

**EUROPEAN PATENT APPLICATION**

Application number: 85103415.7

Int. Cl.<sup>4</sup>: **H 01 H 13/02**

Date of filing: 22.03.85

Priority: 30.03.84 JP 63918/84  
 28.03.84 JP 61824/84  
 02.04.84 JP 48780/84 U  
 03.04.84 JP 49329/84 U  
 22.03.84 JP 41246/84 U

Date of publication of application:  
 06.11.85 Bulletin 85/45

Designated Contracting States:  
 AT BE CH DE FR GB IT LI LU NL SE

Applicant: OMRON TATEISI ELECTRONICS CO.  
 10, Tsuchido-cho Hanazono Ukyo-ku  
 Kyoto 616(JP)

Inventor: Honda, Sueaki  
 c/o Omron Tateisi Electronics Co. (Patent Center)  
 Shimo-Kaifinji Nagaokakyo-Shi Kyoto(JP)

Inventor: Hayashi, Mitsuji  
 c/o Omron Tateisi Electronics Co. (Patent Center)  
 Shimo-Kaifinji Nagaokakyo-Shi Kyoto(JP)

Inventor: Kiyono, Yasuhiro  
 c/o Omron Tateisi Electronics Co. (Patent Center)  
 Shimo-Kaifinji Nagaokakyo-Shi Kyoto(JP)

Inventor: Niwa, Takashi  
 c/o Omron Tateisi Electronics Co. (Patent Center)  
 Shimo-Kaifinji Nagaokakyo-Shi Kyoto(JP)

Inventor: Hayakawa, Tomohiko  
 c/o Omron Tateisi Electronics Co. (Patent Center)  
 Shimo-Kaifinji Nagaokakyo-Shi Kyoto(JP)

Representative: WILHELMS, KILIAN & PARTNER  
 Patentanwälte et al,  
 Eduard-Schmid-Strasse 2  
 D-8000 München 90(DE)

**Push-button switch.**

A switch in which a switch unit is constituted by situating the free end of a first movable member disposed with a contact between stationary contacts opposing to each other along the vertical direction, while engaging the other end of the movable member to a fixed portion, pivoting one end of a second movable member to the free end of the first movable member while engaging a spring to the other end of the second movable member, thereby biasing the contact of the first movable member to one of the stationary contacts, and setting the other end of the second movable member to a switch operation portion, as well as a switch wherein a housing, which enhouses a push button unit containing an illumination unit, a socket unit to be connected to the illumination unit and a plunger to be connected to the push button switch, contains to secure the switch mechanism at the lower opening thereof and the lower end of the plunger is disposed to the switch operation portion.

---

Push-Button Switch

---

Priorities: March 30, 1984 - JAPAN - No. 63918/1984  
March 28, 1984 - JAPAN - No. 61824/1984  
April 02, 1984 - JAPAN - No. 48780/1984 (UM)  
April 03, 1984 - JAPAN - No. 49329/1984 (UM) P 2286-EP  
March 22, 1984 - JAPAN - No. 41246/1984 (UM)

## 2. FIELD OF THE INVENTION

This invention concerns a switch for use in various types of electronic equipments and, more specifically, it relates to a switch actuated by the depressing operation of a push button.

## 3. BACKGROUND OF THE INVENTION

As the general contact structure for the above-mentioned switch, the structure as shown in Figure 20 has been known.

Specifically, to the inner space between a switch cover 201 and a switch base 202 disposed opposing to each other vertically, an upper terminal 203 and a lower terminal 204 are disposed opposingly one above the other with a predetermined gap, and contacts 205, 206 are secured to the opposing faces of both of the terminals 203, 204 respectively.

A common terminal 207 is disposed vertically on one side of the contacts 205, 206, in which the base end of a first movable member 208 is engaged to the lower portion of the common terminal 207 while the free end of the first

movable member 208 is situated in the vicinity of the contacts 205, 206 of the above-mentioned upper and lower terminals 203, 204.

A second movable member 209 inserted between the contacts 205, 206 is engaged at one end thereof to the free end of the first movable member 208, and the second movable member 209 has contacts 210, 210 secured at the positions corresponding to the contacts 205, 206 respectively. Further, a spring 211 is stretched between the outer end of the second movable member 209 and the common terminal 207, so that the contact 210 on the second movable member 209 is always biased to be in contact with the contact 206 on the lower terminal 204.

An operation member 212 undergoing the depressing operation is supported above the free end of the second movable member 209. When the operation member 212 is depressed, the free end of the second movable member 209 moves downwardly to switch the contact 210 of the second movable member 209 from the contact 206 on the lower terminal 204 to the contact 205 on the upper terminal 203.

The contact structures having been constituted as described above have the following problems.

Namely, upon switching the second movable member 209, the second movable member 209 is slanted largely corresponding to the amount of depression of the operation member 212 to result in a slip, due to the slanting,

between the contact 210 of the second movable member 209 and the contact 206 on the lower terminal 204 in a partially contacted state, as well as a similar slippage for the contact between the contact 205 on the upper terminal 203 and the contact 210 of the second movable member 205 after switching operation.

If the slipping contact is acted between the contacts 206, 210 and between the contacts 205, 210, the contact faces are remarkably abraded to roughen the contact faces thereby resulting in malcontact, reduction in the switch operation characteristic and, thus, reduction in the switch life.

#### 4. CONSTITUTION OF THE INVENTION

This invention concerns a switch in which a switch unit is constituted by situating the free end of a first movable member disposed with a contact between stationary contacts opposing to each other along the vertical direction, while engaging the other end of the movable member to a fixed portion, pivoting one end of a second movable member to the free end of the first movable member while engaging a spring to the other end of the second movable member, thereby biasing the contact of the first movable member to one of the stationary contacts, and setting the other end of the second movable member to a switch operation portion, as well as a switch wherein a

housing, which enhouses a push button unit containing an illumination unit, a socket unit to be connected to the illumination unit and a plunger to be connected to the push button switch, contains to secure the switch mechanism at the lower opening thereof and the lower end of the plunger is disposed to the switch operation portion.

## 5. OBJECT OF THE INVENTION

The first object of this invention is to provide a switch free from malfunctions in the contacts and reduction in the switch operation characteristic by preventing the surface of the contacts from being roughened.

The second object is to provide an effective double-throwing or multiple-throwing type switch.

The third object is to provide a push button and illumination type push button switch which can be assembled with easy.

The fourth object is to provide a switch in which an alternating mechanism for holding the depressing operation position of the push button is arranged effectively.

The fifth object is to provide a switch capable of preventing external dusts or the likes from intruding to the inside by an effective sealing mechanism, when constituted as a push button switch.

The sixth object is to provide a switch in which the depressing operation of the push button is disabled and

the push button can be used as a display means, when constituted as an illumination type push button.

The seventh object is to provide a switch capable of obtaining an effective connection for illumination elements contained in a push button, when constituted as an illumination type push button switch.

The eighth object is to provide a switch capable of optionally selecting the mounting structure to an operation panel between the securing using a nut and securing using a resilient member, when constituted as a push button switch.

The ninth object is to provide an effective socket for electrical connection with a switch, when constituted as a push button switch or an illumination type push button switch.

## 6. BRIEF DESCRIPTION OF THE DRAWINGS

The drawings show one embodiment according to this invention, wherein

Figure 1 is an exploded perspective view for an illumination type push button switch,

Figure 2 is a side elevational view for the illumination type push button switch,

Figure 3 is a vertical cross sectional view for the illumination type push button switch,

Figure 4 is a side elevational view for a portion of

the switch showing the mounting state of an illumination unit to a push button unit,

Figure 5 is a side elevational view for a portion of the switch showing the mounting state of the illumination unit to the push button unit when it is reversed,

Figure 6 is a transversal cross sectional view for a element holder portion of the illumination unit,

Figure 7 a-h are explanatory views showing the operation state of the alternating mechanism,

Figure 8 is a vertical cross sectional view for a socket unit portion,

Figure 9 is a partially cut-away perspective view for a socket base,

Figure 10 is a plan view for the socket base when mounted with a lamp,

Figure 11 is a plan view for the socket base when mounted with LED,

Figure 12 is a vertical cross sectional view for a portion of the socket unit,

Figure 13 is a side elevational view for the socket unit,

Figure 14 is a perspective view for a switch mechanism,

Figure 15 is a perspective view for a housing mounting portion,

Figure 16 is a perspective view for a housing mounted

with a resilient member,

Figure 17 is a vertical cross sectional view for a switch socket,

Figure 18 is a plan view for the switch socket,

Figure 19 is a perspective view for a portion of the switch socket, and

Figure 20 is a vertical cross sectional view for a conventional switch.

## 7. EMBODIMENT OF THE INVENTION

This invention will now be described more specifically by way of its preferred embodiment referring to the drawings.

The drawings show an illumination type push button switch in which a push button is illuminated.

As shown in Figures 1, 2 and 3, an illumination type push button switch 20 comprises a push button unit 21 for switching operation, an illumination unit 22 for illuminating the illumination face, a plunger 23 for transmitting the depressing amount of the push button unit 21 downwardly, a socket unit 24 for the electrical connection of the illumination unit 22, a switch unit 25 actuated by the depression of the plunger 23, and a housing 26 for enhousing each of the elements 21 - 25.

### (a) Description of the Push Button Unit

The push button unit 21 is constituted as described



below.

Specifically, a rectangular box-like push button 27 optionally pigmented with red, yellow, green or like other color and opened at the bottom contains in the inside thereof a rectangular mark plate 28 attached with a mark for indicating the switching function and a rectangular diffusion plate 29 for diffusing light, and a reflection member 30 is inserted fittingly therebelow.

The diffusion plate 29 is recessed at the top surface thereof and the mark plate 28 is fitted to the recess.

The reflection member 30 has a rectangular peripheral edge 31 formed at the upper end thereof capable of fitting the lower opening of the push button 27, and a step 32 is formed to the inside of the peripheral edge 31, to which diffusion plate 29 is fitted at the lower surface thereof.

Engagements 33, 33 are formed stepwise at the two opposing positions on the outer circumferential surface of the peripheral edge 31 of the reflection member 30, and engaging protrusions 34, 34 are formed to the inner wall of the bottom opening of the push button 27 corresponding to the engagements 33, 33, so that upon fitting of the reflection member 30 to the opening, the engagements 33, 33 and the engaging protrusions 34, 34 are engaged with each other to integrally secure the push button 27, the mark plate 28, the diffusion plate 29 and the reflection member 30.

The circumferential surface of the reflection member 30 is restricted from the upper to the lower portions as a square conical shape, in which the central portion constitutes a cylindrical portion 35, the inner peripheral surface constitutes a reflection surface 36 slanted toward the central portion and the reflection surface 36 reflects the light from the illumination element contained in the cylindrical portion 35 upwardly.

The cylindrical portion 35 of the reflection member 30 is equipped with a structure for supporting the illumination unit 22 and a structure for regulating the direction of containing the illumination unit 22.

Specifically, supports 37, 37 are suspended at the opposing positions on the cylindrical portion 35 of the reflection member 30 and the supports 37, 37 have elongate grooves 38, 38 each of a length corresponding to the depressing stroke of the push button unit 21.

The illumination unit 22 contained within the opening of the cylindrical portion 35 has protrusions 40 formed at the side of a element holder 39 thereof for fitting the elongate grooves 38.

Further, protrusions 41, 41 acting on the supports 37, 37 are arranged at the lower outer periphery of the element holder 39.

The support 37 has a notch 42 formed at one side edge thereof and an abutment 43 at the lower end thereof, which

act as described below.

As shown in Figure 4, the notch 42 allows the protrusion 41 to be inserted therethrough when the protrusion 40 of the element holder 39 is fitted in the elongate groove 38 of the support 37 in the direction of an housing the illumination unit 22 used as the illumination type push button switch 20.

Further, as shown in Figure 5, an abutment 43 abuts against the upper surface of the protrusion 41 of the element holder 39 and inhibits the insertion of the protrusion 41 when the protrusion 40 of the element holder 39 is engaged in the elongate groove 38 of the support 37 in the direction of enhousing the illumination unit 22 used as a display device by rotating the illumination unit 22 by 180°.

By the operation as described above, the direction of enhousing the illumination unit 22 is regulated to a predetermined direction and, by supporting the illumination unit 22 on the supports 37, 37, assembling work for the push button unit 21 and the illumination unit 22 is facilitated.

The cylindrical portion 35 of the reflection member 30 is equipped with a structure for connecting the plunger 23.

Specifically, engaging fingers 44, 44 are suspended at the opposing positions on the cylindrical portion 35

displaced by 90 degree from the positions for the supports 37, 37, and the engaging fingers 44, 44 are formed with seizing grooves 45, 45 opened at the lower ends.

The plunger 23 is in a cylindrical shape and has protrusions 46, 46 formed on the inner wall surface of the upper end thereof at the positions opposing to the engaging fingers 44, 44. The protrusions 46, 46 are engaged and put between the seizing grooves 45, 45 in the engaging fingers 44, 44 of the reflection member when the reflection member 30 and the plunger 23 are joined, by which the reflection member 30 and the plunger 23 are connected.

Further, by the above-mentioned connection, the depressing operation of the push button unit 21 is transmitted to the plunger 23.

Between the cylindrical portion 35 of the reflection member 30 and the inner wall surface of the housing 26 is formed a seal structure.

Specifically, a step 47 is formed at the outer circumferential edge of the cylindrical portion 35 of the reflection member 30, while a step 48 is formed also at the upper end edge of the plunger 23 corresponding to the step 47, and an annular engaging groove is formed by joining both of the steps 47, 48.

The seal 49 is molded with resilient material into a circular shape surrounding the periphery and the inner end edge 50 of the seal 49 is defined with thicker than the

space of the engaging groove formed by the steps 47, 48. When the steps 47, 48 are joined, the inner end edge 50 is put therebetween and, when the inner end edge 50 is fitted to the engaging groove defined with the steps 47, 48, it is seized and held by the engaging groove.

The outer end edge 51 of the seal 49 is fitted to an annular groove 52 formed to the inner wall surface of the housing 26, and an annular fixing ring 53 is fitted over the upper portion of the annular groove 52 to secure the outer end edge 51 to the annular groove 52.

The seal 49 prevents external dusts or the likes from intruding to the inside.

The upper end of the housing 26 is shaped into a rectangular box-like configuration so that the push button unit 21 constituted as described above may be fitted. The central portion is configurated into a cylindrical shape so that the cylindrical plunger 23 may be mounted.

(b) Description for Illumination Unit

The illumination unit 22 comprises an illumination element 54 and the element holder 39 as described above, and the illumination element 54 includes two types, that is, a lump 55 and a LED 56, which are respectively fitted to the element holder 39 and selected upon use depending on the purpose of use.

Lead terminals 57, 57 of the lump 55 is in a round bar shape and read terminals 58, 58 of the LED 56 are in

a plate-like shape. The plate-like lead terminals 58, 58 are formed somewhat thinner than the round rod-like lead terminals 57, 57.

The illumination unit 22 having thus been constituted is enoused and engaged to the cylindrical portion 35 at the lower end of the push button unit 21.

(c) Description of the Plunger

The plunger 23 is in a cylindrical configuration and has at the upper end edge thereof a diameter reduction step 59, which abuts against a flange 60 formed at the upper end edge of the cylindrical inner wall of the housing 26 thereby being prevented from slip-off when the plunger 23 is inserted from the lower end opening of the housing 26.

Further, a returning spring 61 is enoused to the inside of the plunger 23 and the spring 61 resiliently biases the plunger 23 upwardly by abutting at the lower end thereof against the upper surface of the socket unit.

An operation member 62 and a control member 63 are suspended from the lower peripheral edge of the plunger 23.

The operation member 62 is formed as a pair each opposing to the switch operation portion of the switch unit 25 to perform switching operation upon depression of the plunger 23.

The control member 63 is formed with an elongate groove 64 of a length corresponding to the depressing stroke of the push button unit 21, the elongate groove 64 is engaged with a protrusion 66 disposed on the side of the socket base 65 to control the depression stroke of the plunger 23, as well as control the circumferential rotation of the plunger 23.

The inner circumferential wall surface at the upper end opening of the plunger 23 is disposed with a control structure for controlling the direction of inserting the illumination unit 22 to one direction.

As shown also in Figure 6, protrusions 67, 67 are protruded at the inner circumferential wall surface of the upper end opening of the plunger 23 to thereby form grooves 68 between each of the protrusions 67, 67.

The protrusions 67, 67 and the groove 68 allow to insert the protrusions 41, 41 of the illumination unit 22, and, when the illumination unit 22 is inserted at 180° rotation, the protrusions 67, 67 are abutted against the protrusions 41, 41 to inhibit the insertion of the illumination unit 22 therethrough.

Since the direction of inserting the illumination unit 22 is control to a predetermined direction by the above-mentioned regulation structure, an erroneous insertion can be prevented, for example, in a case of using the LED 56 having a polarity as the illumination

element 54.

An alternating mechanism 69 is formed between the socket unit 24 of the plunger 23 and the socket base 65 of the socket unit 24.

As shown in Figures 3 and 7, the alternating mechanism 69 comprises an alternating cam 71 pivoted on the shaft 70 at the outer wall surface from the socket base 65, and a cam control portion 72 formed to the wall surface of a plunger 23 opposing to the cam 71.

The cam 71 is in a rectangular shape and has engaging grooves 73, 73 formed on two opposing shorter sides.

The cam control section 72 is defined by forming a window 74 to the wall surface of the plunger 23, in which four control sections 75, 76, 77, 78 are formed on the peripheral edge of the window 74.

The first control section 75 is defined by forming an arcuate corner on one upper side of the window 74. When the cam 71 abuts against the first control section 75, the cam 71 is rotated in one direction by a predetermined angle.

The second control section 76 is defined by forming a corner at a position somewhat higher than that for the control section 75 at the other upper end of the window 74, and it controls the rotating position of the cam 71 rotated by a predetermined amount by the above-mentioned first control section 75 by engaging with the engaging



groove 73 situated at the upper end of the cam 71.

The third control section 77 is defined by forming a corner on one side of the middle portion of the window 74, and it controls the position of the plunger 23 at the switch operation position by engaging the engaging groove 73 situated at the lower end of the cam 71, the position of which is controlled by the second control section 76.

The fourth control section 78 is defined with a vertical face formed on one side of the lower portion of the window 74, and it holds the rotating state of the cam 71 which has been rotated by one-half upon successive downward movement and the subsequent returning of the plunger 23.

The alternating mechanism 69 having thus been constituted is operated as shown in Figures a-h.

Specifically, the plunger 23 is situated above and the switch is put to OFF in the state shown in Figure(a).

When the plunger 23 is depressed from the state, the plunger 23 is moved downwardly, in which the first control section 75 abuts against the upper one corner of the cam 71 to rotate the cam 71 clockwise as shown in Figure (b).

Further, when the plunger 23 is moved downwardly, the second control section 76 engages with the engaging groove 73 at the upper end of the cam 71 to stop the rotation of the cam 71 and control the position thereof as shown in Figure (c).

Then, when the depressing operation of the plunger 23 is released, since the plunger 23 is moved upwardly by the spring 61, the third control section 77 abuts against the lower one corner of the cam 71 to slightly rotate the cam 71 clockwise as shown in Figure (d).

Then, as shown in Figure (e), the third control section 77 engages the engaging groove 73 at the lower end to stop the upward movement of the plunger 23. That is, the plunger 23 is locked at that position, where the switch is operated to ON and locked at the ON state.

Then, in order to release the locked state as described above, the plunger 23 is depressed again. Upon this depressing operation, the plunger 23 somewhat moves downwardly.

As shown in Figure (f), since the second control section 76 abuts against one corner of the cam 71, the cam 71 is rotated clockwise to release the locked state.

As shown in Figure (g), the cam 71 is rotated substantially to a horizontal state and, upon releasing the depressing operation of the plunger 23 in this state, the plunger 23 is moved upwardly by the action of the spring 61.

In the initial stage of the upward movement, as shown in Figure (h), the third control section 77 abuts against the side portion of the cam 71 to further rotate the cam 71. When the plunger 23 moves upwardly by this operated

state, the side portion of the cam 71 is in sliding contact with the fourth control section 78, whereby the plunger 23 moves upwardly to the upper limit position, that is, to the position where the switch is operated OFF to return into the position shown by the Figure (a),

As described above, the alternating mechanism 69 can maintain the ON state of the switch by one depressing operation of the push button unit 21 by way of the plunger 23 and can operate the switch to OFF state by a further depressing operation for once.

In the foregoing embodiment, although the cam control portion 72 is defined to the wall surface of the plunger 23, the actuation member 62 of the plunger 23 may be formed broader in the lateral direction and the cam control portion 72 may be formed to the operation member 62 as another means.

#### (d) Description of the Receptacle Unit

The socket unit 24 comprises the socket base 65 as already described and a socket cover 79 joined to the upper surface of the socket base 65.

The socket cover 79 has an engaging structure formed at the upper surface thereof for engaging the element holder 39 for the illumination unit 22.

Specifically, engaging fingers 80, 80 are erected at the upper surface of the socket cover 79 with a pre-determined distance from each other and the engaging

fingers 80, 80 respectively have seizing grooves 81, 81 each opening at the upper ends thereof.

Further, protrusions 82, 82 are formed on the side of the element holder 39 of the illumination unit 22 at the positions opposing to the engaging fingers 80, 80. The protrusions 82, 82 are engaged and put between the seizing grooves 81, 81 of the engaging fingers 80, 80 when the illumination unit 22 is mounted to the upper surface of the socket cover 29, by which the illumination unit 22 is connected to the upper surface of the socket unit 24.

Further, insertion ports 83, 83 are formed to the socket cover 79 so as to penetrate the cover 79. The insertion ports 83, 83 are formed at the positions opposing to lead terminal 57 or 58 of the illumination element 54 when the illumination unit 22 is mounted to the upper surface of the socket cover 79 and allow the lead terminal 57 or 58 to pass therethrough.

Guide members 84, 84 are erected to the upper surface of the socket cover 79 and they function to guide the abutment of the returning spring 61.

As shown in Figure 8 through Figure 11, socket holes 85, 85 are formed in the upper surface of the socket base 65 and they are formed at the positions corresponding to the insertion ports 83, 83 of the socket cover 79.

The socket holes 85, 85 have lateral width capable of

inserting the lead terminal 58 of the LED 56. The holes 85, 85 are formed with recesses 87, 87 at the hole walls 86, 86 respectively, and the recesses 87, 87 are formed vertically and engaged to a portion of the circumferential surface of the round rod type lead terminals 57, 57 of the lamp 55.

To the inside of the socket holes 85, 85 opposing to the hole walls 86, 86, are inserted the free ends of the contact members 88, 88, and the contact members 88, 88 are bent at the middle portions thereof so as to provide a resiliency, and are in resilient contact with the respective lead terminals 57, 58.

By forming the recesses 87, 87 to the hole walls 86, 86, since the thickness is different between the lamp 55 and the lead terminals 57, 58 of the LED 56, by fitting a portion of the lead terminal 57 of the lamp 55 to the recesses 87, 87, the protruding amount of the lead terminal 57 is substantially equal with the thickness of the lead terminal 58 of the LED 56, whereby the resiliency of the contact member 88 is equally acted on both of the lead terminals 57, 58.

While the recess 87 is formed to the hole wall 86, the recess 87 may also be formed on the side of the contact member as another means.

As also shown in Figure 12, grooves 89, 89 to be connected with the socket holes 85, 85 are formed to

the socket base 65 toward the outer circumference, and engaging ports 90, 90 are formed at the intermediate positions between the grooves 89, 89.

The engaging ports 90, 90 are engaged with the engagement 92, 92 formed by bending the upper ends of the connection terminals 91, 91, by which the connection terminals 91, 91 can surely be prevented from detachment even when the downward pulling action is acted to the connection terminals 91, 91.

To the flat portion at the upper ends of the connection terminals 91, 91, are fixed the base ends of the contact members 88, 88.

Further, joining members 93, 93 are formed at the peripheral edge of the socket cover 79 corresponding to the grooves 89, 89 and, when the joining members 93, 93 are fitted to the grooves 89, 89, the upper ends of the connection terminals 91, 91 are covered to obtain satisfactory insulation for the portion of the socket holes 85, 85.

At the same time, the joining position between the socket base 65 and the socket cover 79 is controlled by the engagement between the grooves 89, 89 and the joining members 93, 93.

As shown also in Figure 13, a control portion 94 is formed at the lower surface of the socket base 65, and the control portion 94 is acted on the switch unit 25 to

be described later, the specific operation of which will be made clear in the later explanation for the switch unit 25.

Further, connection members 95, 95 are suspended from the opposing positions at the circumferential edge of the socket base 65, and engaging fingers 96, 96 are formed respectively at the outer side of the lower ends of the connection members 95, 95. The engaging fingers 96, 96 are used for connecting the switch unit 25 as described later.

(e) Description of the Switch Unit

The switch unit 25 comprises a double-throwing type switch mechanism, in which two switch mechanisms 98, 98 are constituted on a plane, and the switch mechanisms 98, 98 are actuated by the paired operation members 62, 62 of the plunger 23 respectively.

The switch mechanism 98 shown in Figure 14 denotes one set and the other set is constituted in a similar manner.

The one set of the switch mechanism 98 comprises a pair of left and right of the first terminal 101 and second terminal 102 having secured stationary contacts 99, 100 opposed to each other one above the other, which are disposed to the switch base 97 and the respective lower ends of the terminal are extended below the switch base 97.

A free end of a first movable member 103 is inserted between the stationary contacts 99, 100 and the free end has such a broad width as bridging the opposing faces of the stationary contacts 99, 99, 100, 100 situated at the left and right. Contacts 104 ----- are secured to the upper and lower surfaces of the broad portion for contact with each of the contacts 99, 100.

An engaging protrusion 105 is disposed at the central portion on the free end of the first movable member, and the base end of the movable member is engaged to an engaging recess 1107 formed to the lower portion of the erected member 106 erected on the switch base 97.

The engaging protrusion 105 of the first movable member 103 is engaged with the engage hole 109 formed at one end of a second movable member 108 and the movable members 103, 108 are pivoted in the rotatable manner.

The second movable member 108 has formed at the other end thereof an erection member 110 formed by bending to erect a portion thereof, and the erected member 11 is disposed to the switch operation portion and it is opposed in contact with the lower end of the operation member 62 of the plunger 23.

One end of a spring 111 is engaged to the erected member 110 of the second movable member 108, and the other end of the spring 111 is engaged to the recess 112 formed at the upper end of the erected member 106. The spring



111 resiliently biases the erected member 110 upwardly, and energizes the contact 104 of the first movable member 103 to press against the stationary contact 104 of the terminal 102 by way of the second movable member 108.

In the state where the contact 104 is in contact with the stationary contact 100 below, the switch function is kept at a OFF state.

When the erected member 110 is depressed by the operation member 62 of the plunger 23 from this state, the dead point of the spring 111 is exceeded due to the downward movement of the erected member 110, whereby the second movable member 108 is reversed and, due to the reversion, the contact 104 of the first movable member 103 moves upwardly to be in contact with the stationary contact 9 of the first terminal 101 above to attain the ON state as the switching function.

As described above when the contact 104 and the stationary contacts 99, 100 are in contact with or aperted from each other, there is no lateral slips between the contacts with each other to prevent the abrasion between them. Further, the contacts are aperted from and in contact with each other under a certain pressure of the spring 111 to attain a stable operation.

Post members 113, 113 are erected at the opposing positions around the peripheral edge of the upper surface of the switch base 97, and engaging holes 114, 114 are

formed to the inside of the base of the post members 113, 113 respectively.

The engaging holes 114, 114 are engaged with the engaging fingers 96, 96 of the connection members 95, 95 suspended from the socket base 65 to connect them with each other.

When the socket base 65 is connected to the switch base 97 as described above, the upper surface of the switch mechanism 98 is covered with the socket base 65. The covered state is particularly effective upon assembling work for the switch. For instance, when the switch mechanism 98 is assembled and contained within the housing 26, each of the elements on the switch mechanism 98 can be prevented from contacting to the opening edge of the housing 26 and disassembling.

Further, in the above-mentioned state, since the control section 94 formed to the socket base 65 is in contact with the upper surface of the spring which is left free to inhibit the swinging movement of the spring 111 each of the elements of the switch mechanism 98 can be prevented from dismantling due to the swing of the spring 111 upon assembling work.

The post members 113, 113 erected on the switch base 97 is grooves 115, 115 formed at the outer surface thereof corresponded to the suspending positions for the connection terminals 91, 91 of the socket unit 24 and capable of

containing the connection terminals 91, 91.

In addition, gaps 116, 116 are formed between the grooved 115, 115 and the connection terminals 91, 91, and the gaps 116, 116 constitute effective insulation when the push button switch 20 is mounted to the switch socket as described later.

(f) Description of the Housing

The housing 26 as described above, has two securing means to a mounting panel 117.

As shown in Figures 15 and 16, one of the securing means is a securing nut 118 and the other is a securing resilient member 119.

The housing 26 described above has a rectangular portion 120 formed at the upper end thereof for enhousing the button unit 21 as described above, and a cylindrical portion 121 formed in continuous with the central portion at the bottom of the rectangular portion 120.

To the inside of the cylindrical portion 121 as described above, are enoused the illumination unit 22, plunger 23, receptacle unit 24 and switch unit 25 having been described previously.

Engaging holes 122, 122 are formed at the opposing positions on the lower end of the housing 26, and the engaging holes 122, 122 are engaged with the engaging fingers 123, 123 formed at the side of the switch base 97, by which the switch unit 25 is secured to the housing 26.

The lower surface of the rectangular portion 120 is formed as an engaging portion 124, thread 125 are formed around the outer circumferential surface at the upper portion of the cylindrical portion 121 for threading engagement with the nut 118. By inserting the cylindrical portion 121 through the opening 126 of a mounting panel 117 and screw-coupling the nut 118, the housing 26 can be mounted to the mounting panel 117 by putting the mounting panel 117 between the engaging portion 124 and the nut 118.

Engaging holes 127, 127 are formed at the opposing positions in the threaded portion 125 of the cylindrical portion 121 and the resilient member 119 as described above is engaged to the engaging holes 127, 127.

The resilient member 119 is formed with a resilient leaf spring material and comprises a band-like portion 128 formed in an annular shape and a plurality of engaging members 129, --- extended upwardly from the band-like portion 128.

The band-like portion 128 is separated at one position, by which the annular member can be extended. Lugs 130, 130 are formed on both joining ends of the band-like portion 128, and a lug 131 is erected to the inside at a position of the band-like portion 128 corresponding to the lug 130.

The lugs 130, 131 as described above are engaged to

the engaging holes 127, 127 of the cylindrical portion 121 respectively by extending the band-like portion 128.

The engaging members 129, --- are bent at the upper ends thereof so as to turn outwardly and the bent portion creates outward biasing force.

As described above, when the housing 26 mounted with the resilient member 119 to the cylindrical portion 121 is inserted to the opening 126 of the mounting panel 117 till it is abutted against the engaging portion 124, the housing can be secured by the engaging members 129, --- of the resilient member 119 that urges the opening 126 outwardly.

As described above, the mounting of the housing 26 includes two modes, that is, by means of the nut 118 and the resilient member 119, which can be used selectively.

(g) Description of the Switch Receptacle

The illumination type push button switch 20 having thus been constituted is mounted to a switch socket 132 to be described below.

The switch socket 132 is formed into a cylindrical shape, in which socket holes 133, --- are formed at the positions on the upper plane corresponding to the first and second terminals 101, 102 of the switch unit 25 and contact members 134, --- are contained to the inside of the socket holes 133, --- with the contact members 134, --- being electrically connected respectively with the

terminals 101, 102.

Further, protrusions 135, 135 are erected to the switch receptacle 132 at the positions corresponding to the connection terminals 91, 91 of the socket unit 24, and the protrusions 135, 135 are inserted in the grooves 115, 115 formed to the post members 113, 113 of the switch base 97 and inserted in the gaps 116, 116 between the grooves 115, 115 and the connection terminals 91, 91.

Then, socket holes 136, 136 are formed to the outer side of the protrusions 135, 135 and contact members 137, 137 are contained within the socket holes 136, 136 and the contact members 137, 137 are electrically connected with the connection terminals 91, 91.

In the switch socket 132 having thus been constituted, the creeping distance between the connection terminans 91, 91 and other terminals 101, 102 is increased to improve the insulation performance by the insertion of the protrusions 135, 135 between the connection terminals 91, 91 and other terminals 101, 102, when the illumination type push button switch 20 is mounted.

In the illumination type push button switch 20 and the switch socket 132 having thus been constituted, improvements have been obtained for the switch operation characteristics, the workability in the assembling of each of the elements and, further, the insulation performance. However, this invention is no way limited only to the

structure of the aforementioned embodiment but it may be constituted with modifications based on the spirit of this invention.

20 ... illumination type push button switch	0160206
21 ... push button unit	22 ...illumination unit
23 ... plunger	24 ... socket unit
25 ... switch unit	26 ... housing
27 ... push button	28 ... mark plate
29 ... diffusion plate	30 ... reflection member
31 ... circumferential edge	32 ... step
33 ... engaging portion	34 ... engaging protrusion
35 ... cylindrical portion	36 ... reflection surface
37 ... support	38 ... elongate groove
39 ... element holder	40 ... protrusion
41 ... protrusion	42 ... recess
43 ... abutting portion	44 ... engaging finger
45 ... seizing groove	46 ... protrusion
47 ... step	48 ... step
49 ... seal	50 ... inner end edge
51 ... outer end edge	52 ... annular groove
53 ... securing ring	54 ... illumination element
55 ... lamp	56 ... LED
57 ... lead terminal	58 ... lead terminal
59 ... step	60 ... flange
61 ... spring	62 ... operation member
63 ... control member	64 ... elongate groove
65 ... socket base	66 ... protrusion
67 ... protrusion	68 ... groove



69 ... alternating mechanism 70 ... shaft  
71 ... alternating cam 72 ... cam control portion 0160206  
73 ... engaging groove 74 ... window  
75 ... first control section  
76 ... second control section  
77 ... third control section  
78 ... fourth control section  
79 ... socket cover 80 ... engaging finger  
81 ... seizing groove 82 ... protrusion  
83 ... insertion port 84 ... guide member  
85 ... socket hole 86 ... hole wall  
87 ... recess 88 ... contact member  
89 ... groove 90 ... engaging port  
91 ... connection terminal 92 ... engaging member  
93 ... joining member 94 ... control portion  
95 ... connection member 96 ... engaging finger  
97 ... switch base 98 ... switch mechanism  
99 ... stationary contact 100 .. stationary contact  
101 .. first terminal 102 .. second terminal  
103 .. first movable member 104 .. contact  
105 .. engaging protrusion 106 .. erected member  
107 .. engaging recess 108 .. second movable member  
109 .. engaging hole 110 .. erected member  
111 .. spring 112 .. recess  
113 .. post member 114 .. engaging hole  
115 .. groove 116 .. gap

0160206

117 .. mounting panel	118 .. nut
119 .. resilient member	120 .. rectangular portion
121 .. cylindrical portion	122 .. engaging hole
123 .. engaging finger	124 .. engaging portion
125 .. screw	126 .. opening
127 .. engaging hole	128 .. band-like portion
129 .. engaging member	130 .. lug
131 .. lug	132 .. switch socket
133 .. socket hole	134 .. contact member
135 .. protrusion	136 .. socket hole
137 .. contact member	201 .. switch cover
202 .. switch base	203 .. upper terminal
204 .. lower terminal	205 .. contact
206 .. contact	207 .. common terminal
208 .. first movable member	209 .. second movable member
210 .. contact	211 .. spring
212 .. operation member	

## 8. CLAIMS

(1) A switch in which a switch unit is constituted by situating the free end of a first movable member disposed with a contact between stationary contacts opposing to each other along the vertical direction, while engaging the other end of said movable member to a fixed portion, pivoting one end of a second movable member to the free end of said first movable member while engaging a spring to the other end of said second movable member, thereby urging the contact of the first movable member to one of the stationary contacts, and setting the other end of said second movable member to a switch operation portion.

(2) The switch as defined in claim 1, wherein two sets of stationary contacts opposing to each other along the vertical direction are disposed on a plane and contacts are disposed at the right and left positions of the first movable member corresponding to said two sets.

(3) The switch as defined in claim 1; wherein a plurality sets of stationary contacts opposing to each other along the vertical direction are disposed on a plane and contacts are disposed to the first movable member corresponding to the plurality of sets.

(4) The switch as defined in claim 1, 2 or 3, wherein a control portion is disposed for controlling the switching movement of the spring that urges the contact of the first movable member to one of the stationary contacts by way of the second movable member.

(5) The switch as defined in any one of claims 1, 2, 3 and 4, wherein a socket unit is secured to the upper surface of the switch unit and a control portion is formed to the lower surface of the socket unit for controlling the swinging movement of the spring of the switch unit.

(6) The switch as defined in any one of claims 1, 2, 3 and 4, wherein a push button unit is enoused to the upper opening of the housing in a manner capable of depressing, an upwardly biased plunger allowed to vertical movement within a predetermined range is fittedly inserted to the inside of said housing and connected with said push button unit and the lower end of the said plunger is disposed to the switch operation portion of the switch unit.

(7) The switch as defined in claim 6, wherein an operation member extended downwardly from a portion of the periphery at the lower end of the plunger is suspended and the lower end of the operation member is disposed to the switch operation portion of the switch unit.

(8) The switch as defined in claim 6 or 7, wherein an illumination unit equipped with an illumination element for illuminating the illumination face of the push button

unit is enoused to the inside of the push button unit with an allowance for a relative vertical movement within a predetermined range, a socket unit for connection with said illumination element is enoused to the inside of the plunger and the socket unit is secured at the upper position of the switch unit.

(9) The switch as defined in claim 8, wherein supports are suspended at the opposing positions on the lower opening edge of the reflection member of the push button unit, and an elongate groove is formed along the vertical direction to each of the supports, and a protrusion engaged to be retained in said elongate groove is disposed to the side of the illumination unit enoused within the opening of said reflection member.

(10) The switch as defined in claim 7, wherein leg members are suspended at the opposing positions on the lower end of the socket unit, and the leg members are secured to the switch base of the switch unit.

(11) The switch as defined in any one of claims 6, 7 and 8, wherein a rectangular alternating cam having engaging grooves formed on the opposing two sides is rotatably journaled to one of the opposing positions at which the plunger and the socket unit are relatively moved vertically and, to the other of the opposing positions, are provided a first control section that is in contact with the upper end of the alternating cam to control the

rotating direction of the alternating cam to one direction when the plunger is started to move downwardly, a second control section for controlling the alternating cam to a rotating position of a predetermined angle based on the engagement with the engaging groove on the upper end when the plunger arrives at the depressing position for the alternating cam, a third control section that engages the engaging groove at the lower end to control the position of the plunger at the switch operating position where alternating cam is rotated by the second control section and a fourth control section for controlling the rotating state of the alternating cam which is rotated by one-half upon successive downward movement and the returning of the plunger.

(12) The switch as defined in claim 11, wherein an alternating cam control portion is formed to the operation portion for the plunger, in the opposing positions between the operation portion of the plunger and the socket unit relatively moving vertically, and the alternating cam is pivoted to the socket unit.

(13) The switch as defined in any one of claims 6, 7, 8 and 9, wherein one end of an annular flexible seal surrounding the periphery is held under pressure to the connection portion between the push button unit and the plunger, and the other end thereof is secured to retain to the inside of the housing.

(14) The switch as defined in claim 8 or 9, wherein a control structure for allowing the mutual insertion of the illumination unit and the plunger passing through the illumination unit only at a predetermined position of the illumination unit is disposed therebetween.

(15) The switch as defined in claim 14, wherein the control structure for the insertion direction between the illumination unit and the plunger is constituted with protrusions arranged on the outer circumferential surface of the illumination unit and grooves formed to the plunger.

(16) The switch as defined in claim 14 or 15, wherein a notch for allowing the protrusions of the illumination unit to insert therethrough when the illumination unit is enoused in the predetermined enousing direction, and an abutting portion for inhibiting the insertion of the illumination unit at a position disabling the depressing operation of the push button unit when the illumination unit is enoused turned by 180° to the predetermined enoused direction of the illumination unit.

(17) The switch as defined in claim 8, wherein the socket unit comprises a socket base and a socket cover joined to the upper surface of the socket base, insertion ports for inserting the lead terminals of the illumination element to pass therethrough are formed to the socket cover, and socket holes are formed at the positions opposing to the insertion ports of the socket cover.

(18) The switch as defined in claim 17, wherein contact members in contact with the lead terminals of the illumination element are engaged to the socket holes of the socket unit, and recesses for engaging a portion of the circumferential surface of the round-rod type lead terminals are formed to the contact members.

(19) The switch as defined in claim 17, wherein contact members in contact with the lead terminals of the illumination element are engaged to the socket holes of the socket unit, and recesses for engaging a portion of the circumferential surface of the round-rod type lead terminals are formed to the hole walls of the socket holes opposing to the contact members by way of the lead terminals.

(20) The switch as defined in any one of claims 17, 18 and 19, wherein engaging ports are formed to the upper surface of the socket base of the socket unit corresponding to the lead terminals of the illumination element, and engaging members formed to the upper end of the illumination element terminals connected with the contact members are engaged to said engaging ports.

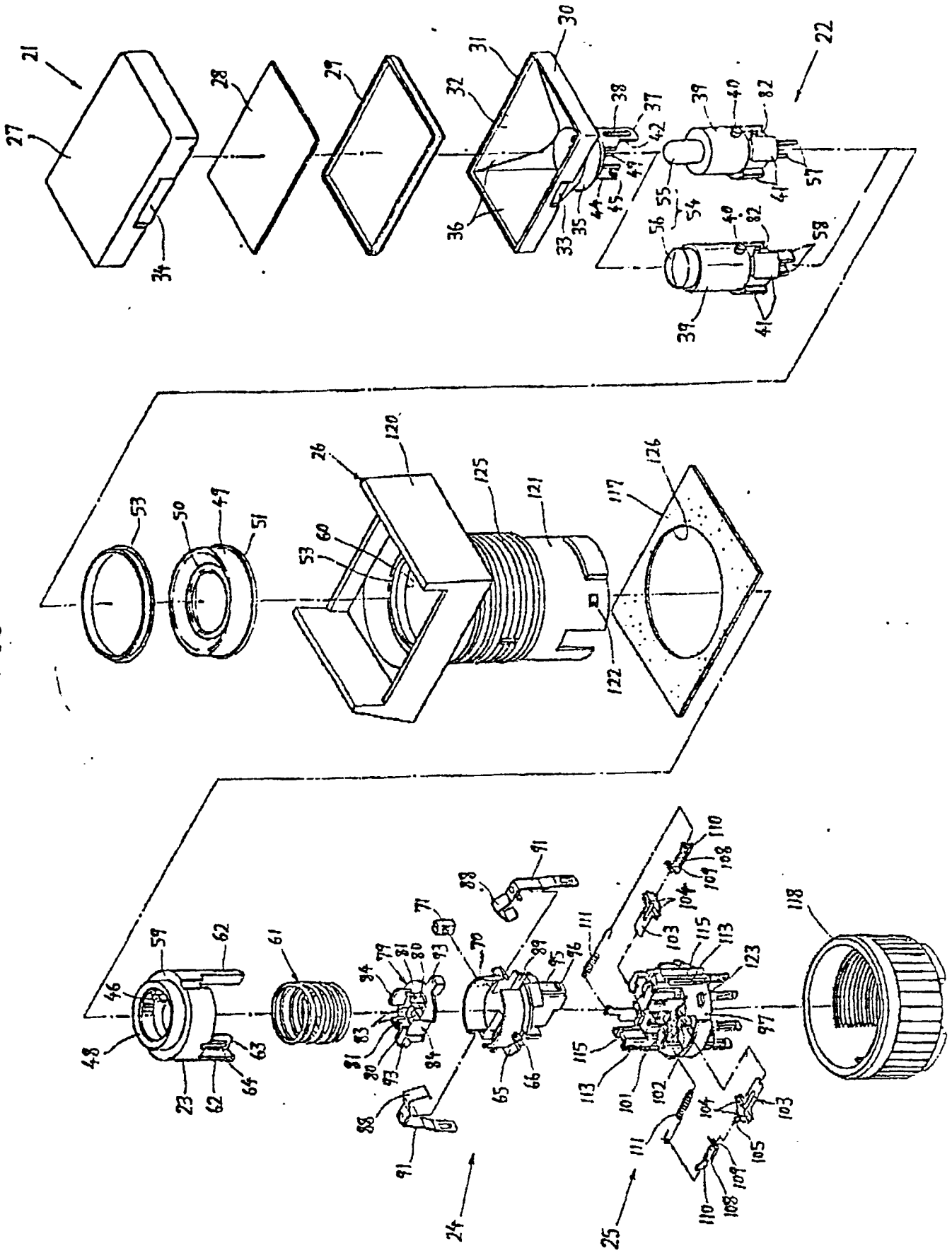
(21) The switch as defined in claim 6 or 8, wherein an engaging portion is formed at the upper end of the outer circumference of the housing, threads for threading engagement with a switch-securing nut are formed around the outer circumference at the lower portion of the engaging portion, and engaging holes for detachably



engaging a switch-securing resilient member are formed to the threaded portion.

(22) A socket for use in switch, wherein first terminals for connection with a switch unit are extended downwardly from the lower surface of a switch base, second terminals for connection with a socket unit are downwardly extended from the side of the switch base, a gap is formed between the second terminals and the switch base opposing to each other, first socket holes are formed to the plane portion of the socket for connecting said first and second terminals for inserting said first terminal, protrusions are disposed at the positions corresponding to said gaps for engagement with said gaps, and second socket holes are formed to said protrusions for inserting said second terminals.

FIG.1





3/15

FIG. 3

0160206

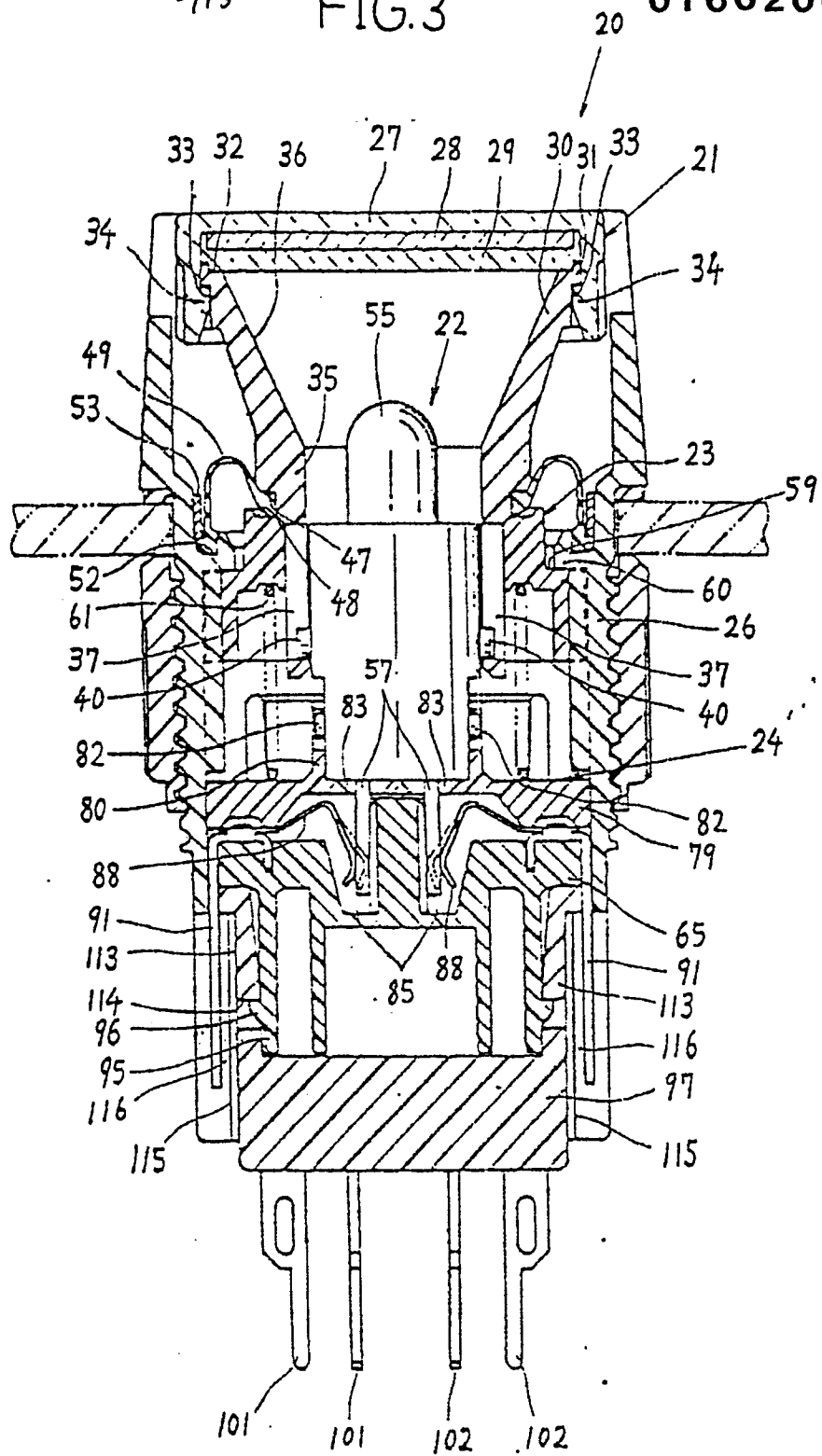


FIG. 4

4/15

FIG. 5 0160206

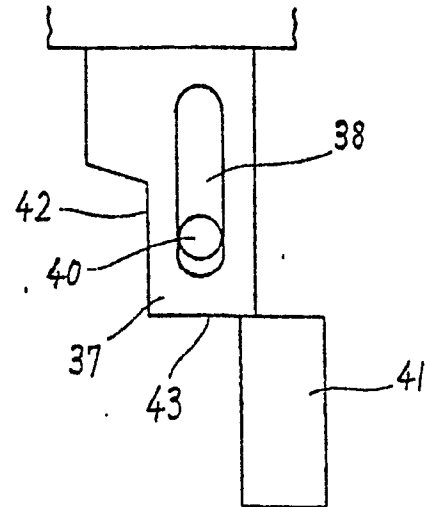
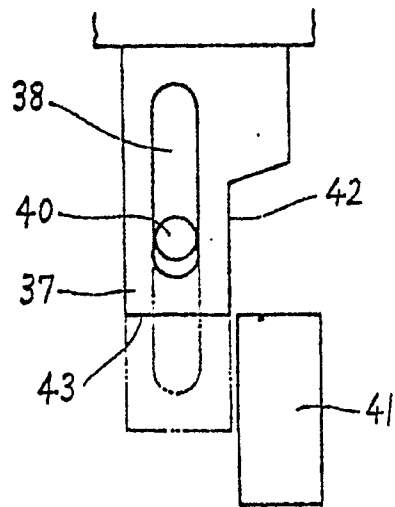


FIG. 6

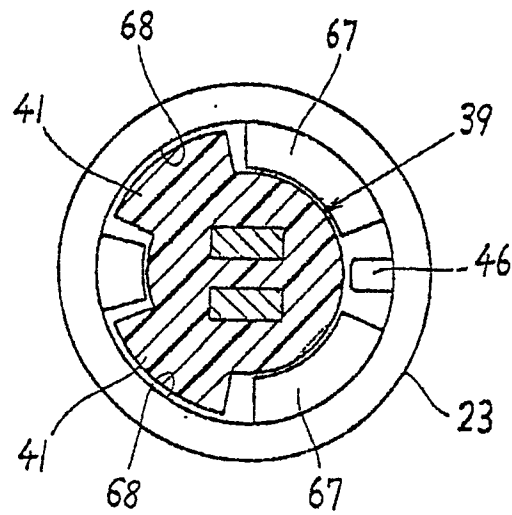
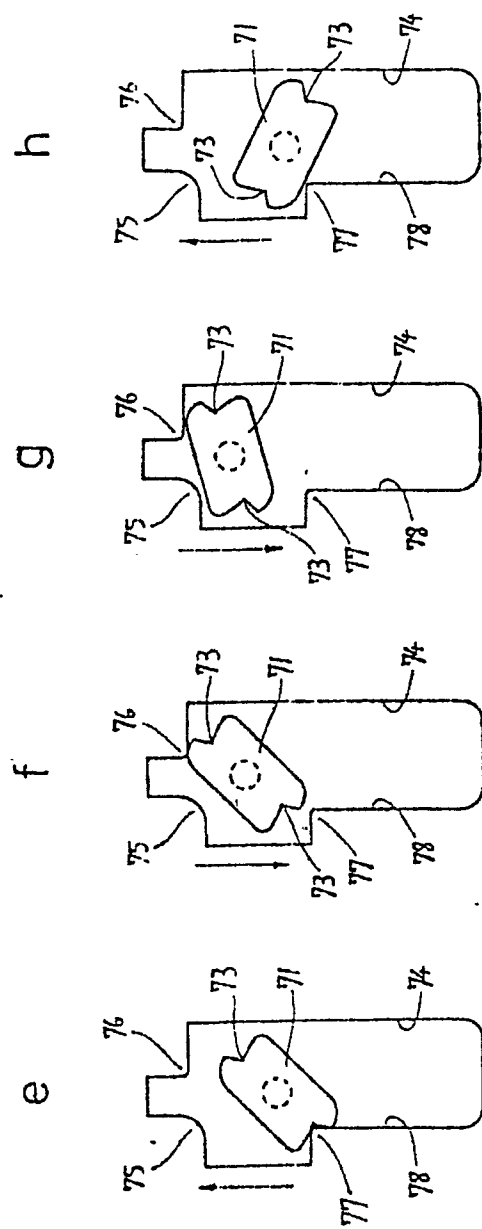
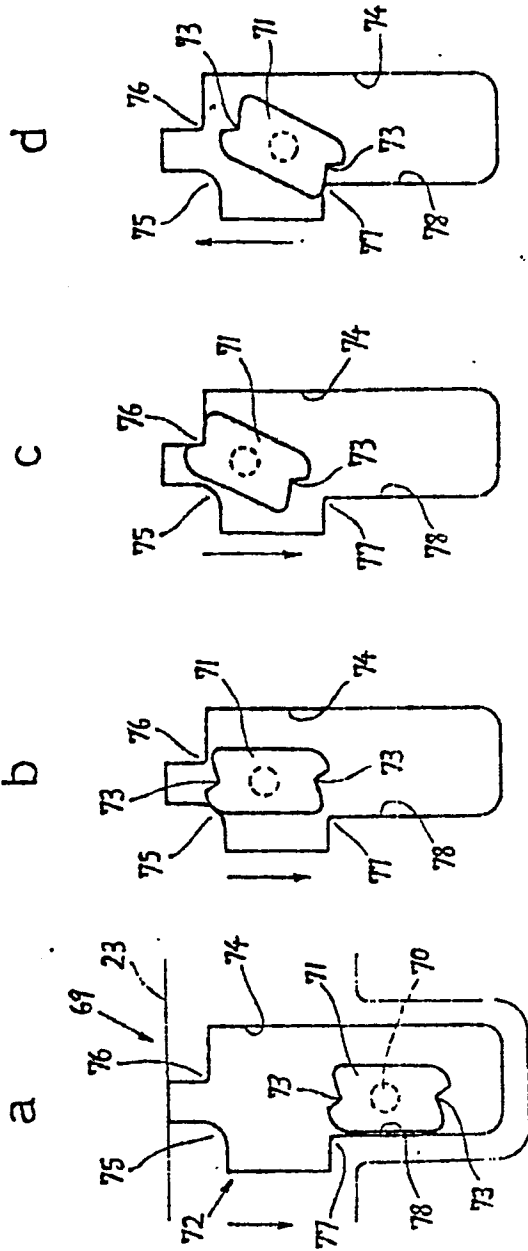


FIG.7



6/15

0160206

FIG.8

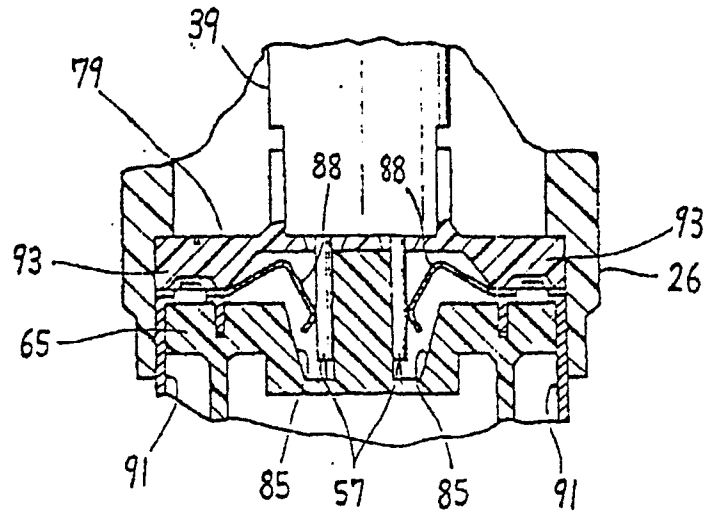


FIG.9

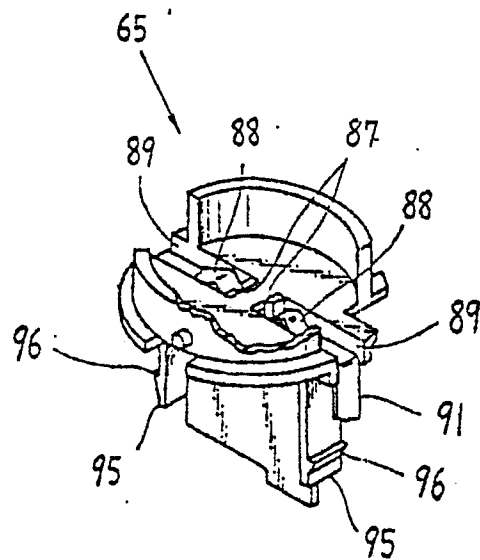


FIG.10

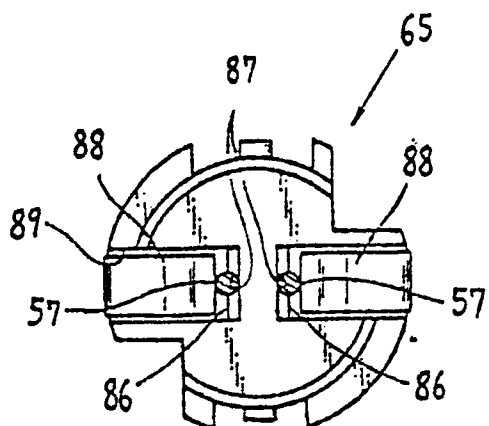


FIG.11

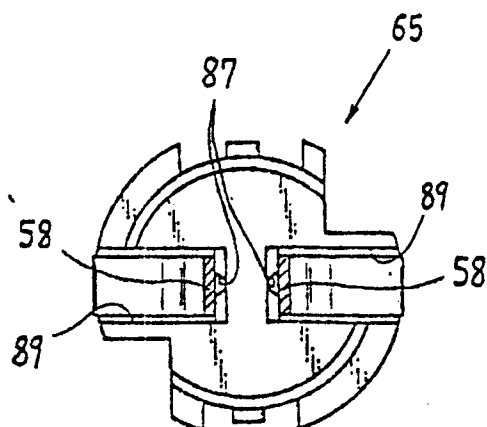


FIG.12

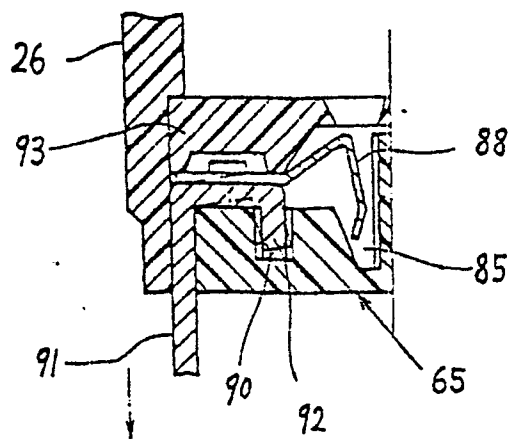
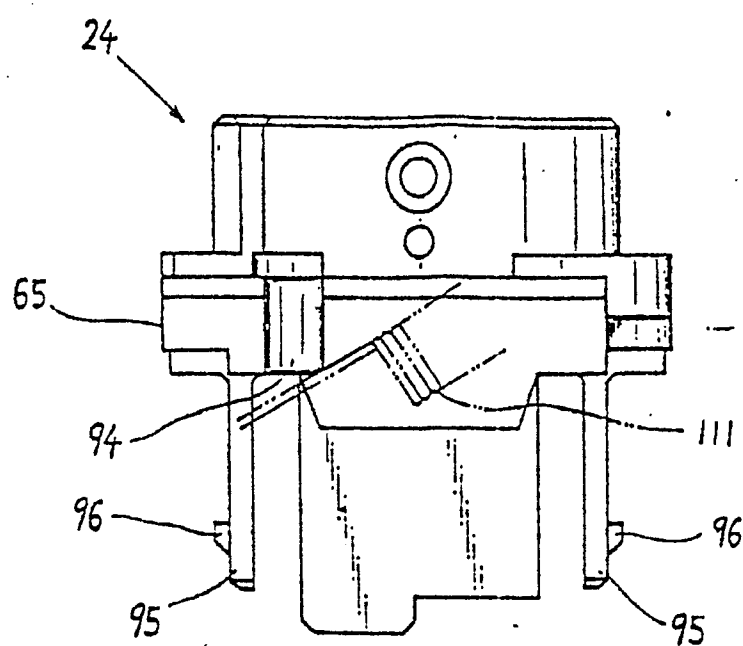




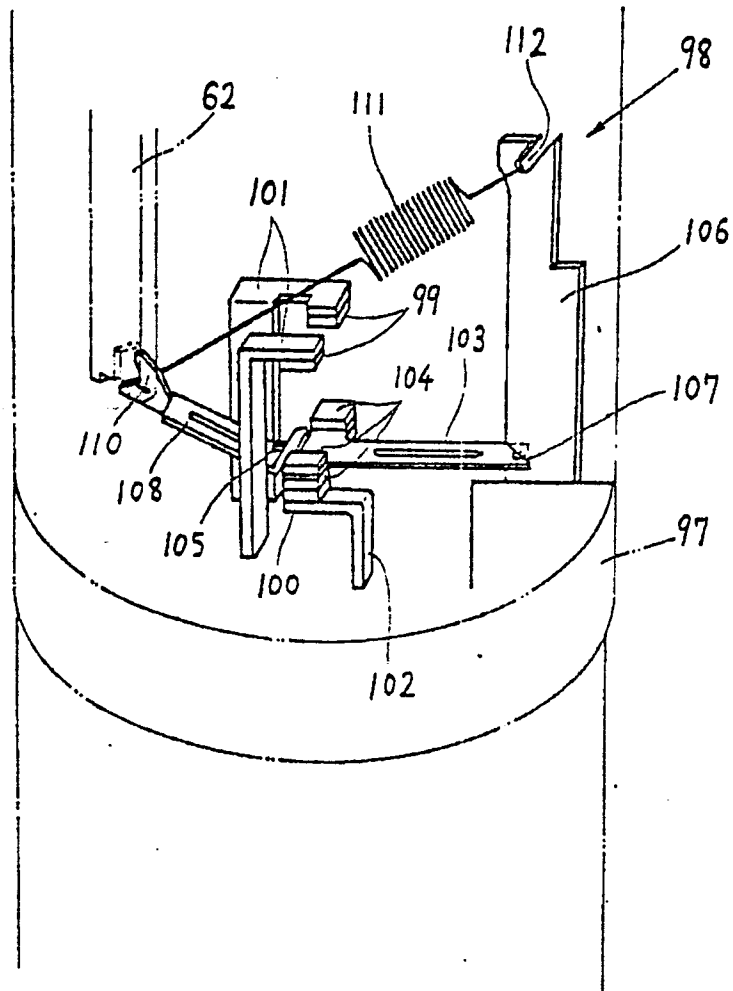
FIG.13



9/15

0160206

FIG.14



10/15

0160206

FIG.15

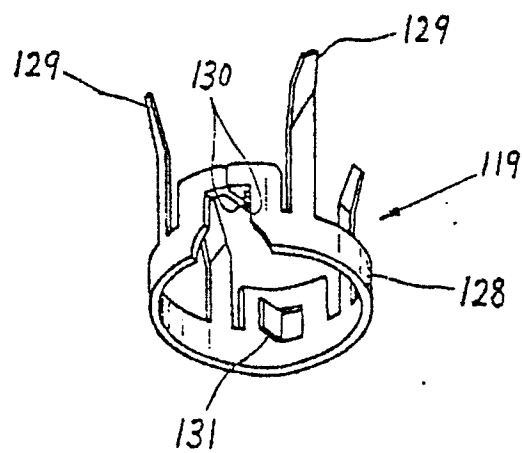
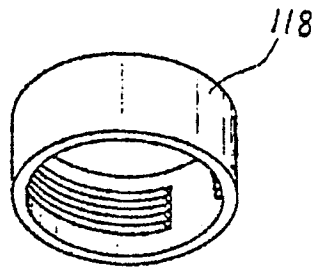
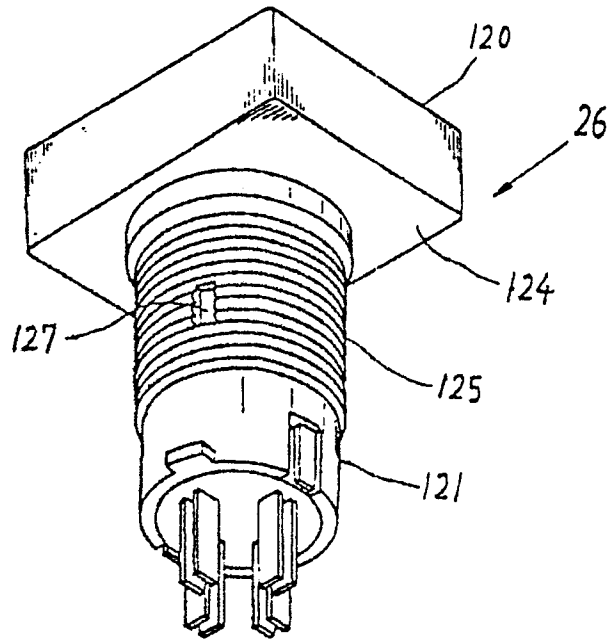
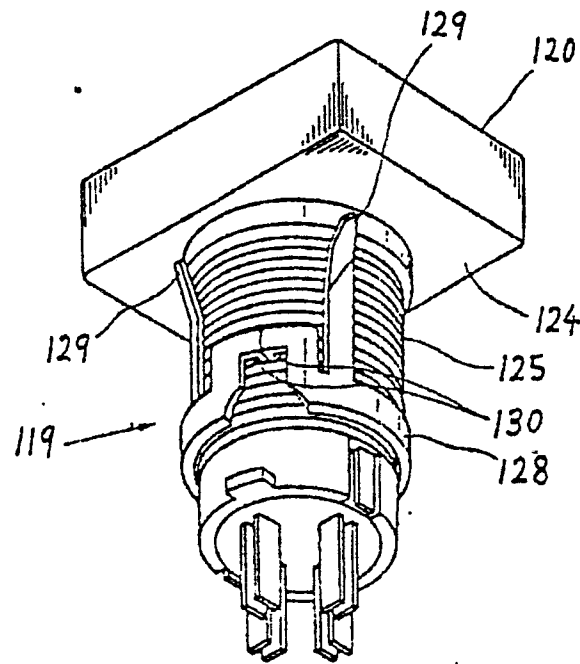


FIG.16



12/15

0160206

FIG.17

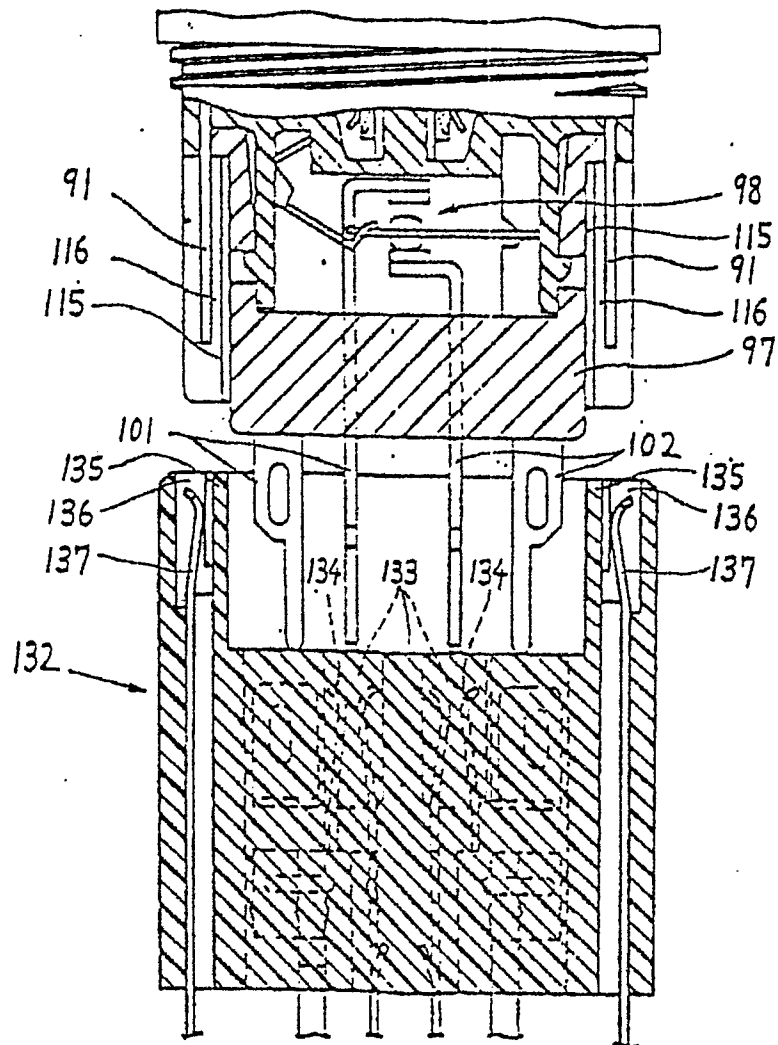
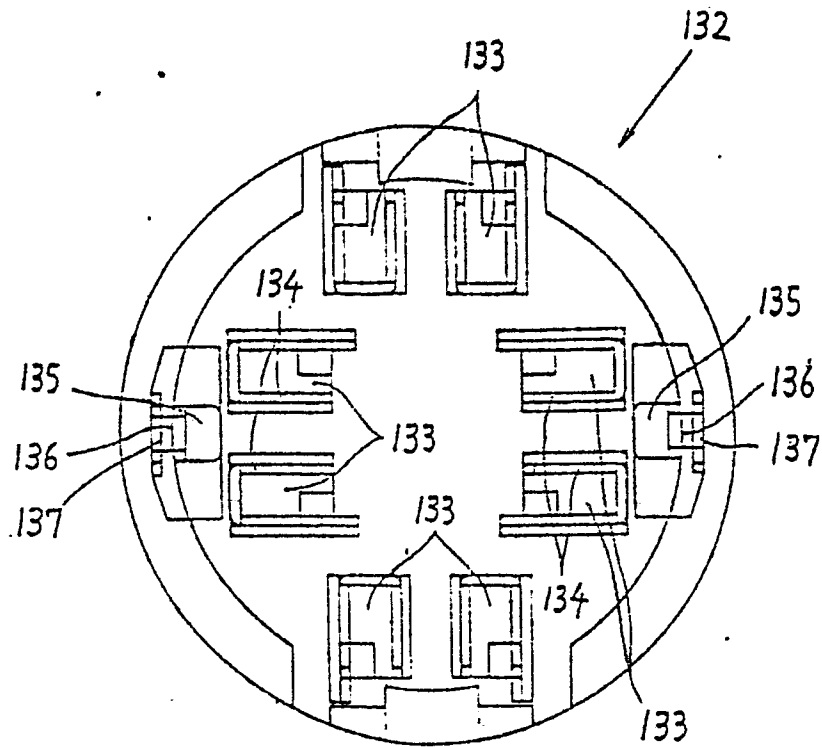


FIG.18



14/15

FIG. 19

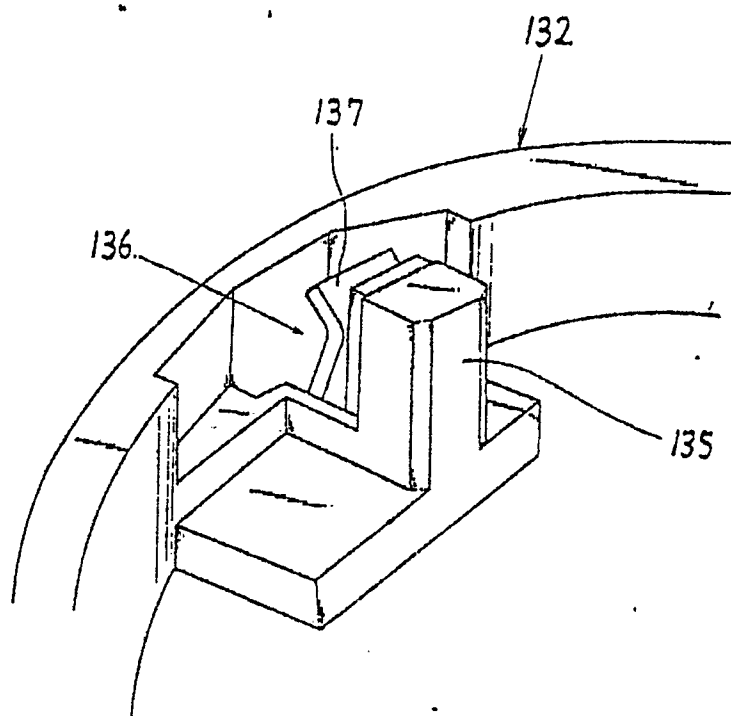


FIG. 20

