

Jan. 12, 1960

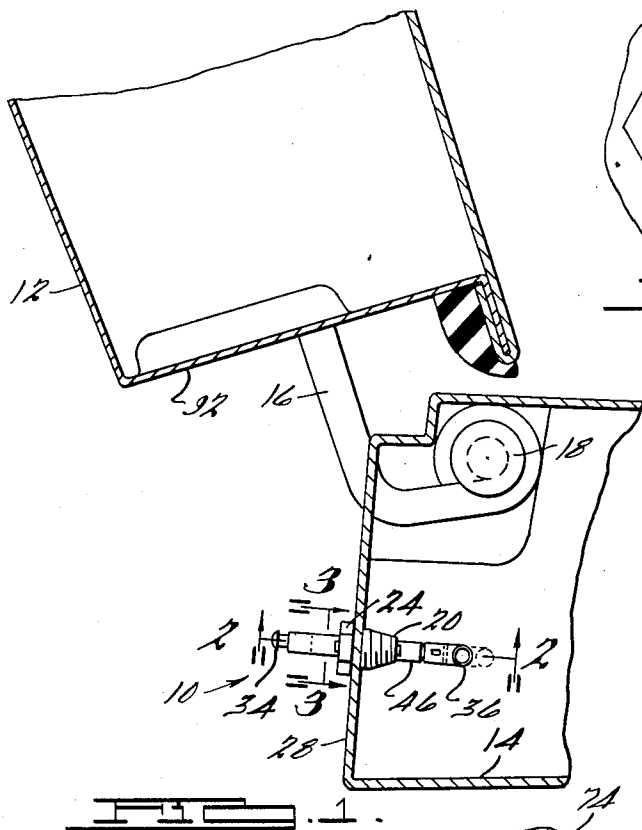
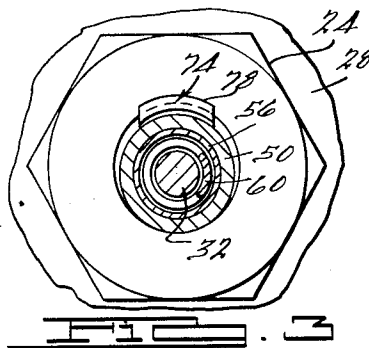
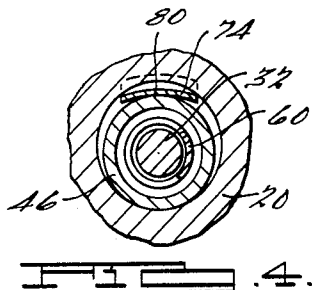
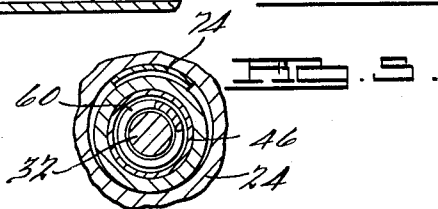
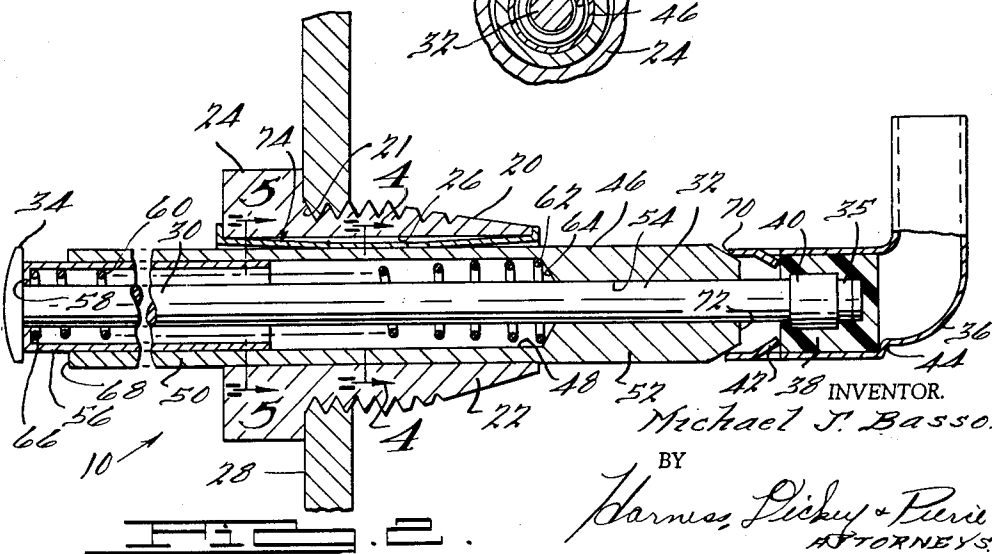
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2,921,155

SELF-ADJUSTING SWITCH

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3 Sheets-Sheet 1



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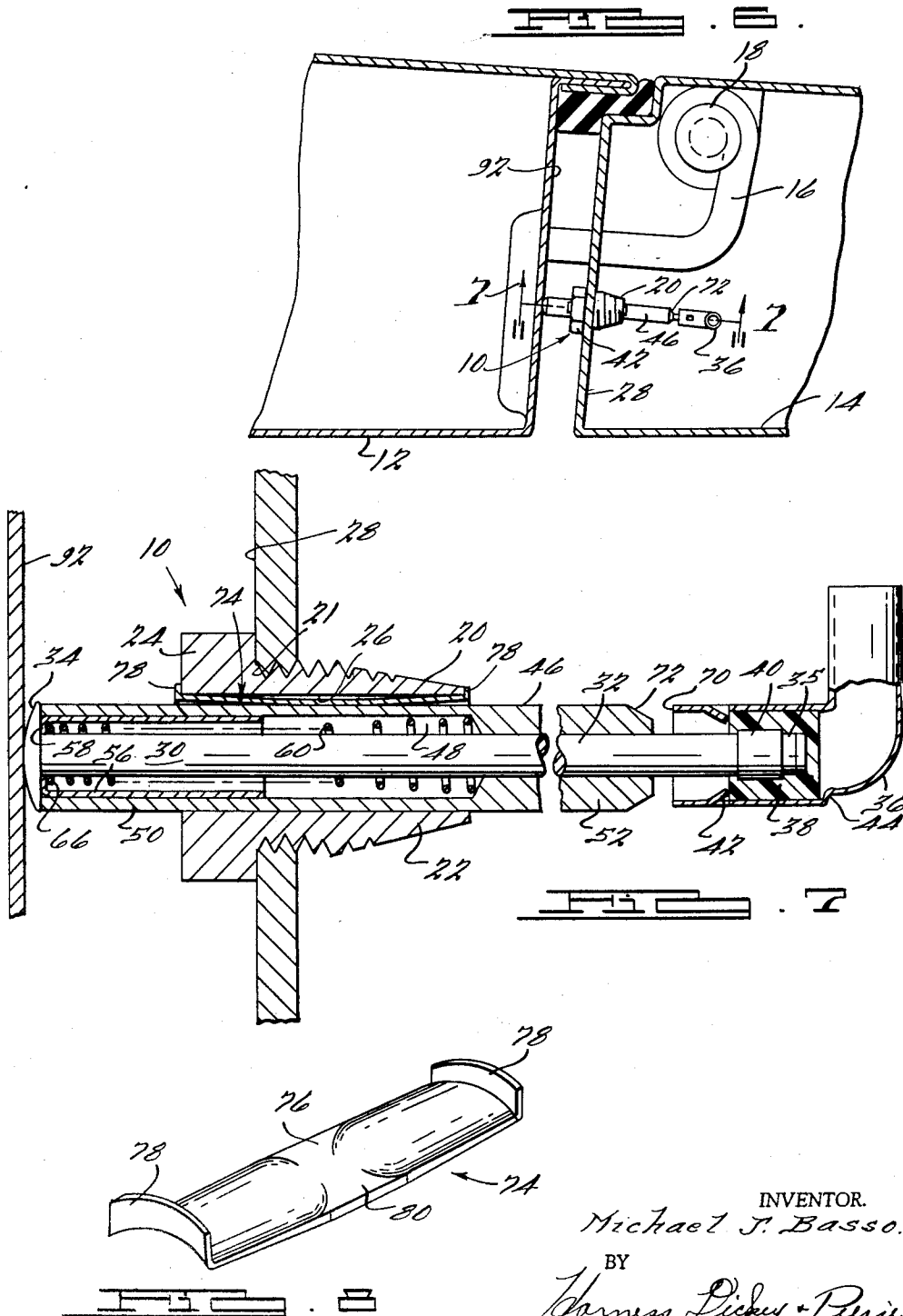
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3 Sheets-Sheet 2



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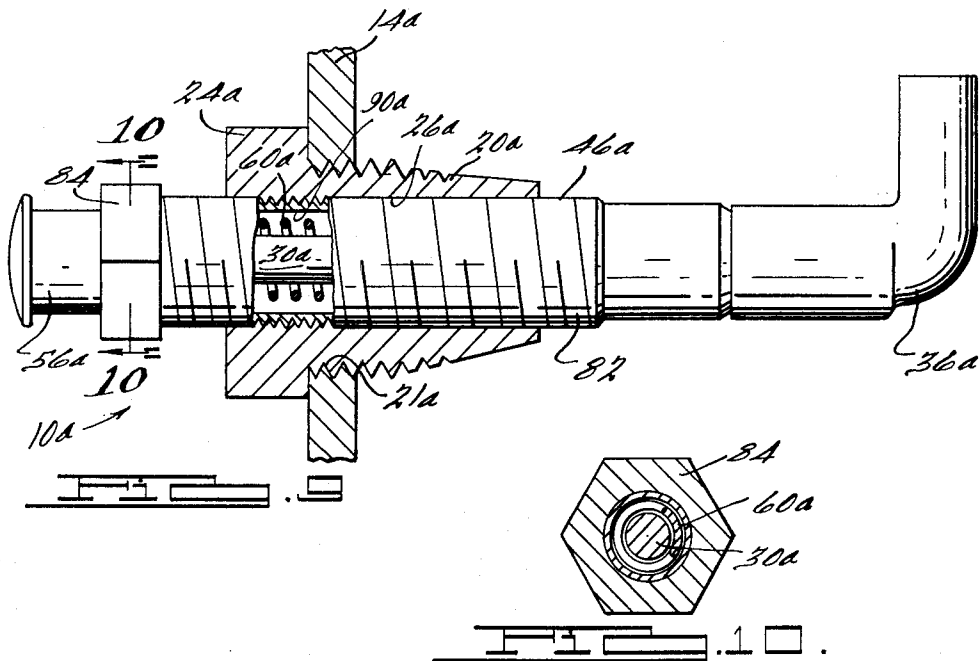
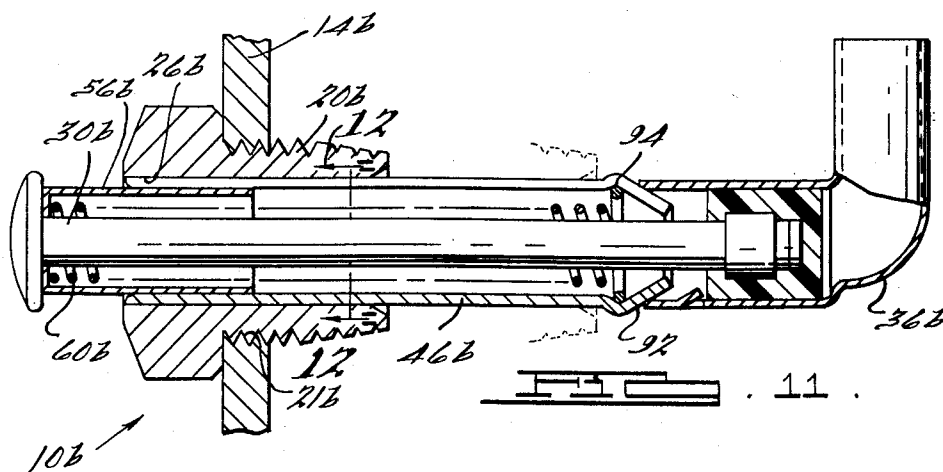
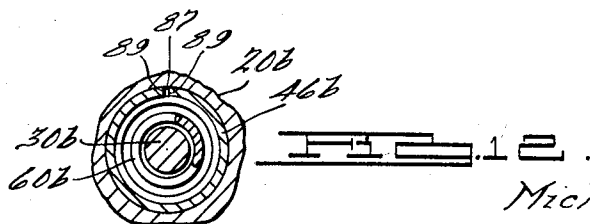
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SELF-ADJUSTING SWITCH

Filed Feb. 10, 1958

3 Sheets-Sheet 3



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1

2,921,155

SELF-ADJUSTING SWITCH

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12 Claims. (Cl. 200—61.82)

This invention relates generally to electric switches and more particularly to a switch assembly which has an adjustable mounting adapting it for a plurality of different installations.

The switch assembly of this invention is particularly adapted for use with closures such as are found in automobiles, namely, the main doors, the glove and luggage compartment doors, and the like. Such switch assemblies normally operate a lighting or other electrical circuit in response to opening and closing of the doors. One of the main problems in a switch assembly for automobiles and similar installations is the adaptation of the assembly to the various clearances between the doors and their supporting frames in automobiles from a mass production assembly line. It is apparent that the clearance spaces between a pair of doors and their corresponding supporting frames are not likely to be identical under such circumstances. Since the clearance between the door and its frame determines the space in which the switch must be located when the door is closed, a switch assembly which is adaptable to various clearances facilitates final assembly of the automobile.

An object of this invention, therefore, is to provide an improved switch assembly which is readily installed under different clearance conditions.

Another object of this invention is to provide a door switch of the above type which is automatically adapted to the clearance space between the door and its frame when the door is first closed with the switch mounted on the frame.

A further object of this invention is to provide a switch of the above type which is simple in construction, economical to manufacture, and reliable in operation in opening and closing a circuit associated with the switch.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims and the accompanying drawing in which:

Figure 1 is a plan view of the switch assembly of this invention, illustrated in assembly relation with a door and its supporting frame, only fragmentary portions of which are shown, and showing the door in an open position;

Fig. 2 is an enlarged longitudinal sectional view of the switch assembly of this invention, looking substantially along the line 2—2 in Fig. 1;

Fig. 3 is an enlarged transverse sectional view as seen along the line 3—3 in Fig. 1;

Figs. 4 and 5 are fragmentary sectional views looking along the lines 4—4 and 5—5, respectively, in Fig. 2;

Fig. 6 is a plan view of the switch assembly of this invention, shown in assembly relation with a door and its supporting frame as in Fig. 1, and showing the door in a closed position;

Fig. 7 is an enlarged longitudinal sectional view of the switch assembly of this invention looking along the line 7—7 in Fig. 6;

2

Fig. 8 is a perspective view of the locking spring which forms a part of the switch assembly of this invention;

Fig. 9 is a longitudinal sectional view of one modified form of the switch assembly of this invention.

Fig. 10 is a transverse sectional view looking along the line 10—10 in Fig. 9;

Fig. 11 is a longitudinal sectional view of another modified form of the switch assembly of this invention; and

Fig. 12 is a fragmentary transverse sectional view looking along the line 12—12 in Fig. 11.

With reference to the drawing, the switch assembly of this invention, indicated generally at 10, is illustrated in Fig. 1 in assembly relation with a door 12 and its supporting frame 14, only fragmentary portions of which are shown. The door 12, illustrated as being a vehicle door, is supported on the hollow frame 14 by means of a hinge 16 so that the door is swingable about a portion 18 of the hinge 16 between the open and closed door positions illustrated in Figs. 1 and 6, respectively.

The switch assembly 10 includes a body member 20 (Fig. 2) having an externally threaded tapered shank 22 and a hex head 24. A bore 26, of a uniform diameter, extends completely through the body 20 in a direction longitudinally thereof. The shank 22 is tapered, as shown in Fig. 2, so as to be self-tapping when inserted in a drilled hole 21 in the frame 14. The shank 22 is advanced in the opening 21 to a position in which the hex head 24 is either adjacent or against the outer frame surface 28, as shown in Fig. 1.

A plunger 30, having an elongated stem 32 and a rounded head 34 secured to one end of the stem 32, is connected at the opposite end 35 of the stem to an L-shape clamping sleeve 36 adapted to receive and be squeezed into clamping engagement with the bared end of a conductor (not shown). A connecting block 38 formed of a plastic or other non-conductive material such as nylon secures the end 35 of the stem 32 to the clamping sleeve 36.

The connecting block 38 surrounds a knob or annular projecting 40 on the stem 32 adjacent the end 35 to provide for a rigid mounting of the block 38 on the stem 32. A plurality of upstruck ears 42 on the sleeve 36 are inclined inwardly into engagement with one end of the block 38 for holding the block 38 in a fixed position against a shoulder 44 on the sleeve 36. This arrangement provides for a positive electrically non-conductive connection of the plunger 30 with the sleeve 36 which is easily accomplished during production of the switch assembly 10.

The plunger 30 is supported for reciprocal movement in an elongated cylindrical supporting member 46 of circular cross section which is in turn mounted for sliding movement within the body member bore 26 which is slightly oversize relative to the member 46. The supporting member 46 is provided with a first axial bore 48 which extends partially therethrough so that a portion 50 of the supporting member 46 is of a relatively thin-walled tubular cross section. The remaining portion 52 of the supporting member 46 is provided with an axial bore 54 of a reduced diameter relative to the bore 48, and is of a size to provide for a sliding fit of the plunger 30 in the portion 52. A sleeve 56 having an interned flange 58 at one end is slidably mounted in the portion 50 with the flange 58 encircling the plunger shank 32 and in engagement with the plunger head 34.

A coil spring 60 positioned about the shank 32 has one end 62 positioned against the internal shoulder 64 formed at the juncture of the bores 48 and 54, and has its opposite end 66 positioned against the flange 58. With the plunger 30 thus assembled with the supporting member 46, the spring 60 acts to force the plunger 30 out-

wardly of the end 68 of the supporting member 46. The movement of the plunger 30 in this direction is limited to a position of the plunger in which the end 70 of the clamping sleeve 36 engages the adjacent end 72 of the supporting member 46. The end 72 is tapered as illustrated in Fig. 2 to facilitate a full engagement of the supporting member 46 and the sleeve 36 for a purpose to appear presently.

In the assembly of the supporting member 46 with the body member 20, a locking spring 74 is initially positioned within the bore 26 in the body member 20. The locking spring 74, as illustrated in Fig. 8, has an elongated plate portion 76 having upturned ends 78. The plate portion 76 has a flat central section 80 and is progressively curved in a direction transversely thereof from the central portion 80 toward the ends 78 which are spaced apart a distance corresponding to the length of the body member 20. When the locking spring 74 is positioned within the bore 26 as illustrated in Fig. 2, the spring ends 78 are located at opposite ends of the body member 20 and act to prevent sliding movement of the locking spring 74 in directions longitudinally thereof relative to the body member 20.

When the plunger supporting member 46 is assembled with the body member 20 as illustrated in Fig. 2, the locking spring 74 acts to provide for a tight frictional engagement of the supporting member 46 with both the spring 74 and the portion of the body member 20 diametrically opposite the spring 74. By virtue of its shape, the spring 74 exerts a force on the supporting member 46 in a direction transversely thereof at the central section 80 of the spring 74. This section 80 is substantially flat and, therefore, provides a maximum retaining force on the supporting member 46 which progressively decreases in a direction toward the ends 78 of the locking spring 74, which are curved to facilitate assembly of the members 20 and 46.

It is apparent that the locking spring 74 provides the necessary force for locking the supporting member 46 to the body member 20 while also being yieldable sufficiently to permit relative longitudinal movement of the body member 20 and the supporting member 46 when the force acting to move the parts is sufficiently large to overcome the frictional forces on the supporting member 46. In addition, the locking spring 74 has sufficient resilience to accommodate varying clearances between the supporting member 46 and the body member 20 under different tolerance conditions.

In the installation of the switch assembly 10 on the frame 14, the body member 20 is threaded into the frame opening 21 as shown in Figs. 1 and 2 with the clamping sleeve 36 clamped to the conductors (not shown) in the circuit to be controlled by the switch assembly 10. During rotation of the body member 20 into the opening 21, the plunger 30 is readily maintained against rotation with a pair of pliers or the like while the body member 20 and the supporting member 46 rotate about the plunger 30. As a result, the wires connected to the clamping sleeve 36 are not twisted during installation of the switch assembly 10.

When the switch assembly has been mounted on the frame 14, the supporting member 46 is partly withdrawn from the body member 20 so that the plunger head 34 is spaced a maximum distance from the body member 20. In this position of the supporting member 46, the inner end 70 of the sleeve 36 is adjacent to but spaced from the inner end of the body member 20. The door 12 is then moved to the closed position illustrated in Fig. 6 to automatically position the plunger 30 a desired distance from the switch actuating side or edge 92 of the door 12 in the following manner. On closing of the door 12, the door side 92 initially contacts the plunger head 34 and moves the head 34 against the pressure of the spring 60 to a position in engagement with the adjacent end 68 of the supporting member 46. On continued closing movement of

the door 12, the force of the door on the plunger head 34 progressively moves the head 34 and the supporting member 46 longitudinally of the body member 20 until the door has been fully closed as illustrated in Fig. 6.

In the closed position of the door 12, the plunger 30 is in a position in which the head 34 is against the supporting member 46 and maintains the clamping sleeve 36 in a spaced position relative to supporting member 46. When the door 12 is opened, the spring 60 provides for movement of the plunger in a direction in which the head 34 is moved away from the adjacent end 68 of the supporting member 46. This movement of the plunger provides for a movement of the sleeve 36 against the tapered end 72 of the supporting member 46. The tapered construction of the end 72 and the compression of the spring 60, so that it continually urges the plunger 30 outwardly, provides for a positive engagement of the end 70 of the sleeve 36 with the end 72 of the supporting member 46.

Since the sleeve 36 is connected to a conductor which is in turn connected to a battery or other source of power, and the body member 20 and the supporting member 46 are grounded through the vehicle frame 14, the sleeve end 70 and the supporting member end 72 function as switch terminals in the circuit controlled by the switch assembly 10. When the door 12 is opened, the terminals 70 and 72 are moved into engagement by the spring 60 so that the circuit is completed through the light or other electrical device controlled by the circuit, and when the door is closed the plunger 30 acts to separate the terminals 70 and 72 and open the circuit.

A modified form of switch assembly, generally indicated at 10a, is illustrated in Fig. 9 mounted on a door frame member 14a. The assembly 10a includes a body member 20a, a plunger 30a, a plunger supporting member 46a, a plunger biasing spring 60a, and a conductor clamping sleeve 36a, all of which parts correspond to the like parts designated by like numerals on the assembly 10. All of these parts are identical to their corresponding parts on the assembly 10 except for the body member 20a which has a threaded bore 26a, and the supporting member 46a which is provided with external threads 82, and is provided at its outer end with a hex shape end portion 84 to facilitate threading of the supporting member 46a into the bore 26a.

On installation of the assembly 10a on the door frame member 14a, the body member is threaded into the frame opening 21a and the support member 46a is threaded into the bore 26a until the hex shape end portion 84 is adjacent the head 24a of the body member 20a. The door (not shown) associated with the frame 14a is then closed and the light or other electrical device controlled by the switch assembly 10a is observed to determine whether the circuit therefor has been opened in response to closing of the door. In the event the circuit has not been opened, the supporting member 46a is gradually retracted in small increments, with the door being closed after each retraction until the switch is actuated in response to closing of the door.

A second modified form of switch assembly is indicated generally at 10b in Fig. 11 mounted on a door frame member 14b. The assembly 10b includes a body member 20b, a plunger 30b, a plunger supporting member 46b, a plunger biasing spring 60b, and a conductor clamping sleeve 36b, corresponding to the like parts with like numerals on the assembly 10. All of these parts are likewise identical to the corresponding parts on the assembly 10 except for the supporting member 46b which is formed of a sheet material and bent to a substantially tubular form as illustrated in Fig. 12, with a longitudinal space 87 between the side edges 89 of the plate which forms the member 46b. The supporting member 46b is stressed so that it tends to enlarge and resume a flat shape so that when it is positioned within the bore 26b in the body member 20b it expands into tight frictional

5

engagement with the body member 20b to positively maintain the supporting member 46b in an adjusted position longitudinally of the body member 20b.

At its inner end 92, the supporting member 46b is shaped to form an internal annular groove 94 which receives and acts as a support for the inner end of the biasing spring 60b. The inner end 92 is likewise formed of a tapered shape as illustrated in Fig. 11 so that it functions like the tapered end 72 of the supporting member 46 in the assembly 10.

The body member 20b is illustrated in solid lines in Fig. 1 in what amounts to an inwardly moved limit position of the supporting member 46b relative to the stationary body member 20b and in broken lines in what constitutes the other limit position corresponding to a maximum retracted position of the supporting member 46b.

In use, the body member 20b is installed on the door frame member 28b as illustrated in Fig. 11 with the supporting member 46b in its limit position illustrated in broken lines in Fig. 11 for the body member 20b. The door associated with the frame member 14b is then closed to slide the supporting member 46b inwardly on the body member 20b and automatically locate the plunger head 34b in a position relative to the door such that the switch is opened and closed on closing and opening of the door.

Although the invention has been described with respect to several embodiments thereof, it is to be understood that it is not to be so limited, since changes can be made therein which are within the scope of the invention as defined by the appended claims.

What is claimed is:

1. A switch assembly comprising a body member adapted to be supported in a grounded stationary position, a support member having a tubular portion and supported on said body member for adjustable movement in opposite directions axially of said tubular portion, a plunger member slidably mounted on said support member for movement axially of said tubular portion, a conductor carrying member, a connecting member formed of a non-conducting material connecting said plunger and said conductor carrying member, spring means on said support member biasing said plunger to a position in which it projects out of one end of said tubular portion and the conductor carrying member attached to the plunger engages said support member, and said plunger member being movable in a direction to move said conductor carrying member away from said support member against the pressure of said spring means.

2. A switch assembly comprising a body member adapted to be supported in a stationary position, a support member having a tubular end portion and an opposite end portion which constitutes a switch terminal, said support member being supported on said body member for adjustable movement in opposite directions axially of said tubular portion, a plunger member slidably mounted in said tubular portion for movement axially thereof, a conductor carrying member, a connecting member formed of a nonconducting material connecting said plunger and said conductor carrying member, spring means on said support member biasing said plunger member to a circuit completing position in which the plunger projects out of one end of said tubular portion and the conductor carrying member engages said terminal to complete a circuit through said switch assembly, said plunger member being movable in a direction to move said conductor carrying member away from said terminal against the pressure of said spring, and stop means on said plunger member engageable with said tubular portion for limiting movement of said plunger member in a direction moving said conductor carrying member away from said support member.

3. A switch assembly comprising a body member, a switch actuating plunger reciprocable relative to said

6

body member between first and second positions spaced apart in a direction longitudinally of the body member, and means including a support member for said plunger member adjustably mounting said plunger member on said body member for said reciprocation and for movement to a plurality of supported positions spaced longitudinally of said body member.

4. A switch assembly comprising an elongated support member, a contact opening and closing plunger member extending longitudinally of said support member and supported thereon for reciprocating movement between a pair of stop positions corresponding to contact opening and closing positions, spring means extending between said support member and said plunger biasing said plunger to one of said stop positions, and a body member for mounting said support member, said support member being mounted on said body member such that said support member is adjustable in a direction longitudinally thereof between spaced limit positions.

5. A switch assembly comprising an elongated support member, a contact opening and closing plunger member extending longitudinally of said support member and slidably supported thereon for movement between a pair of stop positions corresponding to contact opening and closing positions in which one end of said plunger is spaced different distances from the adjacent end of said support member, spring means biasing said plunger to one of said stop positions, and a body member for mounting said support member, said support member being slidably mounted on said body member such that said support member is movable in a direction longitudinally thereof to a plurality of positions, said support member being in frictional engagement with said body member in each of said positions.

6. A switch assembly comprising a body member adapted to be supported in a stationary position, a support member having a tubular end portion and an opposite end portion which constitutes a switch terminal, said support member being slidably supported on said body member for adjustable movement in opposite directions axially of said tubular portion, and being frictionally engaged with said body member in each adjusted position so as to be releasably maintained in said position, a plunger member slidably mounted in said tubular portion for movement axially thereof, a conductor carrying member, a connecting member formed of a non-conducting material connecting said plunger and said conductor carrying member, spring means on said support member biasing said plunger to a circuit completing position in which the plunger projects out of one end of said tubular portion and the conductor carrying member engages said terminal to complete a circuit through said switch assembly, said plunger member being movable in a direction to move said conductor carrying member away from said terminal against the pressure of said spring, and stop means on said plunger member engageable with said tubular member for limiting movement of said plunger member in a direction moving said conductor carrying member away from said support member.

7. A switch assembly for use with a door mounted on a frame and wherein said door is movable between open and closed positions relative to the frame, said switch assembly comprising a plunger member adapted to be mounted on said frame and having an actuating end engageable with said door, support means for said plunger, spring means extending between said support means and said plunger for biasing the plunger toward said door in the closed position thereof, and a body member adapted to be secured to said frame for supporting said assembly thereon, said support means being adjustably mounted on said body member such that said support means is movable to an adjustable position locating said plunger end so that said plunger is moved between positions corresponding to open and closed po-

sitions of said switch assembly in response to opening and closing movement of said door.

8. A switch assembly for use with a door mounted on a frame and wherein said door is movable between open and closed positions relative to the frame, said switch assembly comprising a plunger member adapted to be mounted on said frame and having an actuating end engageable with said door, support means for said plunger, spring means extending between said support means and said plunger for biasing the plunger toward said door in the closed position thereof, and a body member adapted to be secured to said frame member for supporting said assembly thereon, said support means being threadably mounted on said body member so that said support means is movable to an adjusted position on the body member in which the plunger is movable by said spring means to a closed position of the switch assembly on opening of said door and to an open position of the switch assembly on engagement of said door with said plunger end on closing of the door.

9. A switch assembly comprising a body member adapted to be supported in a stationary position, a cylindrical support member having first and second coaxial bores extending through opposite end portions thereof and forming a shoulder at the juncture of said bores, said support member being slidably supported on said body member for adjustable movement in opposite directions longitudinally of the support member, a plunger member slidably mounted in said bores for movement axially thereof and having a head at one end, a conductor carrying member, a connecting member formed of a non-conducting material connecting said plunger and said conductor carrying member, spring means in the larger one of said bores extending between said shoulder and said plunger head biasing said plunger member to a circuit completing position in which the plunger projects out of said larger bore and the conductor carrying member engages the adjacent end of said support member to complete a circuit through said switch assembly, said plunger being movable in a direction to move said conductor carrying member away from said support member against the pressure of said spring, stop means on said plunger member engageable with said tubular member for limiting movement of said plunger member in a direction moving said conductor carrying member away from said support member, and spring means positioned on said body member in engagement with one side of said support member and exerting a force thereon maintaining the transversely opposite side of the support member in frictional engagement with said body member.

10. A switch assembly comprising a body member adapted to be supported in a stationary position, a tubular support member of a split expansible type which

tends to enlarge itself, said support member being supported on said body member for adjustable sliding movement and expanded into frictional engagement therewith, a plunger slidably mounted in said support member for movement axially thereof, a conductor carrying member, a connecting member formed of a non-conducting material connecting said plunger and said conductor carrying member, spring means on said support member biasing said plunger to a circuit completing position in which the plunger projects out of one end of said support member and the conductor carrying member engages the opposite end of the support member to complete a circuit through said switch assembly, said plunger being movable in a direction to move said conductor carrying member away from said opposite end against the pressure of said spring, and stop means on said plunger engageable with said tubular member for limiting movement of said plunger in a direction moving said conductor carrying member away from said support member.

11. A switch assembly comprising a support member, a longitudinally extending plunger member mounted on said support member for reciprocating movement between a pair of positions corresponding to contact opening and closing positions, means extending between said support member and said plunger biasing the plunger to one of said pair of positions, and a body member for mounting said support member, said support member being frictionally mounted on said body member for adjustable sliding movement in directions longitudinally of said plunger member.

12. A switch assembly comprising a body member, a support member threadably mounted on said body member, a longitudinally extending plunger member mounted on said support member for reciprocating movement between a pair of positions corresponding to contact opening and closing positions, means extending between said support member and said plunger biasing said plunger to one of said pair of positions, said support member being threadably mounted on said body member such that it is adjustable in a direction corresponding to the direction of reciprocating movement of said plunger member.

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