automatically reclosable valve means normally closing said opening and being operable in response to a predetermined pressure rise in said arcing zone to uncover said opening, and operable in response to a drop in pressure in said arcing zone to a value less than said predetermined pressure to automatically close said opening.

11. In a circuit interrupter, tubular means of insulating material forming an elongated restricted arc passage, means for striking an arc in said passage at one end thereof and extending the arc through said passage toward the other end thereof, at least inner wall portions of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, closure means for said passage located directly at the end of said gas evolving material at said one end of the arc passage to prevent escape of said gas from said passage and thus cause a gas pressure subtantially above atmospheric pressure to exit in said passage at least subtantially instantaneously after an arc is struck therein, and said closure means including a pressure-responsive valve means for venting said arc passage when the pressure therein reaches a predetermined value above atmospheric pressure, biasing means for holding said valve means closed at pressures below said predetermined pressure and for automatically closing said valve means during a venting operation when the pressure in said passage falls below said predetermined pressure.

12. In a circuit interrupter, tubular means of insulating material forming an elongated arc passage restricted in cross section area, means for striking an arc in said passage at one end thereof and extending the arc through said passage toward the other end thereof, at least inner walls of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, means closing opposite ends of said passage including closure means located directly at said one end of the passage to cause said gas to build up a predetermined pressure restricted to said passage for all values of current, said closure means including pressure-responsive valve means responsive to pressures above said predetermined pressure for venting said passage, biasing means for holding said valve means closed at pressures below said predetermined pressure and for automatically closing said valve means during a venting operation when the pressure in said passage falls below said predetermined pressure, and indicator means movably mounted on said interrupter and adapted to be moved to a readily visible position in response to a venting operation of said valve means.

13. In a circuit interrupter, tubular means of insulating material forming an elongated restricted arc passage, means for striking an arc in said passage at one end thereof and extending the arc through said passage toward the other end thereof, at least inner wall portions of said passage including material capable of evolving an arc extinguishing gas when in proximity to an electric arc, means causing an initial gas pressure substantially above atmospheric pressure to exist in said arc passage at least substantially instantaneously after an arc is struck therein, said last mentioned means including a single means responsive only to evolution of said arc extinguishing gas to limit any pressure rise above said initial pressure, said pressure limiting means being ineffective to limit or diminish said initial pressure, and there being no other means for materially diminishing or limiting sad initial gas pressure.

14. An electric circuit interrupter which is capable of rapidly interrupting currents over a wide range of magnitudes comprising, means of insulating material forming an elongated arc passage which is restricted in at least one cross sectional dimension, means for striking an arc in said passage at one end thereof and extending the arc through said passage toward the other end thereof, means providing a fluid pressure substantially above atmospheric pressure in said arc passage at least substantially instantaneously after an arc is struck therein to aid in extinguishing the arc, the last mentioned means including pressure-limiting means for limiting only pressures in said arc chamber in excess of a predetermined value above atmospheric pressure, said pressure-limiting means being ineffective to limit or diminish pressures in said arc passage up to said predetermined value, and there being no other means for materially diminishing or limiting pressures in said arc passage up to said predetermined value.

15. An electric circuit interrupter which is capable of rapidly interrupting currents over a wide range of magnitudes comprising, means of insulating material forming an elongated arc passage which is restricted in at least one cross sectional dimension, means for striking an arc in said passage at one end thereof and extending the arc through said passage toward the other end thereof, means including a material forming walls of said passage capable of evolving a fluid when in proximity to an electric arc so as to be responsive to said arc for providing a fluid pressure substantially above atmospheric pressure in said arc passage at least substantially instantaneously after an arc is struck therein to aid in extinguishing the arc, the fluid pressure providing means further including pressure-limiting means for limiting only pressures in said arc chamber in excess of a predetermined value above atmospheric pressure, said pressure-limiting means being ineffective to limit or diminish pressures in said arc passage up to said predetermined value, and there being no other means for materially diminishing or limiting pressures in said arc passage up to said predetermined value.

16. In a circuit interrupter, means forming an arcing space in which an arc is struck in a circuit interrupting operation, means independent of the current value of said arc providing a quantity of non-condensable gas at a predetermined fluid pressure above atmospheric pressure in said arcing space at least substantially instantaneously after an arc is struck therein, said arcing space

forming means entirely enclosing said interrupter and including condensing means communicating with said arcing space, and separate means dependent upon the current value of said arc for causing a blast of condensable arc extinguishing gas to flow through said arc.

ALBERT P. STROM
THOMAS E. BROWNE, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
729,729	Burke	June 2, 1903
1,724,396	Creighton	Aug. 13, 1929
1,757,397	Sorensen et al.	May 6, 1930

Number	Name	Date
1,782,089	Baumer	Nov. 18, 1930
1,877,574	Nordhem	Sept. 13, 1932
1,905,236	Mangan	Apr. 25, 1933
1,957,906	Pailin	May 8, 1934
1,976,634	Rawlins	Oct. 9, 1934
2,038,507	Edsall	Apr. 21, 1936
2,074,538	Conrad	March 23, 1937
2,077,276	Slepian	Apr. 13, 1937
2,082,028	Rawlins	June 1, 1937
2,135,164	Brock	Nov. 1, 1938
2,135,166	Bussman	Nov. 1, 1938
2,285,602	MacMahon	June 9, 1942
2,288,117	Triplett	June 30, 1942
2,319,276	Triplett	May 18, 1943
2,319,277	Triplett	May 18, 1943
2,379,200	Triplett	June 26, 1945