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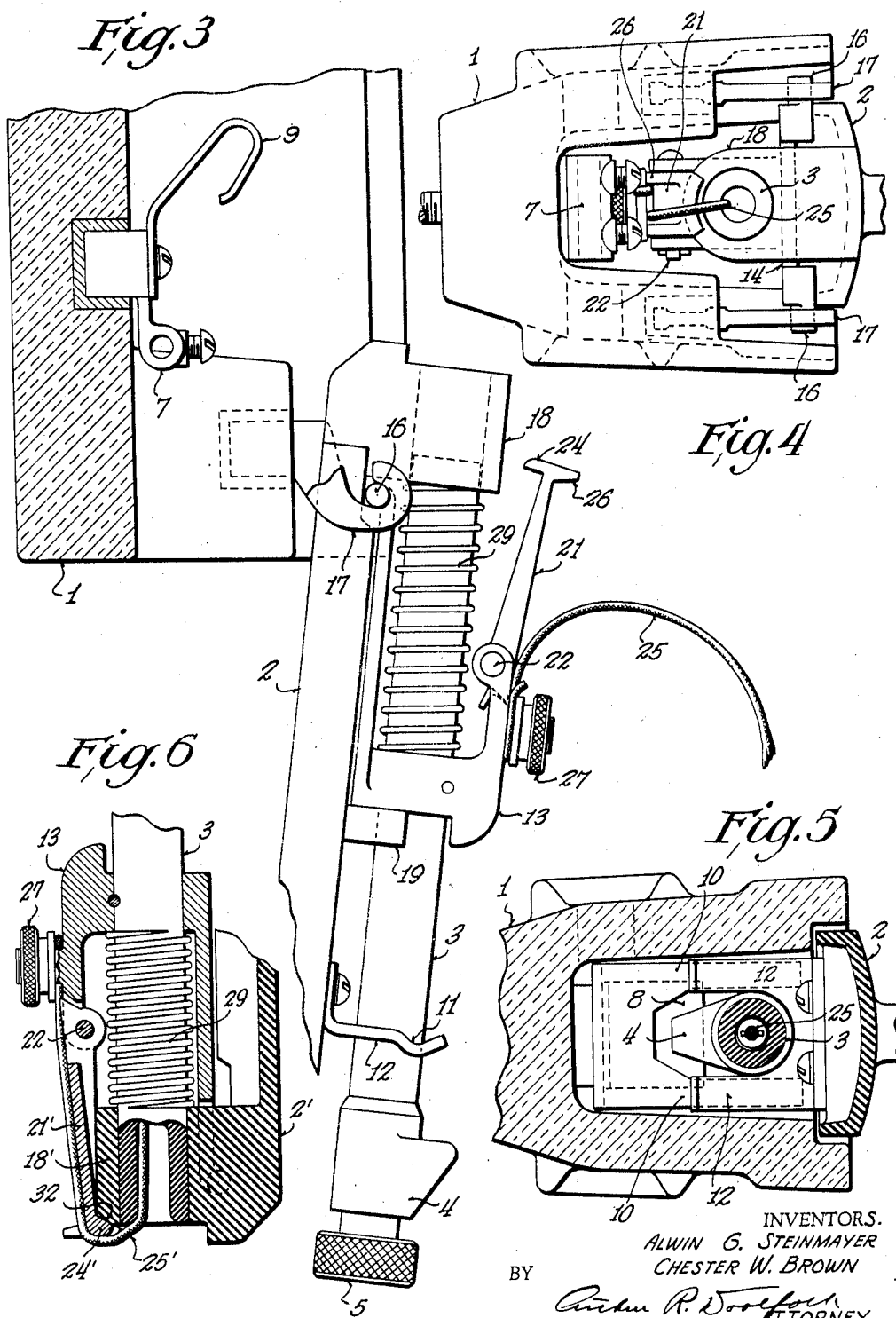
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EXPULSION FUSE

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EXPULSION FUSE

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This invention relates to expulsion fuses and is particularly directed to a housed type of expulsion fuse.

Objects of this invention are to provide a housed type of fuse construction in which a fuse tube and door assembly are provided, in which the door is movably supported with reference to the fuse tube and is released upon blowing of the fuse link so that the door may execute motion with reference to the fuse tube and unlatch the fuse tube and door assembly from the stationary portion of the apparatus, the fuse tube and door assembly thereafter rocking outwardly to open position and thereby completely removing the fuse tube from the circuit and also giving a visual indication that the fuse has blown.

Further objects of this invention are to provide a fuse construction in which the fuse tube stays in place until the door unlatches from the housing by means of a straight downward sliding motion with reference to the fuse tube, in which a main spring is provided for urging the door downwardly to unlatching position, in which the pressure of the main spring is borne by a separate latching lever, in which this latching lever has relatively small inertia and quickly extracts any remaining portion of the fuse link, in certain forms of the invention the latching lever being urged to unlatching and fuse link extracting position by means of a separate spring, and in other forms of the invention the latching lever having a cam action with the door to cause motion of the latching lever either supplemented or not by means of an auxiliary spring acting on the latching lever, the object of one form of the invention being to remove all strain of the main spring from the fuse link and in another form of the invention to transmit only a small portion of the force of the main spring to the fuse link.

Further objects are to provide a construction in which the main spring is located below the lowermost of the two stationary contacts and thereby does not increase the chance of arcing within the housing.

Further objects are to provide a construction in which good positive contact is provided between the contacts of the fuse tube and door assembly and the stationary contacts, in which this secure and positive contact does not impede opening motion of the fuse tube and door assembly as there is no gripping of the contacts of the fuse tube and door assembly by the stationary contacts, but in which the stationary

contacts urge the fuse tube and door assembly towards inoperative position.

Further objects are to provide a construction in which the motion of the door with reference to the fuse tube does not separate the contacts, the movable contacts of the fuse tube and door assembly remaining in engagement with the stationary contacts until after the combined latching and fuse link extracting lever has executed its quick fuse extracting and unlatching motion and has been followed by downward sliding motion of the door with reference to the fuse tube, the fuse tube and door assembly thereafter rocking outwardly to inoperative position, thus insuring complete clearing of the circuit within the fuse tube prior to separating the movable contacts of the fuse tube and door assembly from the stationary contacts while at the same time securing a quick flip-out or fuse link extracting operation to quickly clear the circuit within the fuse tube.

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

Figure 1 is a view, partly in section, showing the device in operative position.

Figure 2 is a fragmentary sectional view of the fuse tube and door assembly removed from the housing.

Figure 3 is a fragmentary view showing the position of the parts after the fuse tube and door assembly has moved downwardly to inoperative position.

Figure 4 is a view, partly broken away, looking upwardly from the bottom of Figure 1.

Figure 5 is a broken away sectional view on the line 5-5 of Figure 1.

Figure 6 is a fragmentary view of a further form of the invention.

Referring to the drawings, it will be seen that a housing 1 of porcelain or other suitable material is provided which has an open bottom and an open front. The open front is normally closed by means of a door 2 of a phenolic condensation compound or of other insulating material. The door 2 is slidably carried, as will hereinafter appear, by means of an expulsion fuse tube 3 which is provided with an upper contact portion 4 closed by means of a screw cap 5 and which is open at its lower end.

The housing 1 is provided with upper and lower terminals 6 and 7 to which are respectively secured the upper and lower stationary contacts 8 and 9.

The upper terminal also carries a bifurcated resilient latching member 10 whose arms are pro-

vided with downwardly depressed portions 10' which yieldingly interlock with upwardly extending portions 11 of a bifurcated latching member 12 carried by the door 2. The latching member 12 may or may not be resilient as desired. If desired both members 10 and 12 may be resilient, or if it is desired, only one of such members may be formed of resilient material.

It is to be noted that the fuse tube 3 extends through the lower contact 13 of the fuse tube and door assembly and may be pinned or otherwise secured thereto, as shown particularly in Figure 2. The lower contact 13 of the fuse tube and door assembly is provided with a downwardly extending portion 14 which has a pair of spaced arms 15 at its lower end, such arms being provided with outwardly extending trunnions 16 which are removably received within the hook like members 17 rigidly carried by the housing.

The door 2 is provided with a projecting sleeve like member 18 which is slidable on the fuse tube 3. This member 18 is positioned between the arms 15 and is integral with the door. The door is also provided with a notched out guiding member 19 intermediate its ends which normally bears against an intermediate portion of the fuse tube and is also provided with a manipulating eyelet 20 so that the door may be manually pulled open or may be manually closed, as by means of a switch stick for instance.

The fuse tube and door assembly cannot be lifted from the hook supports 17 until after the fuse tube and door assembly has swung downwardly to inoperative position, for example as shown in Figure 3.

Any tendency of upward recoil of the fuse tube upon blowing of the fuse link is not transmitted to the door but instead is borne by the overhanging interengagement of the hook supports 17 with the trunnions 16.

It is to be noted from an examination of Figure 1 that the upper and lower stationary contacts 8 and 9 bear against slanting or curved faces of the upper and lower contacts 4 and 13 of the fuse tube and door assembly and do not grip such movable contacts but instead urge the fuse tube and door assembly towards outward rocking motion about the trunnions 16. This outward rocking motion is normally resisted by the interengagement of the latching portions 10' and 11.

A combined fuse link extracting and latching lever 21 is pivotally carried between a pair of bifurcated arms of the lower movable contact 13. For example it may be pivotally carried by means of a pin 22. A spring 23 is provided and urges the latching lever 21 towards the left as viewed in Figure 1, that is to say, towards fuse link extracting and unlatching motion.

This latching lever is provided with a foot portion 24 which latches beneath the lower portion of the sleeve like part 18 of the door 2 and thus locks the door in its elevated position, as shown in Figure 1, until the latching lever is released upon rupture of the fuse link.

The flexible leader 25 of the fuse link extends out of the lower open end of the fuse tube and is guided between rearwardly projecting ears 26 of the combined fuse link extracting and latching lever and extends upwardly and is clamped to the lower movable contact 13 by means of the thumb nut 27. The upper end of the latching lever is provided with a projecting ear 28, as shown in Figure 2, which is adapted to engage an adjacent face of the lower movable contact 13 when the latching lever moves outwardly to the

left to thereby limit the outward motion of the latching lever.

A main spring 29 loosely surrounds the fuse tube 3 and bears at its upper end against the lower contact 13 of the fuse tube and door assembly and at its other end against the sleeve like portion 18 of the door 2, thus urging the door downwardly. However, no force of the main spring 29 is transmitted to the fuse link as the latching lever 21 positively latches beneath the lower portion of the sleeve like member 18 of the door 2. All strain on the fuse link in this form of the invention is obtained through the medium of the auxiliary spring 23 which urges the fuse link extracting and latching lever 21 towards releasing motion.

The fuse link may be of any suitable type and may have, for example, a reduced fusible section 30 and a buttonhead 31 which is clamped against the upper end of the upper contact 4 by means of the threaded clamping cap 5.

The operation of the apparatus is as follows: When an overload occurs, the fuse link is ruptured and the combined latching and fuse link extracting lever 21 is released and under the influence of its auxiliary spring 23 quickly flips or pulls out any remaining portion of the fuse link, the extraction of the fuse link of course being assisted by any gas pressure that may be generated within the fuse tube. However, even with very small overload when very little gas is generated, the latching lever nevertheless quickly pulls any remaining portion of the fuse link out of the fuse tube in a positive and effective manner. It is to be noted that although the combined fuse link extracting and latching lever has a limited stroke, nevertheless this stroke is made very quickly and considerable velocity is imparted to any remaining portion of the fuse link. This action, therefore, materially assists in clearing the circuit within the fuse tube even under light overloads and it is obvious that the clearing is assisted by the expulsive action that takes place within the fuse tube itself. Even if the expulsive action is extremely light and the remaining portion of the fuse link after rupture is not completely and wholly extracted from the fuse tube, it is extracted to a certain degree sufficient at least to lengthen the gap within the tube and thus assist materially in the quick clearing of the circuit even under very light overloads.

It is to be noted that the combined latching and fuse link extracting lever has very little inertia and acts very quickly independently of the motion of any other parts of the apparatus to withdraw any remaining portion of the fuse link and thus secures rapid clearing of the circuit within the fuse tube.

After the latching lever has moved to the left, it releases the door 2 and the door then slides downwardly with reference to the fuse link, unlatching the latching members 11 and 10'. Thereafter the door and fuse tube as a unit rock outwardly to the position shown in Figure 3 and thus remove the fuse tube from the circuit.

It is to be noted from reference to Figure 6 that the latching lever may have a cam action with reference to the sleeve like portion 18' of the door 2'. This latching lever is indicated by the reference character 21' and is provided with a cam foot 24' which has an upper slanting face engaging the lower slanting face 32 of the sleeve like member 18' of the door 2'. The latching lever thus has a cam action with respect to the door so that a part of the force of the main spring

23 is transmitted to the latching and fuse link extracting lever 21' and causes the fuse link extracting and latching lever to move to unlatching position upon rupture of the fuse link. If desired, in this form of the invention an auxiliary spring corresponding to the spring 23 may be employed. In other words, where the cam action is utilized, it may be utilized independently of an auxiliary spring or with an auxiliary spring as desired. Even when a cam action is employed, the parts are so designed that very little of the force from the main spring is transmitted to the fuse link. However, in the form of the invention shown in Figure 1, no force from the main spring is transmitted to the fuse link.

It will be seen that the force of the main spring is in all forms of the invention borne by a latching lever. In the first form of the invention no force of the main spring is transmitted to the latching lever and in other forms of the invention a small fraction of the force of the main spring is transmitted to the latching lever. In all forms of the invention it will be seen that a latching lever having very small inertia has been provided, that this latching lever moves with a quick motion to extract any remaining portion of the fuse link and assist in the quick clearing of the circuit within the fuse tube, and that after the latching lever has executed its motion the door moves downwardly and unlatches the fuse tube and door assembly. At this time the movable contacts of the fuse tube and door assembly move away from the stationary contacts of the housing. This construction, therefore, insures complete and quick clearing of the circuit within the fuse tube prior to opening of the fuse tube and door assembly.

It will be seen further that very simple types of contacts can be employed, that no gripping occurs between the stationary contacts of the housing and the movable contacts of the fuse tube and door assembly, but nevertheless a very firm and adequate contact is obtained.

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. A housed type fuse comprising a housing, a fuse tube pivotally supported from said housing, a door movable with respect to said tube and normally removably locked to said housing, a latching lever normally directly engaging and latching said door against motion with respect to said tube, and a fuse link carried by said fuse tube and restraining said door against motion with respect to said fuse tube.

2. A housed type fuse comprising a housing, a fuse tube pivotally supported from said housing, a door slidably mounted on said tube and normally removably locked to said housing, a latching lever normally latching said door against sliding motion with respect to said tube, and a fuse link carried by said fuse tube and restraining said door against motion with respect to said fuse tube.

3. A housed type fuse comprising a housing, a fuse tube pivotally supported from said housing, a door slidably mounted on said fuse tube, a spring urging said door towards sliding motion, said door and said housing having normally interlocking members releasable when said door slides with respect to said fuse tube, a fuse link carried by said fuse tube and projecting outwardly

from said fuse tube, and a latching lever pivotally supported from said fuse tube and normally latching said door against sliding motion, and latching lever being restrained by said fuse link and releasing said door upon rupture of said fuse link.

4. A housed type fuse comprising a housing having an open front and an open bottom, a door normally closing the open front, a fuse tube normally housed within and pivotally supported from said housing and having an open lower end adjacent the open bottom of said housing, a fuse link within said fuse tube and projecting outwardly from the open lower end of said fuse tube, said door being slidably mounted on said fuse tube, locking means normally locking said door and fuse tube against outward pivotal motion and releasable when said door slides with reference to said fuse tube, and latching means movable independently of said door for normally restraining said door against sliding motion with respect to said fuse tube, said latching means being controlled by the outwardly projecting portion of said fuse link and being released upon rupture of said fuse link.

5. A housed type fuse comprising a housing having an open front, a door normally closing said open front, a fuse tube normally housed within and pivotally supported from said housing, said door being slidably mounted on said fuse tube, a spring urging said door towards sliding motion with reference to said fuse tube, said housing and said door having interlocking means releasable when said door slides with reference to said fuse tube, latching means movable independently of said door for normally restraining said door against sliding motion with respect to said fuse tube, said latching means being biased towards releasing motion, and a fuse link carried by said fuse tube and normally restraining said latching means, said latching means being released upon rupture of said fuse link, said fuse link being free of any stress due to the force exerted by said spring.

6. A housed type fuse comprising a housing having an open front, a door normally closing said open front, a fuse tube normally housed within and pivotally supported from said housing, said door being slidably mounted on said fuse tube, a spring urging said door towards sliding motion with reference to said fuse tube, said housing and said door having interlocking means releasable when said door slides with reference to said fuse tube, latching means movable independently of said door for normally restraining said door against sliding motion with respect to said fuse tube, said latching means being biased towards releasing motion, and a fuse link carried by said fuse tube and normally restraining said latching means, said latching means being released upon rupture of said fuse link, said latching means transmitting a portion of the stress of said spring to said fuse link.

7. A housed type fuse comprising a housing, a door for said housing normally interlocking with said housing and releasable upon motion of said door longitudinally of said housing, a fuse tube pivotally supported from said housing and normally housed within said housing and slidably supporting said door, a main spring urging said door towards sliding motion with reference to said fuse tube, a fuse link within said fuse tube, a pivotally supported latching lever normally latching said door against sliding motion with reference to said fuse tube, said latching lever

being controlled by said fuse link, and an auxiliary spring urging said latching lever towards releasing motion.

8. A housed type fuse comprising a housing, a door for said housing normally interlocking with said housing and releasable upon motion of said door longitudinally of said housing, a fuse tube pivotally supported from said housing and normally housed within said housing and slidably supporting said door, a main spring urging said door towards sliding motion with reference to said fuse tube, a fuse link within said fuse tube, a pivotally supported latching lever normally latching said door against sliding motion with reference to said fuse tube, said latching lever being controlled by said fuse link, and an auxiliary spring urging said latching lever towards releasing motion, said fuse link being free from any stress due to said main spring.

9. A housed type fuse comprising a housing, a door for said housing normally interlocking with said housing and releasable upon motion of said door longitudinally of said housing, a fuse tube pivotally supported from said housing and normally housed within said housing and slidably supporting said door, a main spring urging said door towards sliding motion with reference to said fuse tube, a fuse link within said fuse tube, a pivotally supported latching lever normally latching said door against sliding motion with reference to said fuse tube, said latching lever being controlled by said fuse link, and an auxiliary spring urging said latching lever towards releasing motion, said latching lever and said door having a cam action, whereby a part of the stress from said main spring is transmitted to said fuse link.

10. A housed type of fuse comprising a housing having an open front, a fuse tube normally mounted within said housing, means pivotally supporting said fuse tube from said housing, a door normally closing the open front of said housing, said door being slidably guided by said fuse tube and being biased towards sliding motion with respect to said fuse tube, interengaging locking means carried jointly by said housing and said door and detachable when said door slides with reference to said fuse tube, whereby said door and fuse tube can rock outwardly from said housing as a unit upon release of said interengaging locking means, a fuse link within said fuse tube, and a latching lever biased towards releasing motion and controlled by said fuse link for normally latching said door against sliding motion with respect to said fuse tube.

11. A housed type of fuse comprising a housing having a pair of stationary contacts, a fuse tube having spaced contacts normally engaging said stationary contacts, said fuse tube being pivoted within said housing, a fuse link joining the spaced contacts of said fuse tube, a door slidably mounted on said fuse tube and spring urged towards sliding motion with respect to said fuse tube, and latching means movable independently of said door for latching said door against sliding motion with respect to said fuse tube, said latching means being controlled by said fuse link.

12. A housed type of fuse comprising a housing having a pair of stationary contacts, a fuse tube having spaced contacts normally engaging said stationary contacts, said fuse tube being pivoted within said housing, a fuse link joining the spaced contacts of said fuse tube, a door slidably mounted on said fuse tube and spring urged towards slid-

ing motion with respect to said fuse tube, and latching means movable independently of said door for latching said door against sliding motion with respect to said fuse tube, said latching means being controlled by said fuse link, said door and said fuse tube being biased towards outward swinging motion with respect to said housing.

13. A housed type of fuse comprising a housing having a pair of stationary contacts, a fuse tube having spaced contacts normally engaging said stationary contacts, said fuse tube being pivoted within said housing, a fuse link joining the spaced contacts of said fuse tube, a door slidably mounted on said fuse tube and spring urged towards sliding motion with respect to said fuse tube, a latching lever pivotally mounted on one of the spaced contacts of said fuse tube for latching said door against sliding motion with respect to said fuse tube, said latching lever being controlled by said fuse link and releasing said door upon rupture of said fuse link, said door and fuse tube being biased towards outward rocking motion with respect to said housing.

14. A housed type of fuse comprising a housing having an open front, a fuse tube pivotally mounted within said housing, said housing having stationary contacts and said fuse tube having spaced contacts normally engaging said stationary contacts, a fuse link within said fuse tube connecting the spaced contacts of said fuse tube, a door slidably mounted on said fuse tube, a latching lever pivotally mounted on one of the spaced contacts of said fuse tube for normally latching said door against sliding motion with respect to said fuse tube, a main spring surrounding said fuse tube and urging said door towards sliding motion, and an auxiliary spring urging said latching lever towards releasing motion, said latching lever being controlled by said fuse link.

15. A housed type of fuse comprising a housing, a door for said housing, said housing having upper and lower stationary contacts, a fuse tube having upper and lower contacts normally engaging the upper and lower stationary contacts, a fuse link carried within said fuse tube and normally connecting the contacts of said fuse tube, a spring surrounding said fuse tube and located below the lower stationary contact for urging said door towards sliding motion with respect to said fuse tube, said door being normally detachably interlocked with respect to said housing and being released upon sliding motion of said door, and means controlled by said fuse link for restraining said door against sliding motion.

16. A housed type of fuse comprising a housing, a door for said housing, said housing having upper and lower stationary contacts, a fuse tube having upper and lower contacts normally engaging the upper and lower stationary contacts, said fuse tube being pivotally mounted within said housing, a fuse link carried within said fuse tube and normally connecting the contacts of said fuse tube, a spring surrounding said fuse tube and located below the lower stationary contact for urging said door towards sliding motion with respect to said fuse tube, said door being normally detachably interlocked with respect to said housing and being released upon sliding motion of said door, and means controlled by said fuse link for restraining said door against sliding motion, said stationary contacts biasing said door and fuse tube towards outward swinging motion.

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