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QUICK-ACTION SWITCH DEVICE

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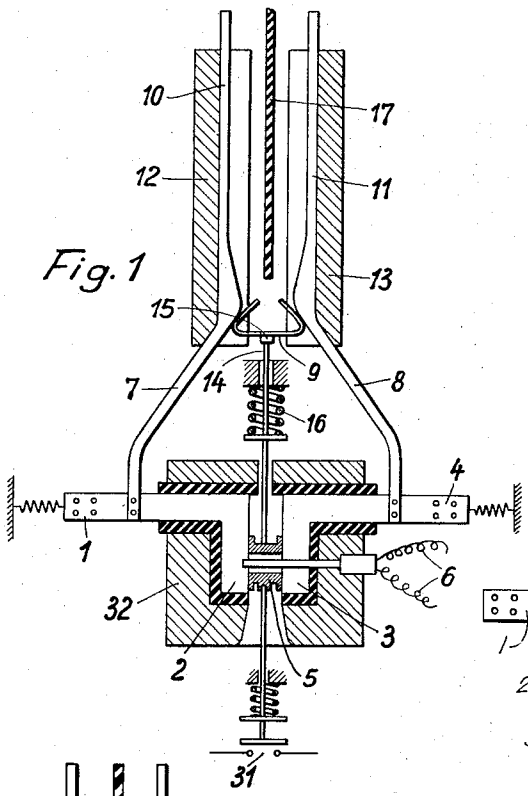


Fig. 1

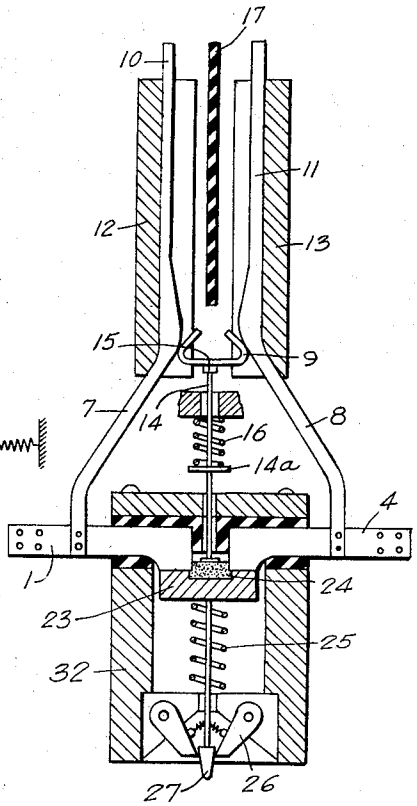


Fig. 3

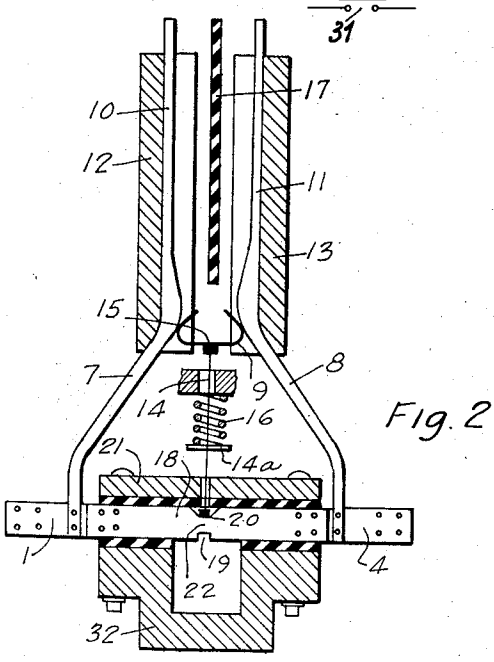


Fig. 2

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QUICK-ACTION SWITCH DEVICE

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11 Claims. (Cl. 200—146)

This invention relates to electric circuit quickbreak devices.

For the rapid breaking of high-current circuits, particularly direct current circuits, the use of high-speed switches is known in which the arc extinction is effected by a sufficient elongation of the arc. In order to accelerate the switching-off operation, it is furthermore known to employ switch devices in combination with sources capable of suddenly releasing chemical energy, for instance, by detonation. In the devices which have thus far become known and have been proposed in the art the chemical energy sources have either been used only for releasing the switch members or, insofar as they are employed for the direct galvanic separation of the current circuit, attempts were made to bring about the extinction of the arc by action from the chemical energy sources themselves. However, where high-power high-current arcs are to be extinguished, this can only be accomplished in switches, the movement of which is released by chemical energy sources, because the extinction of high-power arcs directly by chemical energy sources has not been solved successfully, one reason being that extremely high flash-over voltages have to be dealt with.

This problem has been solved in the electric circuit quickbreak devices according to the invention. In order to shorten the circuit breaking time in relation to the known devices involving the aforesaid disadvantages, quickbreak devices constructed according to the invention are provided, in which the main path of the electric current is interrupted by means of one or several sources of chemical energy and the final switching-off of the current takes place in a shunt path parallel to the interrupted main current path the interruption of the shunt path being effected by elongation and ultimate rupture of the arc. This combination of inventive features offers the advantage that, due to the brief demand upon the chemical energy source, a very rapid opening of the main path can be effected, and that within a short time subsequent to the interruption of the main path the arc extinction can also be brought about in the shunt path. Thereby an almost immediate current limitation with subsequent current cut off is achieved without the production of unduly high excess voltages. Therefore, such switch devices permit extremely high direct current outputs to be concentrated. They particularly make it possible to avoid the troublesome short-circuiting of the mechanical contacts in cases of breakdown, frequently occurring with mechanical transformers. The essential features of the invention will be explained in greater detail by reference to a few embodiments shown, by way of example only, in the accompanying drawings, in which:

Figure 1 shows diagrammatically and in a partially sectional view an embodiment of a quickbreak switch-off device according to the invention.

Figure 2 shows another embodiment of the detonator means arranged in the main current path of the embodiment shown in Figure 1.

Figure 3 illustrates yet another embodiment of the

means forming the main current path of the embodiment shown in Figure 1.

In Fig. 1 an embodiment by way of example for a quickbreak switch-off device produced according to the invention is shown diagrammatically. The main path of the electric current passes from the connection 1 via the main contact means 2 and 3 to the connection 4. The contact means 2 and 3 are bridged in the present embodiment by a detonator casing 5. The connections 6 are connected to the fuse of the explosive charge 6*a* and serve to make the charge explode. Parallel to the main path of the electric current the shunt path extends via the conductors 7 and 8 which shunt path is closed by the bridge 9. The upper portions 10 and 11 of the conductors 7 and 8, which can also be made of a plurality of parts, are disposed within the pole shoes 12 and 13, so that the roots of the arc, which travel along the portions 10 and 11, and their immediate vicinity are subjected to a high magnetic field. The bridge 9 is connected to the rod 14 via a spring 16, which serves for maintaining a determined contact pressure between the parts 9 and 7 or 9 and 8. As long as its lower end abuts against disc 14*a*, which disc is rigidly attached to rod 14, and as long as the rod 14 itself is supported e. g. on the casing 5, at 14*b*, the casing 5 being held in position by the pressure exercised thereon by portions 2 and 3.

The method of operation of the device is as follows: If a circuit break is to be carried out, then the detonator 5 is caused to explode by applying a voltage to the connections 6. By so doing first of all the main path 1, 2, 3, 4 of the electric current is interrupted, whereby almost no arc arises, because the shunt path 7, 9, 8 is still closed. It is thus of particular advantage, that, in the device, as shown in Figure 1 a short temporary increase of the contact pressure between the portions 7 and 9 or 8 and 9 results from the explosion, inside casing 5, which explosion exerts a momentary pressure on rod 14, simultaneously briefly compressing spring 16. As a result thereof the circuit breaking movement of the shunt path is delayed over the interruption of the main path. This has the advantage, that owing to the short temporary increase of the contact pressure between parts 7, 8 and 9 part 9 can be made relatively small and as a result further time can be gained owing to the greater acceleration of this part which is thus made possible. After the destruction of the detonator casing 5 the bridge 9 is rapidly moved downwards under the influence of spring 16 pressing against disc 14*a* and arcs are drawn out between the portions 7 and 9 or 8 and 9 respectively, which quickly unite under the influence of the magnetic fields of the field magnets 12 and 13. The roots of the arc then wander upwards along the bars 10 and 11. An undesired joining or short-circuiting of the arcs can be prevented by an insulated separating wall 17.

The detonator itself is preferably made of a material, which has a high electric conductivity, but is of brittle character, so that a rapid disintegration is possible. In practice, the cartridge alone is not just held between the portions 2 and 3, as is shown in Fig. 1, but it is usually provided with flanges or similar parts, to which it is soldered, welded or secured. Thus the cartridge is held between the bars 2 and 3 together with these retaining portions or clamped in by these portions.

The detonator means 5, 6*a* shown in Figure 1 may also be replaced by the quickbreak means illustrated in Figure 2 which comprise a one-piece, interchangeable conductor member or bar 18 having a notch 19. Such a conductor member can be broken by means of a detonating charge 20, if the entire arrangement is mounted for example on a solid base of insulating material 21. Care has to be taken however, that the parts to be exploded, that is both the detonators as well as the weakened por-

tion 22 of member 18, have the shortest possible constructional length, in order that temperature increases may not occur owing to current heat losses, which under certain circumstances could give rise to an undesired ignition of the charge. In the embodiment of Fig. 3, the main connections 1, 4 are electrically connected by a solid bridge 23, which is under the influence of a propellent charge 24. If during the switch-off process the propellent charge is caused to explode, then it moves the bridge 23 counter to the force of the spring 25 and opens the main current path. By means of suitable locking means (parts 26 and 27 in the embodiment of Fig. 3) care is taken, that in the switched off position the bridge 23 is kept out of contact with the portions 1 and 4. Both when using explosive charges as well as in the use of propellant charges, a protective means such as a casing having a suitable wall thickness (for instance, part 32 in Figure 1) is provided around the main contacts, to avoid damaging the neighbouring parts during the explosion or detonation of the charges.

It will be necessary in most cases, to prepare the opened switch device as quickly as possible for a successive circuit breaking operation. All devices known in connection with fire arms can be used here for the placing of new charges.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What we claim is:

1. An electric current quickbreak switching device comprising, in combination, electrically conductive means constituting a main current path, a source for the generation of chemical energy disposed in said main current path, means for releasing said chemical energy from said source, circuit breaking means in said current path associated with said source of chemical energy and adapted for interrupting said main current path upon release of said chemical energy from said source, electrically conductive means forming a current shunt path for bypassing said main current path, contact making and breaking means in said shunt path, and means serving for elongating to the point of rupture arcs arising in said shunt path upon said contact making and breaking means causing interruption of current flow through said shunt path.

2. An electric current quickbreak switching device comprising, in combination, electrically conductive means constituting a main current path, a source for the generation of chemical energy disposed in said main current path, means for releasing said chemical energy from said source, circuit breaking means in said current path associated with said source of chemical energy and adapted for interrupting said main current path upon release of said chemical energy from said source, electrically conductive means forming a current shunt path for bypassing said main current path, contact making and breaking means in said shunt path, means serving for elongating to the point of rupture arcs arising in said shunt path upon said contact making and breaking means causing interruption of current flow through said shunt path, and means for causing a delay in the interruption of current flow through said shunt path after said main current path has been interrupted.

3. An electric current quickbreak switching device as described in claim 2, wherein said delaying means comprise coupling means linking said circuit breaking means in said main path with said contact making and breaking means in said shunt path.

4. An electric current quickbreak switching device as described in claim 3, wherein said delaying means are adapted to briefly increase contact pressure of said contact making and breaking means in said shunt path utilizing at least part of the released chemical energy from said source.

5. An electric current quickbreak switching device as described in claim 2, further comprising magnetic means disposed adjacent said shunt path so as to place the latter within the magnetic field emanating from said magnetic means, so that said magnetic field is capable or influencing electric arcs arising from the interruption of current flow through said shunt path.

6. An electric current quickbreak switching device as described in claim 2, wherein said source of chemical energy is an explosive charge.

7. An electric current quickbreak switching device comprising, in combination, at least one pair of electrically conductive contact members in spaced relationship to each other so as to form a gap between them, an explosive charge as a source of chemical energy, a detonator means for housing said charge therein, said detonator means being of brittle material of high electric conductivity, said detonator means being disposed between said pair of contact members to conductively bridge the gap therebetween and thus forming a main current path, said detonator means being destroyed upon release of chemical energy from said explosive charge, thereby interrupting current flow through said main current path, electrically conductive means forming a current shunt path for bypassing said main current path, contact making and breaking means in said shunt path, and means serving for elongating to the point of rupture arcs arising in said shunt path upon said contact making and breaking means causing interruption of current flow through said shunt path.

8. An electric current quickbreak switching device comprising, in combination, at least one pair of electrically conductive contact members in spaced relationship to each other so as to form a gap between them, an explosive charge as a source of chemical energy, a current conducting bar connecting said contact members, said contact members and bar forming a main current path, said charge being located on said bar and breaking said bar upon the release of chemical energy from said charge, thereby interrupting current flow through said main current path, electrically conductive means forming a current shunt path for bypassing said main current path, contact making and breaking means in said shunt path, and means serving for elongating to the point of rupture arcs arising in said shunt path upon said contact making and breaking means causing interruption of current flow through said shunt path.

9. An electric current quickbreak switching device comprising, in combination, at least one pair of electrically conductive contact members in spaced relationship to each other so as to form a gap between them, an explosive charge as a source of chemical energy, a current conducting bar connecting said contact members by bridging said gap so that said contact members and bar forming a main current path, said bar having a recess wherein said charge is located on said bar, said charge being adapted for breaking said bar upon the release of chemical energy from said charge, said bar having a restricted cross-sectional area at the spot where said charge is located, thereby interrupting current flow through said main current path, electrically conductive means forming a current shunt path for bypassing said main current path, contact making and breaking means in said shunt path, and means serving for elongating to the point of rupture arcs arising in said shunt path upon said contact making and breaking means causing interruption of current flow through said shunt path.

10. An electric current quickbreak switching device comprising, in combination, at least one pair of electrically conductive contact members in spaced relationship to each other so as to form a gap between them, an explosive charge as a source of chemical energy, electrically conductive protective means surrounding said

charge, said protective means being disposed between said pair of contact members to conductively bridge the gap therebetween, thereby interrupting current flow through said main current path, electrically conductive means forming a current shunt path for bypassing said main current path, contact making and breaking means in said shunt path, and means serving for elongating to the point of rupture arcs arising in said shunt path upon said contact making and breaking means causing interruption of current flow through said shunt path.

11. An electric current quickbreak switching device as described in claim 8, wherein spring means are provided with said detonator means, said spring means urging said detonator means into contact with said pair of contact members so as to conductively bridge said gap therebetween.

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