



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(54) Title: MULTIPLE POSITION MANUAL SWITCH</p>		
<p>(57) Abstract</p>		
<p>A manual switch (2) has a switching plate (9), which can be tilted to several sides and is mounted on a mounting (10). This switching plate (9) can move with star-shaped actuating arms that correspond to the contact arms of a contact spring (7) in the direction of a printed circuit board (6), so that it can close a circuit. At any switch position one can switch back directly into the zero position by means of an adjusting arm (13) by moving the switching plate (9) back into its non-tilted position.</p>		

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## MULTIPLE POSITION MANUAL SWITCH

## BACKGROUND OF THE INVENTION

The invention relates to a multi staged manual switch to selectively close several electrical connections and to interrupt the switched connections, in particular for an electric toothbrush in order to switch on and off different output stages of a toothbrush motor.

Manual switches of the aforementioned kind are employed in numerous electric devices and are known and useful in very different designs. In the case of an electric toothbrush for example, one can switch on different motor speeds with such a manual switch. In the case of a hair dryer correspondingly different heating stages can be selected.

To date such manual switches have been designed as multi stages rotary switches for smaller electric devices used by consumers, for example, for electric toothbrushes or hair dryers. In such rotary switches the sequence of the switching operation is automatically fixed. From the zero position one can switch only into the first and thereafter into the respective other switch position. Even when switching the device off, one has to switch back again from a higher switching stage through all of the lower switching stages, in order to reach the zero position. This manipulation is perceived frequently as tedious.

Of course, it is also known in the state of the art to arrange several pressure contact switches side-by-side in order to switch on several output stages. Then the interrupter has to be coupled to the individual pressure contact switches of the different output stages, so that, when the interrupter is depressed, all of the pressure contact switches are switched back into their zero position. Pressure contact switches with such features are, however, quite

expensive so that to date they are not common in smaller, inexpensive devices for consumer use on account of the cost.

The invention is based on the problem of designing a multi staged manual switch of the aforementioned kind that is constructed as simply as possible so that its switching stages and also its zero position can be switched in any arbitrary sequence.

#### SUMMARY OF THE INVENTION

This problem is solved according to the invention in that the manual switch has a contact spring, which is to be connected to an electric pole and has several star-shaped contact arms in accordance with the number of switching stages. A switching plate is mounted tiltably on a central mounting above the contact spring in order to depress and move against a fixed contact of any arbitrary contact arm. The switching plate is provided with star-shaped actuating arms, which correspond to the contact arms and reach over the contact spring.

With such a multi staged manual switch one can reach different switch positions by tilting the switching plate in different directions. Therefore, only one simple manual switch with only one actuator, namely the switching plate, is required to switch several switching stages. Since the manual switch according to the invention has only one single switching plate, the zero position can be reached by moving the switching plate back into its non-tilted position out of any switch position by means of a single movement of the switching plate, so that in the case of rotary switches one can dispense with the tedious switching through different switching stages when one wants to reach the zero position from a higher switching stage.

The multi staged manual switch according to the invention can be a push button, which remains in the respective switch

position against the force of the contact spring only until an actuating force is exerted on its switching plate, thus for example, until one presses with a finger on its switching plate or on a component that is connected to said switching plate. However, according to an advantageous embodiment of the invention the manual switch can also be designed as a set switch, if a click-stop device is assigned to each actuating arm, in order to fix force-lockingly the actuating arm in its tilted position holding the respective contact arm against a fixed contact.

To reset the switching plate into its non-tilted normal position, in which the manual switch is situated in its zero position, there are clearly perceivable setting paths, if, according to another embodiment of the invention, the switching plate has a return lever in order to move said switching plate out of a tilted, locked position into a non-tilted position causing the manual switch to open.

For every switching of an output stage of the manual switch the return lever swivels in the same direction transversely to the plane of the printed circuit board, if said return lever is pivot-mounted on one side of the switching plate and rests on the side of the switching plate opposite the contact spring. With such a design it is possible to move the return lever back into its normal position by depressing a reset key and thus to reach the zero position of the manual switch from any switch position merely by pressing the reset key.

The switching plate could be operated directly for switching. For application in small, electric devices, however, it is expedient, if there are moveable keying bodies

in order to actuate the actuating arms of the switching plate and the return lever against the spring force in the direction of the actuating arms and the return lever.

The zero position of the manual switch can also be switched indirectly, if, according to another embodiment of the invention, the return lever has on the side opposite its swivelable bearing an adjusting arm, which projects beyond the switching plate and against which the related keying body rests.

The manual switch according to the invention can be arranged in a simple manner sealingly in a housing, if the keying bodies are formed by means of projections of an electric switch cap covering the manual switch.

The design of the mounting, which enables the tilting of the switching plate, can vary widely. For example, it can be a ball socket with which the switching plate with a ball end engages. The manual switch is designed in an especially simple manner if the mounting exhibits a bearing region with outwardly descending bearing surfaces, if the switching plate is held on this bearing region by an axle penetrating the contact spring and the switching plate and if the axle has on the side of the switching plate opposite the contact spring at a distance from the switching plate a head forming an abutment for the switching plate.

The locking of the actuating arms into the respective switch position results in a very low cost for constructing the manual switch, if the switching plate hold for each actuating arm of the switching plate has two elastic guide arms, which extend on the side along the respective actuating arm and which exhibit as the click-stop device a stop projection directed in the direction of the respective actuating arm.

The construction of the manual switch can be simplified even more, if the contact spring is mounted directly on a conducting track of a printed circuit board and its contact arms are designed for making contact with other conducting tracks of the printed circuit board.

The assembly of the manual switch does not involve a great deal of complexity, if, according to another embodiment of the invention, the switching plate holder grasps with an extension through a passage of the contact spring and is fixed in an opening of the printed circuit board.

The invention allows numerous embodiments. To further elucidate the basic principle one of them is depicted in the drawings and is described in the following.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a longitudinal view of a fragment of an electric toothbrush with the manual switch according to the invention.

Figure 2 is a top view of a printed circuit board of the manual switch.

Figure 3 is top view of a contact spring of the manual switch.

Figure 4 is a side view of the contact spring.

Figure 5 is a sectional view of a switching plate holder of the manual switch.

Figure 6 is a top view of the switching plate holder.

Figure 7 is a side view of a switching plate of the manual switch.

Figure 8 is a top view of the switching plate.

Figure 9 is a longitudinal view of the manual switch in a first switch position.

Figure 10 is a top view of the manual switch.

Figure 11 is a longitudinal view of the manual switch in a second switch position.

Figure 12 is a longitudinal view of the manual switch in the zero position.

#### DETAILED DESCRIPTION

Figure 1 shows a subregion of a housing 1 of an electric toothbrush, into which is installed a manual switch 2. To operate this manual switch 2, the housing 1 has an elastic switching cap 3, which has keying bodies 4 and 5, projecting into the housing 1. In addition to these keying bodies, this embodiment also has two other keying bodies, which cannot be seen, however, in Figure 1. If the keying body 4 is depressed, the manual switch 2 switches back into its zero position. If the keying body 5 or one of the two other keying bodies (not visible) is depressed, a specific output stage of the toothbrush is switched on.

Inside the housing 1, the manual switch 2 has a printed circuit board 6, on which is mounted a contact spring 7, is held by means of a switching plate housing 8. This switching plate housing 8 braces a switching plate 9, which rests tiltably on a mounting 10. The individual switch positions of the manual switch 2 result from varying tilted positions of the switching plate 9, wherein the tilting is caused by pressing the keying body 5 and the other keying bodies (not illustrated). Above the switching plate 9 is a return lever 11, which can be pivoted on one side of the switching plate housing 8 by means of a bend 12, leads away over the switching plate 9 on the side opposite the contact spring 7, and has on the side opposite its swivelable bearing an adjusting arm 13, against which the keying body 4 rests. If the keying body 4 is depressed, then the adjusting arm 13 is moved to the right, as shown in Figure 1. Then the return lever 11 presses the upper end of the switching plate 9 to the right, resulting in the bottom end of the switching plate 9 swiveling to the left



and thus assuming its zero position extending parallel to the printed circuit board 6.

Figure 1 also depicts an axle 14, which penetrates the switching plate 9, is locked with its right end, as shown in Figure 1, in the switching plate housing 8 and has on the opposite side a head 15 reaching over the switching plate 9.

The top view of the printed circuit board 6 depicted in Figure 2 shows that said printed circuit board has conducting tracks 16, 17, 18, 19. The conducting tracks 16, 17, 18 have, at a distance from a circular opening 20 in the printed circuit board 6, a fixed contact 21, 22, 23, formed by a surface expansion.

The top view of the contact spring 7 depicted in Figure 3 shows that said contact spring has a passage 24 corresponding to the opening 20 in the printed circuit board 6. Furthermore, said spring exhibits three contact arms 25, 26, 27, which point diagonally to the top as shown in Figure 4. This contact spring 7 is mounted in such a manner on the conducting track 19 of the printed circuit board 6 that its passage 24 aligns with the opening 20. Depending on to which side the switching plate 9, shown in Figure 1, is tilted, it pushes one of the contact arms 25, 26, 27 against one of the fixed contacts 21, 22, 23 of the printed circuit board 6; respectively.

Figures 5 and 6 show the shape of the switching plate housing 8. It is apparent from Figure 5 that said housing has an extension 28 which protrudes at the bottom as shown in Figure 5 and which fits exactly through the passage 24 of the contact spring 7 and through the opening 20 of the printed circuit board 6 and can, thus, fix the contact spring 7 on the printed circuit board 6, a feature that is also evident from Figure 1. Furthermore, Figure 5 shows clearly that the mounting 10 on both sides of the bore hole 29, into which is installed the axle 14, shown in Figure 1, has a bearing surface 30, 31, which descends outwardly as seen starting from

the bore hold 29. The switching plate 9 rests in its tilted position against one of these bearing surfaces 30, 31.

Figure 6 shows that the switching plate housing 8 has three pairs of elastic guide arms 32, 33; 34, 35; 36, 37 that are outwardly directed in the shape of a star when viewed starting from the bore hold 29. The free cross section between the respective guide arms 32-37 is constricted in the vicinity of their respective free end by means of a click-stop device 38, which consists of a stop projection 39, 40, which projects into the space between the guide arms 32-37.

The exact shape of the switching plate 9 can be seen in Figures 7 and 8. Said switching plate has a central bore hold 41, from which three actuating arms 42, 43, 44 lead outwardly in the shape of rays. Said arms are dimensioned in such a manner that they are situated between the pairs of guide arms 32, 33; 34, 35 and 36, 37 above the respective click-stop device 38 when the switching plate 9 installed in the switching plate housing 8 is not tilted. The keying body 5 shown in Figure 1 and the two other keying bodies (not visible) for actuating the switching plate 9 are arranged in such a manner that each keying body 5 can push down one of the actuating arms 42, 43, 44. Said keying body can then push the corresponding contact arm 25, 26, 27 of the contact spring 7, shown in Figure 3, against the corresponding fixed contact 21, 22, 23 of the printed circuit board 6, shown in Figure 2, so that the corresponding switching stage of the manual switch 2 is switched.

When the switching plate 9 is in the position shown in Figure 9, said switching plate is swivel led with its actuating arm 42 in the direction of the printed circuit board 6, so that said plate presses the contact arm 25 of the contact spring 7 against the fixed contact 21, thus switching a first switching stage. In this position, the switching plate 9 lies on the bearing surface 30. At the same time said switching plate has swung the return lever 11 slightly

counter-clockwise around a swivelable attachment, attached by means of the bend 12.

The top view according to Figure 10 shows below the return lever 11 the switching plate 9 with its actuating arms 42, 43, 44. Furthermore, the switching plate housing 8 can be seen that guides these actuating arms 42, 43, 44 with the guide arms 32, 33, 34, 35, which can be seen in Figure 10, and the guide arms 36, 37, which can also be seen in Figure 6.

In Figure 11 the switching plate 9 is swung in the opposite direction to the position according to Figure 9 by pressing on the actuating arm 43 or 44. Then, instead of bracing against the bearing surface 30, it braces in part on the bearing surface 31. Depending on whether it is also swung to the front or the rear, whether the actuating arm 43 or 44 was pushed down, the contact arm 26 or 27 makes contact with the fixed contact 22 or 23, so that either a second or third switching stage is switched. In these positions the return lever 11 was in turn lifted slightly.

If the adjusting arm 13 of the return lever 11 is depressed in the position of the return lever 11, shown in Figures 9 and 11, by depressing the keying body 4, said adjusting arm pushes the switching plate 9 back into a position parallel to the printed circuit board 6, a feature that is shown in Figure 12 and in which none of the fixed contacts 21, 22, 23 is contacted. Thus, it is possible to switch into the zero position from any switch position by depressing the keying body 4.

## List of Reference Numerals

1	housing	26	contact arm
2	manual switch	27	contact arm
3	switching cap	28	extension
4	keying body	29	bore hole
5	keying body	30	bearing surface
6	printed circuit board	31	bearing surface
7	contact spring	32	guide arm
8	switching plate housing	33	guide arm
9	switching plate	34	guide arm
10	mounting	35	guide arm
11	return lever	36	guide arm
12	bend	37	guide arm
13	adjusting arm	38	click-stop device
14	axle	39	stop projection
15	head	40	stop projection
16	conducting track	41	bore hole
17	conducting track	42	actuating arm
18	conducting track	43	actuating arm
19	conducting track	44	actuating arm
20	opening		
21	fixed contact		
22	fixed contact		
23	fixed contact		
24	passage		
25	contact arm		

## Patent Claims

1. Multi staged manual switch to selectively close several electrical connections and to interrupt the switched connections, in particular for an electric toothbrush in order to switch on and off different output stages of a toothbrush motor, wherein the manual switch (2) has a contact spring (7), which is to be connected to an electric pole and exhibits several star-shaped contact arms (25, 26, 27) in accordance with the number of switching stages and above which in order to depress and move against a fixed contact (21, 22, 23) of any arbitrary contact arm (25, 26, 27) a switching plate (9) is mounted tiltably on a central mounting (10), provided with star-shaped actuating arms (42, 43, 44), which correspond to the contact arms (25, 26, 27) and reach over the contact spring (7).

2. Multi staged manual switch, as claimed in claim 1, wherein a click-stop device (38) is assigned to each actuating arm (42, 43, 44), in order to releasably engage the actuating arm (42, 43, 44) in its tilted position holding the respective contact arm (25, 26, 27) against a fixed contact (21, 22, 23).

3. Multi staged manual switch, as claimed in claim 1 or claim 2, wherein the switching plate (9) has a return lever (11) in order to move said switching plate out of a tilted, locked position into a non-tilted position causing the manual switch (2) to open.

4. Multi staged manual switch, as claimed in claim 3, wherein the return lever (11) is pivot-mounted on one side of the switching plate (9) and rests on the side of the switching plate (9) opposite the contact spring (7).

5. Multi staged manual switch, as claimed in at least one of the preceding claims, wherein there are moveable keying bodies (4, 5) in order to actuate the actuating arms (42, 43, 44) of the switching plate (9) and the return lever (11) against the spring force in the direction of the actuating arms (42, 43, 44) and the return lever (11).

6. Multi staged manual switch, as claimed in at least one of the preceding claims, wherein the return lever (11) has on the side opposite its swivelable bearing an adjusting arm (13), which projects beyond the switching plate (9) and against which the movable keying body (4) rests.

7. Multi staged manual switch, as claimed in at least one of the preceding claims, wherein the keying bodies (4, 5) are formed by means of projections of an elastic switch cap (3) covering the manual switch (2).

8. Multi staged manual switch, as claimed in at least one of the preceding claims, wherein the mounting (10) exhibits a bearing region with outwardly descending bearing surfaces (30, 31); wherein the switching plate (9) is held on this bearing region by an axle (14) penetrating the contact spring (7) and the switching plate (9); and wherein the axle (14) has on the side of the switching plate (9) opposite the contact spring (7) at a distance from the switching plate (9) a head (15) forming an abutment for the switching plate (9).

9. Multi staged manual switch, as claimed in at least one of the preceding claims, and further comprising a switching plate housing (8) which includes two elastic guide arms (32-37) for each actuating arm (42, 43, 44) of the switching plate (9), said elastic guide arms (32-37) extending on opposite sides of

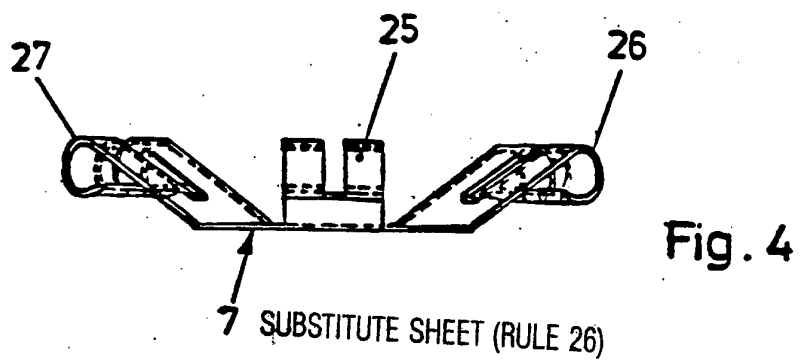
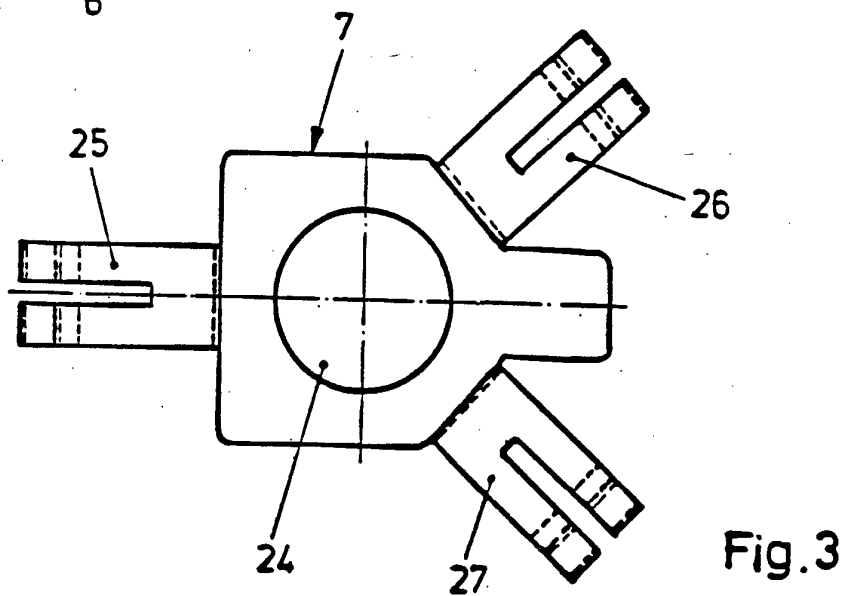
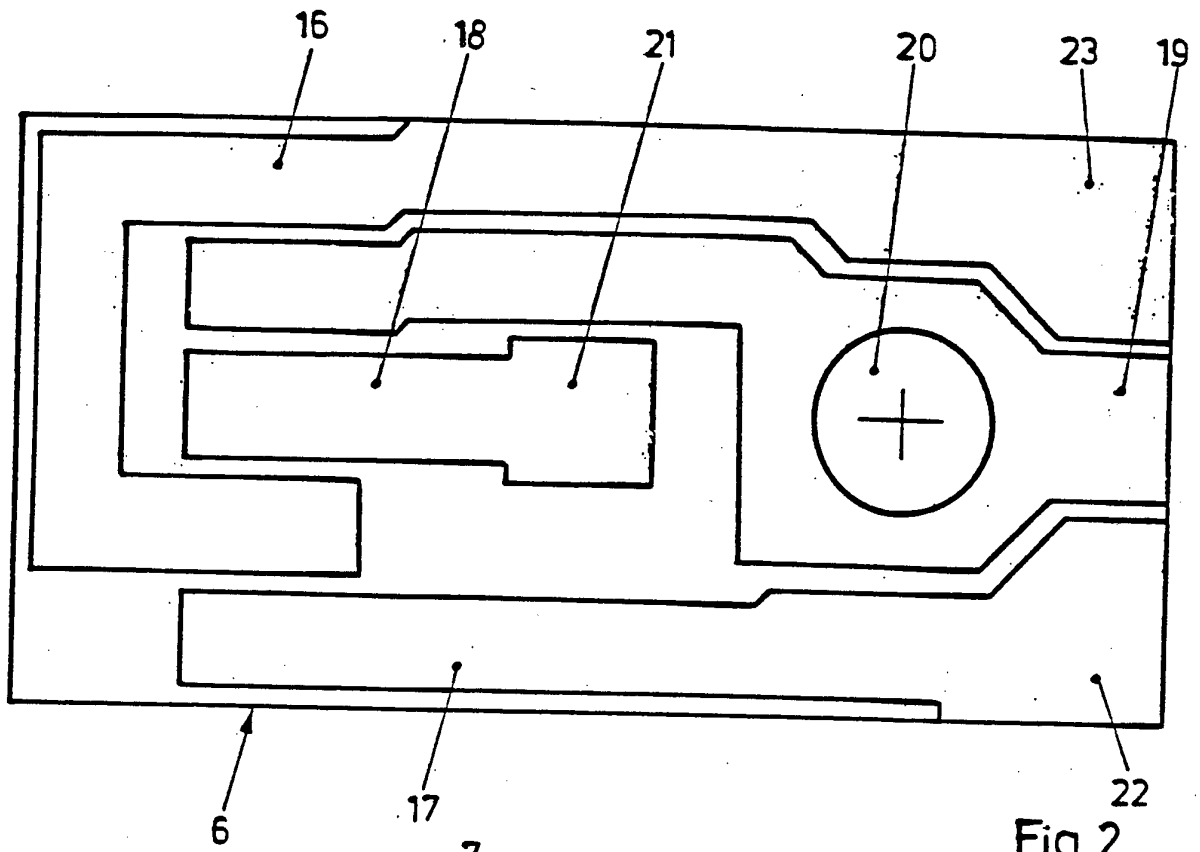
the respective actuating arm (42, 43, 44) and which exhibit as the click-stop device (38) a stop projection (39, 40) directed in the direction of the respective actuating arm (42, 43, 44).

10. Multi staged manual switch, as claimed in claim 1, wherein the contact spring (7) is mounted directly on a conducting track (19) of a printed circuit board (6) and its contact arms (25, 26, 27) are designed for making contact with other conducting tracks (16, 17, 18) of the printed circuit board (6).

11. Multi staged manual switch, as claimed in claim 10, wherein the switching plate housing (8) grasps with an extension (28) through a passage (24) of the contact spring (7) and is fixed in an opening (20) of the printed circuit board (6).







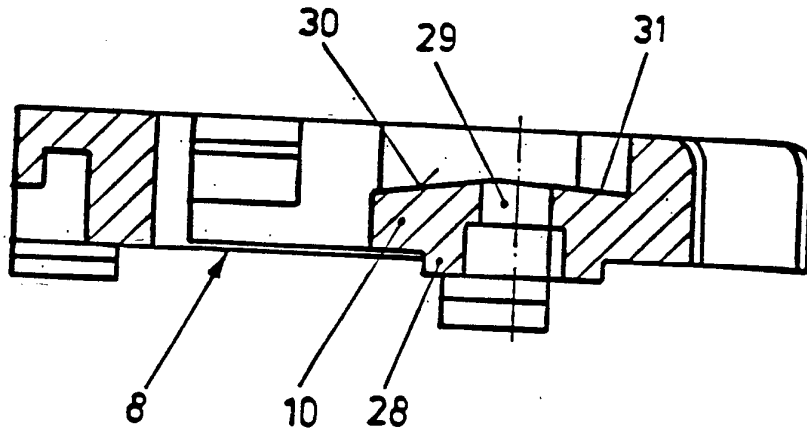


Fig. 5

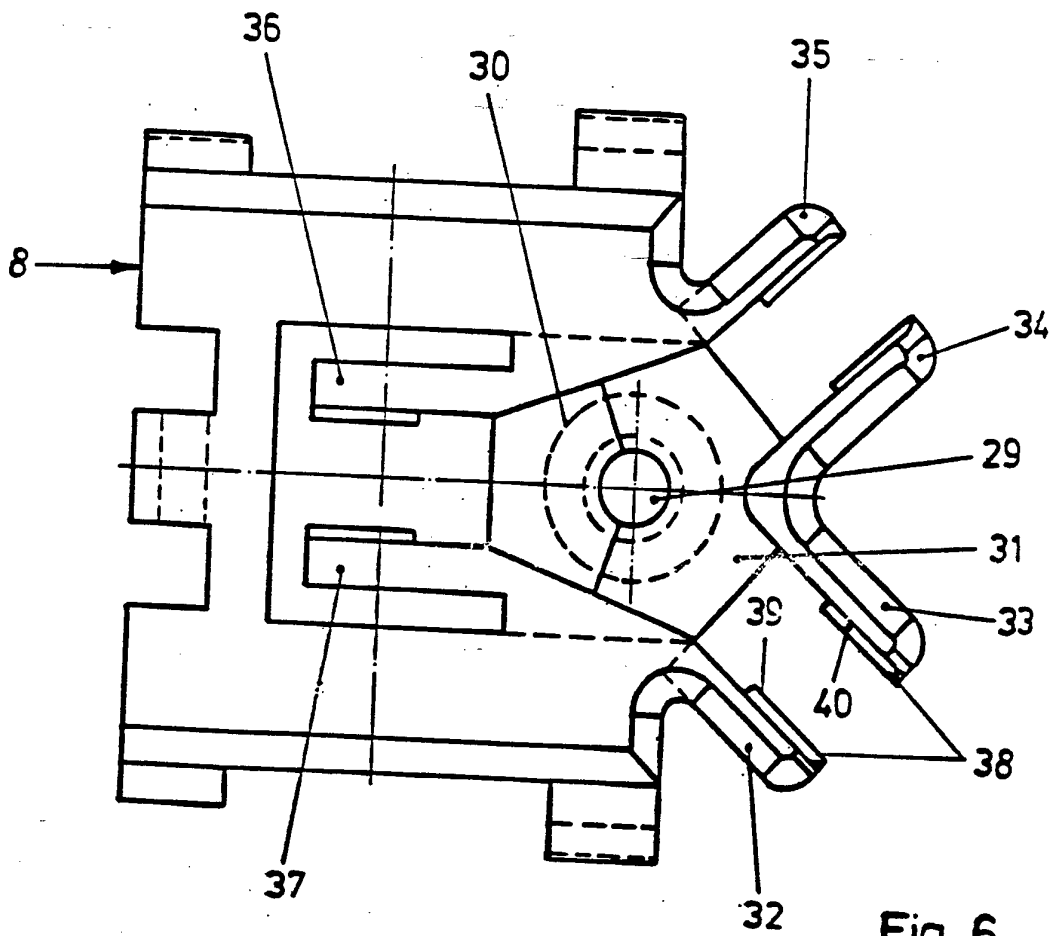


Fig. 6

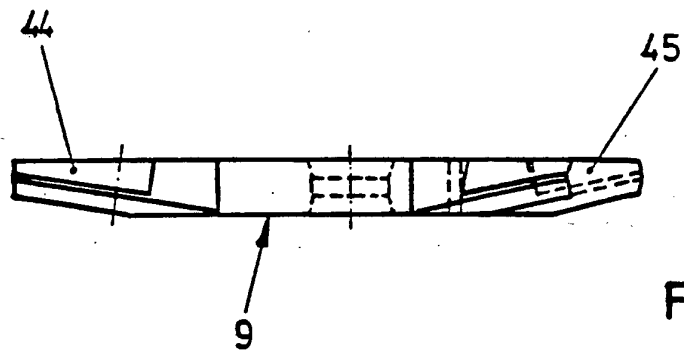


Fig. 7

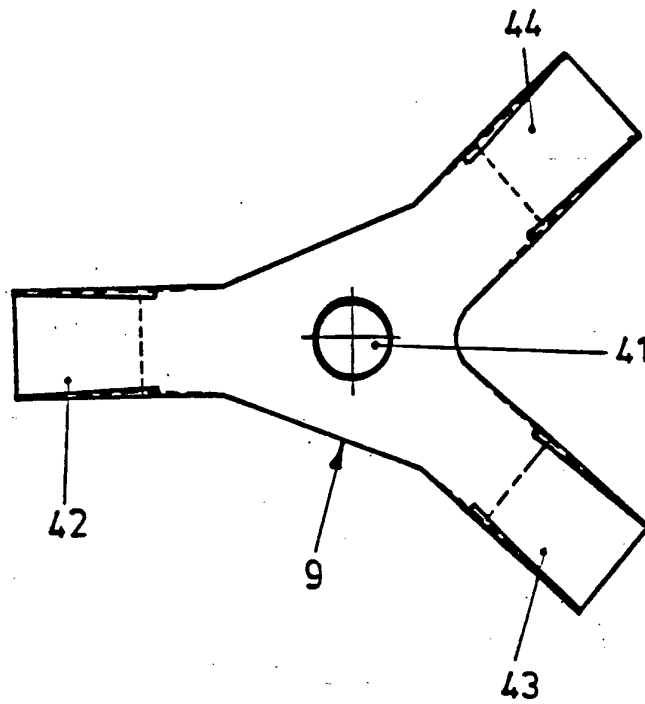


Fig. 8

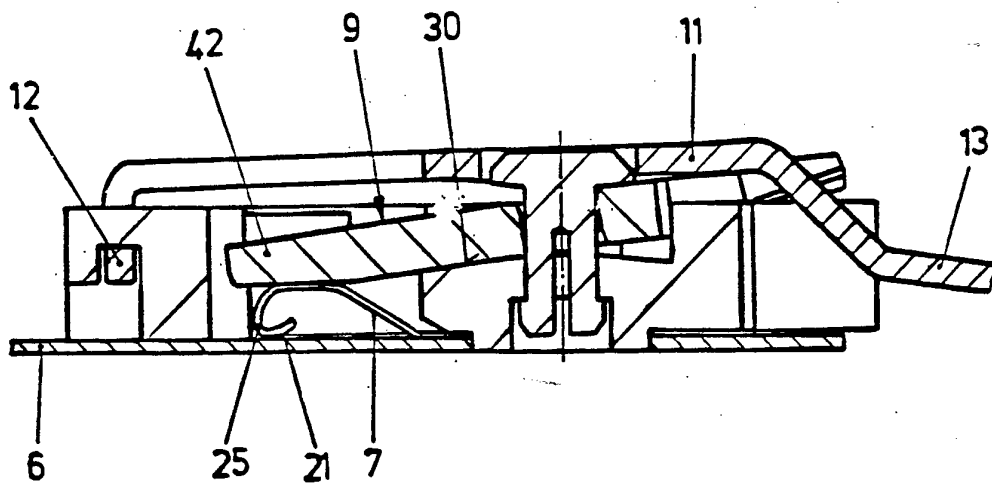


Fig. 9

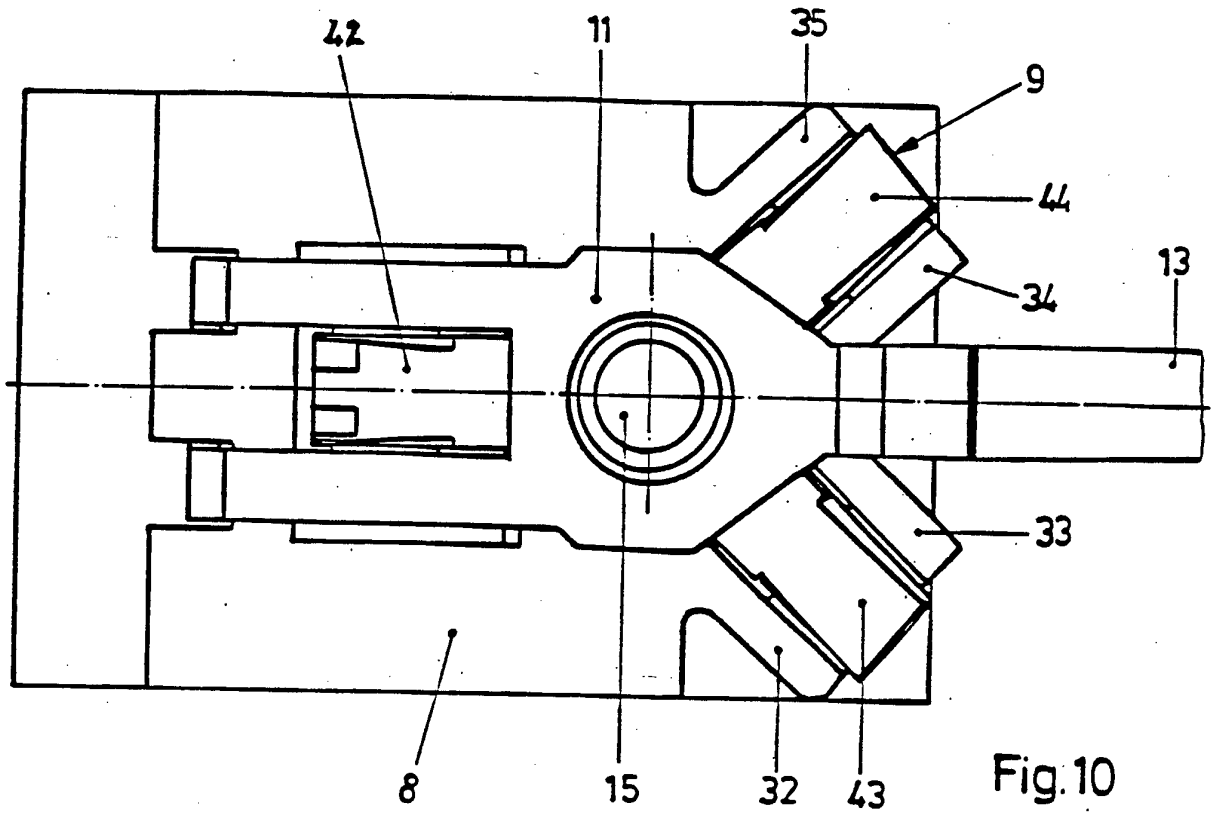


Fig. 10

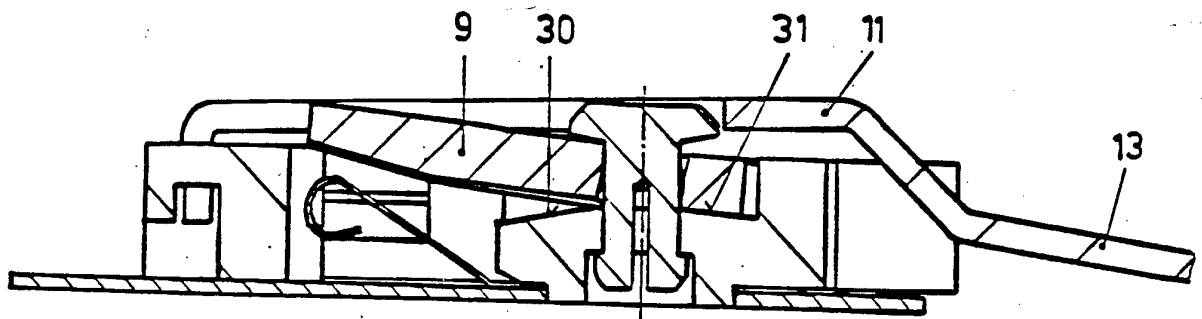


Fig. 11

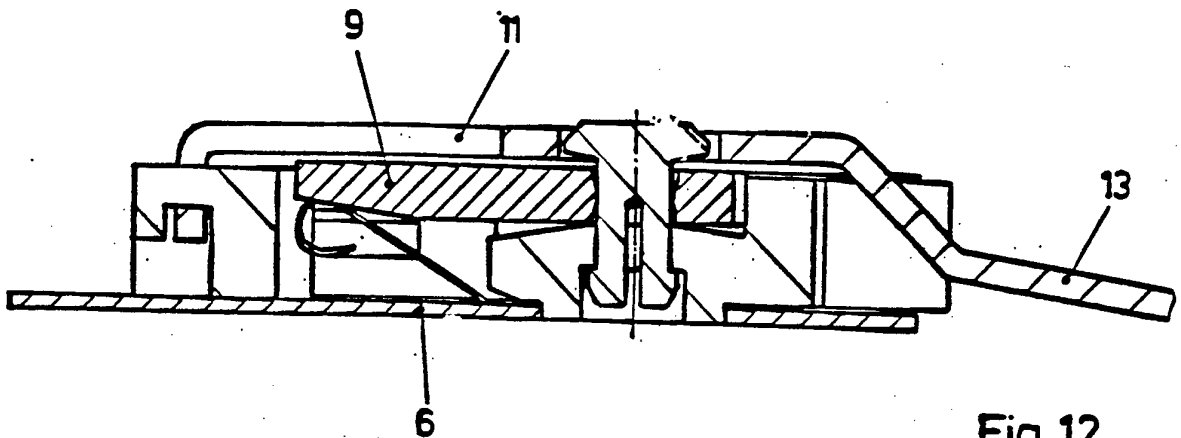


Fig. 12

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 94/13579

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 6 H01H13/70		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) IPC 6 H01H A61C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 086 313 (ASAHI KOGAKU KOGYO) 4 February 1992 see column 3, line 3 - column 4, line 61 ---	1
A	US,A,4 479 516 (F.M.HUNTER) 30 October 1984 see column 2, line 55 - line 62 ---	1
A	FR,A,1 427 082 (LABORATOIRES D'ÉLECTRICITÉ ET DE PHYSIQUES APPLIQUÉES) 27 December 1965 see page 2, left column, paragraph 3-4 ---	1-3
A	EP,A,0 123 184 (BEBIÉ+CO) 31 October 1984 see page 22, line 1 - line 29 -----	1-3,7
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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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