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(52) UK CL (Edition O)
H2E ECAD ECCX ECER EDLA

(56) Documents Cited
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(58) Field of Search
UK CL (Edition N) H2E ECAD
INT CL^6 H01R
On line: WPI

(54) Switched electrical socket outlet

(57) An interlocked socket outlet includes: an isolator in a housing 3 turned ON and OFF by a knob 35, 36; a socket 50 for receiving a plug 60; and, between the knob and the socket, an interlock link which prevents the plug from being removed when the isolator is ON. The interlock may have gears driven by the knob spindle through a square hole 39. The gears move a locking member 51 which engages a tab 58 of the plug 60 when the isolator is switched ON. A spring-biassed abutment 56 prevents the isolator from being switched ON in the absence of a plug by preventing movement of the locking member 51. The abutment 56 is moved away from the locking member 51 when the plug mates with the socket. Instead of gears, the interlock may have an ungeared rotary link, or a pivotal link when the knob is actuated with linear and not rotary movement. More than one abutment may be provided. The or each abutment may be located in a guideway for a key of the plug.

FIG.2

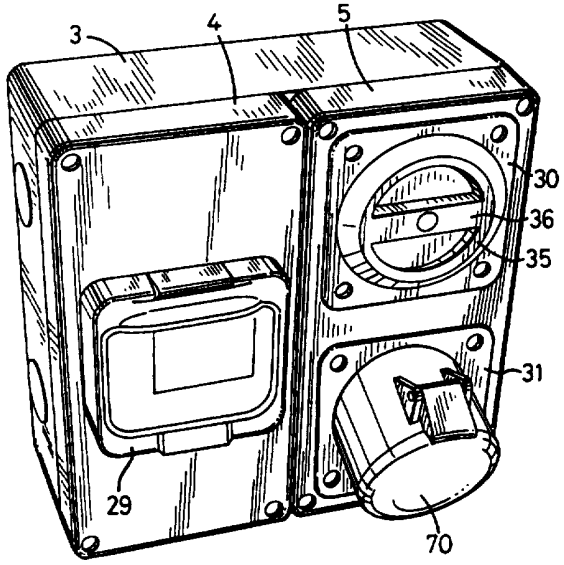
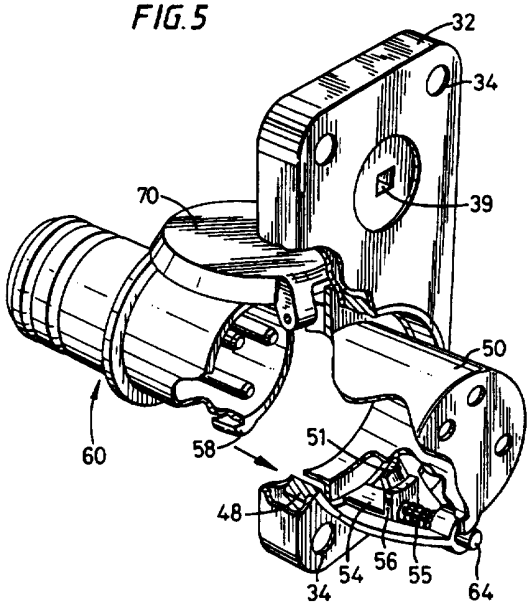


FIG.5



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

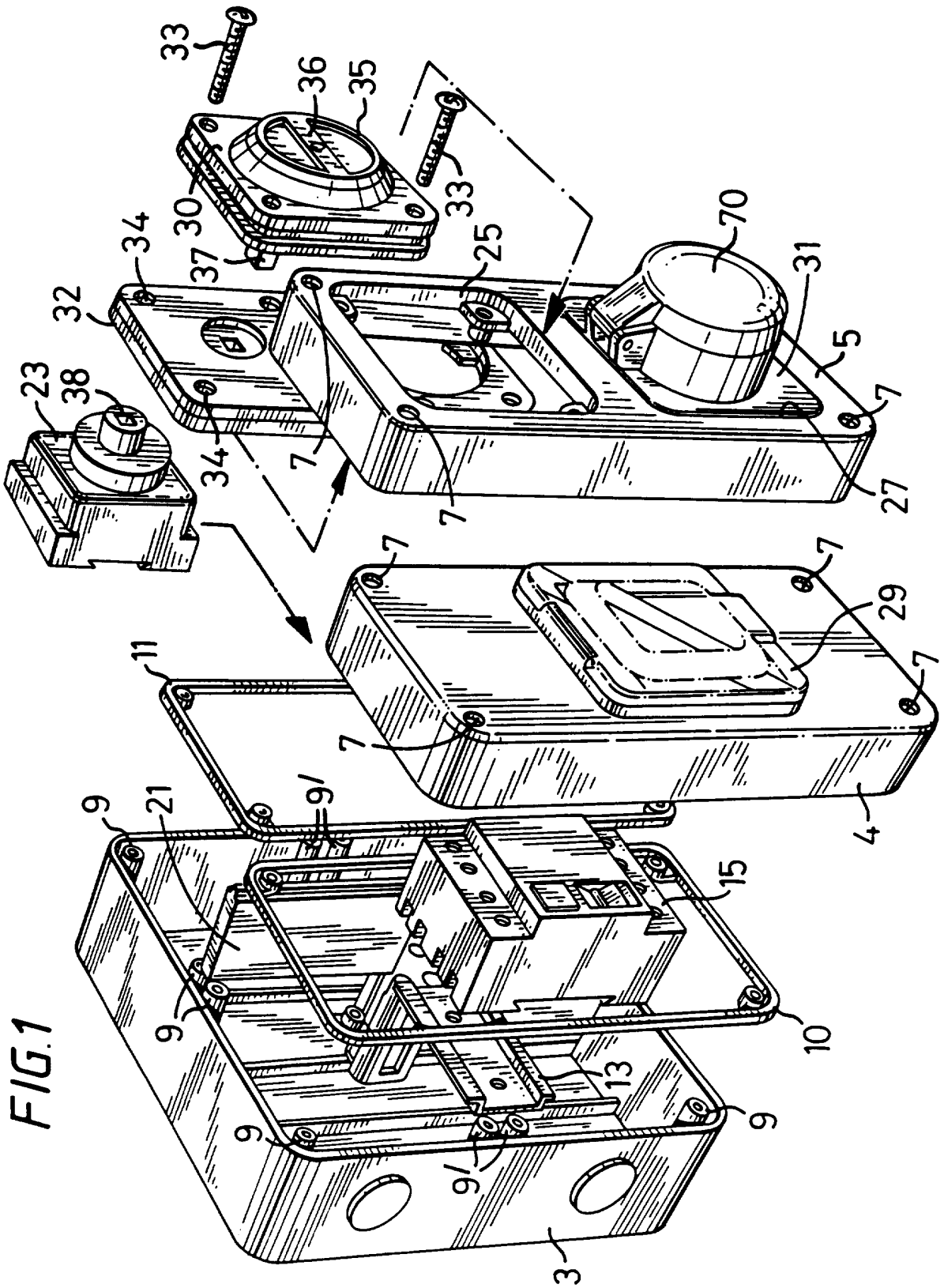
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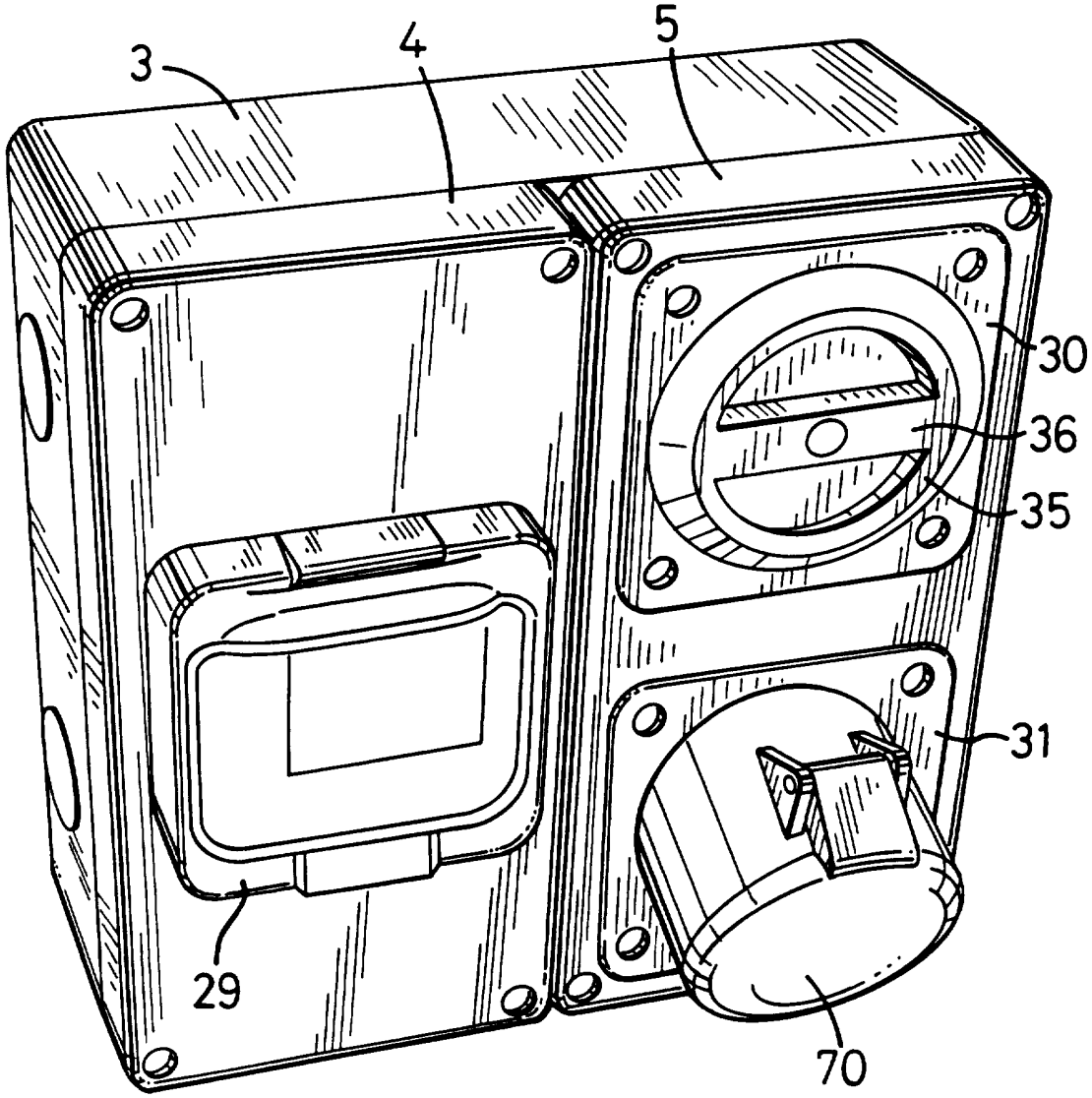
FIG.1

FIG. 2



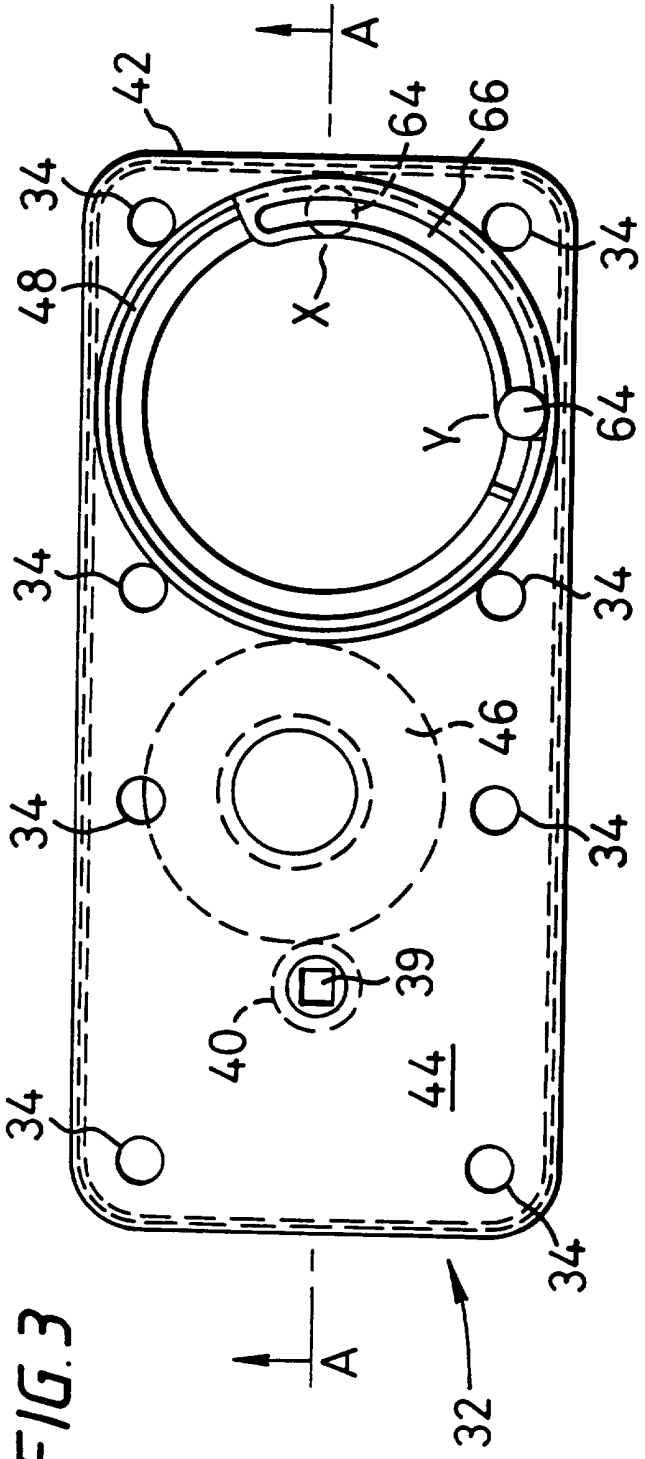

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FIG.3

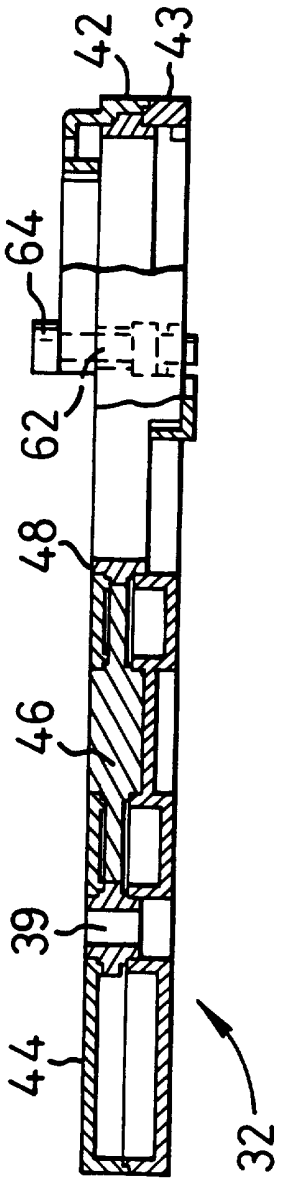
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FIG.4

FIG. 5

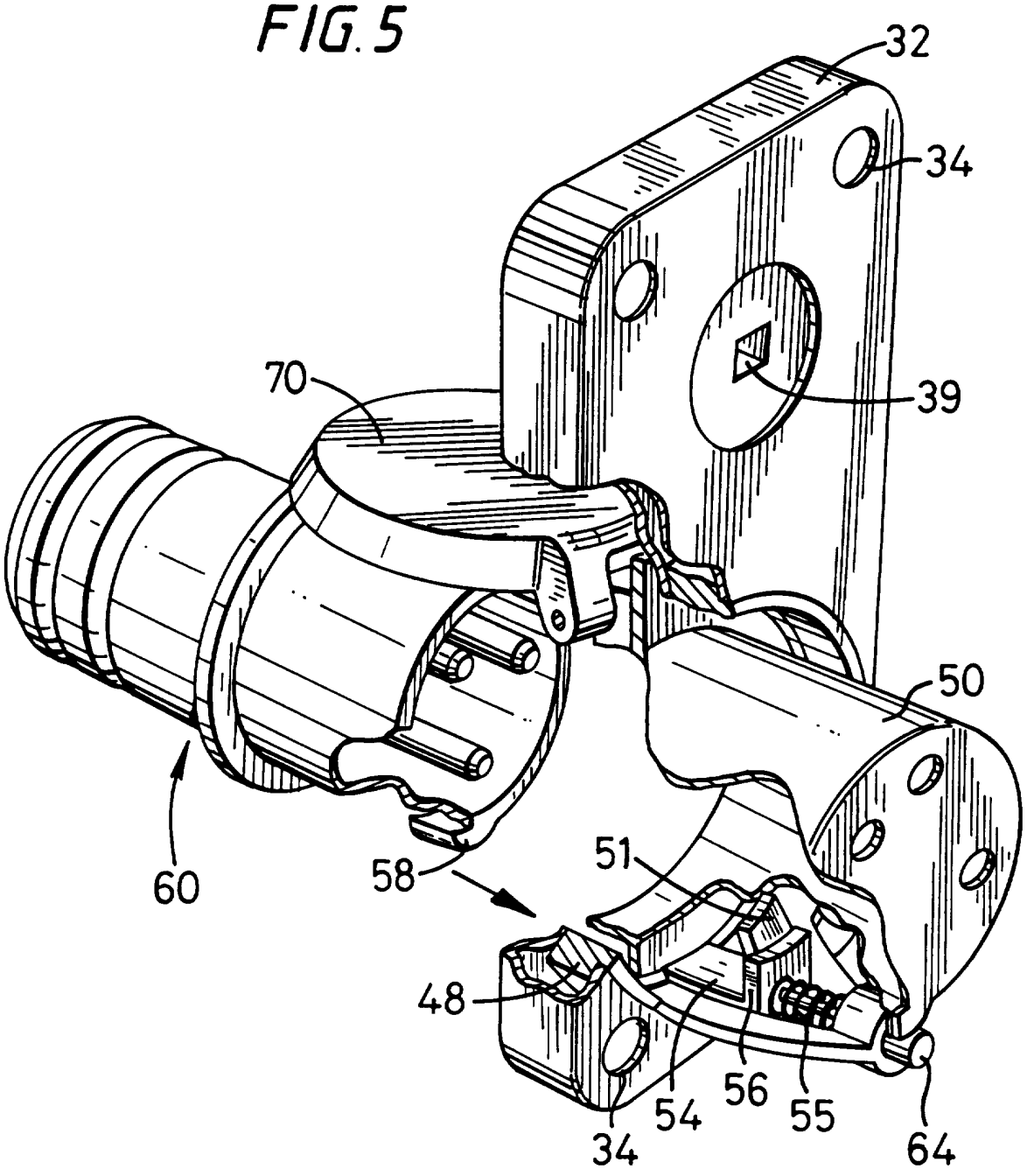


FIG.6

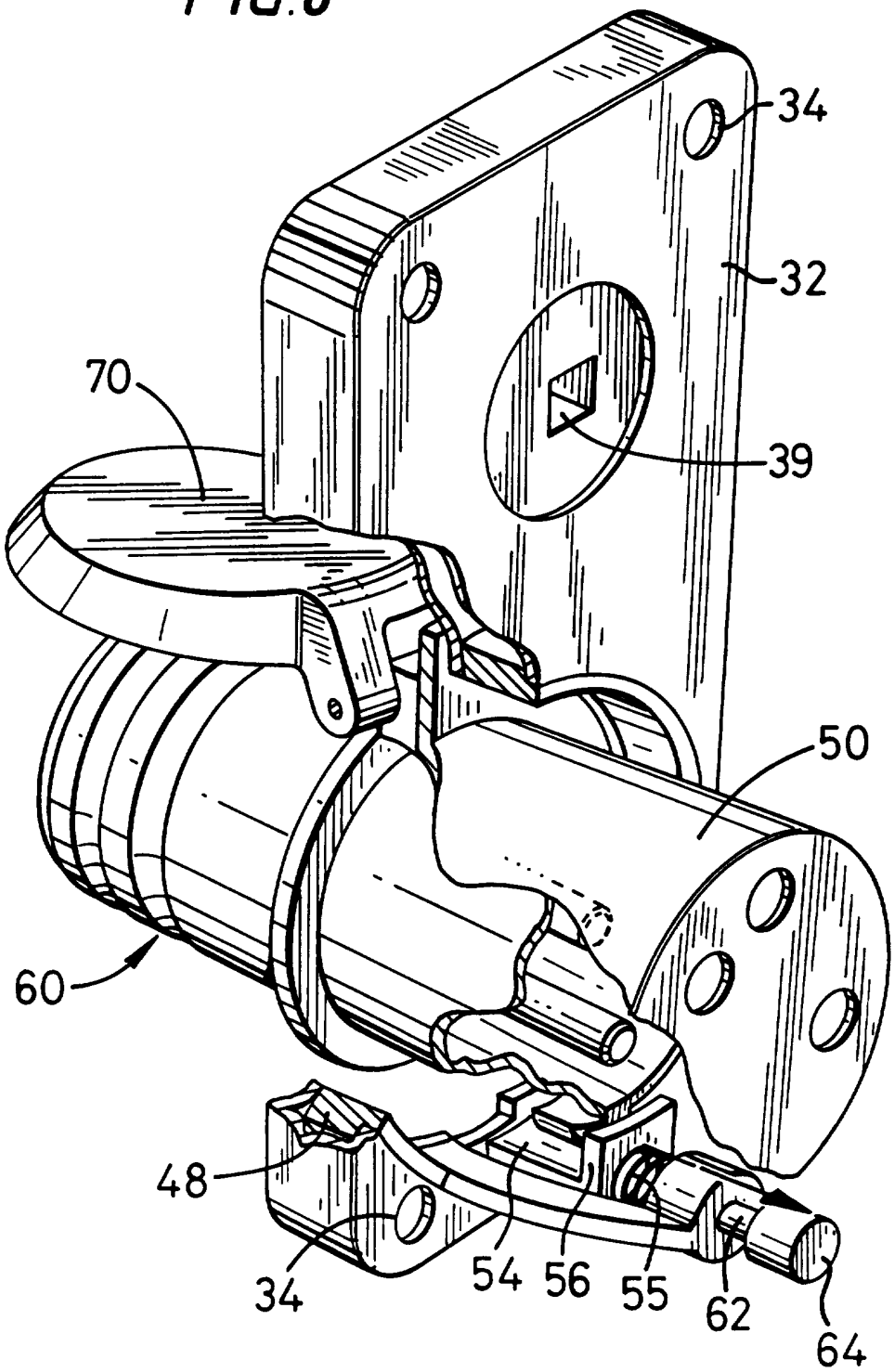


FIG.7

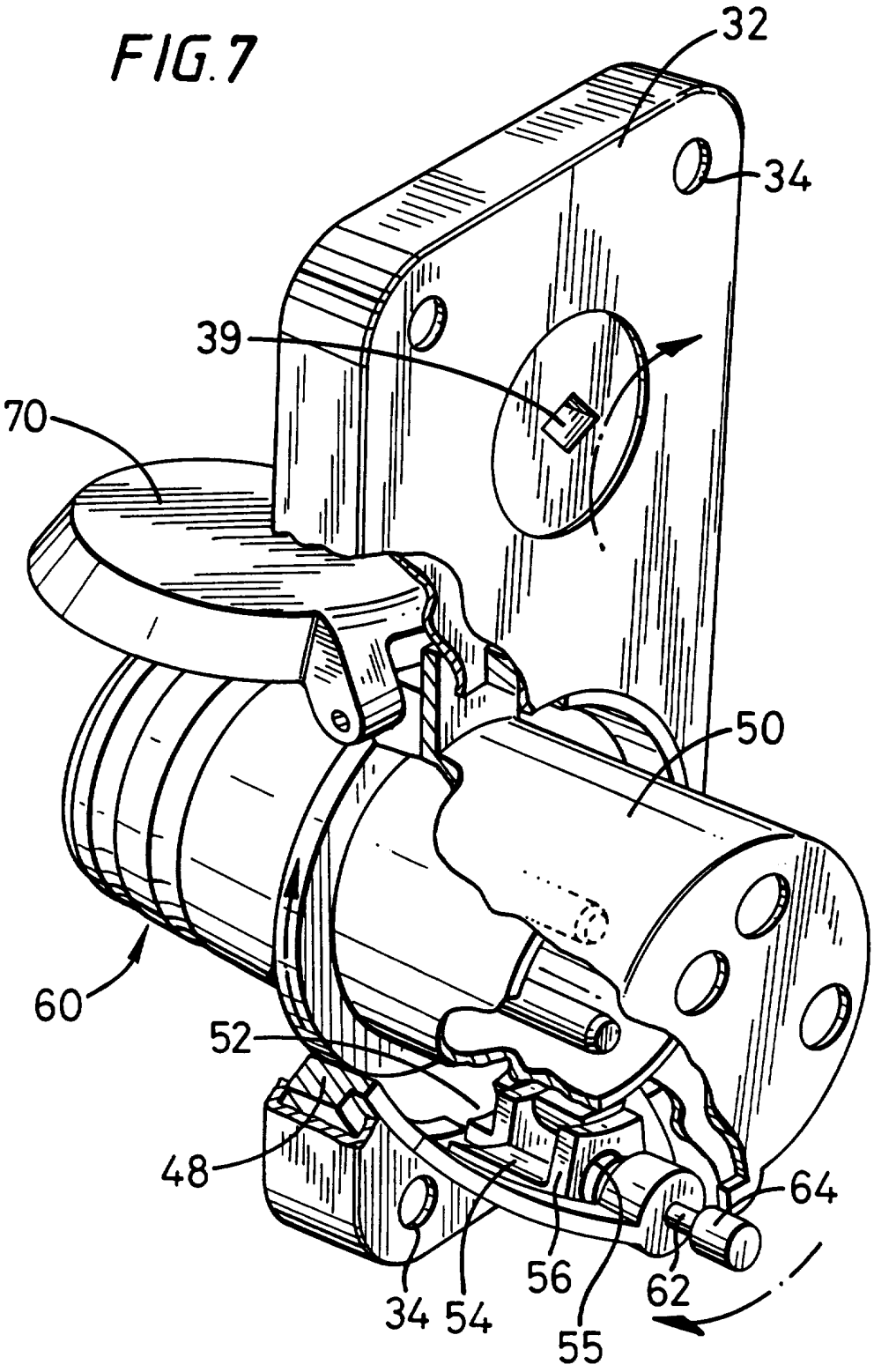


FIG.8

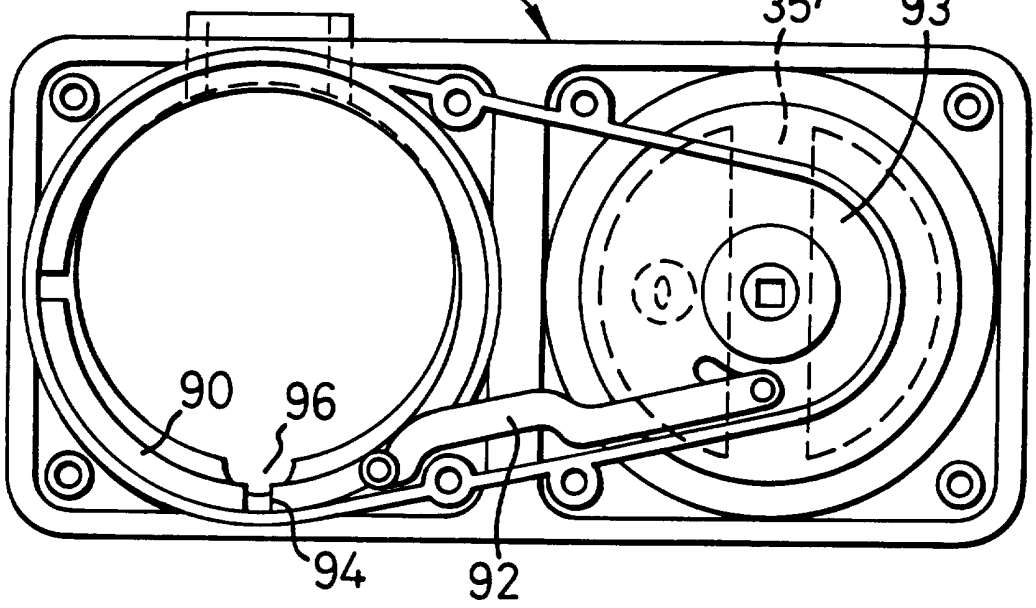
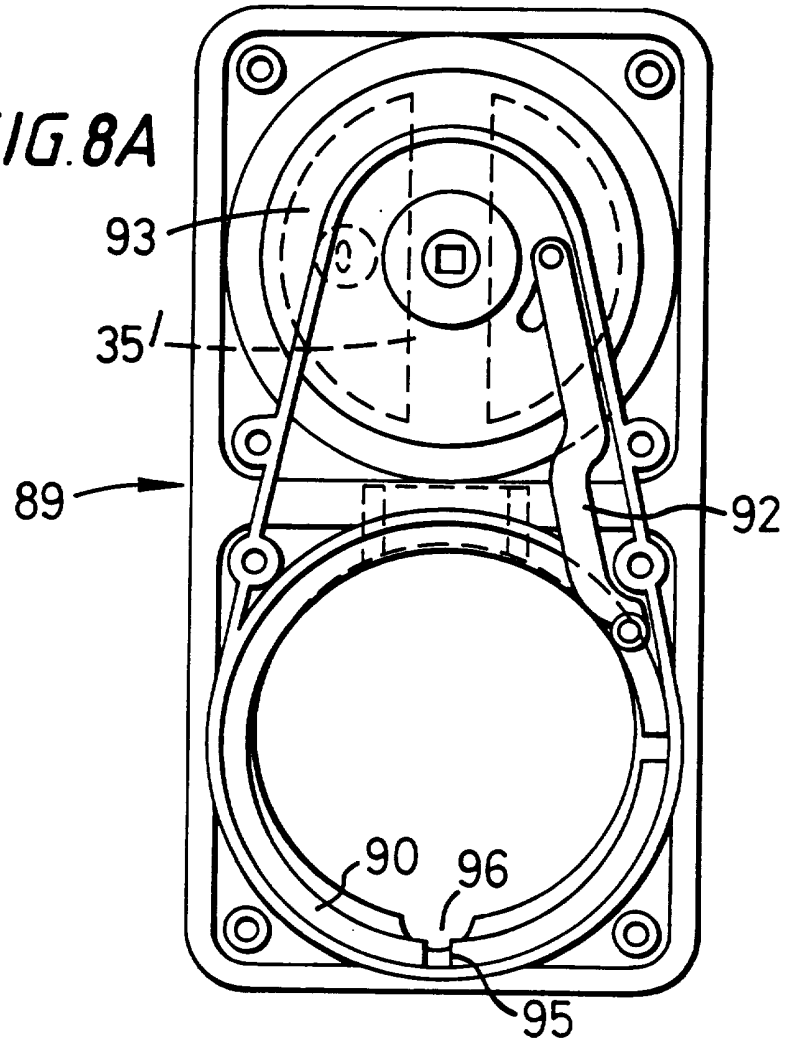
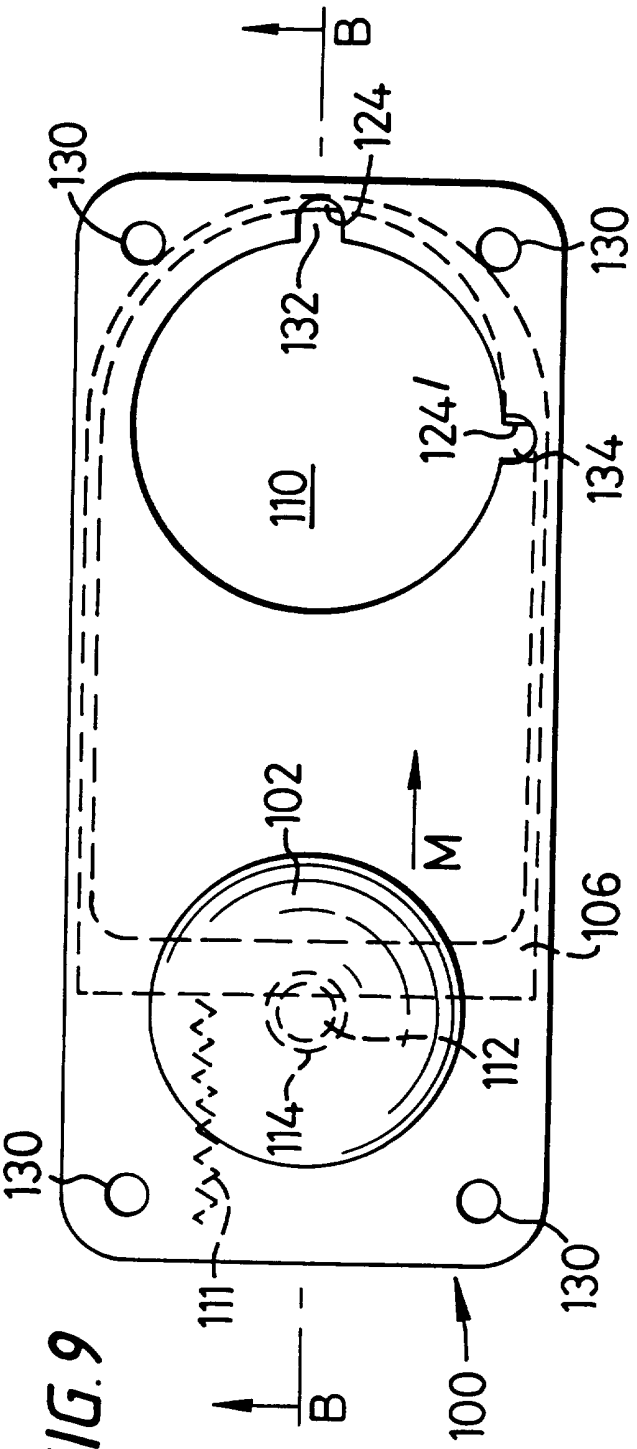


FIG.8A

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114
112
111
B
100

FIG. 9

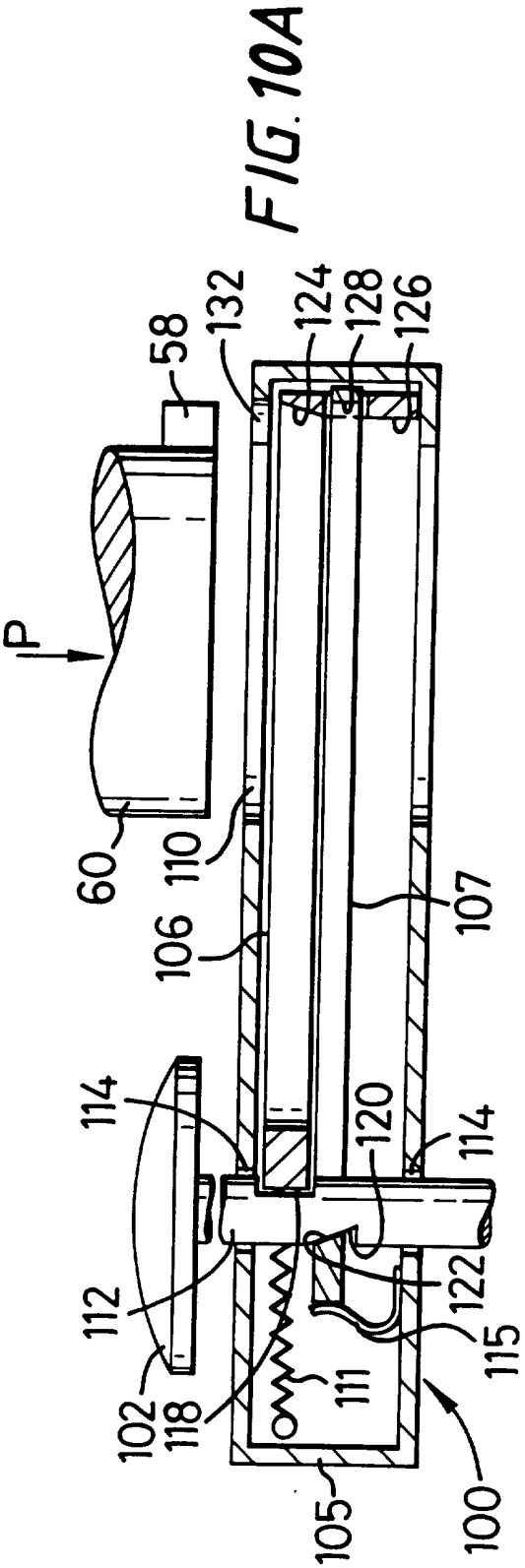
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FIG. 10A

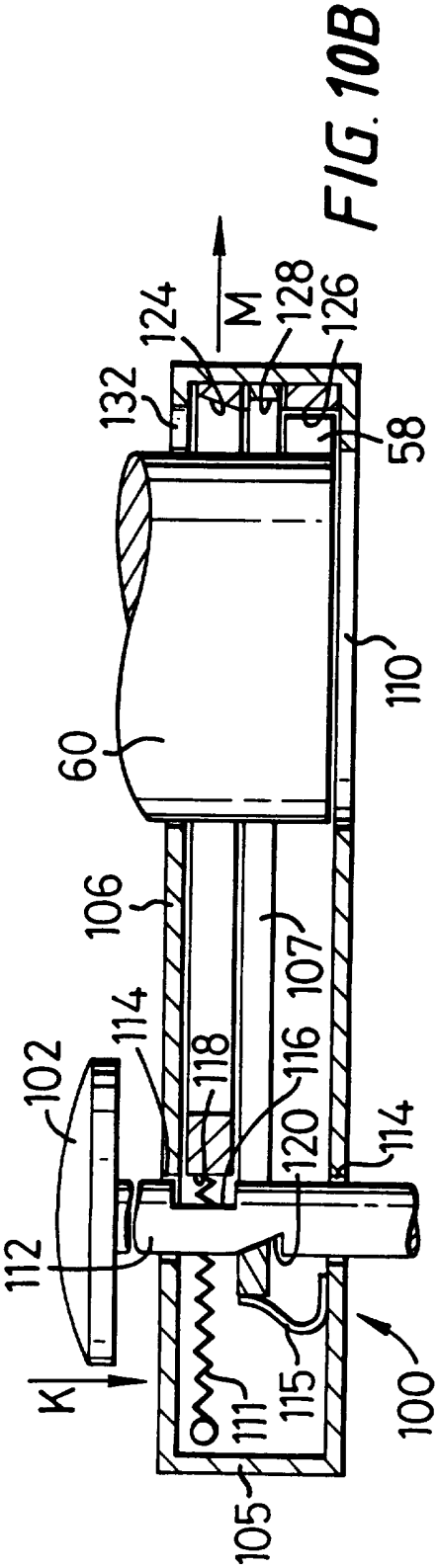


FIG. 10B

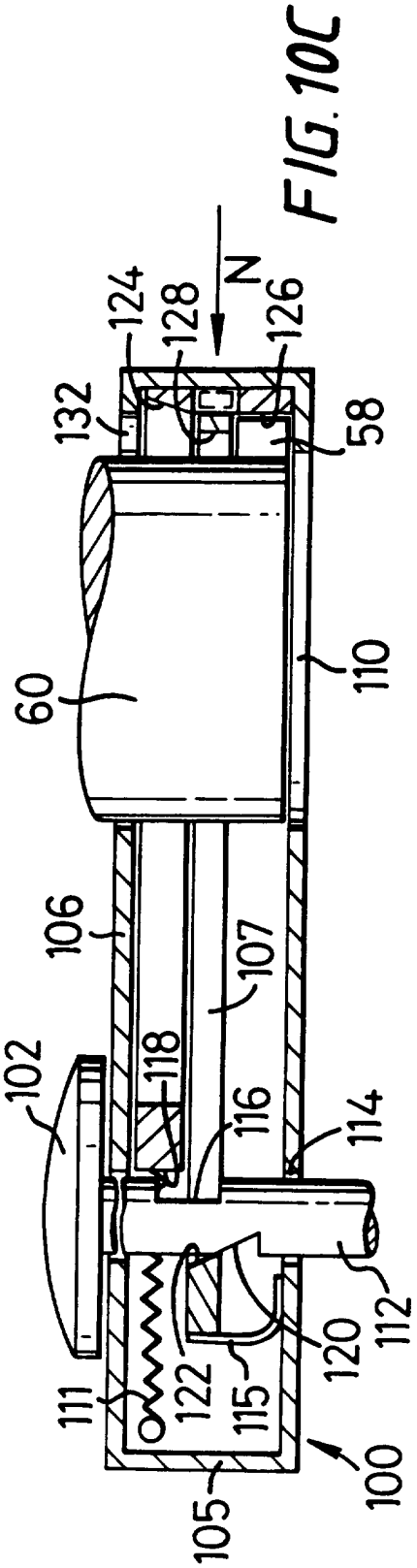


FIG. 10C

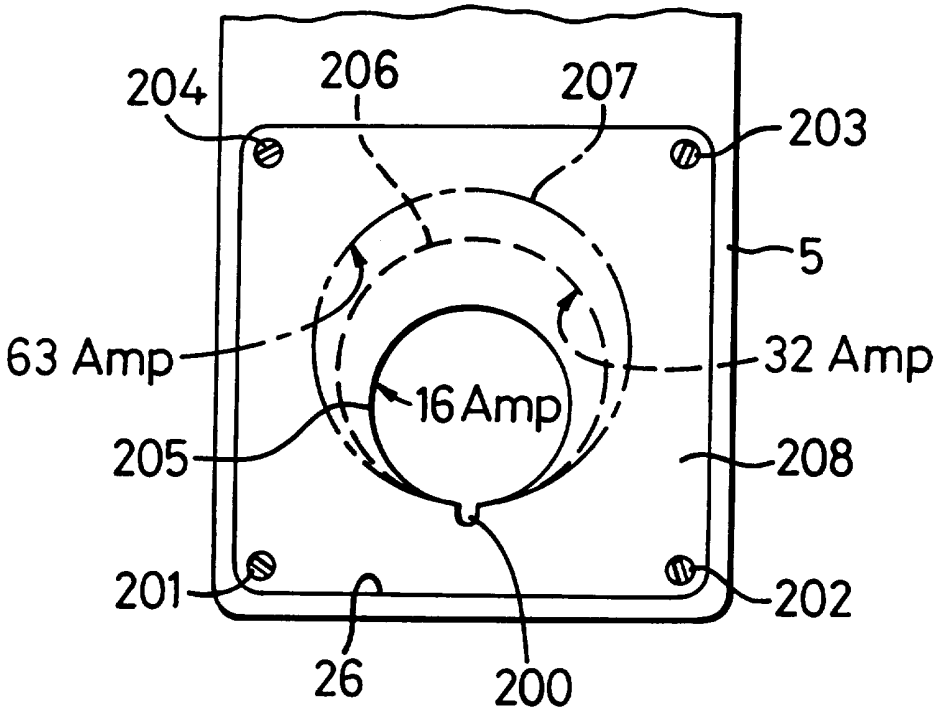


FIG. 11

FIG. 12

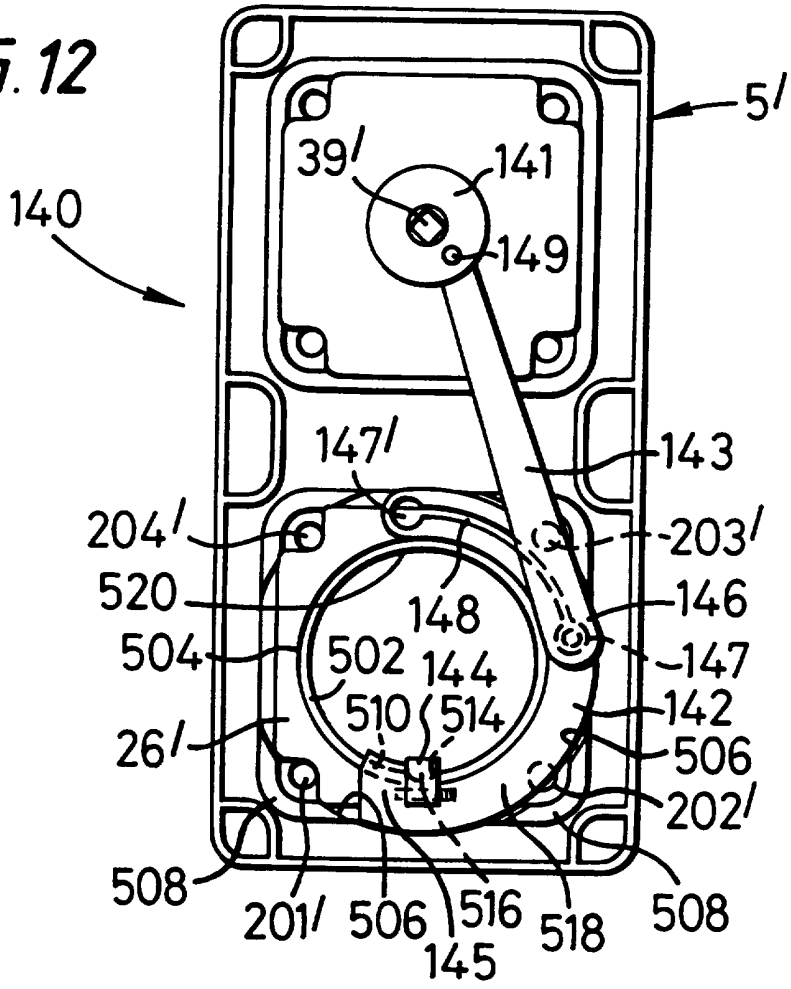
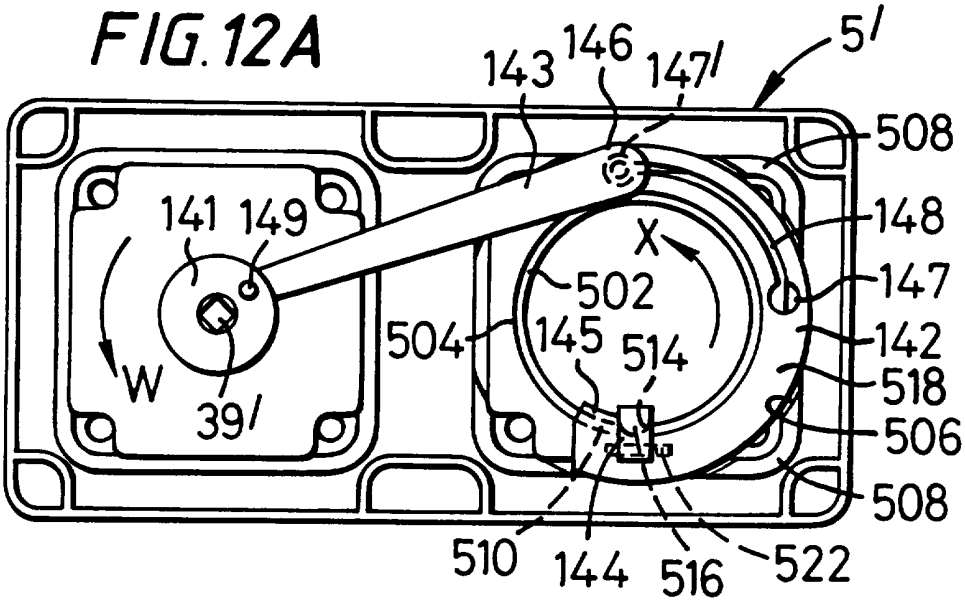


FIG. 12A



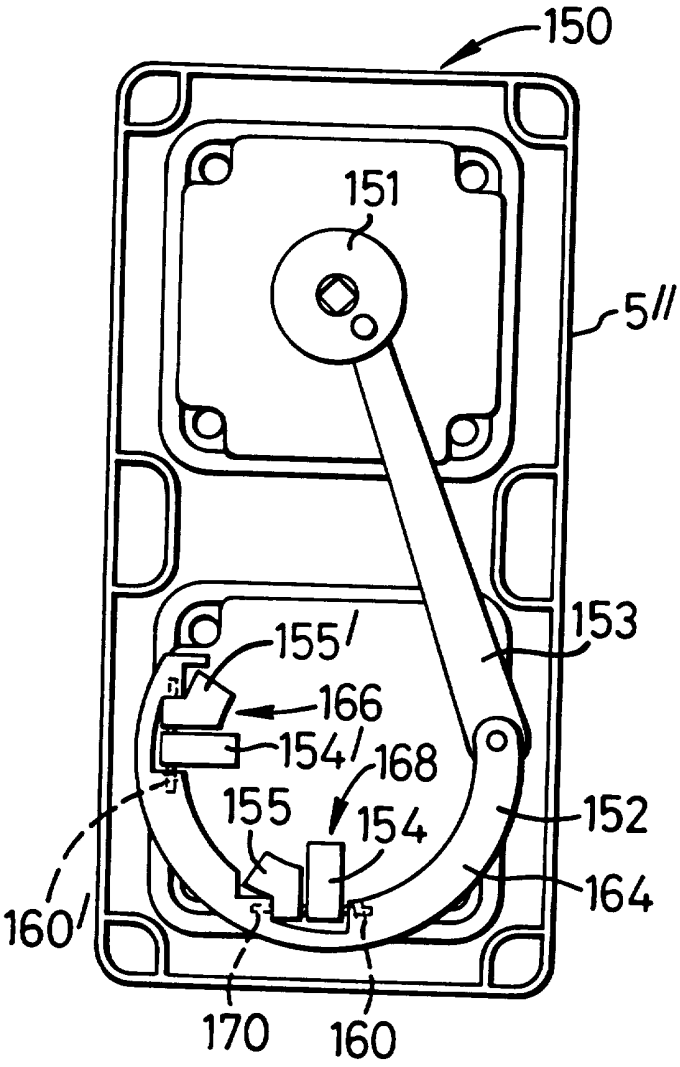


FIG. 13

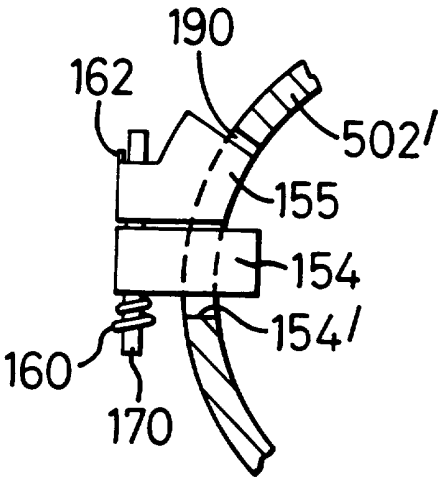


FIG. 13B

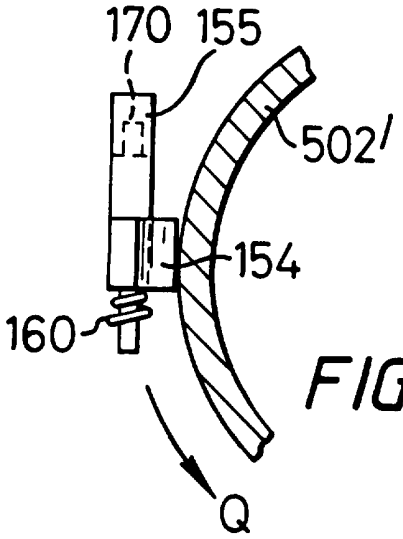


FIG. 13A

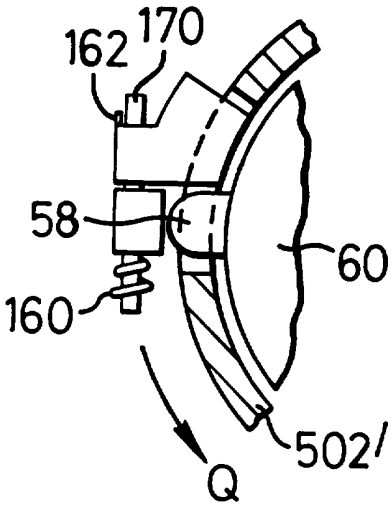


FIG. 13C

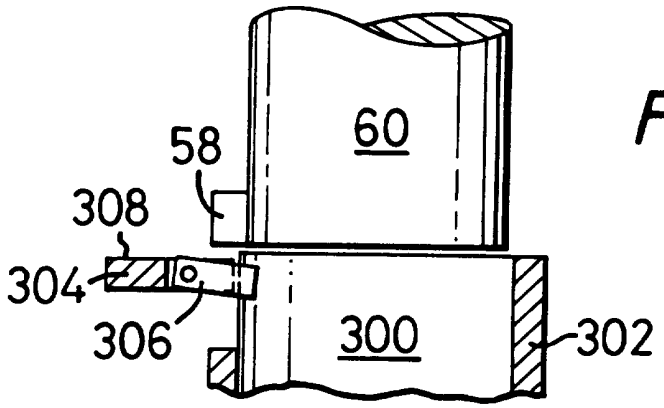


FIG. 14A

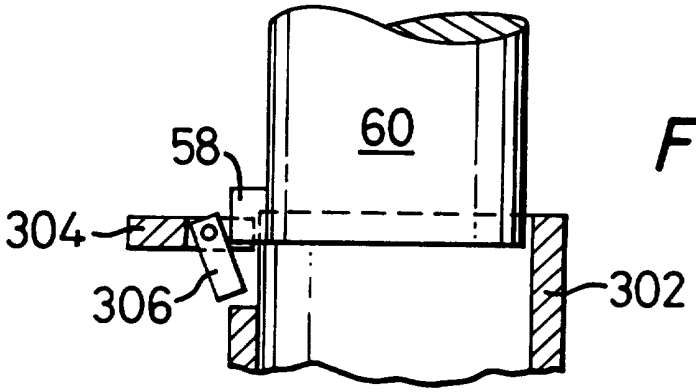


FIG. 14B

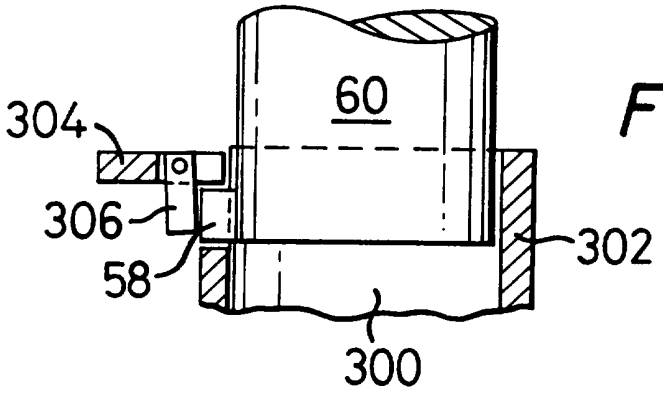


FIG. 14C

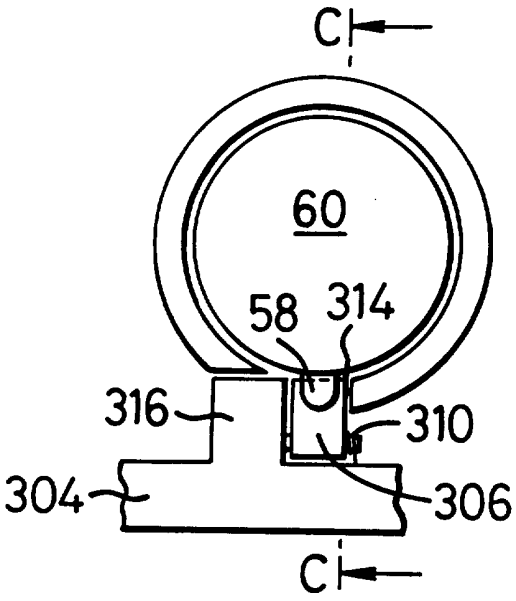


FIG. 15A

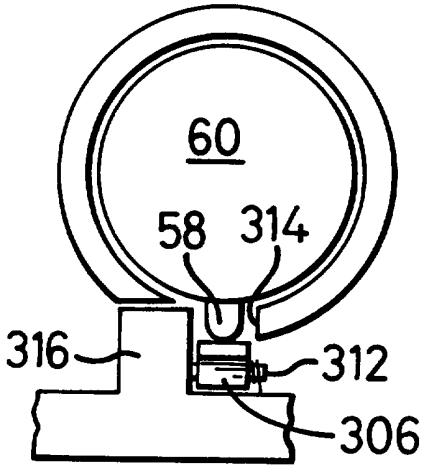


FIG. 15B

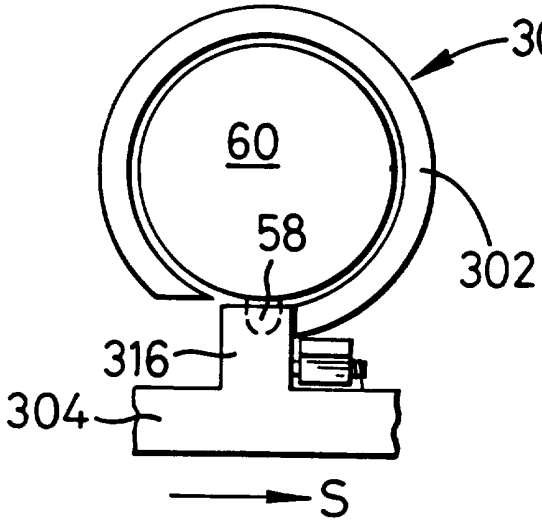


FIG. 15C

FIG. 16

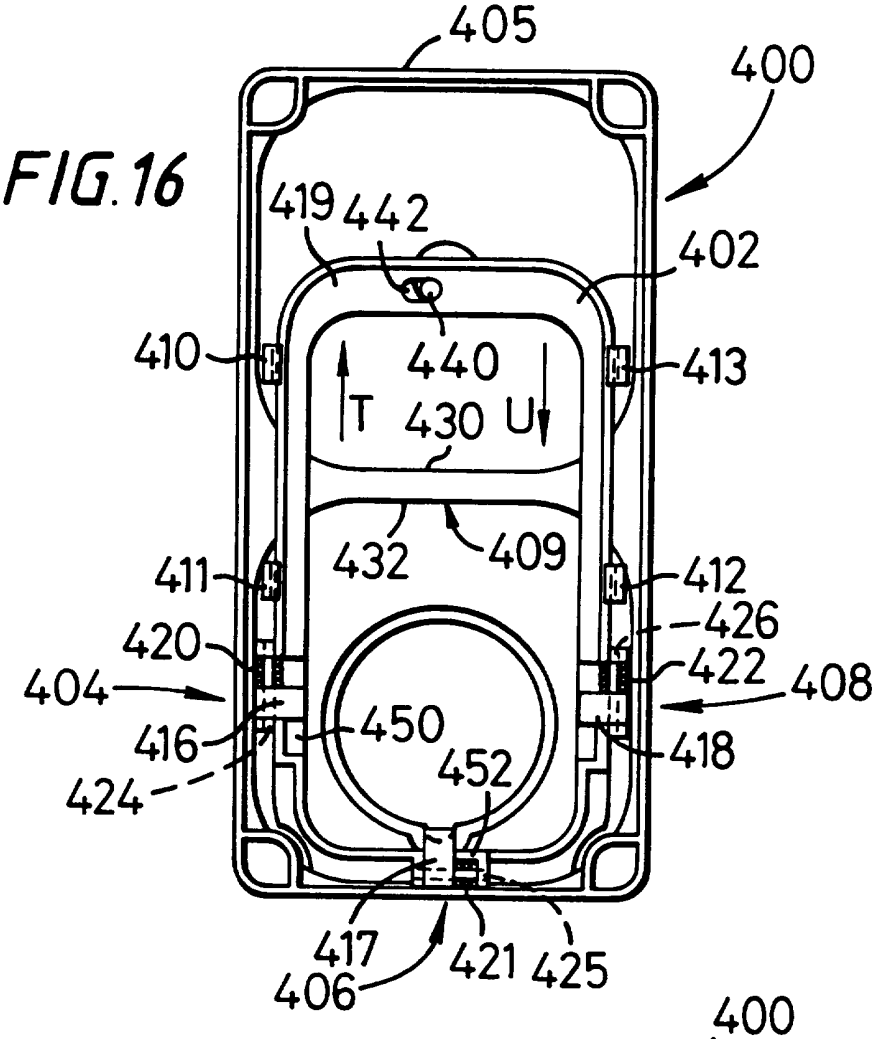


FIG. 16A

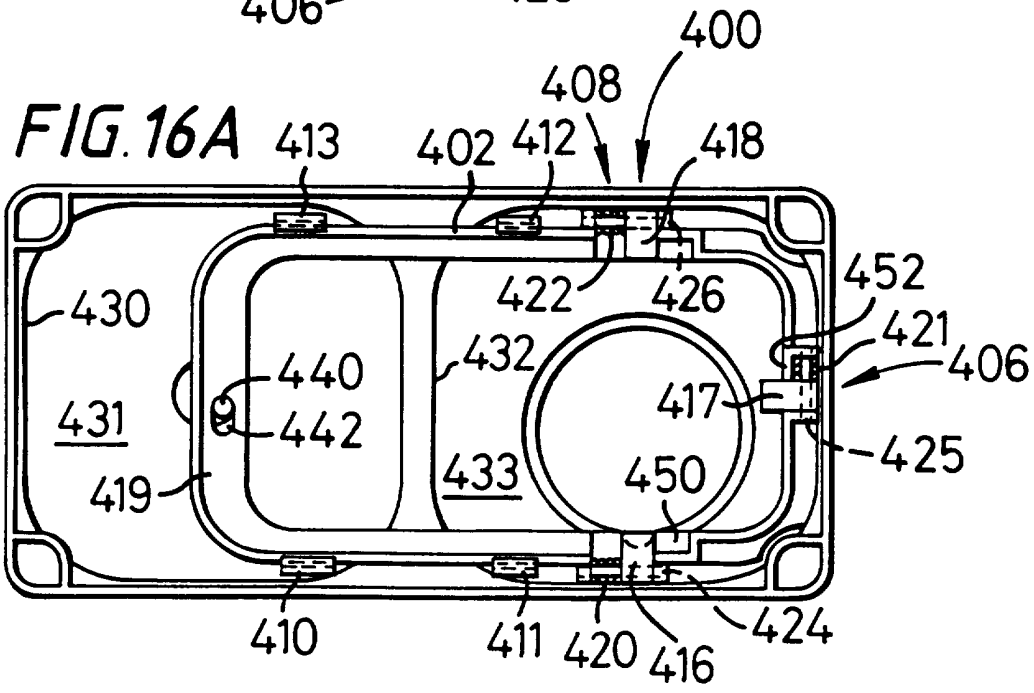


FIG. 17

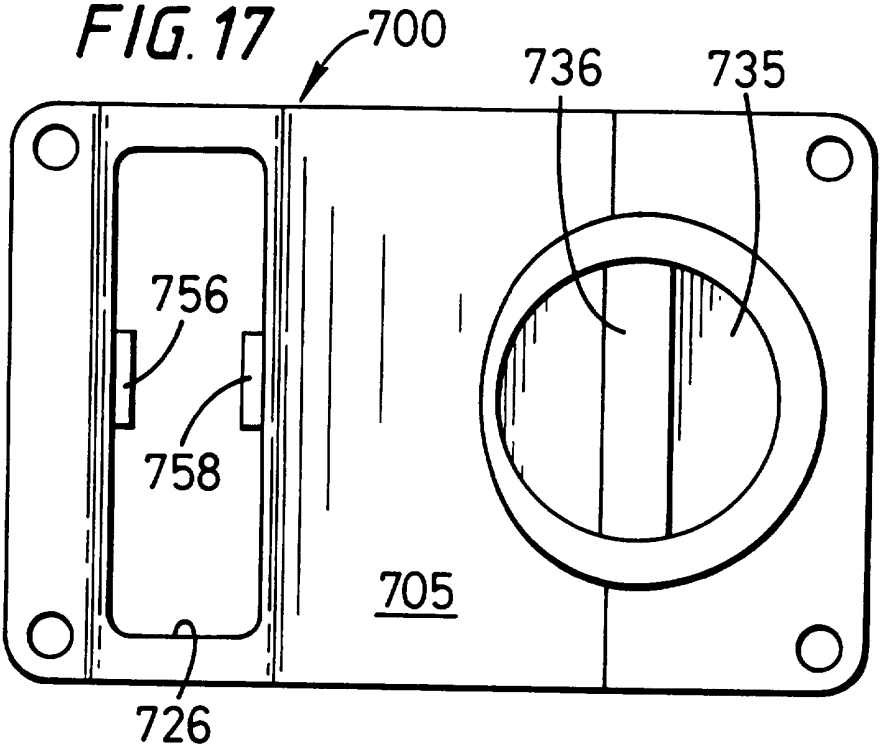
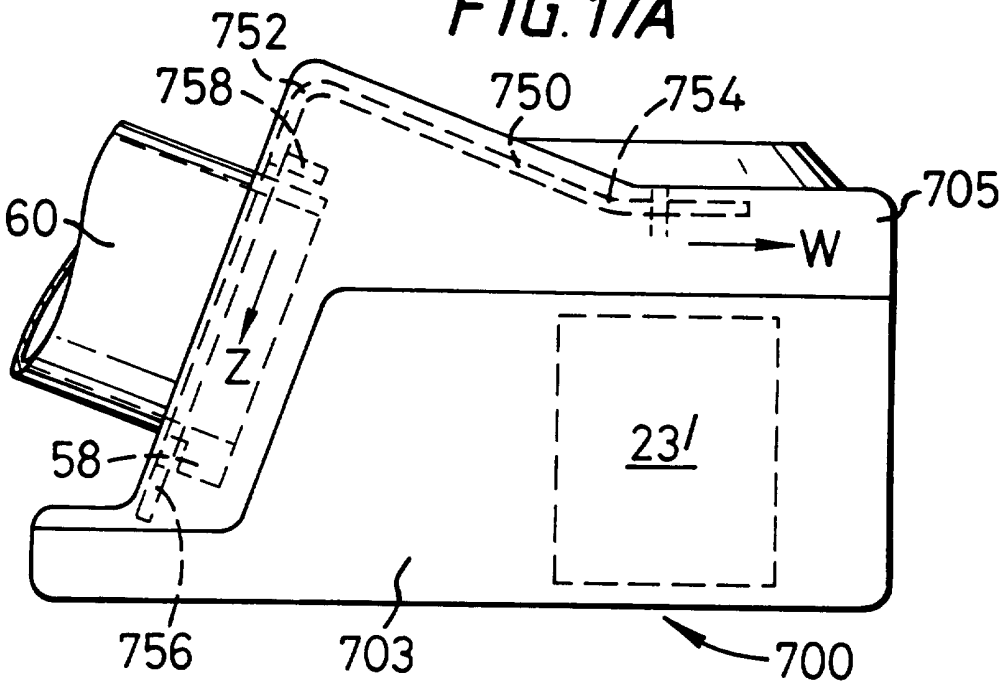


FIG. 17A



Improvements in and relating to electrical switch socket outlets

The present invention relates to electrical socket outlets each having a switch where the switch has an interlock associated with the socket to prevent insertion or removal of a plug from the socket while the switch is in an ON state, hereinafter referred to as "interlockable switch sockets".

Interlocked switch sockets are particularly used in industrial applications, and come in a large range of different configurations. These different configurations arise from the various combinations of plug body size, number and arrangement of plug pins, the supply voltage, and the degree of protection from water and dust afforded to the socket. Plug body size is determined by the current carrying capability of the switch socket and commonly ranges from 16 Amps to 63 Amps. The number and arrangement of pins in the plug is determined by the number of poles or phases provided at the socket and commonly may range from 2 to 5, although in special applications there may be more. The supply voltage may range from a safety extra low voltage of 12 or 24 or 50 volts, to 110 volts, 240 volts, and up to 500 volts, and may also be of alternating current or of direct current, and may be single phase, or multiple phases. The degree of protection from water and dust afforded to the socket ranges from open sockets, through those protected by a hinged dust cover, to those with a water resistant screw down type of cover. There is also the possibility of different types of switches and sizes of enclosures that may be specified. Sockets may also be made with their axis perpendicular to the fixing surface or inclined at an angle to the fixing surface. Hence there is a large range of possible configurations that a customer might require. With current designs of such interlocked switch sockets each particular size and configuration of interlocked switch socket is specifically designed inevitably with many parts particular to that configuration of interlocked switch socket. It is necessary for the manufacturer to assemble all the parts into a complete interlocked switch socket product before sale. This is inconvenient and expensive for the manufacturer and the wholesaler who have to maintain large stock of such products in order to cover the entire range of interlocked switch sockets. Even with large stocks it is likely that customers may have

difficulty in obtaining the particular switch socket outlet they require in sufficient quantity. Frequently customers have to make do with what they can obtain off the shelf, rather than order a specially manufactured unit. In fact many manufacturers are unable to offer all the possible permutations of configurations.

An object of the present invention is to provide an interlockable switch socket which is readily adaptable for a number of different configurations, and an interlock component for an interlocked switch socket which enables such ready adaption.

According to one aspect of the invention there is provided an interlocked socket outlet comprising a housing assembly, an electrical isolator mounted within the housing, a knob for actuating the isolator from an OFF situation to an ON situation, the knob being mounted for at least partial rotation or axial movement to the housing assembly, a socket removably mounted to the housing assembly, the socket being adapted to receive an electrical plug, and an interlock mountable in a guide in the housing assembly, the interlock when mounted being between the knob and isolator so as to interact between a said plug when in the socket and the isolator, the interlock assembly being arranged to prevent removal of the plug from the socket when the isolator is in the ON situation and to allow removal of the plug when in the OFF situation as controlled by the knob.

Preferably the housing assembly comprises a mounting and a base. Further the mounting comprises a mounting aperture which is arranged to receive a said socket. The socket may be one of a plurality of sockets. The knob comprises a knob assembly. The mounting further comprises a mounting aperture arranged to receive the knob assembly.

Preferably the interlock assembly or the interlocked socket outlet comprises a connection means providing at least partial rotative or axial connection between the knob and isolator, said connection means arranged to actuate an interlock means engageable with a said plug in said socket.

The interlock may comprise an interlock housing. The interlock housing may provide the guide for the interlock.

Preferably the interlock member is movable through 90 degrees about an axis parallel to the direction of insertion of the plug into the socket. Alternatively the interlock means has a said interlock member and a said locking member at a plurality of positions, each at 90 degrees to each other about an axis parallel to the direction of insertion of the plug into the socket. The benefit of this is that a socket mounted to the mounting may be re-orientatable in the housing and still be able to interact with the interlock.

The advantage of this invention is that a manufacturer has only to hold in stock a selection of switches and a selection of sockets, which a customer can then combine by fitting into an enclosure together with an interlock to make a particular configuration of interlocked switch socket outlet that the customer requires. This reduces the stock that the manufacturer has to hold, and improves the availability of the product for the customer.

Preferably the interlock comprises a retaining or locking member and an interactive interlock member, the retaining or locking member being at least partly rotatable or movable in an axial direction to trap a plug in the socket, the interlock member being arranged to prevent rotation or axial movement of the locking member in the absence of a plug in the socket. The interlock member can be moved arcuately through 90° relative to the housing or alternatively the interlock member is arranged so that the interlock will operate equally with the plug and socket in one of at least two positions. This has the advantage that the customer can adjust the orientation of a switch and a socket that are part of an interlocked switch socket to suit the particular requirements of his installation. With known existing designs this is impossible, manufacturers normally not offering the customer a choice of orientation. The provision of the slot at the same coincident position as between each of the plurality of different sized sockets relative to the housing enables a single and modular interlock assembly to be provided in the event that interlocking is required.

According to an embodiment of the invention the socket is provided with a flange suitable for fixing to an enclosure or a mounting interface. The axis of the socket relative to the flange is such that the portion of the socket known as the key slot and associated with features necessary for providing the interlocking facility is always positioned in a particular position relative to the flange.

The benefit of this is that any one socket of any of several different possible configurations may be fitted to an enclosure incorporating the said interlocking means or used in conjunction with an enclosure not incorporating interlocking means but with the said interlocking unit to form a part of an interlocked switch socket. This then enables the manufacturer to offer the customer sockets and enclosures as separate components for the customer to assemble as he requires.

In an embodiment of the invention the interlock assembly is formed with a bottom housing and a top housing which enclose a mechanism for interlocking the isolator and a plug in the socket. In one embodiment of this assembly, a shaft for operating a rotary isolator passes through the axis of rotation of a small gear forming part of the mechanism. This small gear is rotated by the shaft when the switch is operated. A larger socket gear is provided which is annular in shape, such that a socket may be mounted so that it protrudes through the centre of the gear. An intermediate gear may be provided to connect the small gear and the socket gear. In one embodiment rotation of the small gear through 90 degrees causes the socket gear to rotate through a fifth of 90 degrees, that is through 18 degrees. This ensures that when the relative orientation of the socket and operative knob for the isolator is changed the orientation of the knob relative the housing of the outlet remains the same.

In a further embodiment of the invention locking and interlocking is achieved by the connecting means and knob mounted for movement in an axial direction with locking and interlocking members arranged as slides mounted for movement in directions at right angles to the axial direction.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is an exploded perspective view of an interlocked switch socket according to the invention,

Figure 2 is a perspective view of the socket of Fig. 1,

Figure 3 is a plan view of an interlock assembly according to a further aspect of the invention for the socket of Fig. 1,

Figure 4 is a cross section of the interlock assembly of Fig. 3 taken on A-A.

Figure 5 is a perspective view of the interlock assembly of Fig. 3 part of the socket Fig. 1 showing a plug about to be inserted in the socket,

Figure 6 is a similar view to Fig. 5 with the plug inserted but unlocked, that is with the isolator in the OFF situation,

Figure 7 is a similar view to Figs. 5 and 6 with the plug inserted and locked into the socket, that is with the isolator in the ON situation,

Figure 8 is a plan view from the rear of a second embodiment of the interlock assembly of Fig. 3 in a first orientation of plug and socket, shown assembled to a mounting,

Figure 8A is a plan view from the rear of the second embodiment of the interlock assembly of Fig. 3 in a second orientation of the plug and socket, shown assembled to a mounting,

Figure 9 is a plan view of a third embodiment of the interlock assembly,

Figures 10A, 10B and 10C are cross sections of the assembly of Fig. 9 taken on BB,

Figure 11 is a diagram of a socket module showing in broken lines two alternative sizes of socket located with respect to the mounting,

Figure 12 is a plan view from the rear of a fourth embodiment of the interlock assembly, shown assembled to a mounting, arranged so that the switch module is mounted vertically above the socket outlet,

Figure 12A is a plan view from the rear of the fourth embodiment of the interlock assembly, shown assembled to a mounting, arranged so that the switch module is mounted horizontally alongside the socket outlet,

Figure 13 is a plan view from the rear of a fifth embodiment of the interlock assembly, shown assembled to a mounting,

Figure 13A is an enlarged plan view of part of the fifth embodiment showing part of a socket wall and the interlock members in an inoperative state,

Figure 13B is an enlarged plan view of part of the fifth embodiment showing part of a socket aligned with the interlock members in an operative state,

Figure 13C is an enlarged plan view of part of the fifth embodiment as shown in Fig. 13B with part of a plug shown inserted into the socket,

Figure 14A is a cross sectional view of a sixth embodiment with the outline of a plug shown in a position prior to insertion into the socket, the cross section being taken on CC in Fig. 15,

Figure 14B is the same cross sectional view of the sixth embodiment shown in Fig. 14A but with the outline of a plug shown in a partly inserted position,

Figure 14C is the same cross sectional view of the sixth embodiment shown in Fig. 14A but with the outline of a plug shown in a fully inserted position,

Figure 15A is a plan view of part of the sixth embodiment as shown in Fig. 14A viewed in the direction of arrow F,

Figure 15B is the same plan view of part of the sixth embodiment as shown in Fig. 14C viewed in the direction of arrow F,

Figure 15C is the same plan view of part of the sixth embodiment as shown in Fig. 15B but with the plug locked into the socket,

Figure 16 is a plan view from the rear of a seventh embodiment shown assembled to a mounting, in a vertical arrangement,

Figure 16A is a plan view from the rear of the same seventh embodiment of Fig. 16, but in a first horizontal arrangement,

Figure 17 is a plan view of an eighth embodiment assembled to an interlockable socket outlet where the socket mounting is at an angle to the plane of the knob,

Figure 17A is a side elevation of the eighth embodiment shown in Fig. 17.

An interlocked switch socket assembly 1 is shown in an exploded view in Fig. 1 and as assembled in Fig. 2. The socket assembly has a housing assembly comprising a base 3, a first mounting 4 and a second mounting 5 which are screwed by screws 7 to pillars 9 on the base with seals 10 and 11 in between. Mounted within the base is a din rail 13 onto which is mounted a residual circuit device (RCD) 15 or a timer a circuit breaker or thermal overload device (not shown). A divider plate 21 slots into the base to divide the base into two compartments. Mounted within the compartment of the base covered by mounting 5 is a rotary isolator 23.

The mountings 4 and 5 have mounting apertures 25, 26 and 27 into which are screwed modular components as particularly and respectively a sealed cover 29, a knob assembly 30 and a socket module 31. The knob assembly 30 which is dimensioned to the same module as the socket module 31 can either be above or below the socket module. Furthermore, and this has particular significance as will be discussed later, the mountings 4 and 5 which are shown aligned vertically can be turned through 90° and screwed to the base 3 on pillars 9'. Thus socket module 31 can be to one side of modular knob assembly 30.

Between the knob assembly 30 and isolator 23 is an interlock assembly 32 which is removably mounted by screws 33 (two only of which are shown for clarity) which pass through holes 34 in the interlock assembly. A knob 35 is mounted rotatably to the knob assembly 30 and has a square arbor 37 forming a connection means attached to it which protrudes rearwardly through a square hole 39 in a first gear 40 to a square hole 38 in isolator 23. This enables the knob 35 to turn the isolator between an OFF situation and an ON situation.

The interlock assembly 32 is shown in detail in Figs. 3 and 4. The assembly 32 comprises a housing 42 formed from a front and a back part (43, 44), between which are first gears 40, second and intermediate gear 46 and third and annular gear 48. Annular gear 48 is driven by gear 40 and by knob 35 with a gear ratio of 1 to 5 so that a 90° rotation of knob 35 turns gear 48 through 18° this is important when considering whether assembly 32 is to be mounted horizontally in the housing assembly or vertically. The annular gear 48 when the interlock assembly is mounted in the housing surrounds socket 50 of socket module 31 as is seen in Figs. 5 to 7.

The interlock assembly 32 further has a locking member 51 which is formed as a radially inwardly directed projection from the inside annular surface of gear 48 and rotates therewith. An interlock member 54 resiliently urged by a spring 55 outwardly in the axial direction, that is towards the front of the whole socket assembly slides into a gap 52 in the front housing part 43. The interlock member 54 also has an abutment part 56 projecting radially inwardly which co-acts with a location pin 62 with head 64 which locates the pin in arcuate slot 66 in rear housing part 44 in position X or Y depending on whether the knob 35 is to one side of the socket module or above or below the socket module ie in a horizontal or vertical orientation.

The interlock arrangements operate as follows:-

Knob 35 must be in the OFF position as shown in Fig. 1 with its bar handle 36 horizontal. Cap 70 on socket module 31 is lifted and plug 60 is inserted in the socket 50, tab 58 entering the gear 48 and striking abutment part 56 to force interlock member 54 out of gap 52. This allows gear 48 to be rotated by knob 35 rotating locking member 51 in front (in the direction of insertion of the plug) of tab 58 so trapping the tab between the locking member 51 and abutment part 56. The knob 35 has then rotated 90° to the ON situation of the isolator, and the locking member has rotated 18°.

If the interlock assembly is required to be on an orientation 90° to that shown in Fig. 5, before assembly the head 64 is used to rotate the gear 48 through 90° this rotates gear 40 through 450° so that the bar 36 will still be horizontal in the OFF situation.

A second embodiment of the interlock assembly 89 is shown in Fig. 8 and 8A. The arrangement is similar in function to that of the first embodiment except that the annular gear is replaced by an annular cylinder 90 which is rotated through about 20° by a link 92 engaging with cam plate 93, which is connected to a knob 35'. As before the assembly 89 my be orientated vertically or horizontally with the knob 35' still horizontal in the OFF situation by aligning one or other slot 94 or 95 with tab slot 96.

Figures 9 and 10A to 10C show a third embodiment of an interlock assembly indicated generally at 100. In this embodiment a knob 102 is mounted for axial movement in a direction R parallel to the direction P of insertion of a plug 60 having tab 58. The plug is the same as that previously shown and described.

The assembly 100 comprises a housing 105 in which there are two slides 106 and 107, the front or outer slide 106 us urged by a tension spring 111 in a direction N from plug insertion major apertures 110 in the housing 105 towards a knob stem 112 forming a connection means which protrudes through minor apertures 114 in the housing 105. The rear or inner slide 107 forming a retaining or locking member is urged by a leaf spring 115 in an opposite direction M from the minor apertures 114 towards the major apertures 110. The knob stem 112 has a notch 116 facing engagement surface 118 slide 106 and a notch 120 facing engagement surface 122 of slide 107. Slide 106 forming an interlock member has apart from engagement surface 118 a camming surface 124 extending inwardly to retaining surface 126 facing towards apertures 110. Slide 107 has a plug retaining part 128 also facing apertures 110.

The inner end of knob stem 112 actuates the isolator (not shown) which may be an emergency switch operating on a push ie axial movement ON/OFF arrangement, although the axial movement of stem 112 can be converted to partial rotary motion by a suitable camming surface (not shown). The knob stem 112 is shown broken at its outer end since the knob will be mounted in a knob assembly as previously described.

The interlock assembly 100 operates as follows:-

In Fig. 10A plug 60 is not inserted into its socket (not shown) but similar to previously described. Knob stem 112 is interlocked by surface 118 of slide 106 engaging in notch 116 and therefor the isolator cannot be operated.

In Fig. 10B the plug 60 is inserted, the tab 58 of the plug shifts slide 106 in direction M by the action of the tab engaging camming surface 124. Surface 118 disengages from notch 116 and unlocks stem 112. Slide 106 is retained in the unlocked position by the tab 58 resting on surface 126.

Knob 102 is pushed in direction R to operate the isolator this causes slide 107 to move in direction N by the action of surface 122 on angled notch 120. Movement of slide 107 in direction N causes plug retaining part 128 to move in front of tab 58 so as to trap plug 60 in the apertures 110 of the assembly 100.

The assembly is removably mounted as before to the socket assembly by screws or protrusions through holes 130 in its housing. The assembly housing can be mounted in two orientations by provision of two tab slots 132 and 134. These may be seen in Fig. 9 which also shows camming surface 124 equivalent to surface 124' on slide 106. A plug retaining part equivalent to part 128' is under surface 124' but cannot be seen in the drawings.

Figure 11 shows some if the different socket sizes which can be accommodated in the interlockable switched socket. A mounting 208 is shown mounted in the mounting aperture 26 of the mounting 5 shown in Fig. 1. The mounting 208 is secured to the mounting aperture by fixing screws 201 to 204. The socket has a plug tab receiving key slot 200 always at the same position relative fixing holes 201-204 of mounting 208 and hence its mounting to mounting aperture 26 of mounting 5 to which it is screwed whether the socket is a small socket (for 16 amps) as shown at 205, a medium sized socket (for 32 amps) 206 or a large sized socket (for 63 amps) 207. The mounting aperture 26 and the mounting 208 are such that a socket may be orientated in any of four perpendicular arrangements vertical or horizontal in the plane of the mounting 208. The sockets shown and described herein may be arranged with their axis along which the plug is inserted perpendicular to the plane of the mounting 208 or inclined at an angle to the mounting.

The benefit of having the key slot 200 always in the same position relative to the fixing holes of mounting 208 is that an interlock arranged to operate with one socket will equally operate with the other sockets in the range. Hence a user may combine modular elements from a range to construct a particular product configured to meet his individual requirements. This may be achieved with the minimum stock holding of components by the supplier while still ensuring immediate availability of the product.

Whilst it is preferred that the interlock assemblies of the embodiments are removably mounted, they may be incorporated as permanent or semi permanent assemblies in the mountings (5) of the housing. The benefit of this is that for high volume products, the manufacturer can obtain benefits from the rationalisation without the additional components such as fixing screws, flanges, and gaskets required for the mounting of individual modules in a modular product.

It may be desirable to restrict the range of socket sizes covered by an interlock assembly to obtain a more compact assembly for a low rated product than could be achieved with a product sized so that it could accommodate larger socket outlets. The majority of the benefits mentioned above will still accrue from having key slot 200 always in the same position.

Figures 12 and 13 show a fourth and fifth embodiment of an interlock indicated generally at 140 and 150 respectively, where the interlock assembly comprises an arcuate slider 142 and 152, linked by a connecting member 143 and 153 to a switch cam or crank plate 141 and 151, each interlock shown assembled to a mounting 5' and 5". A rotary isolator (not shown) may be mounted so that it is operated by means of square arbor passing through the square hole 39'. A rotary knob (not shown) is provided at the front of the mounting. The rotary knob is provided with a similar square hole for connecting with the square arbor.

The fourth embodiment 140 has a hinged latch 144 and a plug retaining part 145. A spring 522 is provided to bias the latch to substantially the same plane as the arcuate slider. An end 146 of the connecting member may be pivotally connected to the arcuate slider 142 at one of at least two positions 147 and 147'. An arcuate slot 148 is provided to enable the pivotal connection of end

146 to be altered between positions 147 and 147'. End 149 of the connecting member is pivotally connected to switch crank plate 141. Arcuate slider 142 has a surface 518 normally positioned facing away from mounting 5'. A socket receptacle 502 is shown mounted to the mounting 5'. Mounting 5' has upstands 508 with slideway surfaces 506 facing the arcuate slider 142. The arcuate slider is mounted in a slideway formed between the outer surface 504 of the socket receptacle 502 and the surfaces 506 of the mounting 5'. Preferably it snaps into the slideway, and is retained therein. The socket receptacle has a cut out portion 510 to allow the plug retaining part 145 and the latch 144 to protrude the inner surface 512. The cut out portion 510 has an edge forming a stop 514. The cut out portion is positioned over a plug tab receiving tab slot 516.

The interlock assembly 140 operates as follows:-

When no plug is inserted into the socket, the latch 144 abuts stop 514 of the socket receptacle, and prevents angular movement of the arcuate slider 142 in the direction of arrow X. Since the switch crank plate 141 is pivotally connected to the arcuate slider by means of the connecting member 143, the switch crank plate is prevented from rotating by the abutment of the latch 144 against the stop 514. Hence it is not possible to switch on the electrical power to the socket. Insertion of a plug into the socket causes the plug tab to move the latch 144 away from the stop 514 in a similar manner to that described below with reference to Fig. 14. When the plug is fully inserted the arcuate slider 142 may be moved permitting the operation of the switch by the switch knob, which causes rotation of the crank plate 141 which in turn moves the connecting means 143 and the arcuate slider. The arcuate slider moves to a second position where the plug retaining part is positioned such that the plug is retained in the socket, in a similar manner to that described below with reference to Fig. 15. While Fig. 12 shows a vertical arrangement of the switch and socket it may be required to have the horizontal arrangement of Fig. 12A while maintaining the position of the tab slot 516 at the bottom of the socket receptacle. To allow the latch and plug retaining part to align with the tab slot in each arrangement the end 146 of the connecting means may be repositioned from position 147 to position 147' or from position 147' to position 147 as required. It should be noted that installations may require a second vertical arrangement where the switch is below the socket. This may be obtained by removing the arcuate slider from the slideway and turning it over 180° and replacing it in the slideway so that the surface 518 that

faced away from the mounting 5' now faces towards the mounting. Positioning the end 146 in position 147 will now give an arrangement where the latch and plug retaining part is at a position 520. By this means also a second horizontal arrangement may be obtained where the switch is to the other side of the socket from the horizontal arrangement. The spring 512 biases the latch to substantially the same plane as the arcuate slider, and permits the latch to be hinged either way with respect to this plane.

Figure 13 shows that the fifth embodiment 150 has at least two hinged latches 154 and 154' resiliently biased by springs 160 and 160', and a hinged plug retaining part 155 and 155' corresponding to each hinged latch. Each hinged plug retaining part 155 and 155' is provided with detents 162 and 162' which are clearly shown in Fig. 13B and C. These ensure that in normal operation the hinged plug retaining part takes up one of three alternative positions, the normal position for the purpose of retaining a plug in the socket being when the plug retaining part is aligned with a surface 164 of the arcuate slider. The plug retaining part may also be positioned so that it is perpendicular in either an upwards or downwards direction with respect to surface 164. Springs 160 and 160' bias the hinged latches to a position substantially parallel to surface 164.

Figs. 13A, B, and C show an enlarged detail of the interlock assembly of Fig. 13, with a socket receptacle 502' fitted to the mounting 5". For clarity the arcuate slider 152 is not shown, but the hinge pin 170 which is mounted to the arcuate slider is visible. Both latch 154 and plug retaining part 155 are mounted to the hinge pin 170. Fig. 13A shows the interlock assembly at position 166, and Figs. 13B and 13C show the interlock assembly at position 168. The plug tab slot 516' may be seen (in hidden detail) behind the latch. The adjacent wall section edge 170 of the socket receptacle 502' is at a level just beneath the plug retaining part 155, and supports the plug retaining part preventing it from hinging towards it. Fig. 13C showing the condition of the assembly when a plug has been inserted into the socket receptacle, but before the switch has been turned on. In Fig. 13A the plug retaining part has been rotated through 90° so that is orientated in a direction protruding upwards from the drawing. In this orientation it is free from obstruction and the interlock may move in the direction of arrow Q.

The interlock assembly 150 operates in a similar manner to assembly 140 to interlock the operation of the switch with the insertion of a plug into the socket, but differs as follows:-

While interlock assembly 140 required the end 146 to be repositioned to adjust the assembly between a vertical arrangement and a horizontal arrangement, no such adjustment is required for interlock assembly 150. Fig. 13A shows the assembly 150 at position 166, showing the hinged plug retaining part 155' displaced by the socket receptacle 502' so that it takes up a first perpendicular position with respect to surface 164. Likewise the latch 154' which is biased by the spring 160' rests against the outer surface 504' and provides no restriction to the free movement of the arcuate slider 152. From Fig 13B showing the same socket receptacle at position 168 it may be seen that the plug retaining part 155 and the latch 154 correspond to the plug retaining part 145 and the latch 144 of the fourth embodiment. They act in exactly the same way to interlock the operation of a switch with the insertion of a plug into the socket receptacle. Although the plug retaining part is hingedly mounted to the arcuate slider, the forces arising from an attempt to remove the plug while the switch is in the ON state will be resisted by the plug retaining part being supported by the edge 170 of the socket receptacle wall. An attempt to switch the socket on will be resisted as in the fourth embodiment by the latch abutting stop 514'.

Figures 14A, B, and C show a detail of a sixth embodiment that is similar in operation of the interlocking to both the previously mentioned fourth and fifth embodiments, although the actual interlock assembly is similar to that of Fig. 16 in that it operates by a linear movement. A plug 60 having a tab 58 being the same as previously shown and described, is shown in Fig. 14A positioned ready for insertion into the socket receptacle 300 (only partly shown) which comprises a wall 302. An interlock member 304 has a latch 306 hingedly mounted to it. Latch 306 is resiliently biased to a position as shown in Fig. 14A substantially in the same plane as surface 308 by a bias spring 310 shown in Fig. 15. Latch 306 hinges on hinge pin 312. As the plug 60 is moved in the direction of arrow R tab 58 displaces latch 306 until the plug is fully inserted as shown in Figs. 14C and 15B when the latch is deflected to a sufficient degree to disengage it from an abutting stop 314. The interlock member 304 may now be moved in the

direction of arrow S by the operation of a switch (not shown) from an OFF state to an ON state so that a plug retaining part 316 of the interlock member 304 is positioned over tab 58 so preventing removal of the plug while the switch is in an ON state.

Figure 16 A and B show a seventh embodiment of an interlock shown generally at 400. The seventh embodiment 400 comprises an interlock member 402 with interlocking features at positions 404, 406 and 408. The interlock member is slidably mounted in the direction of arrows T and U to the mounting 405 by means of upstanding guides 410, 411, 412 and 413. The upstanding guides 410 - 413 are resilient, and the interlock member is arranged to assemble by snap fitting into the guides. The interlocking features at positions 404, 406 and 408 each comprise a hinged latch 416, 417, and 418 which are biased to lie in the same plane as surface 419 of the interlock member by springs 420, 421 and 422. The latches are mounted on hinge pins 424 - 426. The mounting 405 has two mounting apertures 430 and 432 to which are shown mounted respectively a switch knob module 431 and a socket receptacle module 433. Both modules may be orientated in any one of the four possible orientations. (In the vertical arrangement where the switch is positioned below the socket a fourth interlock position would be required at position 409, in which case the interlocking member would move in the direction of arrow U to retain the plug in the socket.) Crank pin 440 is rotated by the operation of the switch knob (not visible), and engages in slot 442. Crank pin 440 is also used to operate an isolator module (not shown in this Fig.).

In the operation of the seventh embodiment 400 when there is no plug inserted into the socket receptacle the switch knob is prevented from operation by the latch 416 in Fig. 16A or 417 in Fig. 16 abutting the edge of the wall 444 in Fig. 16A or 446 and 448 in Fig. 16 preventing the movement of the interlock member 402 and hence preventing the movement of the crank pin 440 in slot 442. The position of the switch knob when no plug is inserted in the socket corresponds to an OFF state of the isolator. When a plug such as the one previously shown and described herein at 60 is inserted into the socket, the latch 416 or 417 is deflected so that it is no longer obstructed by the edge of the wall 444 or 446/448 and the interlock member 402 is free to move when the switch knob is operated by rotating through 90 degrees. Operation of the switch knob moves interlock member 402 so that the plug retaining part 450 in Fig. 16A or 452 in

Fig. 16 is positioned over the plug tab 58 (similarly to that shown previously in Fig. 14C) preventing the removal of the plug while the switch is in the ON state.

Although the embodiments shown and described have the knob and socket mounted in the same plane, the interlocks described herein would be adaptable to a socket such as that shown in Figure 17 and Figure 17A where the socket mounting is in a plane at an angle to the plane of the knob. In Figs. 17 and 17A, an eighth embodiment is shown generally at 700, and comprises a mounting 705 is fitted to a base 703. The mounting 705 has a knob 735 with a knob bar handle 736 rotatably mounted, and a mounting aperture 726 for receiving a socket (not shown). An interlock member 750 forms a connecting means between the socket and the knob, and is slidably mounted in the mounting 5. Interlock member has flexible portions 752 and 754 which enable movement in both directions of arrows W and Z. Interlocking features 756 and 758 correspond to the latches 416 - 418 of Fig. 16. A plug 60 with tab 58 as previously shown and described is shown inserted in the appropriate position for a socket in Fig. 17A, and the interlocking feature 758 has been moved to an inoperative position. In operation the interlock functions in a similar manner to that of the seventh embodiment shown in Fig. 16. Where it is desired to use the socket with the plug positioned vertically above the knob, the socket may be re-orientated through 180 degrees when interlocking feature 758 will be utilised, and interlocking feature 756 will be moved to an inoperative position.

Note that for clarity, in most of the Figures the electrical current carrying components of the plugs and sockets have been omitted. Such features are well known and defined in International Standards.

The description of the preferred embodiments of the invention herein is intended to be illustrative of the scope of the invention, that scope being defined by the following claims and all equivalents thereto.

C L A I M S

1. An interlocked socket outlet comprising a housing assembly, an electrical isolator mounted within the housing, a knob for actuating the isolator from an OFF situation to an ON situation, the knob being mounted for at least partial rotation or axial movement to the housing assembly, a socket removably mounted to the housing assembly, the socket being adapted to receive an electrical plug, and an interlock mountable in a guide in the housing assembly, the interlock when mounted being between the knob and isolator so as to interact between a said plug when in the socket and the isolator, the interlock assembly being arranged to prevent removal of the plug from the socket when the isolator is in the ON situation and to allow removal of the plug when in the OFF situation as controlled by the knob.

2. An interlocked socket outlet as claimed in claim 1 wherein the housing assembly comprises a mounting and a base.

3. An interlocked socket outlet as claimed in claim 2 wherein the mounting comprises a mounting aperture which is arranged to receive a said socket.

4. An interlocked socket outlet as claimed in claim 2 wherein the knob comprises a knob assembly removably mounted to the housing assembly.

5. An interlocked socket outlet as claimed in claim 4 wherein the mounting comprises a mounting aperture which is arranged to receive the knob assembly.

6. An interlocked socket outlet as claimed in any one of claims 1 to 5 wherein the interlock assembly comprises a connection means providing at least partial rotative or axial connection between the knob and isolator, said connection means arranged to actuate an interlock means engageable with a said plug in said socket.

7. An interlock for an interlocked socket outlet as claimed in any one of claims 1 to 5 comprising connection means for providing at least partial rotative or axial connection between the knob and isolator, said connection means arranged to actuate an interlock means engageable with a said plug in said socket.

8. An interlock for an interlocked socket outlet as claimed in claim 7 wherein the interlock further comprises an interlock housing for removably mounting in the housing assembly.

9. An interlock assembly for an interlocked socket outlet as claimed in claim 8, wherein the interlock housing further comprises the said guide.

10. An interlocked socket outlet or interlock as claimed in claim 6 or 7 wherein the interlock means comprises a connecting means arranged to actuate a locking member and further comprising an interlock member so arranged to prevent actuation of the interlock member in the absence of a plug inserted in the socket.

11. An interlocked socket outlet or interlock as claimed in claim 10 wherein the interlock member is resiliently mounted to the locking member.

12. An interlocked socket outlet or interlock assembly as claimed in any one of claims 10 or 11 wherein the interlock member is movable through ninety degrees about an axis parallel to the direction of insertion of the plug into the socket.

13. An interlocked socket outlet or interlock assembly as claimed in any one of claims 10 or 11 wherein the interlock means has a said interlock member and a said locking member at a plurality of positions, each at 90 degrees to each other about an axis parallel to the direction of insertion of the plug into the socket.

14. An interlocked socket outlet or interlock assembly as claimed in claim 6 or 7 wherein the interlock means comprises a first member on or mounted to the connection means arranged to partly rotate by means of a link a partly rotatable locking member and an interlock member engageable with the locking member so arranged to prevent rotation of the locking member in the absence of a plug inserted in the socket.

15. An interlocked socket outlet or interlock assembly as claimed in claim 6 or 7 wherein the interlock means comprises a first member on or mounted to the connection means arranged to move along an axis between the socket and the knob to actuate the interlock means.

16. An outlet or interlock assembly as claimed in claim 6 or 7 wherein the knob is mounted for axial movement, wherein the interlock means comprises a locking member and an interlock member arranged as slides mounted for movement at right angles to the axial direction, and wherein the slides coact with the connection means.

17. An interlocked socket outlet substantially as described herein with reference to any one or more of the accompanying drawings.

18. An interlock assembly for the socket outlet substantially as described herein with reference to any one or more of the accompanying drawings.

Amendments to the claims have been filed as follows

1. An interlocked socket outlet comprising a housing assembly, an electrical isolator mounted within the housing, a knob for actuating the isolator from an OFF situation to an ON situation, the knob being mounted for at least partial rotation or axial movement to the housing assembly, a socket removably mounted to a mounting of the housing assembly, the socket being adapted to receive an electrical plug, and an interlock mountable in the housing assembly in a removable interlock housing which acts as a guide, the interlock when mounted being between the knob and isolator so as to interact between a said plug when in the socket and the isolator, the interlock assembly being arranged to prevent removal of the plug from the socket when the isolator is in the ON situation and to allow removal of the plug when in the OFF situation as controlled by the knob.

2. An interlocked socket outlet as claimed in claim 1 wherein the mounting comprises a mounting aperture which is arranged to receive a said socket.

3. An interlocked socket outlet as claimed in claim 1 wherein the knob comprises a knob assembly removably mounted to the housing assembly.

4. An interlocked socket outlet as claimed in claim 3 wherein the mounting comprises a mounting aperture which is arranged to receive the knob assembly.

5. An interlocked socket outlet as claimed in any one of claims 1 to 4 wherein a connection means provides at least partial rotative or axial connection between the knob and isolator, said connection means arranged to actuate an interlock means engageable with a said plug in said socket.

6. An interlock for an interlocked socket outlet as claimed in any one of claims 1 to 4 comprising connection means for providing at least partial rotative or axial connection between the knob and isolator, said connection means arranged to actuate an interlock means engageable with a said plug in said socket.

7. An interlocked socket outlet as claimed in claim 4 wherein there is provided a connecting means arranged to actuate a locking member and further

comprising an interlock member so arranged to prevent actuation of the connecting means in the absence of a plug inserted in the socket.

8. An interlocked socket outlet as claimed in claim 5 wherein the interlock member is resiliently mounted to the locking member.

9. An interlocked socket outlet as claimed in claim 7 or 8 wherein the interlock member is movable through ninety degrees about an axis parallel to the direction of insertion of the plug into the socket.

10. An interlocked socket outlet as claimed in claim 5 or 6 wherein the interlock means has a said interlock member and a said locking member at a plurality of positions, each at 90 degrees to each other about an axis parallel to the direction of insertion of the plug into the socket.

11. An interlocked socket outlet as claimed in claim 5 or 6 wherein the interlock means comprises a first member on or mounted to the connection means arranged to partly rotate by means of a link a partly rotatable locking member and an interlock member engageable with the locking member so arranged to prevent rotation of the locking member in the absence of a plug inserted in the socket.

12. An interlocked socket outlet as claimed in claim 5 wherein the interlock means comprises a first member on or mounted to the connection means arranged to move along an axis between the socket and the knob to actuate the interlock means.

13. An interlocked outlet as claimed in claim 5 wherein the knob is mounted for axial movement, wherein the interlock means comprises a locking member and an interlock member arranged as slides mounted for movement at right angles to the axial direction, and wherein the slides coact with the connection means.

14. An interlocked socket outlet substantially as described herein with reference to any one or more of the accompanying drawings.

15. An interlock assembly for the socket outlet substantially as described herein with reference to any one or more of the accompanying drawings.

The Patent Office

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Claims searched:	1 to 6, 10 to 17	**Date of search:**	26 October 1995

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): H2E [ECAD]

Int Cl (Ed.6): H01R

Other: On line: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2034983 A	[HARVEY HUBBEL] socket 48, plug 54, switch 16	1 to 6, 10
X	GB 1599306	[HARVEY HUBBEL]	1 to 6, 10, 15
X	GB 1590315	[HARVEY HUBBEL]	1, 6, 10, 11, 14, 15

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.