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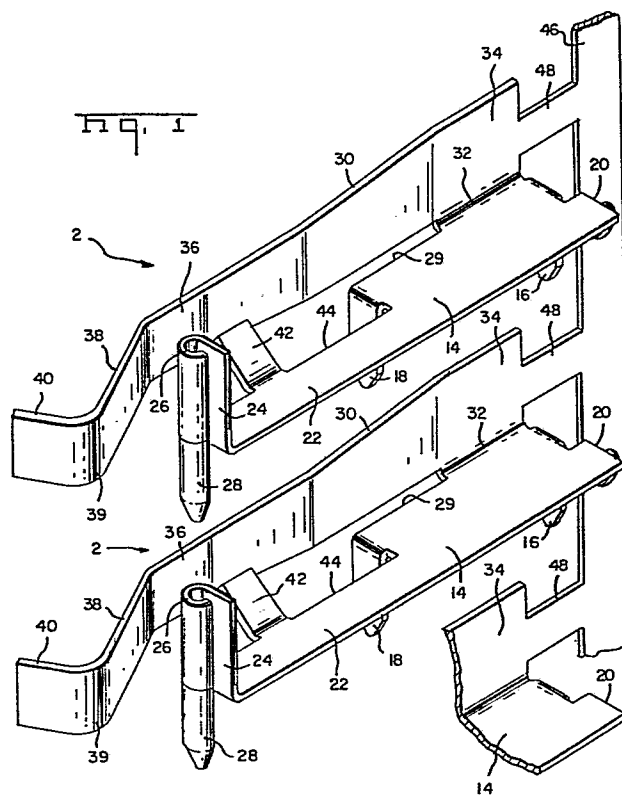
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(54) Switch device for use on circuit board.

(57) One piece stamped and formed switch (2) which is intended for mounting on a circuit board (8) comprises an elongated flat base (14) having mounting tabs (16, 18, 28) extending from its ends. A flange (24) extends from one of the ends in the opposite direction from the direction of the mounting tabs and provides a fixed contact surface (26). A cantilever spring (30) is integral with the base (14) at the opposite end and extends alongside the base past the flange (24). In use, the switch device is mounted on the circuit board (8) by inserting the mounting tabs (16, 18, 28) through holes (4, 6) in the circuit board. Thereafter, an intermediate portion (22) of the base is removed by shearing so that the remaining portions are electrically isolated from each other and the spring arm can be engaged with the flange to close a circuit between the conductors on the underside of the circuit board.



Switch Device for use on circuit board

This invention relates to a stamped and formed sheet metal switch which is intended for mounting on a circuit board for switching conductors on the circuit board.

U.S. Patent 4,152,556 discloses a stamped and formed sheet metal switch device having a cantilever spring, a mounting tab for mounting the spring on a circuit board, and a fixed contact which is also intended to be mounted on a circuit board. The parts of the switch shown in that patent publication are produced by stamping and forming sheet metal and are all integral with each other. After the switch is assembled to the circuit board, connecting portions of the switch device which connect the fixed contact to the spring arm are removed so that the spring arm is electrically isolated from the switch contact. The switch is therefore a normally open switch which can be closed by moving the spring arm against the fixed contact. The fixed contact and the spring arm are connected to the circuit board conductors so that movement of the spring arm against the fixed contact completes a circuit path between the circuit board conductors.

The switch shown in U.S. Patent 4,152,556 is normally open and it would be desirable to produce a switch, by stamping and forming sheet metal, which would be normally closed after being assembled to the circuit board.

The present invention in accordance with one aspect thereof is directed to the achievement of a one-piece switch device which, after assembly to a circuit board forms a normally closed switch. In accordance
5 with a further aspect, the invention is directed to the production of switch devices in strip form so that individual switch devices can be mounted in circuit boards by means of automatic and semi-automatic insertion machines.

10 A switch device in accordance with the invention comprises a one-piece stamped and formed switch having a cantilever contact spring that has a fixed end and a free end, a contact post which is contacted by the contact spring, and mounting members for mounting
15 the fixed end of the contact spring in a circuit board. The contact post is connected to the switch by removable portions of the stamped and formed part which are removed after the switch is assembled to the circuit board. A switch in accordance with the invention is
20 characterized in that the free end of the cantilever contact spring is resiliently biased towards the contact portion and the free end of the cantilever contact spring is held in a location which is spaced from the contact post by an integral stop. The stop is disengaged from the cantilever spring after the spring has
25 been inserted into the circuit board so that the spring arm moves against the contact post under the influence of its resilient bias.

One embodiment of the invention has an integral stop for the contact spring which is removed from
30 the switch after the switch is inserted into the circuit board. An alternative embodiment has a stop which is simply bent after insertion of the switch into the circuit board so that the stop is disengaged from the
35 spring arm.

Specific examples of switches according to

the invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a short section of strip having switch devices in accordance with the invention integral therewith.

FIGURE 2 is a perspective view showing a switch device mounted on a circuit board prior to soldering of the mounting post and tabs to the circuit board conductors.

FIGURE 3 is a view similar to Figure 2 showing the appearance of the parts after soldering and after removal of intermediate portions of the base of the switch.

FIGURE 4 is a plan view of the switch on the circuit board prior to soldering.

FIGURE 5 is a plan view of a short section of a carrier strip having switch blanks integral therewith.

FIGURE 6 is a view looking in the direction of the arrows 6-6 of Figure 5.

FIGURE 7 is a perspective view of another embodiment of the invention showing the switch spaced from the surface of a circuit board.

FIGURE 8 is a view showing the switch installed on the circuit board.

FIGURE 9 is a plan view of the flat blank from which the switch of Figure 7 is formed.

As shown in Figure 3, a switch device 2 in accordance with the invention is intended for mounting in holes 4, 6 in a circuit board 8 having conductors 10, 12 on its underside. The switch device provides switching between these conductors, the disclosed form of the invention being a normally closed switch so that a circuit path will exist between the conductors until the switch is opened.

Prior to insertion into the holes 4, 6, the switch device 2 comprises a relatively elongated flat base portion 14 having a tab 16 extending downwardly from the first end 20 thereof and having an additional
5 tab 18 extending downwardly from the base intermediate its ends. The lefthand portion as viewed in the drawing 22 of the base is of reduced width and has an up-
standing flange 24 at its end. The flange 24 has a laterally extending ear portion which is rolled as shown
10 at 26 to form a contact post on the upper surface of the circuit board. The rolled ear portion extends downwardly beneath the plane of the base 14 to provide a mounting post 28 which is soldered to the conductor 12 on the circuit board.

15 A cantilever spring arm 30 extends beside the lefthand edge 29 of the base portion and is integral at its fixed end 34 with the base portion as shown at 32. As will be explained below, the spring arm is formed when a flat spring blank is bent upwardly from
20 the plane of the base portion 14.

The spring arm is of reduced width along its length and has a contact portion 36 which is opposed to the surface of the contact post 26. The spring arm extends obliquely towards and past the post from the
25 contact portion as shown at 38 and is then bent as shown at 39 to provide a free end portion 40.

The spring arm 30 has a resilient bias urging it to move towards and against the surface of the contact post 26, however, in its as-manufactured form, the
30 spring arm is maintained in spaced relationship to the contact post by means of a stop 42 which is integral with the edge 44 of the reduced width portion 22 of the base. This stop extends obliquely upwardly from the plane of the base and bears against the surface of
35 the contact spring.

Switch devices in accordance with the

invention are produced in continuous strip form, each switch device being connected to a carrier strip 46 by means of a connecting section 48 which extends from the righthand edge of the spring arm at the fixed end thereof.

5 In use, an individual switch device is removed from the carrier strip and inserted into the holes 4, 6 of the circuit board as shown in Figures 2 and 4. The tabs 16, 18 are then clinched against the conductor 10 of the circuit board and the lower ends of these tabs and the lower end of the mounting post 6 are all soldered to the conductors. As shown in Figure 4, the circuit board is provided with an enlarged hole 52 beneath and intermediate portion of the base 14 and beneath the stop 42. After soldering, an intermediate portion of the base, including the stop 42, is removed by shearing as shown at 50, and the spring arm 30 thereafter moves against the surface of the post 26. The spring arm can be disengaged from the post by simply flexing it away from the post. The flexing force can be applied against the end portion or the reverse bend 39 of the spring arm.

15 Figure 5 shows a short section of a strip of blanks from which switch devices in accordance with the invention are formed. The parts of the blanks are identified with the same reference numerals, differentiated by prime marks, as were used above in the description of the formed switch devices. As is apparent from Figure 5, contact metal such as gold can be plated in a narrow band of the strip as shown at 56 and in the formed switch device of Figure 1, the plated surfaces will be on the rolled contact post 26 and on the contact surface 36. The plating is applied to only one surface of the strip of Figure 5 since the surface of the post and the contact surface 36 are both on the visible sides of the blanks of Figure 5.

The preloading or prestressing of the cantilever spring arm 30 is achieved by imparting the profile shown in Figure 6 to the portion 30' of the blank prior to bending the base portion from the plane of the blank to its position as shown in Figure 1. The stop member 42' may be struck upwardly from the plane of the blank so that it will engage the spring arm 30'. When the spring arm 30' is formed as shown in Figure 6, the end portion 40' is drawn inwardly as is apparent from a comparison of the lower blank in Figure 5, which has an unformed or flat spring arm 30', with the upper blank.

Switch devices in accordance with the invention can easily be inserted into circuit board holes by means of automatic or semi-automatic insertion machines. By virtue of the fact that two tabs 16, 18 are provided and these tabs are clinched against the underside of the circuit board after insertion, the holes 4 which receive the tabs can be relatively oversized. The hole 6 which receives the integral solder post 28 will be slightly oversized relative to the diameter of the solder post. The two tabs 16, 18 are precisely located relative to each other during manufacture since they are formed from the same section of the blank and are adjacent to each other.

Figures 7 and 8 show another switch 58 in accordance with the invention, having a cantilever contact spring arm 60 which extends from a base 62. The base 62 extends in a plane that is normal to the surface of the circuit board 8 when the switch is installed and which is also normal to the plane of the contact spring arm 60. A fixed support arm 64 extends from the base 62 alongside the spring arm 60 and mounting tabs 66 are formed on the lower edge of this support arm. An ear 68 extends laterally from the lower edge of the support arm beneath the lower edge of the

contact spring 60 and the fixed contact post 70 is formed on the end of the ear 68.

5 An additional ear 72 extends from the lower edge of the support arm 64, the ear 72 being between the ear 68 and the base 62. The ear 72 extends beyond the spring arm 60 and has an upwardly extending stop 74 on its end.

10 The contact spring arm 60 has a resilient bias such that it tends to move against the fixed contact post 70 but it is prevented from doing so prior to insertion into the circuit board by the stop 74. After insertion of the switch 58 into holes 76, 78 in the circuit board, the stop 74 is bent downwardly as shown in Figure 8, so that the spring arm 60 can move against
15 the fixed contact post 70. An opening 80 is provided in the circuit board 8 to receive the stop 74 when it is bent downwardly. The fixed contact post 70 is electrically isolated from the spring arm 60 by punching out a portion of the ear 68 as shown at 80. This
20 punching operation is also carried out after the switch is assembled to the circuit board.

The switch of Figure 7 may also be manufactured as a part of a continuous strip of switches with the individual switches extending from a carrier
25 strip 82. The switches are carried to the carrier strip by a connecting section 84 which is removed by severing prior to insertion of the switch into the circuit board holes.

Figure 9 shows a flat blank from which the
30 switch 58 is produced. The parts of the blank are identified with the same reference numerals, differentiated by prime marks, as are used above in the description of the switch. The finished switch is produced by bending and forming the blank shown in Figure 9 along the bend
35 lines required to give the switch its final form.

CLAIMS:

1. A one piece sheet metal switch (2, 58) which is intended to be inserted into a circuit board (8), the switch being of the type comprising a cantilever
5 contact spring (30, 60) having a fixed end (34, 62) and a free end (38), a contact post (26, 70) which is contacted by the free end of the contact spring, and mounting members (16, 18, 66) for mounting the fixed
10 end of the contact spring in the circuit board (8), the contact post being connected to the switch by removable portions (44, 68) which are removed after the switch is inserted into the circuit board, the switch being characterized in that:

the free end (38) of the cantilever con-
15 tact spring (30, 60) is resiliently biased towards the contact post (26, 70),

the free end of the cantilever contact
spring (38) is held in a location which is
20 spaced from the contact post by an integral stop (42, 74) which is disengaged from the cantilever spring arm after the switch is inserted into the circuit board so that the contact spring moves against the contact post
(26, 70) and the switch functions as a nor-
25 mally closed switch.

2. A one piece sheet metal switch as set forth in claim 1 in which the integral stop (42) is removed from the switch after the switch is inserted into the circuit board (8).

30 3. A one piece sheet metal switch as set forth in claim 1 in which the stop (74) is bent out of engagement with the spring arm after insertion of the switch is inserted into the circuit board.

4. A one piece sheet metal switch as set forth in
35 claim 1 having an elongated flat base (14) which is positioned against the circuit board (8) when the switch is inserted into the circuit board, the fixed end (34)

of the cantilever contact spring (30) being integral with the base.

5 5. A one piece sheet metal switch as set forth in claim 4 in which the base (14) extends alongside the cantilever contact spring (30) and the contact post (26) is integral with the base (14), and the stop (42) extends from the base portion to the cantilever spring (30) at a location between the fixed end (34) of the contact spring and the contact post (26).

10 6. A one piece sheet metal switch as set forth in claim 5, the removable portions being portions (50) of the base.

15 7. A one piece sheet metal switch as set forth in claim 5, the mounting members being mounting tabs (16, 18) extending from the base (14).

8. A one piece sheet metal switch as set forth in claim 7, the contact post (26) being on a flange (24) which extends from the base (14).

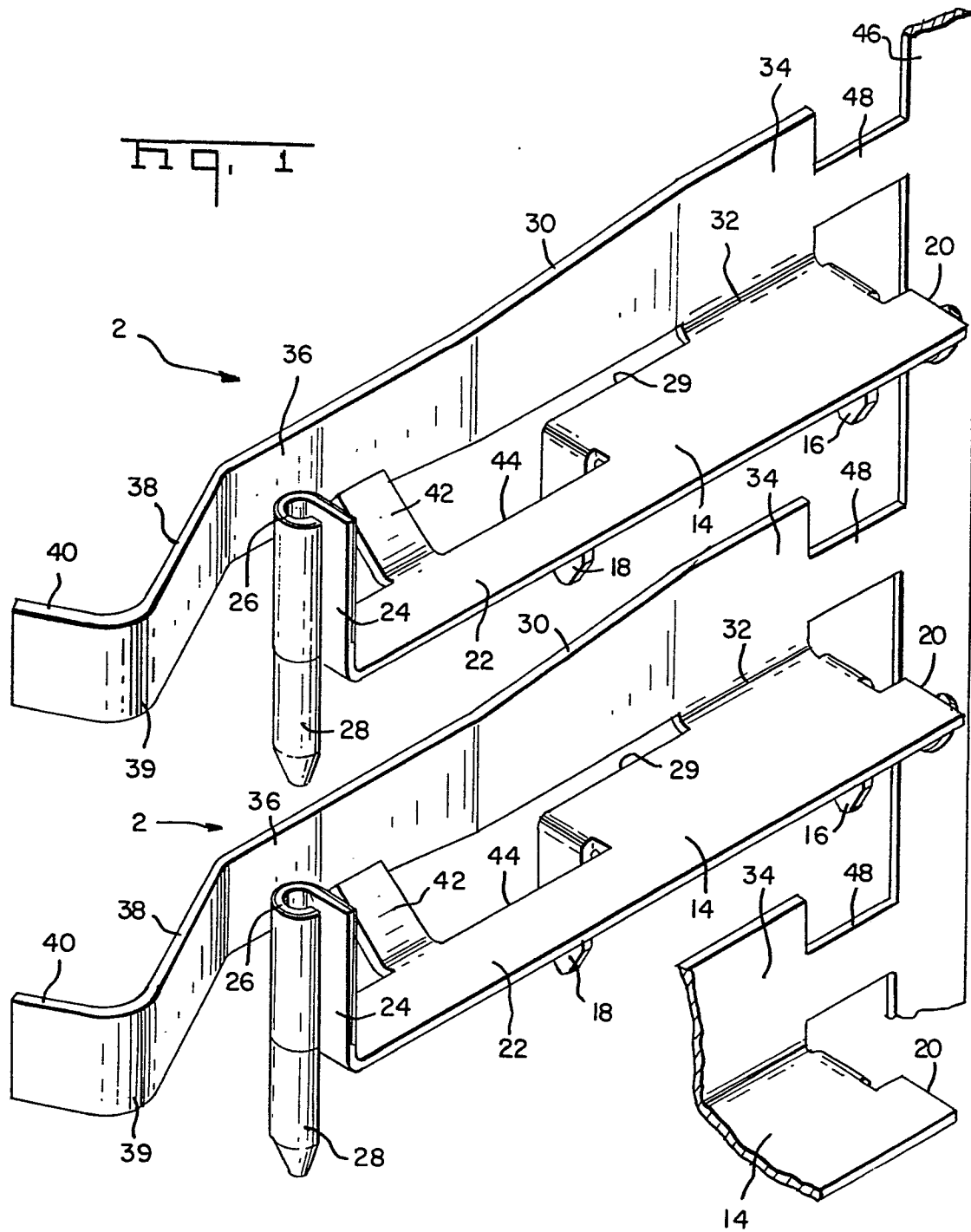
20 9. A one piece sheet metal switch as set forth in claim 8, the switch extending from a carrier strip (46) from which a plurality of identical switches extend.

10. A one piece sheet metal switch as set forth in claim 9, the switch being connected to the carrier switch by a connecting section (48).

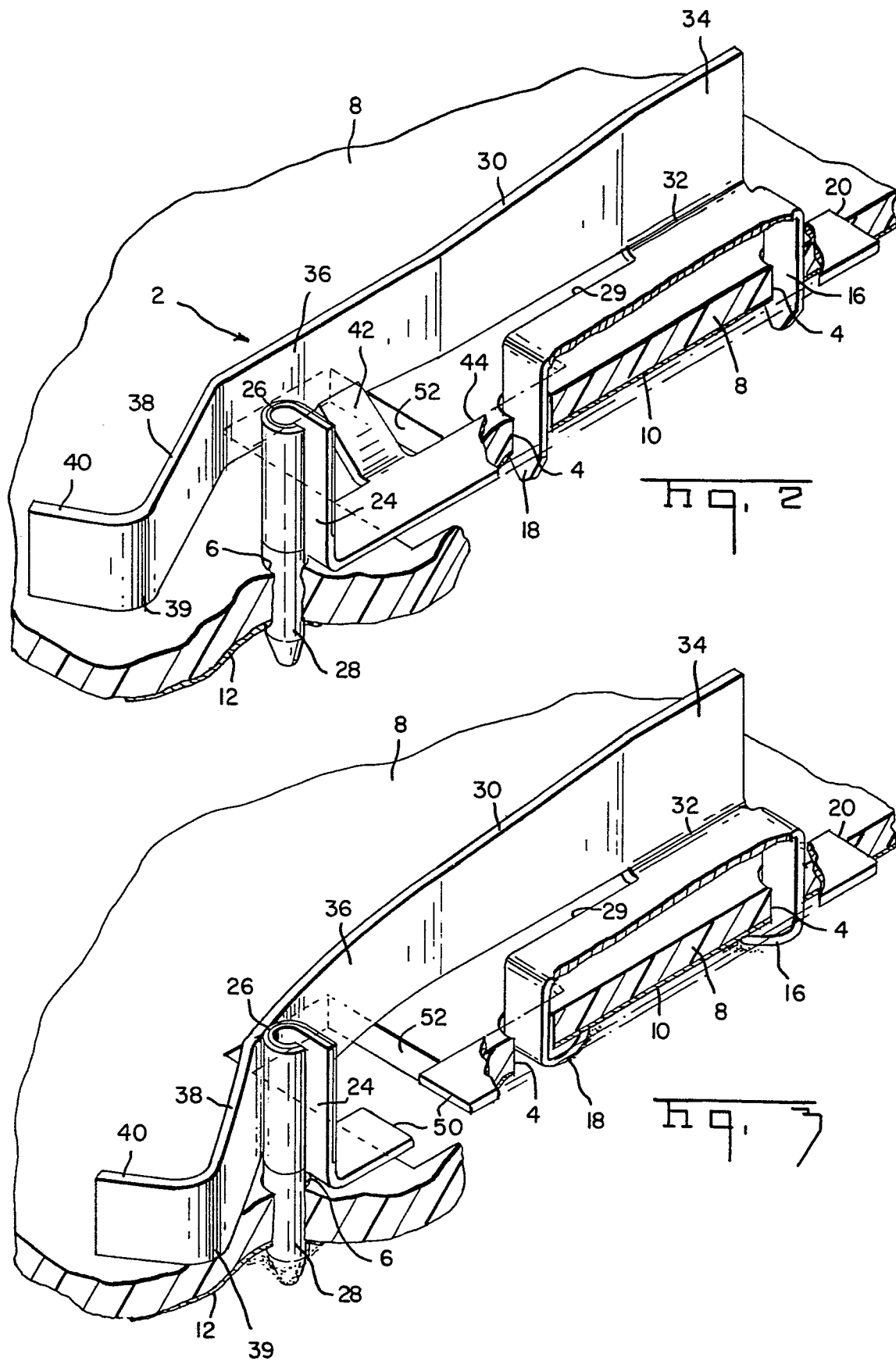
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Fig. 4

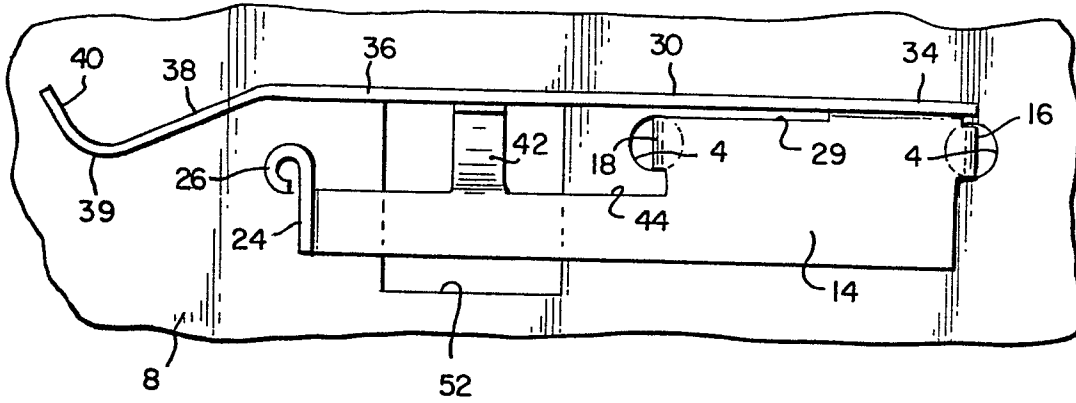


Fig. 5

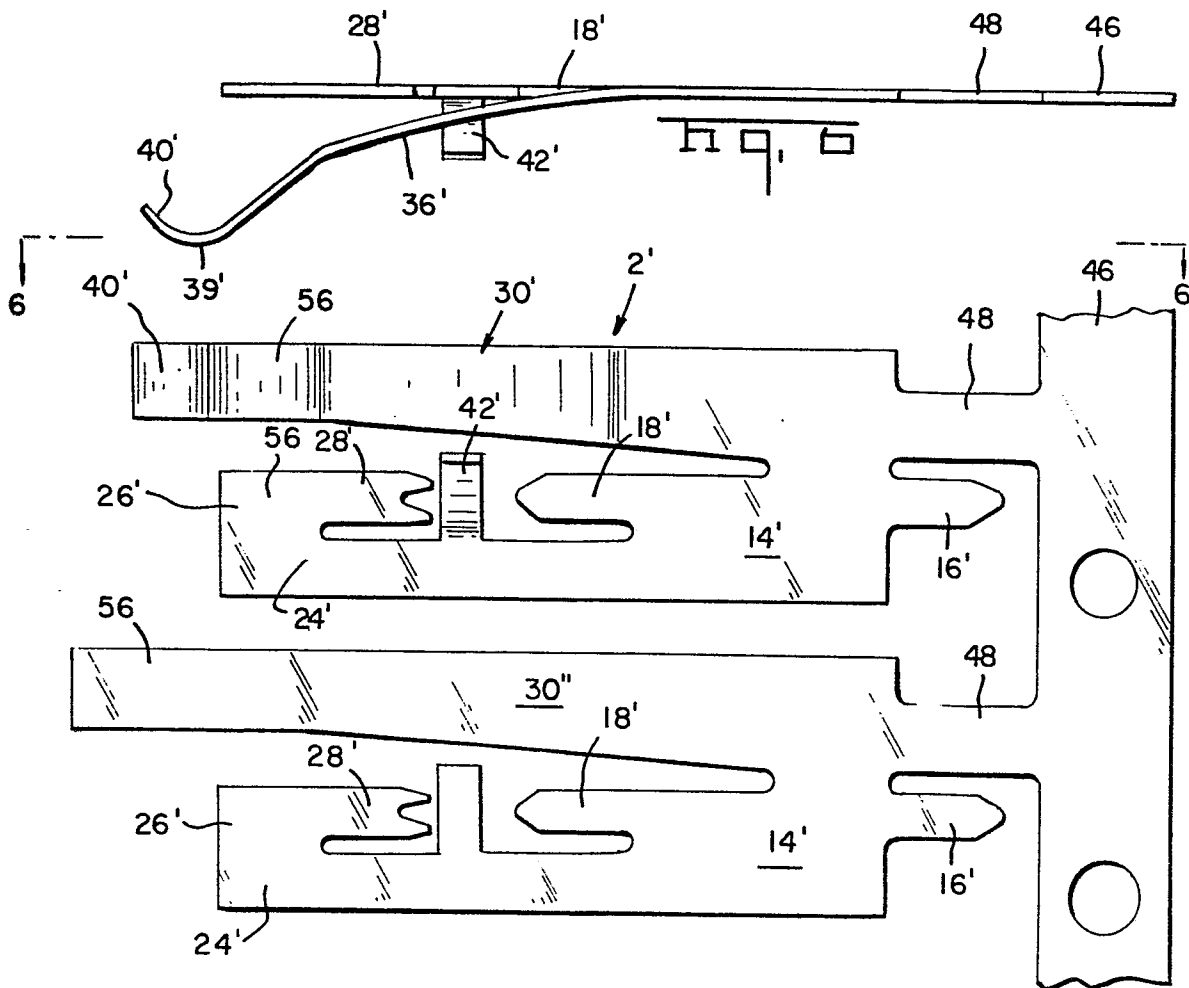
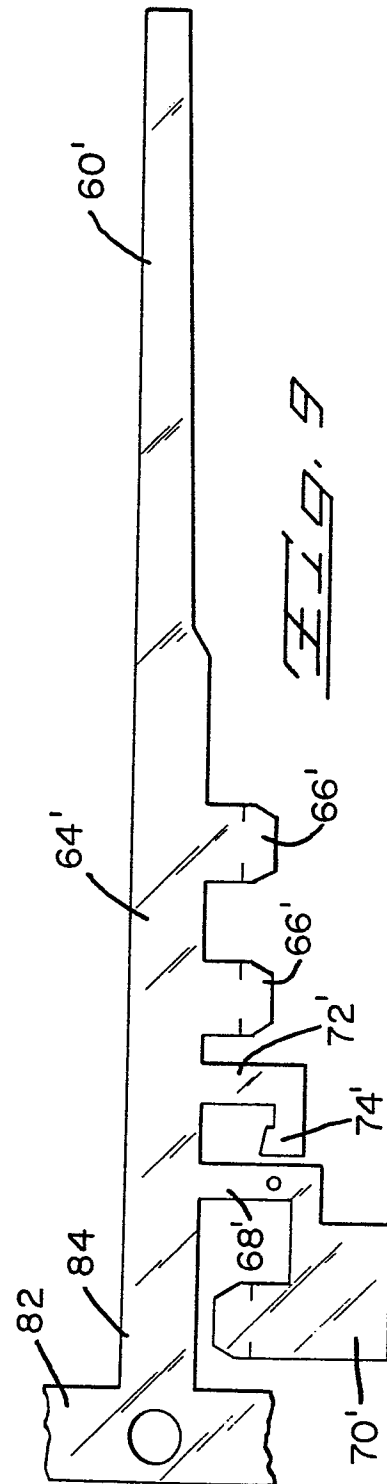
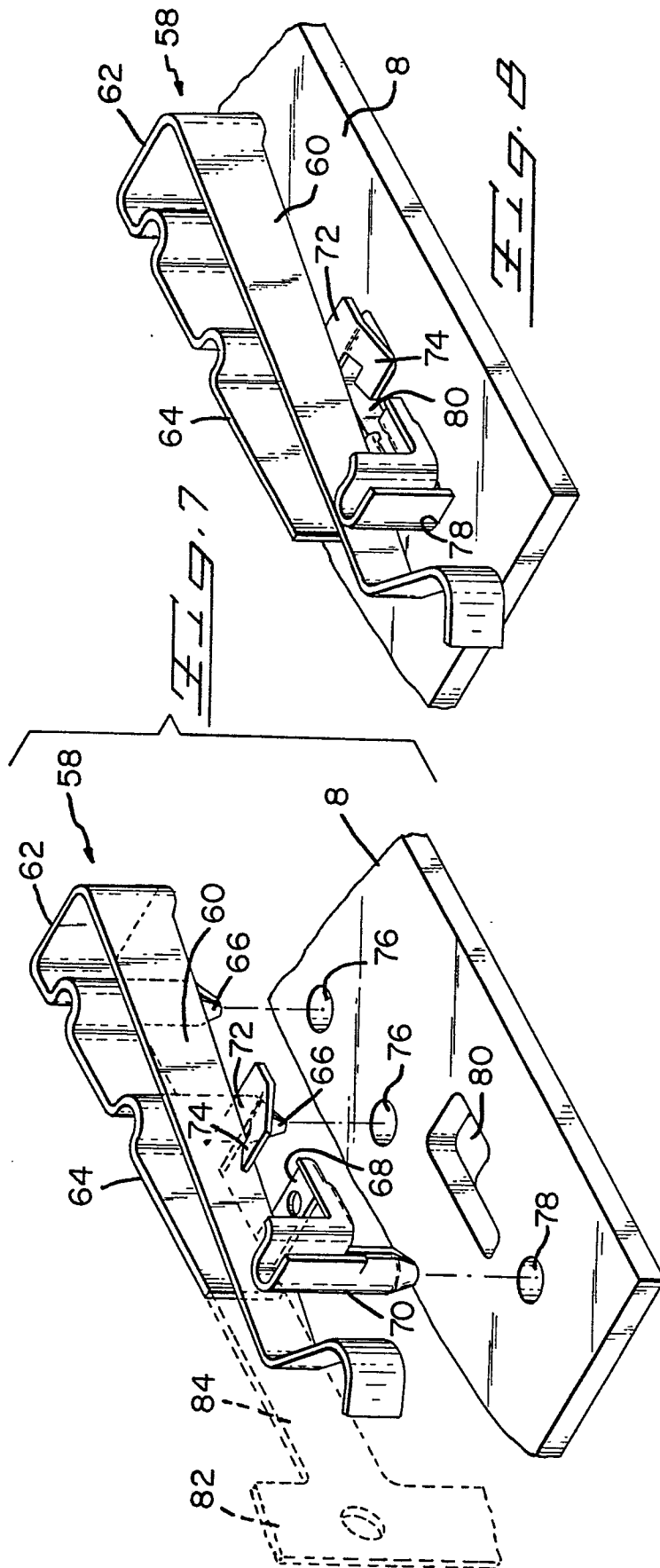


Fig. 6





European Patent
Office

EUROPEAN SEARCH REPORT

0055528

Application number

EP 81 30 5722

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 4 144 430 (AMP)</u> * column 2, line 25 to column 4, line 39 * --	1	H 01 H 11/00
A	<u>US - A - 3 437 772 (CUTLER-HAMMER INC.)</u> * column 2, line 34 to column 3, line 73 * --	1	TECHNICAL FIELDS SEARCHED (Int.Cl. ³)
A, D	<u>DE - B - 2 638 941 (RUDOLF SCHADOW)</u> * column 3, line 16 to column 4, line 41 * & US - A - 4 152 556 --	1	H 01 H 11/00 H 01 H 1/00 H 01 R 43/00
A	<u>DE - A - 2 145 584 (PHILIPS)</u> * pages 4-6 * -----	1	CATEGORY OF CITED DOCUMENTS
			X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons
/ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 31-03-1982	Examiner JANSSENS DE VROOM