Dec. 11, 1945. A. G. STEINMAYER 2,390,670

CUT-OUT

Filed March 29, 1944 3 Sheets-Sheet 1

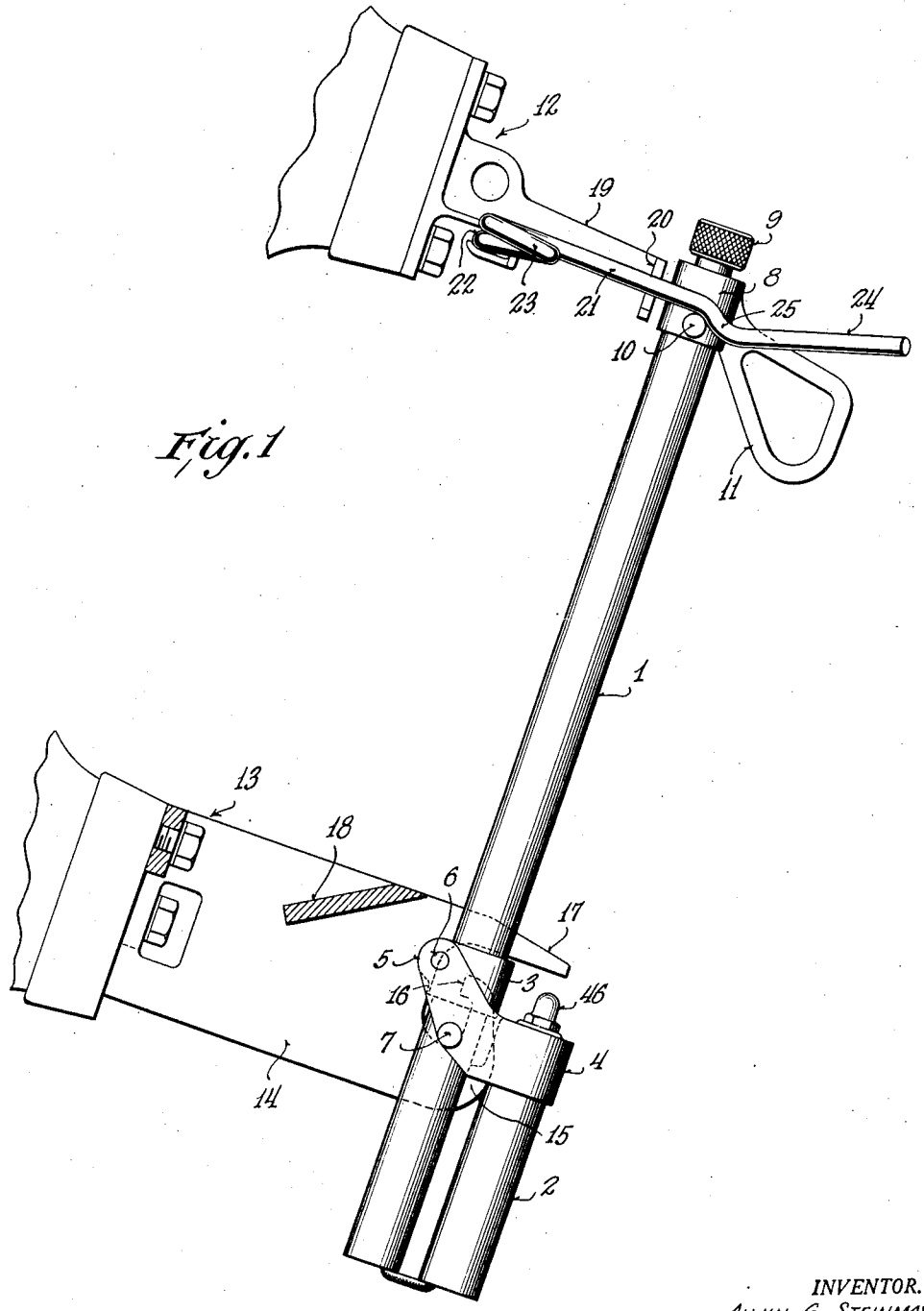


Fig. 1

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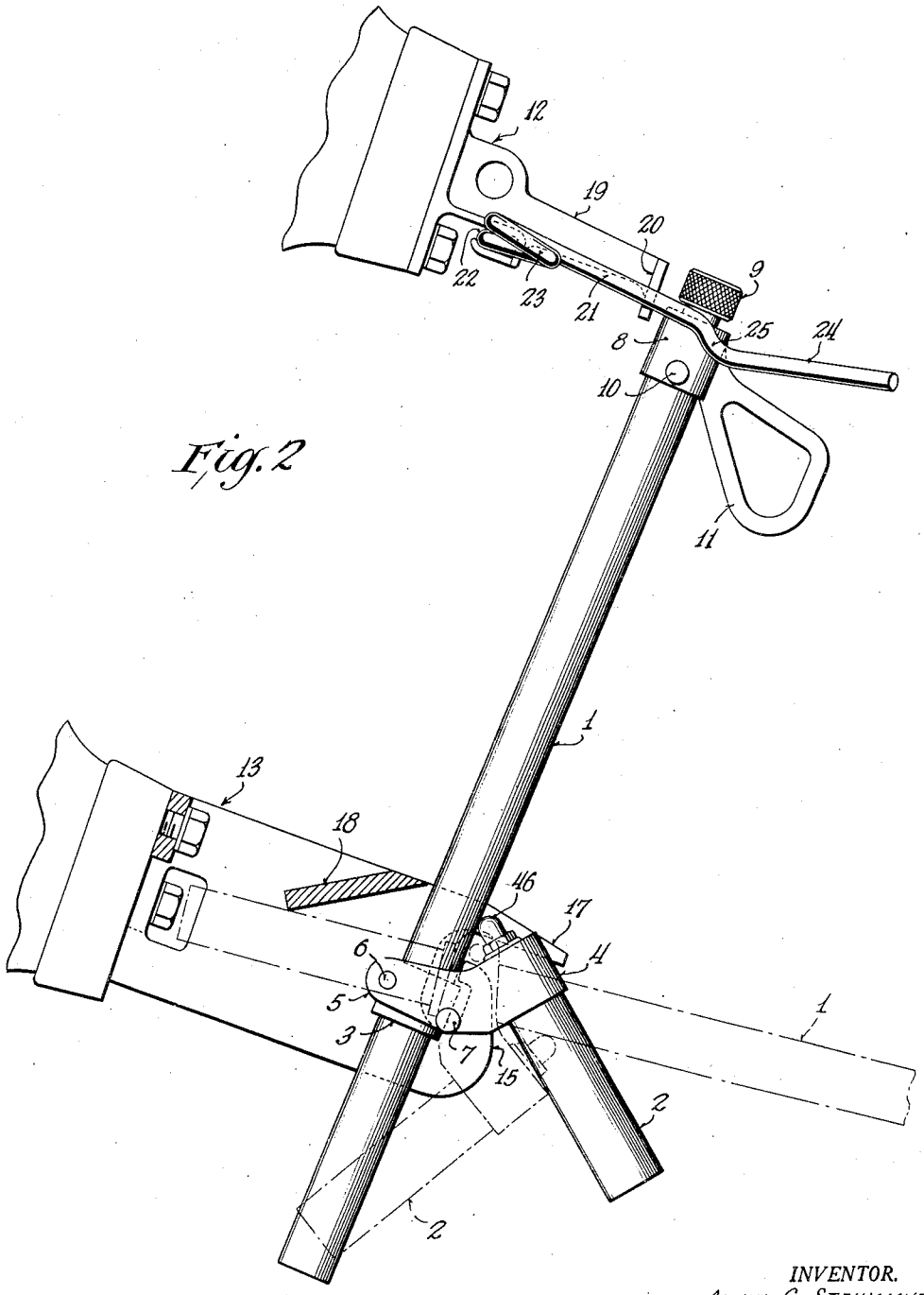


Fig. 2

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Fig. 3

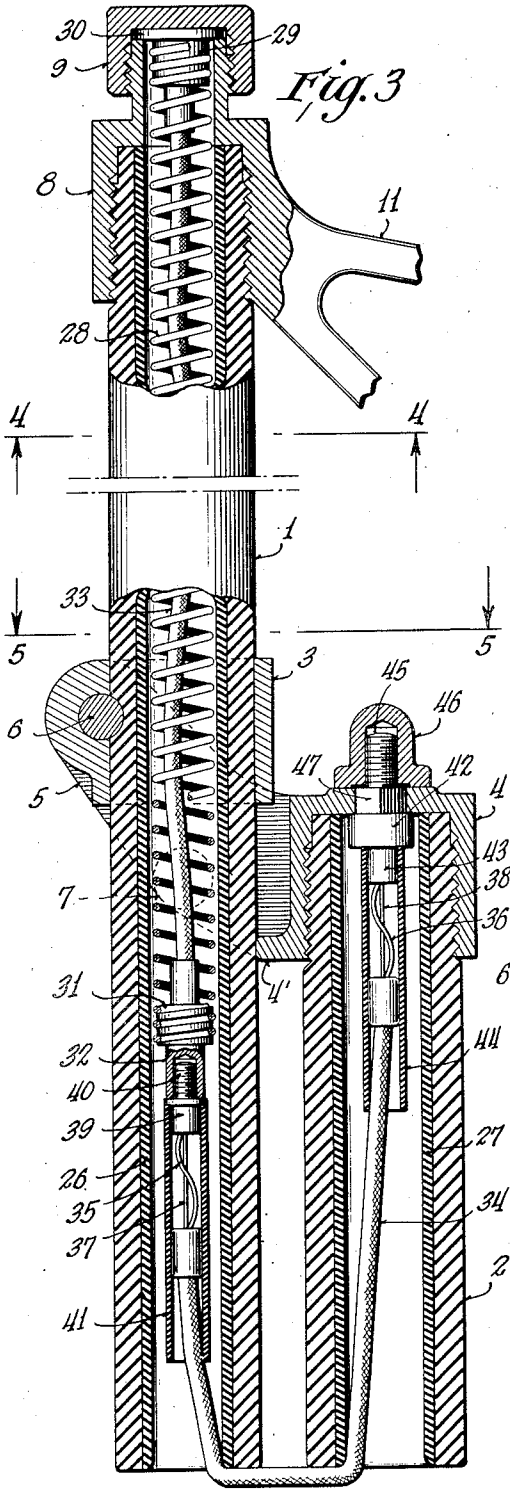


Fig. 4

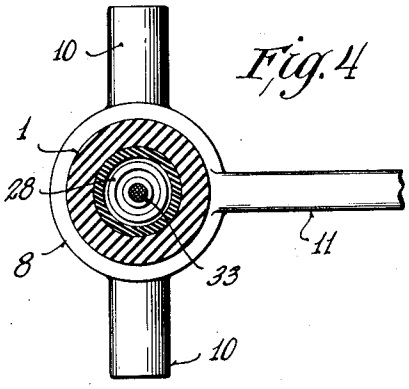
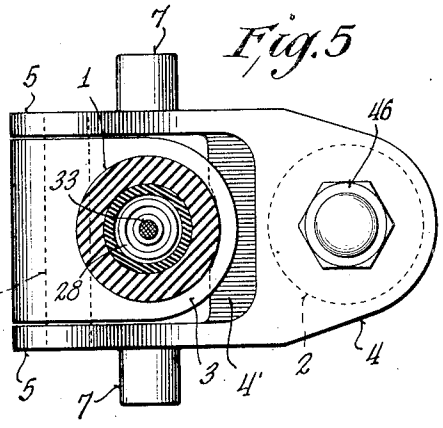


Fig. 5



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UNITED STATES PATENT OFFICE

2,390,670

CUTOUT

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Application March 29, 1944, Serial No. 528,499

17 Claims. (Cl. 200—114)

This invention relates to cut-outs.

Objects of this invention are to provide a cut-out of the drop-out fuse type which will interrupt heavy current at high voltages, and which is so made that it insures interruption of the circuit even under very heavy overloads.

Further objects are to provide a novel type of fuse tube assembly in which a main and an auxiliary fuse tube are employed and are so associated that there is relative motion between the two tubes when the fuse link is ruptured on overload, and which is so made that under normal conditions the fuse link is dropped from the assembly and the lower ends of the fuse tubes are separated and expulsion action takes place in each fuse tube.

Further objects are to provide a double fuse tube assembly in which an elongated main fuse tube having a smaller bore is provided and a relatively shorter auxiliary fuse tube associated therewith having a relatively larger bore, the main fuse tube being equipped with retracting means arranged to elongate the arc, if it should persist in spite of the double expulsion action hereinabove set forth, and to draw the arc into the smaller bore of the main fuse tube to thereby both constrict and elongate the arc to insure its extinction, such action taking place in addition to the double expulsion action.

Further objects are to provide a composite fuse tube assembly in which there is a relatively long main fuse tube provided with a smaller bore and a relatively shorter auxiliary fuse tube provided with a larger bore, the construction being so arranged that excessive building up of pressure in either fuse tube is prevented even under very severe overload conditions.

In greater detail, further objects are to provide a composite fuse tube assembly in which a relatively short auxiliary fuse tube is pivotally mounted adjacent the lower portion of a relatively large main fuse tube and is biased towards rotation with reference to the main fuse tube to release the fuse tube assembly for drop-out motion but which is normally prevented from rotating by the fuse link, the main fuse tube being provided with retracting means which may be used over and over again, relatively short new fuse links being employed and being detachably associated with the retracting means.

Further objects are to provide a fuse tube assembly so arranged that multiple points of interruption are provided and multiple expulsion actions are produced by the construction and in addition to this, arc elongation and extinction in a relatively constricted bore are secured.

Further objects are to provide a novel form of drop-out fuse tube assembly which is relatively simple and inexpensive to construct and which is reliable in operation.

An embodiment of the invention is shown in the accompanying drawings, in which:

Figure 1 is a side elevation of the apparatus showing parts in section and showing the device in its operative position.

Figure 2 is a view corresponding to Figure 1 showing in full lines the device immediately after it has blown and in dotted lines showing the final drop-out position.

Figure 3 is a sectional view through the fuse assembly with the fuse assembly removed from the remaining portion of the apparatus.

Figure 4 is a sectional view on the line 4—4 of Figure 3.

Figure 5 is a sectional view on the line 5—5 of Figure 3.

Referring to the drawings, it will be seen that the device comprises a fuse tube assembly consisting of a main fuse tube 1 and an auxiliary fuse tube 2. The main fuse tube is provided with a rigidly attached metal collar 3 located near its lower end. The auxiliary or shorter fuse tube 2 is provided with an upper terminal member 4 which is provided with a pair of spaced arms 5 located on opposite sides of the collar 3 and pivot about a pivot pin 6 carried by the collar 3, a small web 4' being provided to limit the inward rocking motion of the auxiliary tube 2. The arms 5 are provided with outwardly projecting trunnions 7.

The upper end of the main fuse tube 1 is provided with an upper terminal member 8 provided with a screw cap 9 and with outwardly projecting pins 10. Preferably a manipulating eyelet portion 11 is formed integrally with the upper terminal 8 of the main tube 1.

The fuse assembly is arranged under normal conditions to connect an upper terminal member indicated generally at 12 with a lower terminal member indicated generally at 13. The lower terminal member is provided with a pair of spaced arms 14 which are equipped with upturned hook like portions 15 upon which the trunnions 7 normally rest. These hook like portions are provided with inwardly projecting parts 16 which are overhung by projecting lips 17. The arms 14 are joined by a projecting web 18 which constitutes a stop for the fuse when it is dropped to its lowest position as shown in dotted lines in Figure 2. The upper terminal 12 is pro-

vided with an outwardly projecting arm 19 which has a downwardly tapered cam like portion 20 with cam faces on opposite sides which are gripped between inwardly urged spring arms 21. These spring arms are joined at their rear by a bail like portion 22 which is loosely pivotally carried by the arm 19. Preferably an intermediate coil portion 23 is formed in each arm 21 to increase the resiliency thereof. The gripping action of the arms on the cam surfaces 20 produces a downward reaction on the arms which is transmitted to the projecting pins 10 of the upper terminal 8 of the main fuse tube 1 and thus urges the main fuse tube downwardly and also secures excellent electrical connection between the projecting pins 10 and the cam faces 20.

Preferably the arms 21 slant outwardly and upwardly at their outer ends as indicated at 24 to provide cam or guiding surfaces beneath which the pins 10 are adapted to slide when the fuse tube assembly is rocked back from inoperative to operative position after refusing. The arms 21 are provided with downwardly depressed portions 25 behind which the pins 10 are normally positioned, such downwardly depressed portions constituting latches for the pins 10.

The specific construction of the upper contact structure forms the subject matter of the patent to William O. Schultz for Cutout construction, No. 2,357,772 of September 5, 1944.

It is preferable to have the lower trunnions positioned inwardly with respect to the upper terminal of the fuse tube so as to increase the tendency of the fuse tube to rock downwardly when released from the upper stationary terminal.

Referring to Figures 3, 4 and 5 it will be seen that the main tube 1 and the auxiliary tube 2 are provided with inner fiber liners 26 and 27 respectively. It is to be noted that the main tube 1 is not only longer than the auxiliary tube 2 but has a smaller bore than the auxiliary tube 2. The main tube is provided with a fuse link retracting means which may consist of a helical spring 28 secured at its upper end to an upper head portion 29 provided with a flange 30 clamped in place by the screw cap 9 against the upper contact 8. The lower end of the spring is secured to a lower head 31 which is provided with an internally threaded extension 32. The heads 29 and 31 are joined by a flexible leader 33. The fuse link consists of a flexible leader 34 having fusible sections 35 and 36 at opposite ends thereof and provided with strain wires 37 and 38 respectively associated with the fusible sections 35 and 36 in the usual manner. The fusible section 35 and the strain wire 37 are joined to a cylindrical plug like member 39 which has a screw threaded extension 40 removably screwed into the internally threaded extension 32 of the lower head 31. Preferably a fiber sleeve 41 is carried by the member 39 and surrounds the fusible section and strain wire 35 and 37. The fusible section 36 and the strain wire 38 are joined at their upper ends to a member 42 which has a reduced portion 43 which carries a small fiber sleeve 44 that surrounds the fusible section 36 and strain wire 38. The member 42 is provided with a screw threaded extension 45 which receives the nut or cap 46. It is also provided with a polygonal intermediate section 47 which loosely fits within a similarly shaped aperture formed in the terminal 4 of the auxiliary tube 2 to prevent the member 42 from turning when the nut 46 is screwed in place.

The fuse tube assembly tends to move downwardly due to the weight of the assembly but primarily due to the downward pressure furnished by the spring arms 21 and transmitted to the fuse tube as previously described. However, the fuse tube is prevented from moving downwardly as the trunnions 7 are seated within the arms 15 of the lower contact or support and also as the auxiliary fuse tube 2 is prevented from rotating about the pivot pin 6 for the reason that the fuse link holds the lower end of the auxiliary fuse tube 2 against motion with reference to the lower end of the main fuse tube 1. However, when the fuse link is ruptured in a manner hereinafter to appear, the auxiliary fuse tube 2 is released at its lower end and is free to rotate about the trunnions 7 in the hooked arms 15. There is a tendency, due to the downward pressure on the main fuse tube 1, to produce this rotation as the pivot pin 6 is located to the left of the trunnions 7 as viewed in Figure 1. Consequently when the auxiliary fuse tube 2 is released at its lower end, it rotates from the position shown in Figure 1 to that shown in full lines in Figure 2 and thus lowers the pivot pin 6 and consequently the main fuse tube 1, allowing the pins 10 of the upper contact 8 of the main fuse tube to detach themselves from the spring arms 21 of the upper contact. Thereafter the fuse tube assembly rocks downwardly to the dotted line position shown in Figure 2, being arrested at its lowest point by means of the stop 18.

It is preferable to make the fusible section 36 in the auxiliary fuse tube 2 of a slightly smaller current carrying capacity than the fusible section 35 in the main fuse tube 1. It is to be noted that the auxiliary fuse tube 2 is of a larger bore than the main fuse tube 1 and that the fusible section 36 is located at a point more remote from the open lower end of the auxiliary fuse tube 2 than the fusible section 35 from the open lower end of the main fuse tube 1. It is intended that a greater pressure shall be built up in the auxiliary fuse tube 2 due to this arrangement than in the main fuse tube 1 and it is intended that the first interruption should be normally in the auxiliary fuse tube 2. The increase in size of the auxiliary fuse tube 2 reduces the constriction in the tube. It is made relatively large so as to get the maximum rupturing capacity for heavy overloads. The main fuse tube 1 is, as stated, smaller in diameter and it can be safely made smaller in diameter than the auxiliary fuse tube 2 because the fusible section 35 is located immediately adjacent the lower open end of the main fuse tube 1 so that there is no excessive pressure built up. In addition to this, as the arc is retracted into the main fuse tube 1, it is desirable to have the bore of the main fuse tube 1 relatively small so as to confine the arc as much as possible to insure extinguishing of the arc. The successive or simultaneous blowing of the fusible sections also frees the leader 34 so that it can drop out from the fuse tube assembly, the motion of the auxiliary fuse tube 2 with reference to the main fuse tube 1 also assisting in this action.

On light overloads even if the fusible section 36 blows without blowing the fusible section 35, the motion of the lower end of the auxiliary fuse tube 2 away from the main fuse tube 1 together with the retraction of any remaining portion of the fuse link upwardly into the main fuse tube 1 due to the action of the spring 28 would insure clearing of the circuit by lengthening of the arc path. If there was any tendency for the arc to hold on,

it is obvious that the fusible section 35 would also blow. Even if through improper coordination of the fusible sections 36 and 35 it should happen that the fusible section 35 blew first, no harm would result. Under a heavy short circuit invariably the fusible section 36 would also blow. On the other hand, if the fusible section 35 should blow first on a relatively small overload, the arc would be extinguished as it would be drawn upwardly into the main fuse tube 1 into the long constricted space therein.

It is obvious that the purpose of the small fiber tubes 41 and 44 is to assist in clearing the device on very small overloads as these fiber tubes provide very small or constricted spaces within which the arc is initiated and the tendency, therefore, to extinguish the arc is increased. However, the main arc extinguishing action on both heavy and light overloads takes place as described in detail hereinabove.

After the fuse tube has dropped to its lowest position, it may be removed by lifting the trunnions 7 from the hook members 15. The device is then refused and the trunnions 7 are repositioned in the hook members 15 and the fuse assembly may then be rocked back into operative position. In refusing, the retracting means is used over and over and a new fuse link is substituted for the blown fuse link. The fuse links are relatively short and result in material saving in cost for successive renewals.

It will be seen that a novel form of drop-out fuse tube assembly has been provided by this invention in which use is made of both a relatively large bore short auxiliary tube and a relatively small bore long main tube, the construction being such that excessive building up of pressure in either tube is prevented even under very heavy overloads for the reasons hereinabove set forth.

It will also be seen that under overload, particularly under heavy overload, rupturing of the fuse link occurs at two spaced points in two different fuse tubes and that expulsion action takes place in each of the fuse tubes, thus increasing the rupturing capacity of the device, and, in addition to this, that arc extinction also occurs due to the elongating of the arc in the relatively constricted main fuse tube, the retracting mechanism also serving the function of increasing the gap and preventing restriking after the extinction of the arc prior to the dropping out of the fuse tube assembly from operative to inoperative position. It will be seen further that the fuse link is tensioned by the retracting means and also by the tendency of the auxiliary fuse tube to rotate with reference to the main fuse tube.

It will be seen further that the mechanism is relatively simple and inexpensive and is easy to produce and is very reliable in operation.

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.

I claim:

1. A fuse construction comprising an elongated main fuse tube having a closed end, a relatively short auxiliary fuse tube having a closed end, both said fuse tubes having open ends, retracting means in said main fuse tube biased for motion towards the closed end of said main fuse tube, and a fuse link extending outwardly from the open end of each of said fuse tubes, said fuse link having two spaced fusible sections arranged with a fusible section in each fuse tube, said fuse link being attached at one end to said retracting means and at its other end adjacent the closed end of said auxiliary fuse tube.

2. A fuse construction comprising an elongated main fuse tube having a closed end, a relatively short auxiliary fuse tube having a closed end, both said fuse tubes having open ends, retracting means in said main fuse tube biased for motion towards the closed end of said main fuse tube, and a fuse link extending outwardly from the open end of each of said fuse tubes and being positioned partly in each of said fuse tubes, said fuse link having a fusible section located within said auxiliary fuse tube adjacent the closed end thereof and having a second fusible section located within said main fuse tube adjacent the open end thereof, said fuse link having one end secured to said auxiliary tube and having the other end secured to said retracting means.

3. A fuse construction comprising an elongated main fuse tube having a closed end, a relatively short auxiliary fuse tube having a closed end, both said fuse tubes having open ends, retracting means in said main fuse tube biased for motion towards the closed end of said main fuse tube, and a fuse link extending outwardly from the open end of each of said fuse tubes and being positioned partly in each of said fuse tubes, said fuse link having a fusible section located within said auxiliary fuse tube adjacent the closed end thereof and having a second fusible section located within said main fuse tube adjacent the open end thereof, said fuse link having one end secured to said auxiliary tube and having the other end secured to said retracting means, said auxiliary fuse tube having a relatively large bore and said main fuse tube having a relatively small bore.

4. A fuse construction comprising an elongated main fuse tube, a relatively short auxiliary fuse tube, both of said tubes having closed upper ends and open lower ends, retracting means within said main fuse tube extending downwardly from adjacent the upper closed end, and a fuse link having a fusible section adjacent the upper closed end of said auxiliary fuse tube and extending downwardly through the lower open end thereof and into the open lower end of said main fuse tube, said fuse link being attached to the lower end of said retracting means at one end and being attached at its other end adjacent the closed end of said auxiliary fuse tube.

5. A fuse construction comprising an elongated main fuse tube having a closed end and having an open end, a relatively short auxiliary fuse tube having a closed end and having an open end, the open ends of said fuse tubes being normally positioned adjacent each other, means biasing the open end of said auxiliary fuse tube away from the open end of said main tube, a fuse link having a fusible section located within said auxiliary fuse tube, said fuse link extending out of the open end of said auxiliary fuse tube into the open end of said main fuse tube and normally preventing separation of the open ends of said fuse tubes, and retracting means attached to one end of said fuse link and located within said main fuse tube, the other end of said fuse link being attached adjacent the closed end of said auxiliary fuse tube.

6. A fuse construction comprising an elongated main fuse tube having a closed upper end and having an open lower end, an auxiliary fuse tube having a closed upper end and an open lower end, said auxiliary fuse tube being pivoted to said

main fuse tube, a fuse link having a fusible section adjacent the closed upper end of said auxiliary fuse tube and anchored adjacent the upper closed end of said auxiliary fuse tube and extending outwardly from the lower open end of said auxiliary fuse tube into the open lower end of said main fuse tube, retracting means in said main fuse tube attached to the other end of said fuse link, the open lower ends of said fuse tubes being normally held in proximity to each other by said fuse link, and means biasing said auxiliary fuse tube towards rocking motion with reference to said main fuse tube.

7. A fuse construction comprising an elongated main fuse tube having a closed upper end and having an open lower end, an auxiliary fuse tube having a closed upper end and an open lower end, said auxiliary fuse tube being pivoted adjacent its upper end to said main fuse tube at a point adjacent the lower end of said main fuse tube, a fuse link having a fusible section adjacent the closed upper end of said auxiliary fuse tube and anchored adjacent the upper closed end of said auxiliary fuse tube and extending outwardly from the lower open end of said auxiliary fuse tube into the open lower end of said main fuse tube, retracting means in said main fuse tube attached to the other end of said fuse link, the open lower ends of said fuse tubes being normally held in proximity to each other by said fuse link, and means biasing said auxiliary fuse tube towards rocking motion with reference to said main fuse tube.

8. A double fuse tube assembly comprising two tubes having adjacent open ends, one of said tubes having a larger bore and having a closed end, the other of said tubes having a smaller bore, and a single fuse link extending through the open ends of each tube and provided with a first fusible section adjacent the closed end of the tube of larger bore and provided with a second fusible section adjacent the open end of the tube of smaller bore, said fuse link having opposite ends supported from the tube of larger bore and from the tube of smaller bore respectively.

9. A double fuse tube assembly comprising two tubes having adjacent open ends, one of said tubes having a larger bore and having a closed end, the other of said tubes having a smaller bore, and a single fuse link extending through the open ends of each tube and provided with a first fusible section adjacent the closed end of the tube of larger bore and provided with a second fusible section adjacent the open end of the tube of smaller bore, said fuse link having opposite ends supported from the tube of larger bore and from the tube of smaller bore respectively, said first fusible section being of smaller current carrying capacity than said second fusible section.

10. A double fuse assembly comprising two fuse tubes each having one end closed and the other end open, one of said tubes having a smaller bore and the other of said tubes having a larger bore, and a single fuse link partly housed in each tube and extending outwardly from the open end of one tube to the open end of the other tube, said fuse link having a fusible section in each tube with the fusible section in the tube of larger bore having a smaller current carrying capacity than the fusible section in the tube of smaller bore, said fuse link having opposite ends supported from the tube of larger bore and from the tube of smaller bore respectively.

11. A double fuse tube construction comprising two pivotally joined tubes each provided with a terminal portion and with an open end, means tending to cause relative pivotal motion between said tubes, and a fuse link partly housed by each tube and having a fusible section located within one of said tubes, said fuse link normally preventing said pivotal motion and having opposite ends electrically connected to the terminal portions of the respective tubes.

12. A double fuse tube construction comprising two pivotally joined tubes each provided with a terminal portion and with an open end, means tending to cause relative pivotal motion between said tubes, and a fuse link partly housed by each tube and having a fusible section located within each of said tubes, said fuse link normally preventing said pivotal motion and having opposite ends electrically connected to the terminal portions of the respective tubes.

13. A double fuse tube construction comprising two fuse tubes having closed upper ends and open lower ends, and a fuse link extending from one fuse tube to the other fuse tube and having a fusible section in each fuse tube connected by a leader adjacent the open ends of said fuse tubes, whereby upon rupture of both of said fusible sections said leader will drop downwardly away from said fuse tubes, the opposite ends of said fuse link being supported from the respective tubes.

14. A drop-out circuit interrupter comprising upper and lower stationary contacts, a fuse tube assembly normally supported from said lower stationary contact and detachably latched to said upper contact, said fuse tube assembly including a main fuse tube and an auxiliary fuse tube pivoted to said main fuse tube and to said lower stationary contact and arranged to cause unlatching from said upper stationary contact when said auxiliary fuse tube pivots with respect to said main fuse tube, and a fuse link partly housed in each of said fuse tubes and normally holding said auxiliary fuse tube against motion and having a fusible section adapted to rupture on overload to release said auxiliary fuse tube, said fuse link having its opposite ends supported from said main and auxiliary fuse tubes respectively.

15. A drop-out circuit interrupter comprising an upper and a lower stationary contact, a fuse tube assembly comprising a main fuse tube and an auxiliary fuse tube provided with trunnions seated in said lower contact and being pivoted to said main fuse tube at a point spaced laterally of said trunnions, a fuse link located partly in both of said fuse tubes and normally restraining said auxiliary fuse tube from motion with respect to said main fuse tube, and cooperating means carried jointly by said main fuse tube and said upper stationary contact for temporarily holding said fuse tube assembly against drop-out motion and released when said auxiliary fuse tube moves with respect to said main fuse tube, said fuse tube assembly being biased for drop-out motion, said fuse link having its opposite ends supported from said main and auxiliary fuse tubes respectively.

16. A drop-out circuit interrupter comprising an upper and a lower stationary contact, a fuse tube assembly comprising a main fuse tube and an auxiliary fuse tube provided with trunnions seated in said lower contact and being pivoted to said main fuse tube at a point spaced laterally of said trunnions, a fuse link located partly in both of said fuse tubes and normally restraining said auxiliary fuse tube from motion with respect to said main fuse tube, said fuse link hav-

ing a fusible section in said auxiliary fuse tube, retracting means in said main fuse tube for retracting said fuse link, and cooperating means carried jointly by said main fuse tube and said upper stationary contact for temporarily holding said fuse tube assembly against drop-out motion and released when said auxiliary fuse tube moves with respect to said main fuse tube, said fuse tube assembly being biased for drop-out motion, said fuse link being attached at one end to said retracting means and at its other end to said auxiliary fuse tube.

17. A drop-out circuit interrupter comprising an upper and a lower stationary contact, a fuse tube assembly comprising a main fuse tube and an auxiliary fuse tube provided with trunnions seated in said lower contact and being pivoted to said main fuse tube at a point spaced laterally of said trunnions, a fuse link located partly in both of said fuse tubes and normally restraining said auxiliary fuse tube from motion with respect to said main fuse tube, said fuse link having a fusible section in both of said fuse tubes with the fusible section in said auxiliary fuse tube having the smaller current carrying capacity, retracting means in said main fuse tube for retracting said fuse link, and cooperating means carried jointly by said main fuse tube and said upper stationary contact for temporarily holding said fuse tube assembly against drop-out motion and released when said auxiliary fuse tube moves with respect to said main fuse tube, said fuse tube assembly being biased for drop-out motion, said fuse link having one end attached to said retracting means and having the other end attached to said auxiliary fuse tube.

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