Dec. 9, 1941. W. O. SCHULTZ ET AL 2,265,765

REPEATING FUSE CONSTRUCTION

Filed Nov. 17, 1934 4 Sheets-Sheet 1

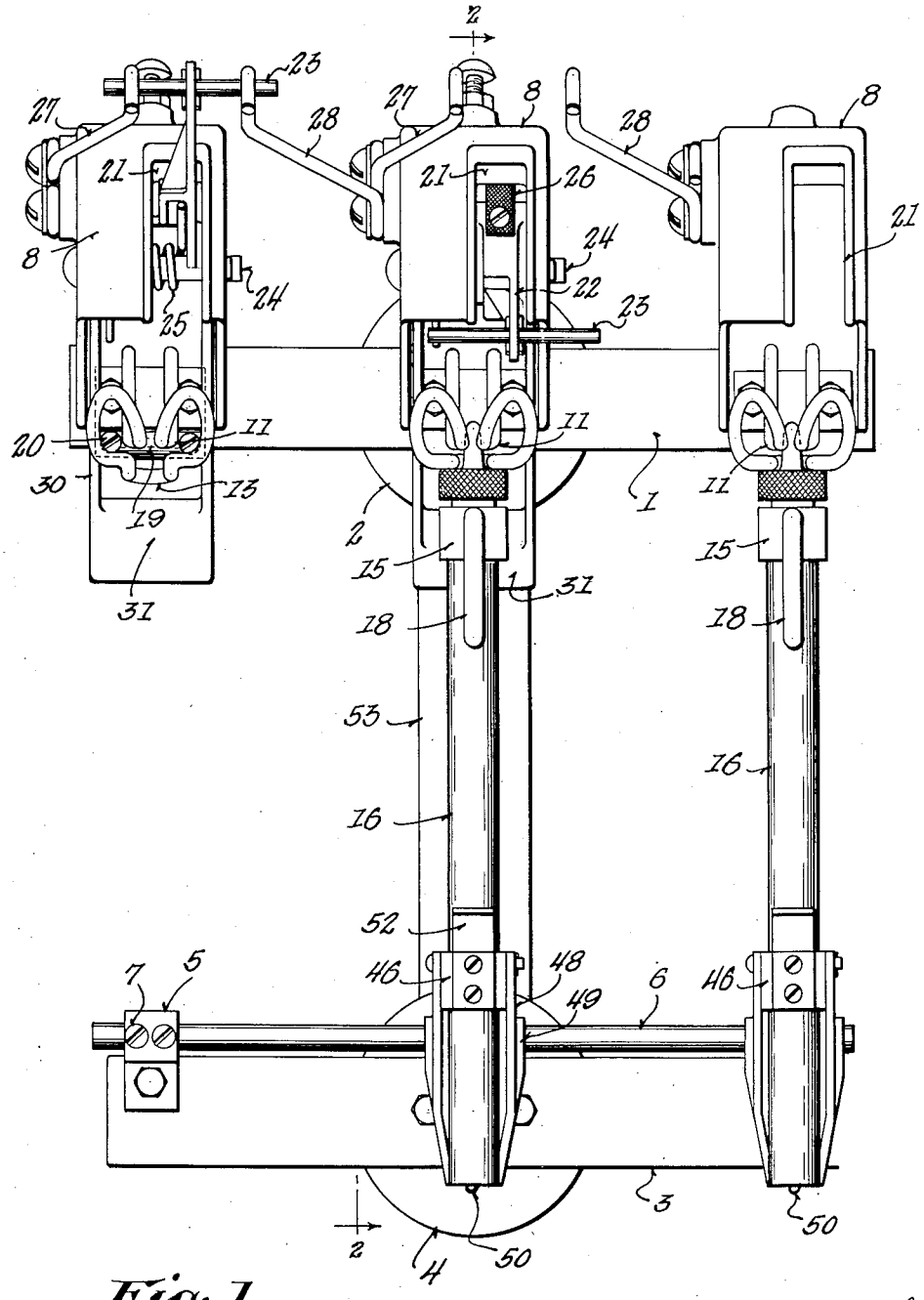

Fig. 1

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Fig. 7

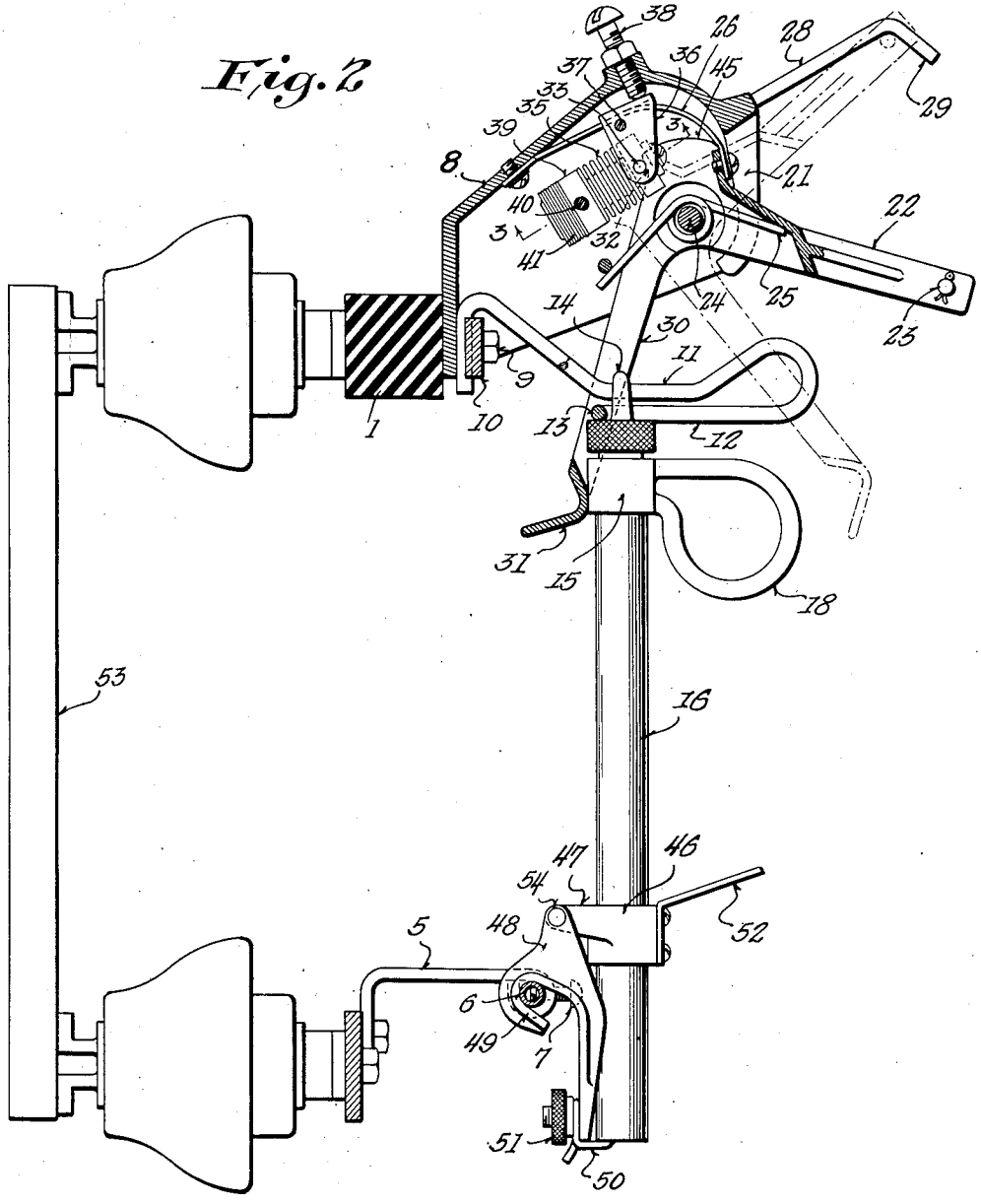
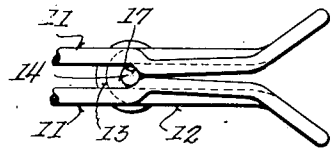


Fig. 9



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REPEATING FUSE CONSTRUCTION

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Fig. 3

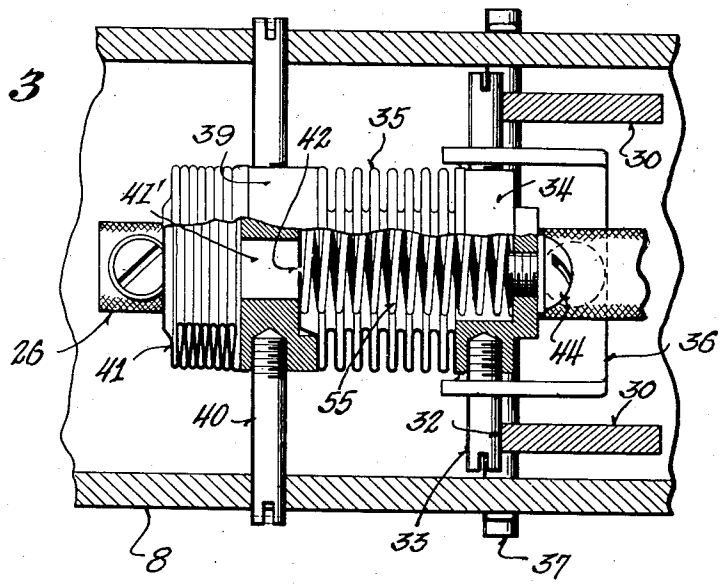


Fig. 7

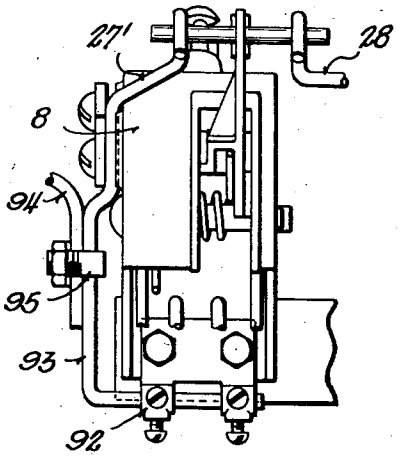
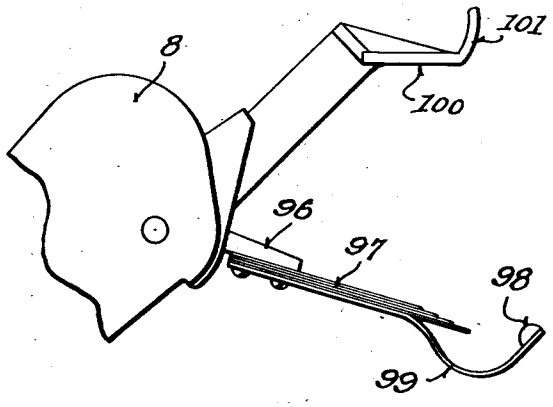


Fig. 8



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REPEATING FUSE CONSTRUCTION

Filed Nov. 17, 1934 4 Sheets-Sheet 4

Fig. 4

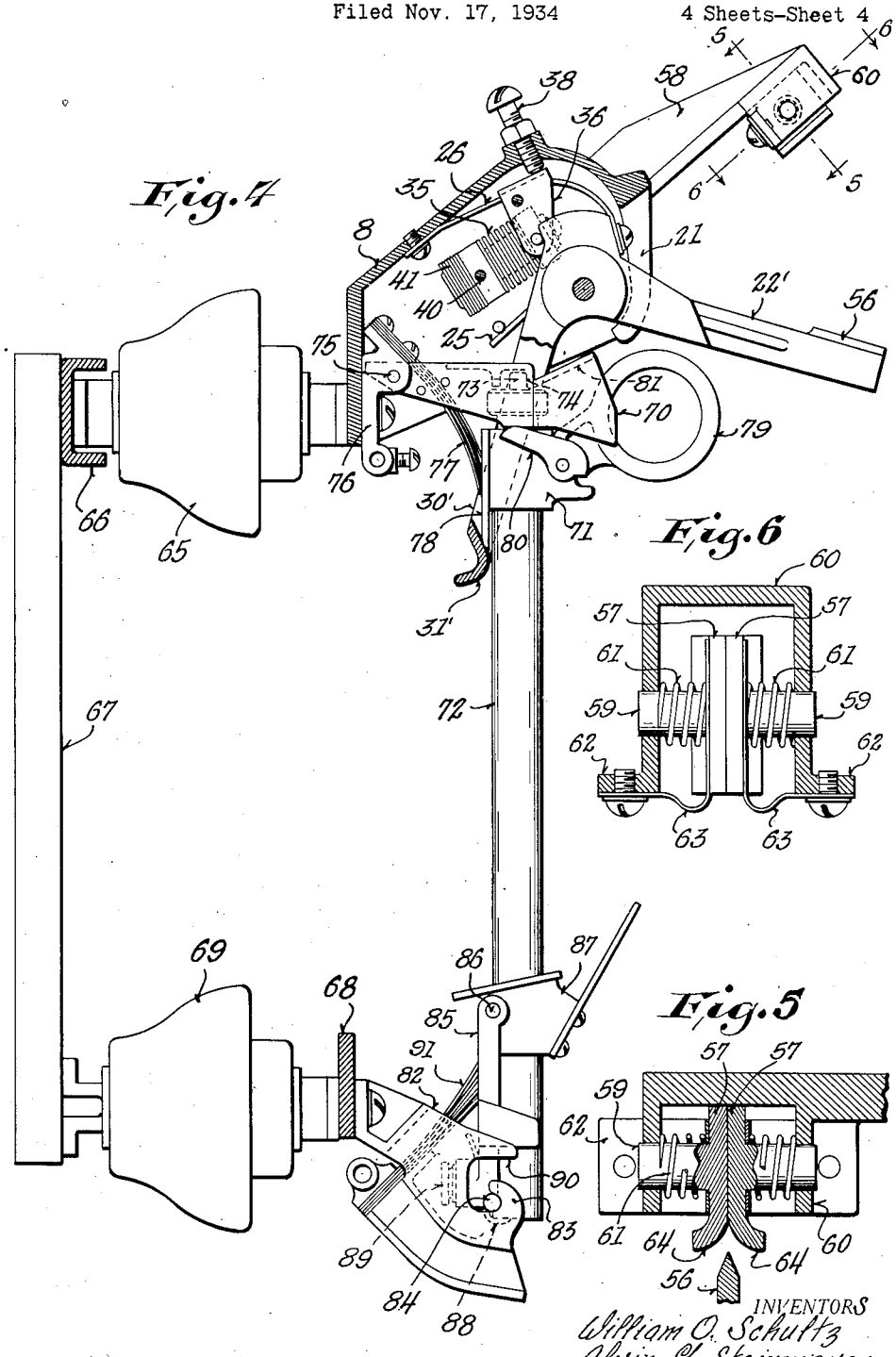

Fig. 6

Fig. 5

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UNITED STATES PATENT OFFICE

2,265,765

REPEATING FUSE CONSTRUCTION

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Application November 17, 1934, Serial No. 753,438

89 Claims. (Cl. 200—126)

This invention relates to a repeating fuse construction and is particularly directed to a construction in which a device is provided which recloses the circuit after the blowing of a fuse and connects a fresh or reserve fuse in the circuit, such device being capable of repeating as many times as the device is designed for.

The advantage of this automatic repeating fuse construction is that the device lends itself to transmission service and customer's substation service. Frequently in these services short circuits occur due to any one of many causes, such as a tree falling across a pair of lines, a pair of lines being whipped together by a wind, a flashover, a temporary ground, or the branch of a tree which in a violent wind may be blown against the line. Under these and similar conditions it frequently happens that the trouble is only temporary and that it either ceases of itself or the fault is burned out almost immediately.

This invention is designed to provide a device which will take care of conditions such as outlined above, which will electrically disconnect the blown fuse from the line, and after a predetermined brief interval immediately connect a reserve or fresh fuse in the line, such device providing for the successive operation of as many fuses as the device is equipped to handle, and to provide a device of this type in which the time delay interval is automatically secured by a time delay mechanism.

Further objects are to provide a construction in which the timing means is so made that it is adjustable so that the time interval between the dropping out of one fuse and the closing of the circuit through a succeeding fuse may be adjusted in a very simple manner to provide reclosing of the circuit through the succeeding fuse after any selected predetermined interval of time has elapsed, and to so construct the device that this adjustment may be readily made by means located exteriorly of the protecting hood housing the upper portion of the device.

Further objects are to provide a device of this type in which the blown fuse may be readily removed and refused without interrupting the service through an auxiliary fuse, and in which the refused fuse may be moved back into position without interrupting the service, although disconnecting the succeeding fuse.

Further objects are to provide a construction in which all of the fuses are initially mechanically held in place, in which no fuse has to be first mechanically moved into place before it is ready to operate upon the blowing of a preceding or first fuse, and in which the reserve fuses, although mechanically in place, are nevertheless automatically electrically connected in service in succession as the preceding fuse or fuses blow.

Further objects are to provide a construction in which the device is well suited for high voltage lines, in which each fuse as it blows drops downwardly and swings outwardly clear of the upper contact to thereby provide maximum spacing at the open portion of the circuit, and in which switch mechanism is provided for connecting the succeeding fuse, the switch mechanism being so constructed that when open a wide spacing is obtained between the contacts of the switch, and in which the switch closes with a quick motion so that arcing even under heavy load conditions is minimized.

Further objects are to provide a construction for repeating fuses in which the blown fuse may be readily removed by a switch stick and may be readily replaced after refusing by such switch stick without requiring the lineman to handle any portion of the fuse structure while it is connected to either side of the high tension circuit.

Further objects are to provide a repeating fuse construction in which upper and lower stationary contacts are provided for the several fuses, in which the fuses are so made that they have an open lower end, the fuse link extending through the fuse tube and having its major portion housed thereby, the lower part of the fuse link extending outwardly through the lower open end and holding restraining mechanism in place, the construction being such that when the fuse blows, the severed fuse link releases such supporting or restraining mechanism and allows the fuse to drop downwardly and swing outwardly, and in which the fuses are provided with closed upper ends with the switch for connecting the succeeding fuse being located adjacent the upper contacts so that the switches located adjacent the upper contacts for connecting successive fuses are positioned at a point far removed from the blast of conducting vapors.

Additionally, it is to be noted that by having the fuse tube open at its lower end and the switches located adjacent the upper portion of the structure, whipping of the fuse link, if any portion thereof remains, will not accidentally connect another fuse, but in which the actual electrical connection of a successive fuse in the circuit occurs by the operation of the switch located adjacent the upper contacts of the blown fuse; in other words, to so construct the device

that the reclosure parts are far removed from the lower or active ends of the fuse tube.

Further objects are to provide a construction in which it is impossible to throw a fuse tube into its upper or closed position without disconnecting the circuit to the next adjacent fuse, so that irrespective of any lack of care of the lineman no pair of fuses will be left permanently in circuit.

Further objects are to provide a construction of repeating fuses in which any one of several different types of switch contacts may be used, in which a secure positive closing of the switch is obtained when a fuse blows, in which the automatic timing mechanism is housed and protected from the weather, and in which the adjustment of such timing mechanism may be made with the utmost ease.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 is a face view of the device with one of the fuses removed, to more clearly show the construction.

Figure 2 is a sectional view on the line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary view approximately on the section 3—3 of Figure 2, showing the timing mechanism.

Figure 4 is a view corresponding to Figure 2, showing a further form of the invention.

Figure 5 is a sectional view on the line 5—5 of Figure 4 and drawn to an enlarged scale.

Figure 6 is a sectional view on the line 6—6 of Figure 4 drawn to an enlarged scale.

Figure 7 is a view of the upper portion of the apparatus with parts broken away showing a further modified form.

Figure 8 is a view of a modified form of reclosing switch.

Figure 9 is a fragmentary view looking directly downwardly on one of the upper contacts as shown in Figures 1 and 2.

Referring to the drawings, particularly Figures 1, 2 and 3, it will be seen that the device comprises an upper supporting bar 1 of any suitable insulating material, such as impregnated wood and a phenolic condensation product. This supporting member 1 may be carried from an upper insulator 2, or, if desired, each of the upper head portions of the device may be carried separately by insulators.

The lower portion of the device is carried by a supporting bar 3 which may be of metal, and this bar in turn is carried by a supporting insulator 4. It is to be noted that the lower bar 3 carries a plurality of outwardly projecting arms 5, see Figures 1 and 2, which are looped around and secured to a pivot rod or member 6. The member 6 may be a hollow tube, as shown, and screws, as indicated at 7 see Figures 1 and 2, lock the pivot member 6 to the brackets 5. One of the lead-in conductors may be inserted in the end of the tube or pivot member 6 and locked in place by the adjusting screws 7, in a well known manner.

Each fuse has associated therewith an upper hood 8 of metal which is clamped to the supporting bar 1 by means of bolts 9 passing through clamping plates 10, see Figure 2. The upper contacts are formed of spring rod material looped in the manner shown in Figures 1, 2 and 9, and have their ends clamped between the plates 10 and the adjacent portion of the hoods 8.

These upper contacts are provided with outwardly projecting upper and lower arms 11 and 12. The lower arms terminate in a looped portion 13 which constitutes a stop for the upper projecting pin 14 of the upper contact 15 of the fuse tube 16. The arms 11 are provided with a shouldered portion 17, see Figure 9, which holds the pin portion 14 of the upper contact from outward motion, but due to the resilient clamping of these arms, such upper pin can be bodily moved outwardly when a switch stick is moved into the manipulating eye 18, see Figure 2. The arms diverge outwardly, as shown in Figure 9, to thereby provide a guide for guiding the upper contact in place when the fuse is rocked upwardly into position.

One of the fuses is provided with an upper terminal member 19, see Figure 1, to which a lead-in conductor may be clamped by means of screws 20.

Each hood 8 is provided with a slotted portion 21, see Figure 1, through which a projecting switch arm 22 extends, as shown in Figures 1 and 2. This switch arm carries a contact 23 which may be formed as a pin held in place by split pins, as indicated in Figures 1 and 2. The switch arm 22 is pivoted within the hood upon the pivot pin 24 and is urged towards closed position by means of the spring 25. It is electrically connected to the hood through the pin, but a better connection is provided by means of the flexible leader 26, see Figure 2.

The hoods may be provided with stationary contacts 27 with the exception of the last hood or righthand hood, as viewed in Figure 1. All of the hoods with the exception of the first hood or lefthand hood, as viewed in Figure 1, are provided with stationary contact members 28 which extend towards the preceding hood. These contacts 27 and 28 are in the form of spring arms or horns and are each provided with a slanting portion 29 beneath which the pin 23 is forced when the switch arm 22 rocks into uppermost or switch closing position, thereby scraping the contacts clean at each closing motion.

The switch arms are rocked towards open position by the closing of the fuse tube. Each switch arm 22 has a bell crank extension 30 which is provided with a transversely extending lower cross head or cross bar 31 which is engaged by the fuse tube 16, preferably the upper contact 15 thereof, as shown in Figure 2, whenever the fuse is rocked into closed position. The switch open position with the fuse in its active or circuit closing position is shown in full lines in Figure 2, the switch being shown in open position in such full line showing. The switch is shown in closed position in the dotted line showing of Figure 2, that is to say, when the fuse has dropped outwardly to inoperative position.

Referring particularly to Figures 2 and 3, it will be seen that the arms 30 are formed in duplicate and are spaced from each other. This is shown most clearly in Figure 3. The switch arm 22, however, may be a single arm, as shown in Figure 1. The two arms 30 are provided with shouldered upper portions 32, see Figure 2, which engage projecting pins 33 carried by the timing mechanism or time delay mechanism, as will hereinafter appear.

The pins 33 are screwed into a head 34 of an expansible metal bellows 35 and are also pivotally carried by the U-shaped or bifurcated lever 36, see Figures 2 and 3. The lever 36 is pivotally mounted within the hood 8 upon a pin 37, as shown in Figures 2 and 3, so that the lever is free to pivot about such pin and to thereby operate the metal bellows 35. The outward or up-

ward rocking motion of the lever **36** is determined or limited by means of the set screw **38**, see Figure 2. This set screw constitutes an adjusting means extending outwardly from the hood for adjusting the timing of the divice, as will appear hereinafter.

The inner end of the metal bellows is carried by a head **39**, see Figures 2 and 3, which in turn is carried by the pivot pins **40** pivotally mounted within the hood **8** and screwed into the head **39**. This head is provided with an opening **41'** therethrough and the lower end of the bellows is provided with a small or constricted opening **42**, see Figure 3. A reservoir metal bellows or receiving metal bellows **41** is secured to the outer or under side of the head **39**.

It is to be noted from Figure 3 that the upper head **34** of the metal bellows **35** is provided with a filling opening which is closed by means of the screw or plug **44**. The two bellows are filled with alcohol with the receiving bellows **41** contracted and the restraining bellows **35** in its expanded position. Thereafter, when the switch arm **22** rocks towards closed position, its shouldered portions **32**, see Figure 3, will strike the pins **33** and compress the bellows **35**, the lever **36** freely rocking about the pivot **37**.

The bellows **35** is therefore contracted, but this contracting is slow as the liquid, such as alcohol for instance, has to be forced through the restricted passageway **42** and consequently the closing motion of the arm **22** is delayed, thereby giving a time delay for the closing of the switch. The period of delay is determined by the adjustment of the screw **38**, see Figure 2, as this determines the initial compression or position of the bellows **35**.

However, from reference to Figure 2, it will be noted that the switch lever has a rounded upper portion **45** so that after the shouldered portions **32** have passed the pins **33**, the rounded portion **45** will thereafter rock past the pins with a quick motion, thereby allowing quick final closing of the switch, though the initial closing motion of the switch is delayed.

The fuse tube first drops downwardly so that its upper contact clears the stationary contact with which it is normally interlocked. The means for securing this downward dropping motion may include the collar **46** locked to the fuse tube, as shown in Figure 2, and provided with a rearwardly extending portion **47**. This rearwardly extending portion is pivotally received by the upwardly projecting ears of the bifurcated lever **48**. This lever **48** is provided with hooklike portions **49** which are pivotally and detachably mounted upon the supporting rod or lower pivot member **6**. The lever is restrained from outward motion by means of the fuse link **50**, such fuse link extending from the upper contact **15** through the tube and outwardly through the lower end and being clamped to the lower portion of the lever **48** by means of a thumb nut **51**, as shown most clearly in Figure 2.

If desired, the collar **47** may be provided with an outwardly projecting lip **52** which may be received in a suitably shaped portion of a switch stick in a well known manner to permit the removal of a blown fuse by means of the switch stick or the replacing of a refused fuse tube.

Any suitable frame work may be employed for supporting the device. For instance, a base member **53**, as shown in Figures 1 and 2, may be provided so that the entire device is a unitary structure and may be mounted wherever desired.

The operation of the apparatus is as follows:

Assuming that all of the fuses are in place, the first fuse is connected in the line as it electrically connects the upper terminal member **19** with the lower terminal member, which, in reality, is the pivot member **6**. If an overload occurs, the fuse link **50**, see Figure 2, is ruptured and expelled thereby releasing the lever **48**. In view of the fact that the collar **46** is pivoted, as indicated at **54**, to the link **48** at a point forwardly of the pivotal support for the link **48**, the lower end of the fuse tube will drop downwardly and outwardly, thereby lowering the upper contact **14** from engagement with the upper stationary contact. The fuse tube will thereafter rock outwardly and downwardly. As the fuse tube moves out of the way, the cross bar **31** of the lever **30** is no longer restrained and the switch arm or lever **22** moves towards closed position under the influence of the spring **25**, see Figure 2.

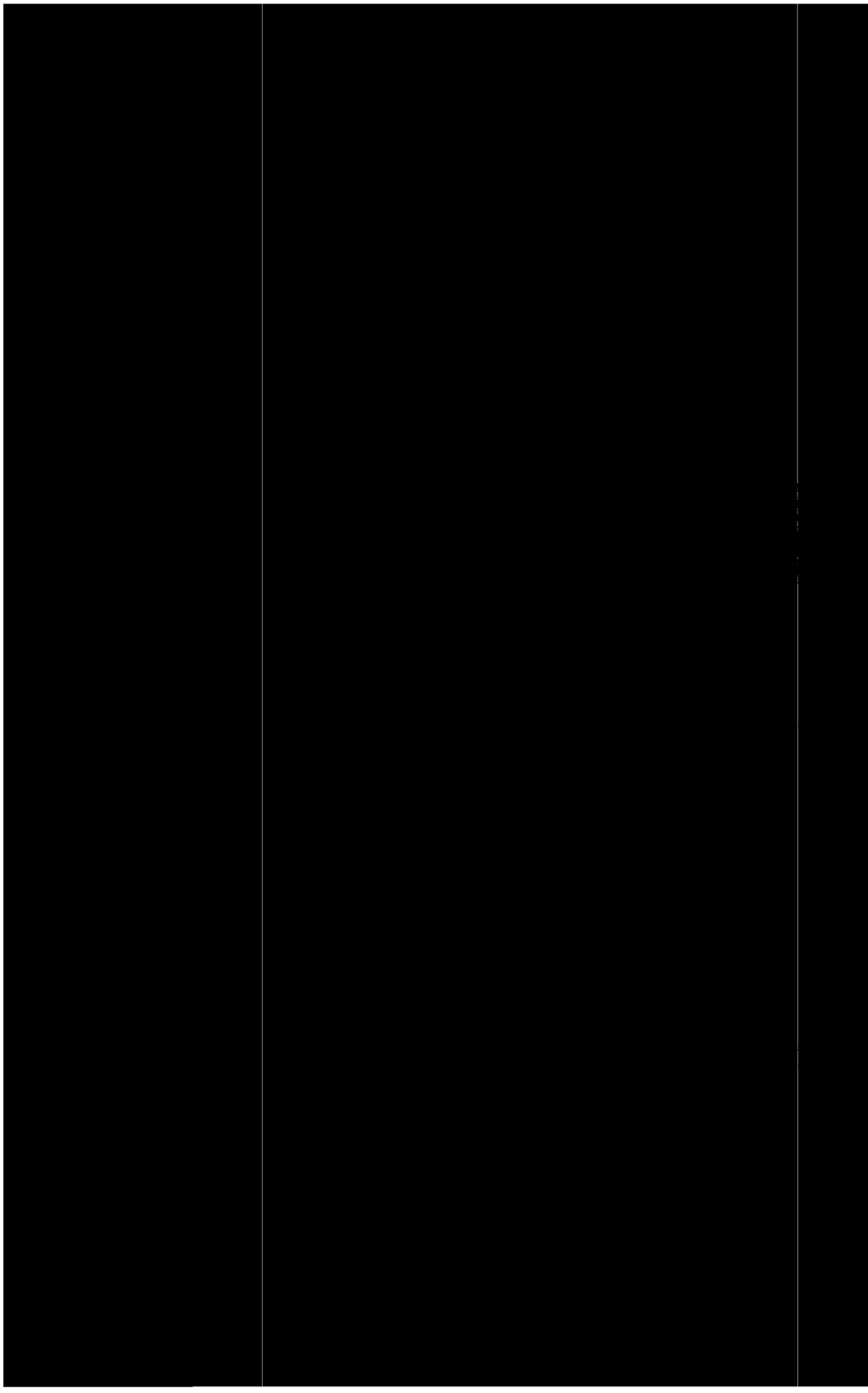
This motion of the switch lever is retarded by the bellows **35**, as previously described and consequently the closing motion of the switch lever is retarded. However, the final motion of the switch lever is a quick closing motion, as previously described, thereby connecting the next adjacent fuse in circuit through the medium of the switch arms **27** and **28** and the movable contact or pin **23**. The interval of time between the blowing of one fuse and the connecting in circuit of the next adjacent fuse is determined by the setting of the set screw or regulating member **38**, see Figure 2 as previously described.

If the overload has ceased, obviously this new fuse will not blow. However, if the overload persists or recurs, the new fuse will blow and the action heretofore described will be repeated, the next adjacent fuse being connected in circuit after a predetermined interval of time.

When it is desired to refuse a blown fuse, this may be readily done by detaching it from the support or pivot bar **6**, as previously described. Thereafter the fuse is refused and replaced and rocked into position, the pin **14** being guided by the divergent arms **11**, such arms slightly springing apart when the pin moves behind the shouldered portion **17** thereof, see Figure 9. During the latter part of the closing motion of the fuse, the switch arm will be rocked into open position due to the fuse contacting with the cross bar **31**, see Figure 2. The bellows **35** will then be expanded by means of the internally carried spring **55**, see Figure 3, and will draw the liquid from the reservoir or receiving bellows **43** back into the bellows **35**.

The invention may take other forms from that described. For instance, as shown in Figure 4, a different form of switch may be employed. In this form of the invention the switch is provided with the spaced arms **30'** which are connected at their lower portion by a cross arm **31'**, as previously described. However, the switch arm **22'** terminates in a switch blade **56** which is preferably bevelled at its edge, see Figures 4 and 5. This knife portion of the switch blade is adapted to separate the plates **57**, see Figures 5 and 6, of the stationary contacts carried by the projecting arm **58**, the arm or member **58** corresponding to the member **28** in Figure 2.

The plates **57** of the stationary contacts may each be provided with projecting pins **59** which loosely pass through openings in a small housing **60** carried by the member **58**, see Figure 4. Helical springs **61** loosely surround the pins **59** and urge the contact plates **57** towards each other,



stated, to provide any interval between the blowing of one fuse and the connecting of a succeeding fuse. It forms the subject matter of our copending application Serial Number 753,439, filed November 17, 1934, for Time delay mechanism for repeating fuses. This delay is particularly desirable not only under the conditions set forth, but also when there is a highly inductive load in the circuit, as under these conditions the arcing time inside the tube may be appreciable. However, it is not possible for the next fuse to be connected in active position immediately as the time delay intervenes. Even under these very severe conditions a further action takes place to guard against even the premature dropping of the fuse from its closed circuit position prior to the extinguishing of the arc within the fuse tube.

It is obvious that during the entire explosive action of the fuse tube there is an upward reaction which tends to hold the fuse tube in its active position. The reclosure switch cannot function until the fuse tube has moved outwardly and released such reclosing switch. It is, therefore, apparent that even under the most severe conditions, the device is wholly reliable in its operation.

Additionally, this invention provides a repeating fuse which is positive in its action and which insures a uniform and reliable operation of the device.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

We claim:

1. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a discharge opening at the bottom, each of said fuse units being normally mechanically held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, an electric line normally connected through said first fuse unit, and normally opened switch means permanently biased towards closed position and located at a point remote from the open end of said fuse unit for connecting said electric line through said second fuse unit upon blowing of said first fuse unit.

2. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units being normally mechanically held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, an electric line normally connected through said first fuse unit, normally opened switch means permanently biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, and time delay mechanism for restraining the closing motion of said switch means.

3. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units being normally mechanically held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, an electric line normally connected through said first fuse unit, normally opened switch means permanently biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, and time delay mechanism for restraining the closing motion of said switch means, said time delay means releasing said switch means on the latter part of the closing motion of said switch means, whereby a quick final closing of said switch means is secured.

4. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, an electric line normally connected through said first fuse unit, each of said fuse units being normally mechanically held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, each of said fuse units including a fuse tube having an open end, normally opened switch means permanently biased towards closed position and located at a point remote from the open ends of said fuse units, said switch means being released upon blowing of said first fuse unit, and time delay mechanism for delaying the closing motion of said switch means.

5. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, an electric line normally connected through said first fuse unit, each of said fuse units being normally mechanically held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, each of said fuse units including a fuse tube having an open end, normally opened switch means permanently biased towards closed position and located at a point remote from the open ends of said fuse units, said switch means being released upon blowing of said first fuse unit, and time delay mechanism for delaying the closing motion of said switch means, said time delay mechanism delaying the closing motion of said switch throughout a portion only of said closing motion, the remainder of said closing motion constituting a quick motion.

6. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a fuse link therein, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by the fuse link of said first fuse unit for releasing said first fuse unit upon blowing of said first fuse unit, switch means permanently biated towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, and time delay mechanism for causing a delay in the closing motion of said switch means after the blowing of said first fuse unit.

7. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a discharge opening at the bottom and having a fuse link extending through said fuse tube and passing outwardly through the open bottom end thereof, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by said fuse link for releasing said first fuse unit upon blowing of said first fuse unit, switch means permanently biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, and time delay mechanism for causing a delay in the closing motion of said switch means after

the blowing of said first fuse unit, said switch means being located at a point remote from the open end of said fuse units.

8. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a fuse link therein, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by said fuse link of said first fuse unit for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, and time delay mechanism for causing a delay in the closing motion of said switch means after the blowing of said first fuse unit, said time delay mechanism automatically resetting itself when said switch means is subsequently opened.

9. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a fuse link therein, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by said fuse link of said first fuse unit for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, time delay mechanism for causing a delay in the closing motion of said switch means after the blowing of said first fuse unit, and means associated with said switch means for resetting said switch means when said first fuse unit is moved back into operative position.

10. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a fuse link therein, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by the fuse link of said first fuse unit for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, time delay mechanism for causing a delay in the closing motion of said switch means after the blowing of said first fuse unit, and means associated with said switch means for automatically resetting said switch means when said first fuse unit is moved back into operative position, said time delay mechanism including means for automatically restoring said time delay mechanism to its initial position when said switch means is moved to open position.

11. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a fuse link therein, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by the fuse link of said first fuse unit for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, time delay mechanism for causing a delay in the closing motion of said switch means after the blowing of said first fuse unit, and means connected to said switch means and positioned within the path of travel of said first fuse unit for opening said switch upon closing of said first fuse unit.

12. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, each of said fuse units including a fuse tube having a fuse link therein, said first fuse unit being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means controlled by the fuse link of said first fuse unit for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position for connecting said electric line through said second fuse unit upon blowing of said first fuse unit, said switch means being restrained from closing motion when said first fuse unit is in operative position, and time delay mechanism for causing a delay in the closing motion of said switch means after the blowing of said first fuse unit, said switch means having an arm provided with means normally located rearwardly of said first fuse unit when said switch means is open and located in the path of movement of said first fuse unit when said switch means is closed, whereby said switch means is positively moved to open position when said first fuse unit is moved back to operative position.

13. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, said fuse units being normally mechanically held in operative position, an electric line normally connected through said first fuse unit, means for releasing said first fuse unit upon blowing of said first fuse unit, and switch means biased towards closed position and including a switch arm normally restrained from closing motion by said first fuse unit and a stationary contact carried by said second fuse unit, a second arm rigid with said switch arm and having a portion normally positioned rearwardly of said first fuse unit, and time delay means retarding the initial closing motion of said switch arm and releasing said switch arm during final closing movement of said switch arm.

14. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, said fuse units being normally mechanically held in operative position and each having its lower end provided with a discharge opening, means for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position and including a switch arm pivoted adjacent the upper end of said first fuse unit and normally restrained from closing by said first fuse unit, and a stationary contact for said switch arm, said stationary contact being carried adjacent and normally electrically connected to the upper portion of said second fuse unit.

15. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, said fuse units being normally mechanically

held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position and including a pivotally mounted switch arm and provided with a transversely extending contact, said switch arm being normally restrained from closing by said first fuse unit, a stationary contact projecting from adjacent said first fuse unit and normally electrically connected thereto, and a second stationary contact projecting from adjacent said second fuse unit and normally electrically connected thereto, said transverse movable contact bridging said stationary contacts when said switch arm rocks to closed position.

16. An automatic repeating fuse construction comprising a first fuse unit and a second fuse unit, said fuse units being normally mechanically held in operative position, means for releasing said first fuse unit upon blowing of said first fuse unit, switch means biased towards closed position and including a movable, pivotally mounted switch blade adjacent said first fuse unit and normally electrically connected thereto, said switch blade being normally restrained from closing by said first fuse unit, and a stationary contact for said switch blade, said stationary contact having two movable contact portions spring pressed towards each other and normally in contact and adapted for separation by said switch blade, and normally electrically connected to said second fuse unit.

17. A repeating electrical device including a first cut-out and a second cut-out, said first cut-out having a fuse tube mounted for movement from circuit closing position to open circuit position, means normally holding said tube in circuit closing position and released when said fuse blows, an electric line normally connected through said first cut-out, a switch for connecting said electric line through said second cut-out, said switch being normally held in open circuit position, and means permanently urging said switch towards closed circuit position, the fuse tube of said first cut-out being normally positioned in the path of movement of said switch and serving as a latch directly engaging said switch to hold said switch in open circuit position until said tube moves from circuit closing position.

18. A repeating electrical device including a first cut-out and a second cut-out, said first cut-out having a fuse tube mounted for movement from circuit closing position to open circuit position, means normally holding said tube in circuit closing position and released when said fuse blows, an electric line normally connected through said first cut-out, a switch for connecting said electric line through said second cut-out, said switch being normally held in open circuit position, means permanently urging said switch towards closed circuit position, the fuse tube of said first cut-out being normally positioned in the path of movement of said switch and serving as a latch directly engaging said switch to hold said switch in open circuit position until said tube moves from circuit closing position, and motion retarding mechanism opposing the movement of said switch towards closed circuit position.

19. A repeating electrical device including a first cut-out and a second cut-out, said first cut-out having a fuse tube mounted for movement from circuit closing position to open circuit position, means normally holding said tube in circuit closing position and released when said fuse blows, an electric line normally connected through said first cut-out, a switch for connecting said electric line through said second cut-out, said switch being normally held in open circuit position, means permanently urging said switch towards closed circuit position, the fuse tube of said first cut-out being normally positioned in the path of movement of said switch and serving as a latch directly engaging said switch to hold said switch in open circuit position until said tube moves from circuit closing position, motion retarding mechanism opposing the movement of said switch towards closed circuit position, said retarding mechanism releasing the switch after a predetermined movement for an unhampered continued movement of the switch to circuit closed position.

20. A repeating electrical device including a first cut-out and a second cut-out, said first cut-out having a pivotally mounted fuse tube mounted for movement from circuit closing position to open circuit position, means normally holding said tube in circuit closing position and released when said fuse blows, and a switch normally in open circuit position and having a switch operating arm disposed in the path of movement of the fuse tube of said first cut-out normally engaged by said fuse tube and held in open position when the first cut-out is in circuit closed position, and means urging said switch towards circuit closing position.

21. The combination of a fuse unit having a fuse tube mounted for movement from circuit closing position to open circuit position, latch means normally holding said tube in circuit closing position, said fuse unit having a fusible element, means controlled by said fusible element for releasing said tube from said latch when said fusible element is ruptured, and a switch provided with a switch operating arm extending into the path of movement of said tube, said tube normally holding said switch in open circuit position, and having a closed end normally located adjacent said switch.

22. A repeating electrical device including a first cut-out and a second cut-out, said first cut-out having a fuse tube provided with an open end and pivoted adjacent said open end and closed at its other end, latch means normally engaging the closed end of said tube and holding said tube in circuit closing position, said first cut-out having a fusible element, means controlled by said fusible element for releasing said tube from said latch when said fusible element fuses, and a switch urged towards circuit closing position and having a switch operating arm adjacent the closed end of said tube and disposed in the path of movement of said tube, said tube normally holding said switch in open circuit position until said tube is released from said latch.

23. The combination of a fuse unit having a pivotally mounted fuse tube open at one end and closed at the other end, latch means normally engaging the closed end of said tube and holding said tube in circuit closing position, said fuse unit having a fusible member, means controlled by said fusible member for normally holding said fuse tube in engagement with said latch and releasing said fuse tube from said latch when said fusible member is fused, a switch disposed adjacent the closed end of said tube and having a switch operating arm normally directly engaged by said tube to hold said switch in open circuit position, and means urging said switch towards closed circuit position.

24. The combination of a fuse unit having a fuse tube provided with an open end and pivoted adjacent said open end and closed at its other end, latch means normally engaging the closed end of said tube and holding said tube in circuit closing position, said fuse unit having a fusible member, means controlled by said fusible member for normally holding said fuse tube in engagement with said latch and releasing said fuse tube from said latch when said fusible member is fused, a switch disposed adjacent the closed end of said tube and having a switch operating arm normally directly engaged by said tube to hold said switch in open circuit position, and means urging said switch towards closed circuit position.

25. The combination of a fuse unit having a pivotally mounted fuse tube open at one end and closed at the other end, latch means normally engaging the closed end of said tube and holding said tube in circuit closing position, said fuse unit having a fusible member, means controlled by said fusible member for normally holding said fuse tube in engagement with said latch and releasing said fuse tube from said latch when said fusible member is fused, a switch disposed adjacent the closed end of said tube and having a switch operating arm normally directly engaged by said tube to hold said switch in open circuit position, means urging said switch towards closed circuit position, and motion retarding mechanism opposing the movement of the switch towards circuit closing position.

26. The combination of a fuse unit having a pivotally mounted fuse tube open at one end and closed at the other end, latch means normally engaging the closed end of said tube and holding said tube in circuit closing position, said fuse unit having a fusible member, means controlled by said fusible member for normally holding said fuse tube in engagement with said latch and releasing said fuse tube from said latch when said fusible member is fused, a switch disposed adjacent the closed end of said tube and having a switch operating arm normally directly engaged by said tube to hold said switch in open circuit position, means urging said switch towards closed circuit position, and motion retarding mechanism opposing the movement of the switch towards circuit closing position, said retarding mechanism releasing the switch after a predetermined movement for an unhampered continued movement to circuit closing position.

27. The combination of a fuse unit having a fuse tube open at one end and closed at the other end, a support for said tube, a pivot link pivotally connected with said tube and with said support, a fuse link carried by said fuse tube and normally holding said pivot link substantially stationary relative to said tube, latch means on said support normally holding said tube against pivotal movement while said pivot link is held by said fuse link, a switch mounted on said support and having a switch operating arm engaged by the closed end of said tube and holding said switch in open circuit position, and means urging said switch towards closed circuit position.

28. The combination of a fuse unit having a fuse tube open at one end an closed at the other end, a support for said tube, a pivot link pivotally connected with said tube and with said support, a fuse link carried by said fuse tube and normally holding said pivot link substantially stationary relative to said tube, latch means on said support normally holding said tube against pivotal movement while said pivot link is held by said fuse link, a switch mounted on said support and having a switch operating arm engaged by the closed end of said tube and holding said switch in open circuit position, means urging said switch towards closed circuit position, and motion retarding mechanism opposing the movement of said switch towards circuit closing position.

29. A repeating circuit interrupting device including a first cutout and a second cutout, said first cutout having a pivotally mounted arcing tube with an expulsible conductor therein, movable latch means to engage and hold the tube in closed circuit position, means to release the tube from the latch by the bodily movement of said tube without the necessity of motion of said latch means, a circuit closing switch controlled by the first cutout for closing an electrical circuit through the second cutout, and motion retarding means controlling the closing movement of said circuit closing switch.

30. A repeating circuit interrupting device including a first cutout and a second cutout, said first cutout having an arcing tube which is movable between closed circuit and open circuit positions, an expulsible conductor within said tube, means to latch the tube in closed circuit position by an approximately lateral motion of the tube, means to release the tube from closed circuit positioned by approximately longitudinal motion of the tube, a circuit closing switch controlled by the first cutout by closing an electrical circuit through the second cutout, and motion retarding mechanism controlling the closing movement of said closing switch.

31. A repeating circuit interrupting device including a first cutout and a second cutout, said first cutout comprising an arcing tube, a conductor in said tube, movable latching means at each end of the tube cooperating to hold the tube in closed position under normal circuit conditions and to release the tube under overload conditions in the circuit, a circuit closing switch controlled by the first cutout for closing an electrical circuit through the second cutout, and time delay mechanism controlling the closing movement of said closing switch.

32. A repeating circuit interrupting device including a first cutout and a second cutout, said first cutout comprising an arcing tube pivotally mounted and movable between closed circuit and open circuit positions, a conductor within the tube, latch means at each end of the tube which means are operable to hold the tube in closed circuit position under normal circuit conditions and to release the tube under overload conditions in the circuit, a circuit closing switch controlled by the first cutout for closing an electrical circuit through the second cutout, and motion retarding mechanism controlling the closing movement of said closing switch.

33. A combined circuit interruptor and circuit closer comprising a plurality of current responsive circuit interrupting units, at least one of the current responsive circuit interrupting units having an operative and an inoperative position and being automatically released for motion to inoperative position upon the occurrence of an overload, a circuit closing switch normally in open position and movable to circuit closing position after one of said units has operated, whereby to close a circuit through another of said units, and motion retarding mechanism opposing the closing movement of said switch.

34. A circuit interruptor comprising a body portion having terminals, an arcing tube open at one end and pivotally mounted and supported from said body portion adjacent said open end for endwise movement, an expulsible conductor in said tube normally completing an electric circuit between said terminals, latching means holding said tube in circuit closing position, and current responsive means for releasing said latching means; in combination with a circuit closer comprising an automatic circuit closing means normally engaged by the upper end of said tube to be held thereby in open circuit position and releasable for circuit closing movement when said tube has been released.

35. A circuit interruptor comprising a body portion having terminals, an arcing tube open at one end and pivotally mounted and supported from said body portion adjacent said open end for endwise movement, an expulsible conductor in said tube normally completing an electric circuit between said terminals, latching means holding said tube in circuit closing position, and current responsive means for releasing said latching means; in combination with a circuit closer comprising an automatic circuit closing means normally held in open circuit position and releasable for circuit closing movement, when said tube has been released, and motion retarding means opposing circuit closing movement of said circuit closing means.

36. A circuit interruptor comprising a body portion having terminals, an arcing tube open at one end and pivotally mounted and supported from said body portion adjacent said open end for endwise movement, an expulsible conductor in said tube normally completing an electric circuit between said terminals, latching means holding said tube in circuit closing position, and current responsive means for releasing said latching means; in combination with a circuit closer comprising an automatic circuit closing means normally held by the upper end of said tube in open circuit position and releasable for circuit closing movement when said tube has been released, and motion retarding means opposing circuit closing movement of said circuit closing means.

37. A circuit interruptor comprising a body portion having terminals, an arcing tube pivotally mounted and supported from said body portion adjacent one of the ends of said arcing tube for endwise movement, circuit interrupting means in said tube normally completing an electric circuit between said terminals, latching means holding said tube in circuit closing position, and means releasable on the occurrence of an overload for releasing said latching means; in combination with a circuit closer comprising an automatic circuit closing means normally engaged by the end of said tube remote from said pivot to be held thereby in open circuit position and releasable for circuit closing movement when said tube has been released.

38. A circuit interruptor comprising a body portion having terminals, an arcing tube pivotally mounted and supported from said body portion adjacent one of the ends of said arcing tube for endwise movement, circuit interrupting means in said tube normally completing an electric circuit between said terminals, latching means holding said tube in circuit closing position, and means releasable on the occurrence of an overload for releasing said latching means; in combination with a circuit closer comprising an automatic circuit closing means normally engaged by the end of said tube remote from said pivot to be held thereby in open circuit position and releasable for circuit closing movement when said tube has been released, and motion retarding means opposing circuit closing movement of said circuit closing means.

39. A circuit interruptor comprising a body portion having terminals, an arcing tube pivotally mounted and supported from said body portion adjacent one of the ends of said arcing tube for endwise movement, circuit interrupting means in said tube normally completing an electric circuit between said terminals, latching means holding said tube in circuit closing position, and means releasable on the occurrence of an overload for releasing said latching means; in combination with a circuit closer comprising an automatic circuit closing means normally engaged by the end of said tube remote from said pivot to be held thereby in open circuit position and releasable for circuit closing movement when said tube has been released, motion retarding means opposing circuit closing movement of said circuit closing means, and manually adjustable means for defining a maximum duration of engagement of said motion retarding means with said circuit closing means.

40. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices mounted for individual rotation about a common axis at their lower ends, releasable holding means at the lower ends of said fuse devices, said releasable holding means being released upon blowing of the corresponding fuse device to allow such fuse device to rotate from operative to inoperative position, said fuse devices being normally held in a substantially upright operating position, means for normally connecting one of said fuse devices in an electric circuit, and switching means for sequentially connecting the next fuse device at its upper end into said circuit when the preceding fuse device blows.

41. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices rotatably mounted at their lower ends, releasable holding means at the lower ends of said fuse devices, said releasable holding means being released upon blowing of the corresponding fuse device to allow such fuse devices to rotate from operative to inoperative position about their lower ends, said fuse devices being normally held in a substantially upright operating position, and switching means for sequentially connecting the next fuse device at its upper end into a circuit when the preceding fuse device is released.

42. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices normally occupying a substantially vertical position and mounted for individual rotation about a common axis at their lower ends, holding means adjacent the lower end of said fuse devices, means for releasing the holding means individual to each fuse device on blowing of the corresponding fuse device to permit rotation of such fuse device from operative to inoperative position, means for connecting one of said fuse devices in an electric circuit at its upper end while the upper ends of the remaining fuse devices are electrically disconnected, and switching means for sequentially connecting the next fuse device in said circuit at its upper end on release of the preceding fuse device.

43. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices having upper and lower terminal members

and mounted for individual rotation about a common axis at their lower ends, releasable on blowing of said fuse devices for individually holding said fuse devices in a substantially vertical position and against rotation about said axis, means for commonly connecting said lower terminal members to an electric circuit, means connecting the upper terminal of one of said fuse devices to complete said circuit while the other upper terminal members remain electrically disconnected, and switching means for sequentially shifting said circuit from one upper terminal member to the next on release of the preceding fuse device.

44. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices mounted for individual rotation about a common axis at their lower ends, releasable holding means adjacent the lower ends of said fuse devices, said releasable holding means being released upon blowing of the corresponding fuse device to allow such fuse device to rock about the common axis from operative to inoperative position, said fuse devices being normally held in a substantially vertical position, means normally connecting one of said fuse devices in an electric circuit, switching means for sequentially connecting the next fuse device at its upper end into said circuit when the preceding fuse device blows, and time delay means disposed to cooperate with said switching means for delaying the connection of the next fuse device into said circuit.

45. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices rotatably mounted at their lower ends, releasable holding means at the lower ends of said fuse devices, said releasable holding means being released upon blowing of the corresponding fuse device to allow such fuse device to rotate from operative to inoperative position, switching means for sequentially connecting the next fuse device at its upper end into a circuit when the preceding fuse device is released, and hydraulic escapement time delay means arranged and adapted to retard the movement of said switching means for delaying the connection of the next fuse device into said circuit.

46. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices mounted for individual rotation about a common axis at their lower ends, releasable holding means adjacent the lower ends of said fuse devices, said releasable holding means being released upon blowing of the corresponding fuse device to allow said fuse device to rock from operative to inoperative position about the said common axis, said fuse devices being normally mounted in a substantially vertical position, means for connecting one of said fuse devices in an electric circuit at its upper end while the upper ends of the remaining fuse devices are electrically disconnected, switching means for sequentially connecting the next fuse device at its upper end on release of the preceding fuse device, and time delay means arranged and adapted to oppose the operation of said switching means for delaying the connection of the next fuse device into said circuit.

47. An automatic fuse restoring mechanism comprising in combination a plurality of fuse devices having upper and lower terminal members and mounted for individual rotation about a common axis at their lower ends, releasable holding means adjacent the lower ends of said fuse devices and individual to said fuse devices, said releasable holding means being released upon the blowing of the corresponding fuse device to allow said fuse device to rock from operative to inoperative position, said fuse devices being normally held in a substantially vertical position, means for commonly connecting said lower terminal members to an electric circuit, means for connecting the upper terminal members of one of said fuse devices to complete said circuit while the other terminal members remain electrically disconnected, switching means for sequentially shifting said circuit from one upper terminal member to the next on release of the preceding fuse device, and a regulatable hydraulic escapement time delay device arranged and adapted to control the movement of said switching means, whereby the shifting of said circuit to the next upper terminal member is delayed for a predetermined interval after the preceding fuse device is released.

48. An automatic fuse mechanism comprising in combination a plurality of fuse devices at least one of which is rotatably mounted adjacent one end, releasable holding means for releasably holding said rotatably mounted fuse device against rotation, said releasable holding means being releasable upon blowing of the rotatably mounted fuse device to allow such fuse device to rotate from operative to inoperative position, switching means for sequentially connecting a successive fuse device into a circuit when the rotatably mounted fuse device is released, and fluid escapement time delay means arranged and adapted to retard the operation of said switching means for delaying the connection of the succeeding fuse device into said circuit.

49. In a circuit opening device, a plurality of fuses of the tube type, each pivotally supported at the lower end thereof, and mechanism adjacent the upper ends of the tubes for operatively associating the fuses with the circuit in succession as each fuse is blown in turn.

50. In a circuit opening device, a plurality of tube type fuses, transfer mechanisms, one of which is associated with each of said fuses for transferring the circuit connection to the next fuse when the associated fuse is blown, each transfer mechanism including a connector movable from a normal inoperative position to a position where it connects the next tube into the circuit, means biasing said connector to said connecting position, and means whereby the associated fuse restrains said connector from movement under the biasing force of said biasing means, said means for causing said fuse to restrain said connector being biased to terminate said restraint but being operable only in response to the operation of the associated fuse to terminate said restraint.

51. In a multiple unit circuit interrupter, a connecting member for each unit movable from a normal position for establishing a connection with another unit upon operation of the first unit to open circuit condition, means for moving the connecting member into position for connection with a second unit, means for retarding the initial movement of said connecting member, means associated with said connecting member for rendering said retarding means inoperative upon movement of said connecting member beyond a predetermined point to enable the final movement of said connecting member to be accelerated, and means operative upon the return of said connecting member to its normal position for reestablishing the operative relation between

said retarding means and said connecting member.

52. In a circuit opening device, a plurality of expulsion fuses of the tube type, each pivotally supported at the lower end thereof, and mechanism adjacent the upper ends of the tubes for operatively associating the fuses with the circuit in succession as each fuse is blown in turn, and housings, one for enclosing the mechanism adjacent each tube.

53. In a circuit opening device, a plurality of fuses of the tube type, means for pivotally supporting each of said fuses at one end thereof, movable means for releasably engaging the other end of each of said fuses, means acting upon the blowing of a fuse for moving said fuse out of engagement with its movable means, and means acting upon the movement of said fuse for connecting the next fuse into the circuit, said means including said movable means and mechanism whereby said movable means is moved slowly at first and afterward with a snap action.

54. In a multiple-unit circuit interrupter, a plurality of circuit interrupting elements, a connector for normally releasably engaging each element, means including said connector for connecting another element into the circuit upon the disengagement of the first element from its connector following the operation of the first unit to open-circuit condition, and means cooperating with the first unit for restoring said connector to its original position upon moving said unit to circuit-closing position.

55. In a circuit opening device, a plurality of tube type fuses, transfer mechanisms, one of which is associated with each of said fuses for transferring the circuit connection to the next fuse when the associated fuse is blown, each transfer mechanism including a movable connector, a rotatably mounted member carrying said connector, said member having means cooperating with the associated fuse to restrain said member from movement, a spring biasing said member into conductive relation with the next fuse, and means acting through the associated fuse to terminate said cooperation and thereby remove the restraint upon blowing of the associated fuse.

56. In a circuit interrupter, a fuse comprising a tube, a fusible element therein and means for moving said tube upon fusion of said element, a connector normally engaging said tube and in circuit with said fusible element, means for moving said connector upon fusion of said element and motion of said tube, means for retarding the initial movement of said connector, the final movement of said connector being completed with a snap action, and means engageable by said connector upon the completion of its movement for establishing a new connection to the circuit.

57. In a circuit interrupter, a fuse tube, a contact member movable between two positions and normally held in one of said positions by said fuse tube for delivering current thereto, means associated with said fuse tube which is operable when the fuse is blown to cause said fuse tube to release said contact member, means operable upon the release of said member to move the member to the other of said positions, and a contact cooperating with said member when it has been moved to said other position for establishing a new circuit through the interrupter around the blown fuse.

58. A multiple shot fuse assembly comprising in combination, an initially active pivotally mounted fuse unit; a second and normally inactive fuse unit associated therewith; and a switch biased to close the circuit through the second fuse unit having a blade directly engaging and held open by the first fuse unit and adapted to close automatically when the first fuse blows.

59. A multiple shot fuse assembly comprising, in combination, an initially active fuse unit; a second and normally inactive fuse unit associated therewith; a switch biased to close the circuit through the second fuse unit directly engaging and held open by the first fuse unit and adapted to close automatically when the first fuse blows; and variable time delay means associated with said switch whereby the circuit may be restored after a definite time interval sufficient to permit an ordinary transient condition to subside.

60. In a multiple fuse assembly for high tension transmission lines, a pair of adjacent switch type drop out fuses each arranged in a vertical plane and having fuse units inclined to swing outwardly and downwardly when they are blown; means normally connecting one of the fuses in the circuit; a switch for connecting the upper terminal of the active fuse with the upper terminal of the inactive fuse and having an arm in the path of the upper end portion of the active fuse whereby it is opened automatically when the active fuse unit is swung to its closed position; means biasing the switch to close automatically when the active fuse unit is blown and drops out; and a conductor connecting the other terminals of said fuses together whereby the circuit is closed automatically through the inactive fuse after the active fuse is blown.

61. The combination, with a pair of fuse devices and a transfer switch for shifting a circuit from one fuse device to the other in response to the movement of said one fuse device on blowing thereof, of operating means disposed to be engaged by said one fuse device during movement thereof for closing said transfer switch, and fluid controlled time delay means for preventing the closure of said transfer switch for a predetermined interval.

62. In a reclosing fuse device of the drop out type, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a cylindrical housing having end walls and a dividing wall, the dividing wall being provided with a restricting passage through which a fluid is forced to flow by relative movement between the dividing wall and one end wall, a lever fulcrumed at one end and having a cam surface, said lever being movable with one of said end walls of said housing, and means cooperating with said cam surface and initiated in motion on blowing of said one fuse device for rendering said time delay device effective to delay the closure of said transfer switch.

63. Circuit control apparatus comprising, in combination, a fuse device normally disposed in one position to complete a circuit and to be moved to another position on blowing of the fuse therein, normally open switch means located at one end of said fuse device and disposed to complete a circuit between the terminals of said fuse device, switch actuating means active during movement of said fuse device for initiating the operation of said switch means, and time delay means located at said one end of said fuse device for

preventing the immediate closure of said switch means, said switch actuating means being released from said time delay means in advance of the closure of said switch means to acquire sufficient momentum to quickly close said switch means.

64. The method of automatically shifting an electric circuit by a transfer switch from one drop out fuse device to the next fuse device on blowing of the one fuse device, which comprises storing energy by placing the one fuse device in operative position, releasing the stored energy at a relatively high rate on blowing of the one fuse device, decreasing the rate of energy release during a predetermined interval, and again increasing the rate of energy release for closing the transfer switch.

65. A repeating fuse cut-out comprising, in combination; a pair of rotatably mounted fuse devices disposed to be released for rotation on blowing thereof, one of said fuse devices being normally connected in a circuit; a rotatably mounted switch device disposed to cooperate with said one fuse device on rotation thereof when it blows for transferring said circuit to the other of said fuse devices, and a hydraulic escapement device for delaying the transfer of said circuit comprising a pair of flexible bellows members having end walls and a common support member therebetween having a restricted opening, a liquid filling said bellows members, and means for causing one of said rotatably mounted devices to operatively engage the end wall of one of said bellows members during its rotation to force said liquid through said restricted opening into the other bellows member.

66. A repeating fuse cut-out comprising, in combination, a pair of rotatably mounted fuse devices disposed to be released for rotation on blowing thereof, one of said fuse devices being normally connected in a circuit; a rotatably mounted switch device disposed to cooperate with said one fuse device on rotation thereof when it blows for transferring said circuit to the other of said fuse devices, and a hydraulic escapement device for delaying the transfer of said circuit comprising a pair of flexible bellows members having end walls and a common support member therebetween having a restricted opening, a liquid filling said bellows members, means for causing one of said rotatably mounted devices to operatively engage the end wall of one of said bellows members during its rotation to force said liquid through said restricted opening into the other bellows member, and a compression spring disposed to cooperate with said one bellows member for biasing it against the movement thereof caused by one of said rotatably mounted devices to restore it to its normal position when the force causing said movement is relieved.

67. A repeating fuse cut-out comprising, in combination; a pair of rotatably mounted fuse devices disposed to be released for rotation on blowing thereof, one of said fuse devices being normally connected in a circuit; a rotatably mounted switch device disposed to cooperate with said one fuse device on rotation thereof when it blows for transferring said circuit to the other of said fuse devices, a hydraulic escapement device for delaying the transfer of said circuit comprising a pair of flexible bellows members having end walls and a common support member therebetween having a restricted opening, a liquid filling said bellows members, means for causing one of said rotatably mounted devices to operatively engage the end wall of one of said bellows members during its rotation to force said liquid through said restricted opening into the other bellows members, a compression spring disposed to cooperate with said one bellows member for biasing it against the movement thereof caused by one of said rotatably mounted devices to restore it to its normal position when the force causing said movement is relieved, and externally operable adjusting means for changing the action of said escapement device in delaying the transfer of said circuit.

68. In a reclosing fuse device of the drop out type, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a cylindrical housing having relatively movable walls, one of which is provided with a restricting passage through which a fluid is forced to flow by relative movement between said walls.

69. In a reclosing device, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a cylindrical housing having end walls and a dividing wall, the dividing wall being provided with a restricting passage through which a fluid is forced to flow by relative movement between the dividing wall and one end wall, and resilient means for restoring said timing device to its normal condition when the force causing said relative movement is relieved.

70. In a reclosing fuse device, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a cylindrical housing having end walls and a dividing wall, the dividing wall being provided with a restricting passage through which a fluid is forced to flow by relative movement between the dividing wall and one end wall, and resilient means for restoring said timing device to its normal condition when the force acting on said dividing wall is relieved.

71. In a reclosing fuse device, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a cylindrical housing having end walls and a dividing wall, the dividing wall being provided with a restricting passage through which a fluid is forced to flow by relative movement between the dividing wall and one end wall, and resilient means for restoring said timing device to its normal condition when the force acting on one of said end walls is relieved.

72. In a circuit opening device, a fuse tube, a connector member, movable between two positions and normally held in one of said positions by said fuse tube, for delivering current to said fuse tube, means associated with said fuse tube which is operable when the fuse is blown to cause said fuse tube to release said movable member, a spring operable upon the release of said member to move said member to the other of said two positions, and a contact cooperating with said member when it has been moved to said other position to establish a new circuit through said device around the blown fuse tube.

73. The combination, with a pair of rotatably

mounted fuse devices and a transfer switch for shifting a circuit from one fuse device to the other in response to the rotation of said one fuse device after blowing thereof; of a hydraulic escapement time delay device disposed to prevent closure of said transfer switch for a predetermined interval after blowing of said one fuse device comprising a flexible bellows filled with liquid disposed to escape therefrom through a restricted aperture, and a spring inside said bellows for extending the same; spring means, rotatably mounted lever means biased by said spring means into engagement with said one fuse device and restricted thereby until it is blown, and means operatively interconnecting said flexible bellows and said lever means in such manner that rotation of said lever means after being released by said one fuse device is delayed while said liquid is being forced through said aperture by contraction of said bellows by said spring means, said lever means being unrestrained by said bellows when the former is rotated to its normal position on rotation of said one fuse device to its normal operative position, said bellows thereupon being extended by said spring therein.

74. Circuit control apparatus comprising in combination, a fuse device normally disposed in one position to complete a circuit and to be moved to another position on blowing of the fuse therein, normally open switch means located at one end of said fuse device and disposed to complete a circuit between the terminals of said fuse device, means responsive to the movement of said fuse device for initiating the operation of said switch means, and time delay means located at said one end of said fuse device for preventing the immediate closure of said switch means.

75. In reclosing fuse apparatus, in combination, a rotatably mounted fuse device, a rotatably mounted transfer switch device for shifting the circuit from said fuse device to another fuse device and adapted to move in cooperation with said fuse device on blowing thereof, and a timing mechanism adapted to cooperate with one of said rotatably mounted devices for delaying the closure of said transfer switch device.

76. In circuit control apparatus, in combination, a drop out fuse device mounted on a trunnion pivot at its lower end and disposed to complete an electric circuit, a rotatable switch device having a pivoted contact arm disposed in the path of said fuse device on rotation thereof about said trunnion pivot and a stationary contact member, said contact arm being disposed to engage said stationary contact member on rotation of said fuse device, and time delay means for cooperating with one of said rotatable devices to delay the closure of said switch device for a predetermined interval.

77. Circuit control apparatus comprising, in combination, a first fuse device and a second fuse device rotatably mounted for movement from one position to another position in response to gravity; means for individually holding said fuse devices in said one position, said holding means being individually released on blowing of the fusible elements of said fuse devices; means for connecting said first fuse device in an electric circuit, switch means for connecting said second fuse device in said electric circuit, means for operating said switch means to the closed position on movement of said first fuse device toward said other position, and hydraulic escapement means arranged and adapted to delay the closure of said switch means for a predetermined interval after the fusible element of said first fuse device blows.

78. In a reclosing fuse device of the drop out type, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a time delay mechanism dependent for its action upon substantially straight line movement, operating means for said time delay mechanism disposed to produce rotary movement, and cam means operatively interconnecting said time delay mechanism and said operating means.

79. In a reclosing fuse device of the drop out type, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a housing provided with end walls and a dividing wall having a restricting passage through which a fluid is forced to flow by substantially rectilinear relative movement between the dividing wall and one end wall, a lever provided with a cam surface, means for storing energy on placing said one fuse in service and disposed to release its energy through rotary movement on blowing thereof, and means for translating said rotary movement into substantially rectilinear movement by said cam surface to cause said fluid to flow through said restricting passage.

80. The combination, with a pair of rotatably mounted fuse members and a transfer switch for shifting a circuit from one fuse member to the other in response to the rotation of said one member of a lever member rotatable with said one fuse device during a portion of its travel for closing said transfer switch, and hermetically sealed hydraulic escapement means disposed to cooperate with one of said rotatable members for delaying the closure of said transfer switch for a regulatable time interval.

81. The combination, with a pair of rotatably mounted fuse members and a transfer switch for shifting a circuit from one fuse member to the other in response to the rotation of said one member, of a rotatable lever member disposed to move in cooperation with said one fuse member for closing said transfer switch, externally operable hermetically sealed hydraulic escapement means disposed to retard the movement of one of said rotatable members for delaying the closure of said transfer switch to shift said circuit to said other fuse device, and adjusting means for said retarding means to change the interval required to effect closure of said transfer switch.

82. In a reclosing fuse device of the drop out type, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a chamber formed by a flexible bellows into which a fluid is forced to flow through a restricted passage as a result of substantially rectilinear movement, a lever having a cam surface; means for storing energy on placing said one fuse in service, and said means being disposed to release its energy through rotary movement; and means for translating said rotary movement into substantially rectilinear movement by said cam surface to cause said fluid to flow through said restricting passage on blowing of said one fuse and preventing the time

delay action of said device from being effective when said one fuse device is restored.

83. In a reclosing fuse device, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a chamber formed by a flexible bellows into which a fluid is forced to flow through a restricted passage.

84. In a reclosing fuse device, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising a chamber formed by a flexible bellows from which a fluid is forced to flow through a restricted passage.

85. In a reclosing fuse device of the drop out type, in combination, a time delay device for determining the time interval between the blowing of one fuse and the closing of a transfer switch to reestablish the circuit through the next fuse, comprising two hermetically sealed chambers connected by a restricting passage through which a fluid is forced to flow.

86. A hydraulic escapement device for determining the interval between the blowing of one fuse of a reclosing fuse device and the closing of a transfer switch to reestablish the circuit through the next fuse comprising, in combination, a pair of flexible bellows members, a liquid filling said bellows member, and connecting means between said bellows members having a restricted opening through which said liquid is forced to flow to provide said interval.

87. A hydraulic escapement device for determining the interval between the blowing of one fuse of a reclosing fuse device and the closing of a transfer switch to reestablish the circuit through the next fuse comprising, in combination, a pair of flexible bellows members, a liquid filling said bellows members, and a support member for said bellows members disposed intermediate thereof and having a restricted opening through which said liquid is forced to flow to provide said interval.

88. A hydraulic escapement device for determining the interval between the blowing of one fuse of a reclosing fuse device and the closing of a transfer switch to reestablish the circuit through the next fuse comprising, in combination, a pair of flexible bellows members, a liquid filling said bellows members, connecting means between said bellows members having a restricted opening through which said liquid is forced to flow from one of said bellows members to the other to provide said interval, and resilient means cooperating with said one bellows member for biasing it to the normal position.

89. A hydraulic escapement device for determining the interval between the blowing of one fuse of a reclosing fuse device and the closing of a transfer switch to reestablish the circuit through the next fuse comprising, in combination, a pair of flexible bellows members, a liquid filling said bellows members, a support member for said bellows members disposed intermediate thereof and having a restricted opening through which said liquid is forced to flow from one of said bellows members to the other to provide said interval, and a compression spring cooperating with said one bellows member for biasing it to restore said liquid thereto.

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