Aug. 28, 1945. J A. HALLANDER 2,383,546

BOX SWITCH

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FIG. 1.

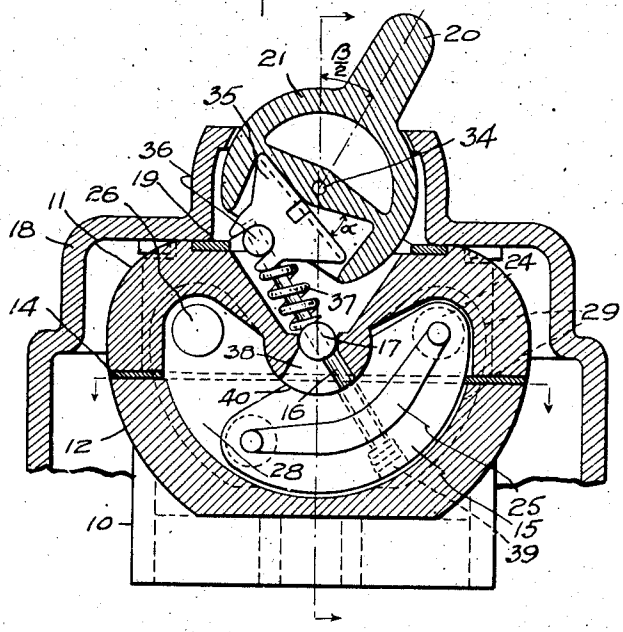
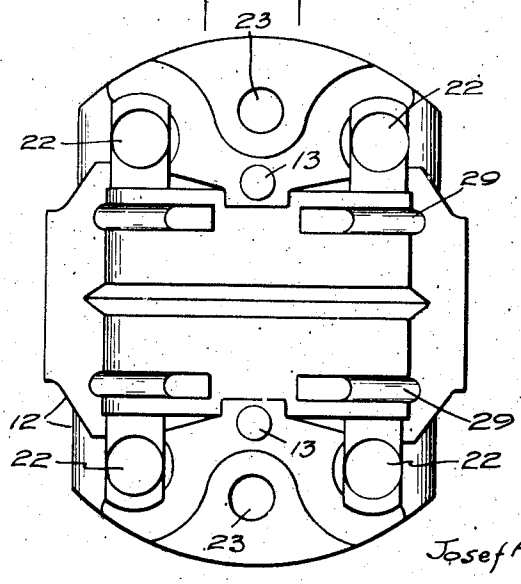


FIG. 2.



Josef Anshelm Hallander
INVENTOR

BY

ATTORNEY

Aug. 28, 1945. J. A. HALLANDER 2,383,546

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FIG. 3.

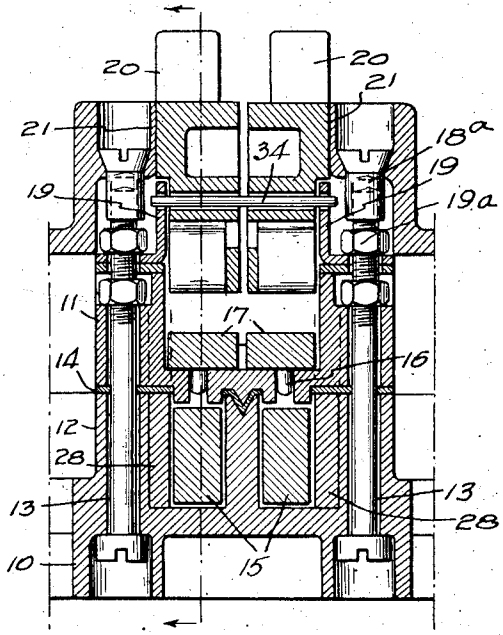
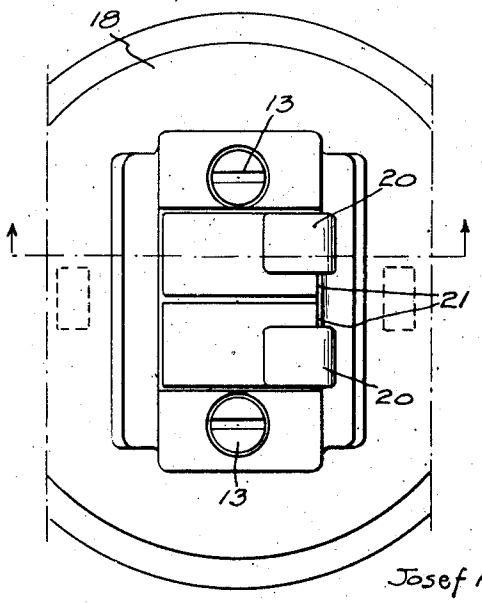


FIG. 4.



INVENTOR
Josef Anshelm Hallander

BY
his ATTORNEY

Aug. 28, 1945. J. A. HALLANDER 2,383,546

BOX SWITCH

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FIG. 5.

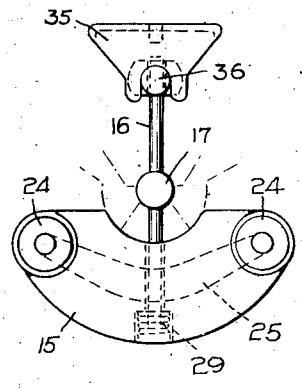


FIG. 7.

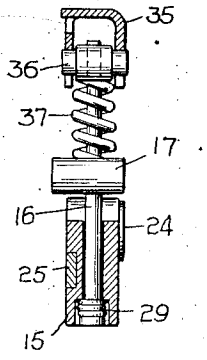


FIG. 6.

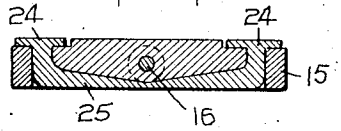


FIG. 8.

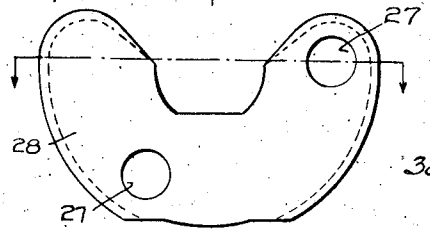


FIG. 10.

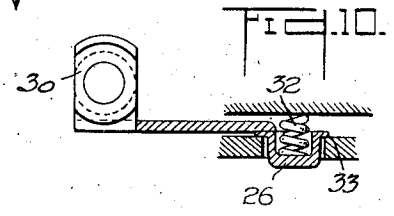
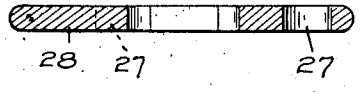


FIG. 9.



Josef Anshelm Hallander
INVENTOR

BY

ATTORNEY

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UNITED STATES PATENT OFFICE

2,383,546

BOX SWITCH

Jósef Anshelm Hallander, Stockholm, Sweden

Application July 2, 1942, Serial No. 449,408
In Sweden September 14, 1939

8 Claims. (Cl. 200—67)

The present invention relates to electric box switches of the enclosed quick break switch type with a switching member adjustable between two end positions, which member by its motion from one end position to the other within a casing consisting of insulating material, such as porcelain, steatite or the like, closes and breaks a circuit connected to the switch. The invention has for its objects to obtain a switch of the kind in question which possesses special advantages over earlier known switches of this type, particularly with respect to safe operation, sound damping, simple construction, simple manipulation and usefulness for various purposes.

According to the invention, these objects are accomplished by the arrangement of a reciprocable switching member which is adapted to fit in a pocket provided at each end of its path of motion and almost closed by the said member, in order to obtain an instantaneous compression or expansion of the air confined in the pocket when the switching member approaches or leaves either end position. A switch according to the invention has a very high reliability of operation since in consequence of the air pocket the motion of the switching member is softly and effectively braked so that its operation becomes smooth and at the same time practically noiseless and a spark extinguishing air current past the contact elements is produced preventing the formation of arcs with resultant burning of the contact surfaces.

In a practical application of the invention, the shape of the path of motion is made similar to that of the switching member along the largest possible part of the length of motion of said member and form a chamber tightened against the surrounding air. In a suitable embodiment the switching member is formed as a pendulum in the shape of a ring sector or ring segment with plane side walls, said pendulum swinging around a shaft mounted in the wall of the switch casing, the said side walls being, for example, perpendicular to the swinging shaft. However, the path of motion of the switching member may, of course, be straight instead of arc-shaped, and the side walls of the switching member may have any other suitable shape than the one indicated above. They may, for example, be wedge- or lens-shaped in cross section although the plane parallel shape is probably the most advantageous one from the point of view of manufacture.

The invention will be more closely described hereinafter, reference being had to the accompanying drawings in which Figs. 1 to 10 show an embodiment of an electric box switch according to the invention, whereby also other characteristic features of the switch will be indicated.

Referring to the drawings:

Fig. 1 is a sectional view of the switch parallel to the path of motion of the switching member.

Fig. 2 is a top view of the lower part of the switch casing, the upper part of the casing together with switching member and partitions having been removed.

Fig. 3 is a sectional view of the switch on line III—III of Fig. 1.

Fig. 4 is a top view of the switch.

Figs. 5 to 7 show the switching member and parts of its motion mechanism.

Figs. 8 to 9 show a detachable partition in the switch casing, and

Fig. 10 shows the construction of the stationary contact elements provided in said partition.

As will be seen from the drawings, the reference numeral **10** indicates the switch casing itself which is made in two parts **11** and **12** held together by screw bolts **13**. Between the parts **11** and **12** there is inserted a packing **14** to make the tightening along the joint hermetic. The switch casing **10** contains the movable switching member **15**, which is formed as a swinging ring sector or ring segment with plane, parallel side walls, and which through the intermediary of the pendulum shaft **16**, traversing the switching member, is rockable about a pivot shaft **17** mounted in the part **11**. The outer casing **18** of the switch is held in place by nuts **18a** engaging the upper ends of the screw bolts **13** and a bearing bracket **19** rests on top of the upper casing part **11** and is held in place by intermediate nuts **19a** on the bolts **13**. The operating member **21**, which has the shape of a hollow cylinder and is provided with an operating arm **20**, is rockable about a pivot pin **34** supported in the bracket **19**. In the lower part **12** of the switch casing there are, as usual, apertures **22**, Fig. 2, for the necessary number of pole screws and also two apertures **23** for screws by which the switch is adapted to be fixed to a fundament, to a wall or the like, whereby the casing **18** may be more or less countersunk, for example in surrounding plaster or panel.

As will be seen particularly in Fig. 1 and in Figs. 5 to 7, the switching member **15** is adapted for so-called double breaking of the respective line branches. For this purpose two metallic contact elements **24** are provided on one side of the switching member, one after the other viewed in the direction of motion of the switching member. Said contact elements are mutually con-

nected by a thick copper wire 25 which, just as the contact elements 24, is countersunk in the material of the switching member, and which is flattened in the middle to enable the passing through of the pendulum shaft 16. The movable contact elements 24 cooperate with two stationary switching elements 26, Figs. 1 and 10, located in the switch casing and made in the shape of resilient metal bushes loosely fitted in apertures 27 in plate-shaped wall portions 28 which laterally limit the path of motion of the switch member. The wall portions 28, which preferably are of the same material as the switch casing 10, are located in grooves 29 in the two casing parts 11 and 12, and may, after removal of the upper part 11, be detached in order to be substituted or put in again in reverse position to permit another switching combination. Such a change is considerably facilitated by the switching elements 26 being connected with their respective terminal sleeves 30 by means of a flexible metal cable 31, preferably of copper wire, which also permits of a resilient yielding of the switching elements loaded by a screw spring 32 and provided with an annular supporting flange 33.

In the embodiment shown, see particularly Figs. 2–4, the switch casing 10 is symmetrically built and contains two switching members, each of which is enclosed in its individual chamber tightened against the surrounding air and against one another. Said chambers surround the path of motion of the respective switching member so closely and fit, particularly at the ends of said path of motion, to the profile of the switching member so exactly that at the change-over motion an air pocket almost closed by the switching member is formed at each end of the path of motion. Thus, evidently an instantaneous compression or expansion of the air quantity enclosed in the pocket arises according as the switching member approaches or leaves its end position. As the switching motion proceeds the displaced air quantity must, of course, make its way past the switching member between said member and the walls of the surrounding chamber whereby a high speed air flow is obtained past the contact surfaces of the switching elements. If at the breaking of the current there should be any tendency of arc formation the arc is consequently immediately quenched by the air current so that a burning of the contact surfaces is prevented. The hermetic enclosure of the switching member with the resultant reduced supply of oxygen from the surrounding air also contributes to this effect. At the same time an effective damping of the rapid change-over motion in the vicinity of the end positions is obtained by the air pockets, thus enabling a practically noiseless operation of the switching member.

In order to insure a rapid change-over—in spite of the damping at the end positions of the switching member—between said positions by an instantaneous motion independent of the manual operating speed, the motion mechanism of the switching member is constructed in the following way.

Between the operating member 21 which is rockable around a shaft 34 in the supporting bracket 19, said shaft being parallel to the pivot shaft 17 of the switching member, and an extension of the pendulum shaft 16 located outside the switch casing 10, there is coupled an easily movable intermediate member 35 which, on one hand, is guided by the manually actuated operating member 21 and which, in turn, operates the switching member by actuation of the pendulum shaft. This intermediate member provides an instantaneous motion impulse for the switching member after the manual operating motion has passed beyond half its path of motion. For this purpose the easily movable intermediate member 35 consists of a tilting bridge, Figs. 1, 5, and 7, which is loosely fitted in the operating member 21 and adapted to be tilted against said operating member under relative rolling motion. The two outwardly directed legs of said tilting bridge are jointed with a cross piece 36 displaceably mounted on the pendulum shaft 16 and resting against a screw spring 37 provided between the cross piece and the swinging shaft 17 and surrounding the shaft 16. Due to the pressure from the spring 37, the operating member 21 as well as the bridge 35 and the switching member 15 are held in one of the end positions of said members as long as the operating arm 20 is not actuated. Since the tilting angle α of the bridge relatively to the operating member 21 is made larger than half the operating angle $\beta/2$ of the last-mentioned member between its end positions, the turning motion of the operating arm in the direction towards its opposite end position will, to begin with, substantially only compress the spring 37. After the intermediate position of the operating arm has been passed, the tilting bridge 35 will, however, under the action of the spring force, instantaneously tilt over to its opposite end position in the member 21 on carrying along the pendulum shaft 16 and the switching member 15 provided thereon so that the main part of the breaking or closing motion will take place instantaneously.

As has already been pointed out, it is of the greatest importance that the chambers enclosed by the switch casing 10 are shut off from the surrounding air as hermetically as possible. For this purpose it is necessary that the opening 38 in the part 11, which opening is necessary for the passing through of the pendulum shaft 16 and formed as a bearing for the pendulum, is well shut off on the outside by the swinging shaft 17 which serves as bearing member. The spring 37 contributes to insure a sufficient contact pressure of the shaft 17, and at the same time a spring 39 located at the opposite end of the pendulum shaft holds the switching member pressed against the internal boundary-surface of the opening 38, whereby a good tightening of said opening is obtained. If necessary, the inside of the opening 38 can for the same purpose be provided with a tightening plate 40 or the like mounted on the interior wall of the switch casing or on the pendulum shaft 16.

Although the invention has been described in detail in connection with a certain embodiment to illustrate the invention, it is evident that the invention is not limited to relate to said embodiment only. The invention may, of course, be varied in many ways within the frame of the inventive idea forming the basis of the invention. For example, instead of two switching members a single or several switching members may be enclosed in the common switch casing. The partitions located in the switch casing may also be stationary instead of detachable although the last mentioned arrangement is connected with special advantages, particularly with respect to the possibility of obtaining all the switch types occurring in practice, such as single, double or multipole switches, multi-way switch arrange-

ments for chandelier lamps and so on by a simple changeover within a single standardized switch aggregate. Two or several switching members with appertaining motion mechanisms may also be operated by a single, manually actuated operating member instead of an operating member with appertaining operating arms for each switching member as in the embodiment illustrated.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted in the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, control means for said switching member including a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod being secured to and extending radially of said swing shaft and switching member, and an actuating arm projecting radially from said swing shaft on the outside of said casing, and means for sealing said aperture in said casing against the flow of air therethrough.

2. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted into the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod being secured to and extending radially of said swing shaft and switching member, an actuating arm projecting radially from said swing shaft outside of said casing, means for sealing said aperture in said casing against the flow of air therethrough, a manually actuated operating lever, and means to transmit motion from said lever, to said actuating arm.

3. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted into the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod being secured to and extending radially of said swing shaft and switching member, an actuating arm projecting radially from said swing shaft outside of said casing, means for sealing said aperture in said casing against the flow of air therethrough, a manually actuated operating lever, rockable about an axis parallel to that of said switching member, a tiltable bridge loosely fitted in said manually actuated operating lever and adapted to be tilted against the latter under relative rolling motion, said bridge having outwardly directed legs, a cross piece slidably mounted on said actuating arm, and a helical spring surrounding said actuating arm and pressing against said cross piece to urge it away from said swinging shaft, the legs of said bridge being jointed to said cross piece.

4. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted into the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod being secured to and extending radially of said swing shaft and switching member, and an actuating arm projecting radially from said swing shaft outside of said casing, said aperture in said switch casing being formed as a bearing for said swing shaft and being closed on its outside by the latter.

5. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted into the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod being secured to and extending radially of said swing shaft and switching member, an actuating arm projecting radially from said swing shaft outside of said casing, and a sealing plate for said aperture in said switch casing, said plate being mounted on said connecting rod adjacent the inner wall of said chamber.

6. An electric box switch of the enclosed quick break type, comprising a substantially hermet-

ically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted into the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod extending radially of said swing shaft and switching member and the latter being slidable on said connecting rod, a spring supported on said connecting rod and urging said switching member into contact with the inner wall of said chamber in which said aperture is provided, and an actuating arm projecting radially from said swing shaft outside of said casing.

7. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing enclosing a hollow chamber having substantially the shape of a ring segment, stationary contacts inserted into the inner walls of said chamber, a switching member having the shape of a similar ring segment of less angular length, said switching member fitting snugly in said chamber and being adjustable therein to assume alternatively two positions at substantially opposite ends of said chamber, metallic contact elements carried on said switching member for cooperation with said stationary contacts, a swing shaft disposed coaxially with both said ring segments and supported on said casing, a connecting rod extending from said shaft through an aperture in said casing into said switching member, said connecting rod being secured to and extending radially of said swing shaft and switching member, an actuating arm projecting radially from said swing shaft outside of said casing, a manually actuated operating lever rockable about an axis parallel to that of said switching member, a tiltable bridge loosely fitted in said manually actuated operating lever and adapted to be tilted against the latter under relative rolling motion through an angle which is smaller than half the rocking angle of said operating lever, said bridge having outwardly directed legs, a cross piece slidably mounted on said actuating arm, and a helical spring surrounding said actuating arm between said cross piece and said swing shaft, the legs of said bridge being jointed to said cross piece.

8. An electric box switch of the enclosed quick break type, comprising a substantially hermetically sealed switch casing of insulating material, a reversible plate-shaped wall portion loosely inserted in said casing and forming with the inner walls of the latter a switching path of substantially uniform cross-section closed at its opposite ends, loaded metal bushes inserted into apertures in said reversible wall portion and having flanges to limit their movements relative to the latter, said bushings forming spaced stationary contacts adjacent said switching path, a movable switching member having a cross-section similar to and slightly smaller than that of said switching path and end surfaces shaped in accordance with the end surfaces of said path, said switching member carrying metallic contact elements and being reciprocable in said casing to assume alternatively two positions at substantially opposite ends of said switching path so as to close and break a circuit connected to the switch, control means for said switching member passing through an aperture in the wall of said casing, and means for sealing said aperture against the flow of air therethrough.

JÓSEF ANSHELM HALLANDER.