March 18, 1958 O. HEUBERGER ET AL 2,827,523

FUME-PROOF ELECTRIC SWITCH DEVICE

Filed May 21, 1956

FIG. 1

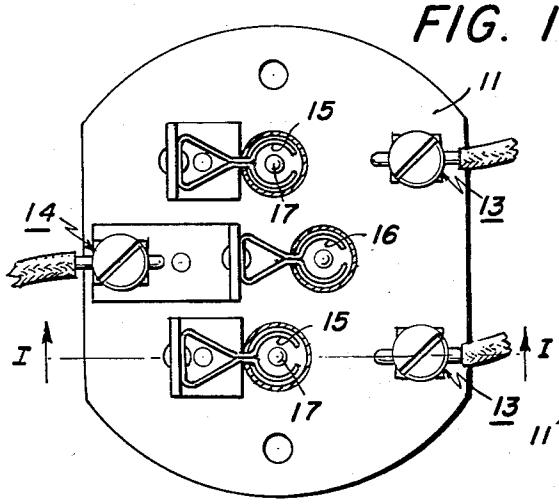


FIG. 5

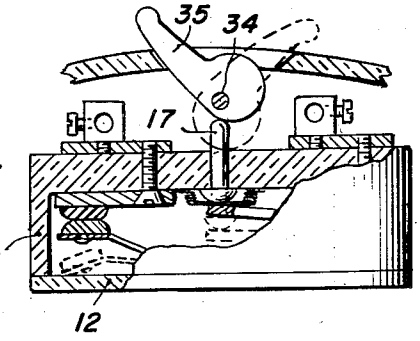


FIG. 2

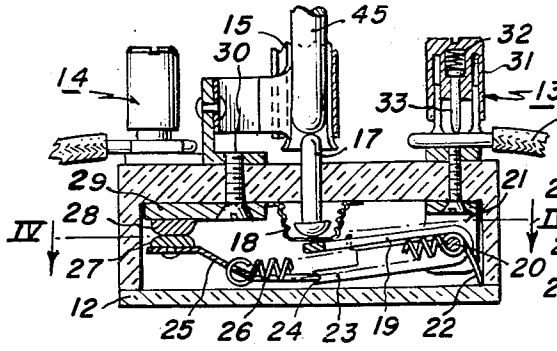


FIG. 3

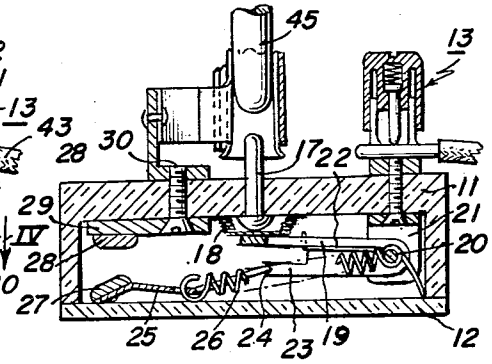
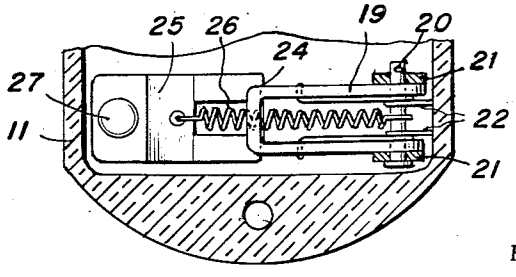


FIG. 4



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FUME-PROOF ELECTRIC SWITCH DEVICE

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1 Claim. (Cl. 200—51.09)

As the operation of electric switches is accompanied or may be accompanied by sparking, which is liable to cause the ignition of explosive gas mixtures, it is known that all electric switch devices must fulfil especially high requirements when they are installed in places where explosive gas mixtures may be formed. This is especially the case when switch devices are installed in store rooms, in which inflammable and relatively easily volatile liquids are stored, because there may be present for periods of hours or days explosive gas mixtures which diffuse into electric switch devices and are therefore liable to be exploded by sparking in the electric switch devices.

On the other hand, there is the possibility that explosive gas mixtures may be formed for short periods of time from vapours occurring transiently in rooms in which work is normally carried out, for example, in factories and laboratories connected with the chemical industry, surgical operation, theatres, etc. However, rooms of this kind, owing to the purpose for which they are used, are ventilated and during working hours, which is the only time when explosive vapours can be formed, are hardly ever left unattended for long periods, so that explosive gas mixtures cannot remain undisturbed for long periods in such rooms, whereas fumes of explosive or inflammable gases may well pass by electric switches. It is desirable also in these cases so to protect electric switch devices that in the event of the accidental presence of explosive vapours these devices cannot cause ignition or explosion. However, it is not necessary that the protection should be so thorough as to be effective against the continuous presence of explosive gases for periods of days. It is sufficient so to construct the electric switch devices that, for a period of a few hours, explosive gas mixtures cannot penetrate by diffusion from the exterior into the interior of the closed device although the closure may not be absolutely tight.

The present invention provides a fume-proof electric switch device, which comprises a quick break switch having contact elements which are closed and opened upon the movement of a rockable lever past a dead centre position, an enclosure within which the said switch is housed so as to be substantially inaccessible to gases, and a control member which is movable to transmit motion from outside the enclosure to the rockable lever therein for closing and opening the contact elements, the said movable control member being located so as to prevent substantial diffusion of gases to the interior of the enclosure.

Advantageously a switch device in accordance with the invention is combined with the socket portion of a plug and socket connector, and the said control member is movably mounted so as to transmit motion to the rockable lever by way of a substantially diffusion-resisting guide or bore. The arrangement may be such that the plug portion does not move the control member until the plug portion is almost completely inserted. By

thus combining the quick break switch with a plug and socket connector it is ensured that sparking cannot occur upon inserting and removing the plug portion, because the socket portion is not live, and the making or breaking of the switch contacts takes place only when the socket portion has made proper contact with the plug portion and therefore no sparking can occur at those parts which are not protected against vapours.

In this construction the control member actuating the quick break switch advantageously takes the form of a pin movable parallel to the axis of the socket portion, and advantageously provided in the axis of a socket and guided in a manner substantially resistant to gas diffusion, such as a closely fitting bore of sufficient length.

Apparatus constructed in accordance with the invention is shown by way of example in the accompanying drawings in which

Fig. 1 is a plan view of the socket portion of a plug and socket connector having a safety earth connection and with the protective cover removed,

Fig. 2 is a section taken on the line I—I in Fig. 1 with the quick break switch closed,

Fig. 3 is a section taken on the line I—I in Fig. 1 with the quick break switch open,

Fig. 4 shows a plan view of the quick break switch only, and

Fig. 5 shows a modification in the form of a tumbler switch having a manually operable lever.

In all the figures **11** denotes a cylindrical supporting base made of a suitable insulating material, for example, an artificial resin or more especially a ceramic material and having a strong upwardly directed supporting surface. By means of a cover plate **12** which, when the apparatus is completely assembled, is fixed in a suitable manner, for example, by glue or cement, a practically air-tight closed space is formed, which contains the quick break switch. On the supporting surface of the base are fixed, for example, by screws terminals **13** for the two poles of the current and a terminal **14** for the earth lead. There are also mounted on the base resilient sockets **15** to receive the pins of the plug portion and also a socket **16** for the earthing pin of the plug portion. Within the socket **15** there is proveded a control member in the form of a pin **17** which is axially slidable in the base with little play. In Figure 2 the pin is shown in its lowermost position and in Figure 3 in its uppermost position. The lower part of the pin **17** is housed within a space which is closed air-tight by means of an extensible bellows **18**. As shown in Fig. 2 the bellows **18** are in the extended position and in Fig. 3 in the collapsed position.

The pin **17** and bellows **18** are in contact with a rocking lever **19**. The latter is rockable about a spindle **20** which is fixed in a frame **21**. The frame is fixed to and in metallic contact with the terminals **13**. By means of a spring **22** the rocking lever is pressed into the upper position shown in Fig. 3, provided that the pin **17** through the bellows **18** does not depress the lever **19** into its lowermost position under the influence of an external force, namely upon the insertion of the plug pin **45**. The rocking lever **19** has a lower part **23** which terminates in a notch **24**, in which a contact lever **25** is held by a spring **26**. This contact lever carries at its other end a contact bead **27** which together with a contact bead **28** makes and breaks contact with the socket **15**. The contact bead **28** is fixed to and in metallic contact with the socket **15** through a metal member **29** and screw **30**.

The operation of the switch device is as follows:

When the plug portion is fully inserted the pins **45** of the plug are in their lowermost position (see Fig. 2) and they depress the pin **17**, which in this construction

is advantageously made of insulating material, and the rocking lever **19**, **23** is in its lowermost position and the contact **27**, **28** is closed. When the plug is pulled out of the sockets, the rocking lever is lifted under the action of the spring **22** and the contact lever **25** is first moved slightly to the left, whereby any slight sintering of the contact bead **27** to the contact bead **28** which may occur due to the action of strong currents, is broken. Then, after the dead centre position has been passed, the contact lever is suddenly withdrawn into the lowermost position shown in Fig. 3 and the circuit is broken. This breaking of the circuit takes place within the closed space formed by the hollow base **11** and the plate **12**, and occurs before the plug pin **45** has lost metallic contact with the socket **15**, so that no external sparking can occur. At this instant, however, the socket **15** is not live, so that when the plug pin **45** is finally withdrawn from the socket **15** no sparking can occur.

Advantageously the device of this invention is protected against any unintended separation of the terminal **13** from the wire **43** (for example, through some vibration or percussion). This is accomplished by providing the terminal **13** with a cap screw **31** inside of which are a spring **32** and a pin **33** which hold wire **43** in position. As a result, when the cap screw **31** is slightly loosened the wire **43** is still held in place by the spring **32** and the pin **33**, so that no sparking can occur.

Figure 5 illustrates the same principle as applied to an ordinary manually operated tumbler switch. The pin **17** is in this case operated by the switch lever **35** which is mounted eccentrically on a pivot **34**. The positions of the parts when the pin **17** is in its uppermost position, are shown in full lines, and in broken lines when the pin is in its lowermost position in which the circuit is broken. The quick break switch itself is constructed in the same manner as in Figs. 2 and 3, so that it is only incompletely shown in Fig. 5.

The switch device shown in Figs. 1–5 may be modified in certain respects. Thus, for example, in most cases the bellows **18** may be dispensed with by arranging that the pin **17** shall move in its guide or bore with very little play. Furthermore, instead of connecting the contact bead **28** to the socket **15** which receives a plug, it may be connected to the terminal **13**, and in this case it is not necessary to construct the pin **17** of insulating material, because immediately after the contact **27**, **28** is broken all the other parts of the switch device are free from current.

Finally, instead of the notch **24**, there may be provided a pivot.

The quick break switch and its enclosure shown in Figs. 1 to 3, owing to its compact construction, may be built into the socket portion of a wall plug and socket connector of conventional type in place of the usual unprotected support of the socket portion of such a connector. By giving the supporting base **11** and the cover plate **12** sufficiently strong dimensions the switch device can be so constructed that it will not be shattered by an explosion occurring in the interior thereof, should this happen due to exceptionally unfavorable circumstances.

It is a great advantage of the construction shown in Figs. 1–3 that it requires very little space while affording all the protection against fire and explosion hazards normally required and that therefore no changes are necessary with most of the usual supports for the conventional unprotected wall plug and socket connectors. It is furthermore surprising that even without the use of completely gas-tight closures the protection is excellent.

What is claimed is:

A plug and socket connector having connecting means accessible from the outside for inserting a connecting plug, a base portion carrying said connecting means and being of customary size and dimensions but forming a hollow bottom portion, a quick breaking switch in the circuit between the main line and one of the connecting means, and located in said hollow space, and a cover forming together with said hollow base portion an enclosure within which said switch is housed so as to be substantially unaccessible to gases, and a control member, movable to transmit motion from outside the enclosure to said switch for opening or closing it, said movable member being located so as to prevent substantial diffusion of gases to the interior of the enclosure, said control member being actuated by insertion of the connecting plug in such a manner that the plug makes electrical connection with the socket before the switch is actuated, the entire connector having a size not exceeding that of a conventional plug and socket connector so that it may be mounted in a housing in place of such a conventional connector.

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