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(54) Method of producing an electric supply switch, particulary for electric household appliances and similar, and switch produced thereby

(57) An electric switch for selectively supplying current to user assemblies, such as motors, heating elements and similar, of electric household appliances, the switch including a number of metal strips blanked and appropriately shaped to form the corresponding arms of flexible blade (9) switches activated by a number of rotary cams (25) on a rotary shaft (24); the blades (9) of each switch are connected integrally at one end to two respective supporting strips (5, 6) connected to two lateral strips (7) parallel to the blades of the switches; the blades are cut at an intermediate point to form two flexible free ends supporting the two contacts of each switch; to superimpose the ends of each pair of blades, a tight loop-shaped bend (15) is formed in the two lateral strips to shorten them and bring the blades in each pair closer together by a sufficient length to form an adequate contact portion; the grid of conducting strips so formed may be fitted to the surface of or molded into a flat support (19) of insulating plastic, leaving an opening (23) at the flexible blades; and the various pairs of flexible blades of the various switches are separated electrically from one another by forming gaps in a portion of the supporting or lateral strips.

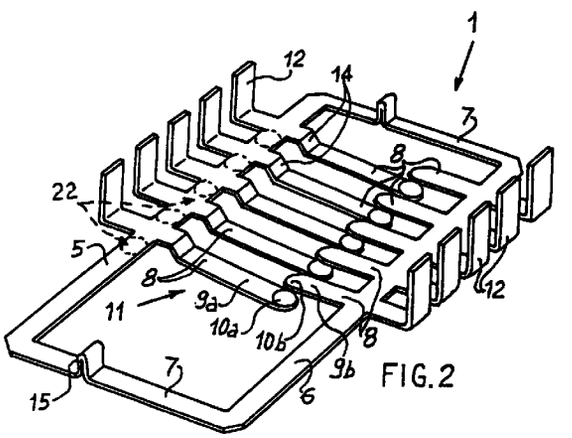

FIG.2

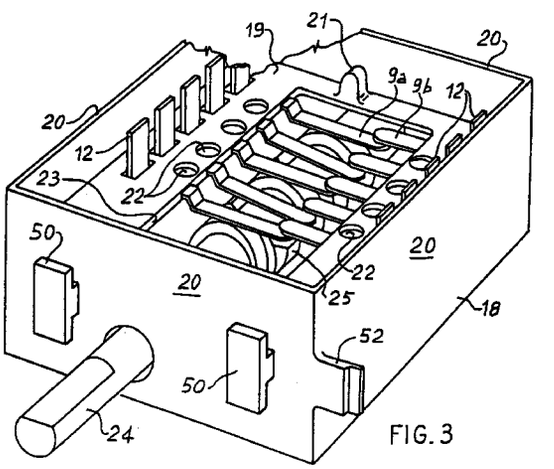

FIG.3

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Description

The present invention relates to a method of producing an electric supply switch, particularly for electric household appliances and similar, and to the switch produced thereby; the switch being of the type comprising at least a pair of movable contacts comprising two elastic, electrically conductive blades projecting from a supporting base, having partially superimposed free ends, and which are connected and/or disconnected by respective cam means.

Commonly used switches of the above are known in which the contacts are fitted to the partially superimposed free ends of a pair of flexible elastic blades (leaf spring switch); and the contacts are normally moved from a stable rest position - which may be either open or closed - to another alternative stable position by means of a rotary cam integral with a rotary shaft operated manually by the user.

The blades are fitted individually to an insulating resin support so that the free ends with the contacts project; and the two blades are connected to two end contact tabs, which are fitted with respective known terminals, one connected to the mains or a voltage source, and the other to a user device such as an electric motor, heating element, etc..

Assembling such a switch is therefore a time-consuming job, in that all the blades and end contact tabs must be assembled individually; and the stress to which the blades are subjected continually during switching may eventually result in weakening of the fastenings.

It is an object of the present invention to provide a method of producing an electric switch in the shortest possible time and involving only a small number of operations.

It is a further object of the present invention to provide a switch featuring a minimum number of discrete separately assembled components, and which may be produced on an automated assembly line.

According to the present invention, there are provided a method of producing an electric supply switch, particularly for electric household appliances and similar, and a switch produced thereby; the method comprising a step wherein a flat grid of electrically conductive strips is cut from a metal sheet to form a no matter how complex electric circuit comprising a pair of supporting strips connected to each other by at least one auxiliary strip and by at least one functional strip parallel to the auxiliary strip and in which an intermediate transverse cut is made to form a pair of blades connected in projecting manner to the supporting strips and having abutting free ends at said cut;

the method being characterized by comprising the steps of:

a) bending at least one of said blades so that predetermined portions of said abutting free ends lie in different planes;

b) forming a loop-shaped bend in the auxiliary strip to shorten the auxiliary strip and bring the supporting strips closer together by a sufficient length to superimpose said predetermined end portions of the blades and so form a leaf spring electric switch;

c) molding on to the electric circuit as modified in steps a) and b) an electrically insulating resin container, a bottom wall of which incorporates the circuit;

d) forming a gap in the supporting strips and/or in the auxiliary strip to electrically separate the blades;

f) fitting the container with a rotary shaft fitted with at least one cam, which, through an opening in the wall, contacts and flexes one of the blades to open and close the electric switch.

The present invention also relates to the switch produced using the method according to the invention.

A preferred, non-limiting embodiment of the method and switch according to the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows an elementary conducting structure to illustrate the principle of the present invention;

Figure 2 shows a preferred embodiment of the conducting grid of an electric switch in accordance with the present invention;

Figure 3 shows an electric switch in accordance with the present invention and featuring a conducting grid of the type shown in Figure 2;

Figure 4 shows a modular conducting grid produced using the method according to the present invention;

Figure 5 shows a multiple switch featuring the Figure 4 conducting grid.

Number 1 in Figure 1 indicates a non-limiting elementary conducting grid by which to form an electric switch according to the method of the present invention. Conducting grid 1 comprises a number of electrically conductive metal strips 2 formed in a single blanking operation from a metal sheet; a so-called auxiliary strip 3 which conducts no current in the finished switch; and a functional strip 4 parallel to auxiliary strip 3. The ends of strips 3 and 4 are connected to a pair of opposite supporting strips 5 and 6.

Figure 2 shows a preferred, non-limiting embodiment of conducting grid 1 in Figure 1, wherein two lateral auxiliary strips 7 and a number of parallel functional strips 8 are connected to supporting strips 5 and 6. Strips 3-8 are all coplanar, and, during the blanking operation, functional strips 4 or 8 are cut transversely and substantially centrally to form pairs of blades 9a, 9b, the blades in each pair of which remain connected in projecting manner to respective supporting strips 5 and 6, and have respective free ends 10a, 10b facing each other, so that each pair of blades is predisposed to form a switch 11 of the finished switch.

At each pair of blades 9a, 9b and outwards of supporting strips 5 and 6, end tab connectors or contact terminals 12 are formed projecting from, and bent roughly 90° in relation to the plane of, conducting grid 1.

In the same blanking operation (or in a follow-up operation), a bend 14 is formed in some of the blades, e.g. blades 9a, or at any rate at least one of the blades in each pair is so deformed that ends 10a, 10b lie in different, contiguous or noncontiguous, planes, and, according to the non-limiting embodiment shown, blades 9a are separated perpendicularly by a small gap from respective blades 9b to form normally-open switches (with the blades parted). Similarly, and according to a variation not shown, normally-closed switches (with ends 10a and 10b of the blades contacting) may also be formed.

Following the blanking operation, auxiliary strips 3 or 7 are deformed using a special tool (not shown) by which each auxiliary strip is subjected lengthwise to stress F (Figure 1) and bent to form a loop-shaped bend 15, which shortens auxiliary strips 3 or 7 to bring the supporting strips, and hence blades 9a, 9b connected to them, closer together by a sufficient length to superimpose ends 10a and 10b and so form an adequate electrical contact portion between the blades.

In the next step in the method according to the invention, conducting grid 1, shortened as described above, is placed inside a mold on an injection press (not shown) and molded, using electrically insulating synthetic resin, to a respective container 18 (Figure 3). More specifically, conducting grid 1 is embedded in a base or bottom wall 19 located inside the container and forming one piece with the lateral walls 20.

Following the molding operation, gaps are formed in predetermined portions of supporting strips 5 and 6 and/or auxiliary strips 3, 7 to electrically insulate the various functional parts of the electric circuit, and in particular the conductor portions forming independent switches. More specifically, by means of punches on the mold, holes 22 (Figures 2, 3) are formed in opposite strips 5 and 6 to electrically separate blades 9a from blades 9b and from any other blades by which they might be shortcircuited, for which purpose, base wall 19 is formed with ready-made openings/holes for exposing the portions to be punched. Wall 19 also comprises an opening 23 at and for permitting access for the control of blades 9a, 9b, and which is so sized that the supporting strips and at least part of blades 9a, 9b are embedded inside wall 19.

Switches 11 are operated by means of a shaft 24 rotating in known manner on two opposite walls of container 18, and which in turn is either operated manually by the user or powered in any known manner. Shaft 24 is fitted with a number of known rotary cams 25, one for each switch, and each of which cooperates with a respective flexible blade 9a or 9b to flex it and so bring respective contact ends 10a and 10b into contact with each other depending on the profile of the cam. Conversely, when not contacted by respective cam 25, each blade 9a or 9b remains in a rest position clear of contact end 10b or 10a, so that the respective switch remains open. Obviously, in the case of normally-closed switches, shaft 24 is so assembled as to flex the blades in each pair away as opposed to towards each other.

Inside container 18, contact terminals 12 project from base wall 19 in two rows on either side of blades 9, and are connected to the terminals (not shown) of wires connected to the mains on one side and to the user equipment on the other.

Wall 19 also comprises projections 21 for enclosing the bends 15 (Figure 2) shortening strips 7.

The method of producing an electric switch according to the present invention may also be used to advantage for forming complex conducting grids, one of which, indicated by 30, is shown in the partially sectioned view in Figure 4. Grid 30 comprises a number of similar or dissimilar sections 31, 32, 33, etc., each of which in turn comprises a group of switches 34a, 34b formed by known blanking operations similar to that described above. More specifically, each section 31, 32, 33 comprises two lateral auxiliary strips 36 and 37 connected to the ends of intermediate transverse supporting strips 38 to which the outer ends 39 of the blades in each group of switches 34a, 34b are connected. At the blanking step, bends 40 similar to bends 15 in Figure 2 are formed in strips 36 and 37 to shorten the portions of strips 36 and 37 relative to each group of switches 34a, 34b, so that the facing ends 42a and 42b of the blades in each group of switches are superimposed to form an electric contact portion 43.

At this point, conducting grid 30 is molded into a supporting wall 44 of a container 46 (Figure 5) of electrically insulating synthetic resin to form a switch 41 with a number of independent sections, in each of which the group of switches 34a, 34b is activated by a respective shaft 48a, 48b fitted with a number of cams 47 rotated independently about their axis by the user.

Wall 44 comprises a number of projections 45 enclosing the bends 40 formed in strips 36 and 37.

As in the single switch in Figure 3, gaps are formed in both lateral strips 36, 37 and transverse strips 38 to electrically separate the sections of switch 41 and, within each section, the parts supplying different equipment.

In this connection, Figure 5 shows a number of the holes 49 formed in wall 44 at the molding step to permit the passage, at the next step, of punches by which to form respective holes for electrically and mechanically interrupting strips 36, 37, 38.

Containers 18 and 46 comprise members enabling removable fitment to the casing of a household appliance, and which provide for fast assembly and removal of the containers for troublefree access to the switches with no tools required. Said fastening members comprise T-shaped tabs 50 (Figures 3, 5) formed in one piece on the outer surface of a wall 20, 51 of container 18, 46, e.g. on the wall facing control shaft/s 24, 48. Tabs 50 extend parallel to and a small distance from

wall 20, 51, and fit on to respective projections (not shown) on the appliance or inside through openings to form a known bayonet connection. A retaining tooth 52 is formed in one piece with one end of wall 20, 51, and flexes past a fixed stop on the appliance, e.g. an edge of one of said through openings, for preventing free withdrawal of the switch.

By means of a small number of blanking and molding operations, the present invention therefore provides for producing a single or multiple switch in considerably less time as compared with currently used methods.

Claims

1. A method of producing an electric supply switch, particularly for electric household appliances and similar; the method comprising a step wherein a flat grid (1; 30) of electrically conductive strips (2) is cut from a metal sheet to form a no matter how complex electric circuit comprising a pair of supporting strips (5, 6; 38) connected to each other by at least one auxiliary strip (3, 7; 36, 37) and by at least one functional strip (4, 8; 34a, 34b) parallel to the auxiliary strip and in which an intermediate transverse cut is made to form a pair of blades (9) connected in projecting manner to the supporting strips (5, 6) and having abutting free ends (10a, 10b; 42a, 42b) at said cut;

   the method being characterized by comprising the steps of:

   a) bending at least one of said blades so that predetermined portions of said abutting free ends (10a, 10b; 42a, 42b) lie in different planes;
   b) forming a loop-shaped bend (15; 40) in the auxiliary strip to shorten the auxiliary strip and bring the supporting strips (5, 6) closer together by a sufficient length to superimpose said predetermined end portions (10a, 10b; 42a, 42b) of the blades and so form a leaf spring electric switch (11);
   c) molding on to the electric circuit as modified in steps a) and b) an electrically insulating resin container (18; 46), a bottom wall (19; 44) of which incorporates the circuit;
   d) forming a gap (22; 49) in the supporting strips and/or in the auxiliary strip to electrically separate the blades (9);
   f) fitting the container (18; 46) with a rotary shaft (24; 48a, 48b) fitted with at least one cam (25), which, through an opening (23) in the wall, contacts and flexes one of the blades (9a) to open and close the electric switch (11).

2. A method of producing a multiple electric switch (41), particularly for electric household appliances and similar, said switch comprising a flat grid (30) of electrically conductive strips cut from a metal sheet to form a no matter how complex electric circuit comprising a number of supporting strips (38) connected at both ends to two lateral strips (36, 37); said supporting strips also being connected in pairs by separate groups of strips (34a, 34b) parallel to said lateral strips; the method being characterized by comprising the steps of:

   a) making an intermediate transverse cut in each strip of said groups (34a, 34b) of parallel strips to form pairs of blades connected respectively in projecting manner to said supporting strips, said blades having abutting free ends (42a, 42b) at said cut;
   b) forming a loop-shaped bend (40) in said lateral strips (36, 37) in an intermediate position between said supporting strips, to bring said supporting strips closer together by a sufficient length to superimpose predetermined end portions of said blades and form distinct groups of electric leaf spring switches;
   c) injection molding said electric circuit, as modified in steps a) and b), into a bottom wall (44) of a container (46) of electrically insulating resin;
   d) forming gaps in predetermined points (49) of said supporting strips and said lateral strips, to electrically separate said blades from one another and from said lateral strips;
   e) fitting said container, for each group of said switches, with a rotary shaft (48a, 48b) fitted with a number of cams (47); each cam, via an opening in said wall, contacting and flexing one blade in each group to open and close each of said electric switches.

3. A method as claimed in Claim 2, characterized in that step a) also comprises the operation of bending only one blade (9a) in said pairs, so that said blade is offset parallel to the other blade (9b).

4. An electric supply switch, particularly for electric household appliances and similar, comprising a flat grid (1) of electrically conductive strips (2) cut from a metal sheet to form a no matter how complex electric circuit comprising a pair of supporting strips (5, 6) connected to each other by an auxiliary strip (3, 7) and by at least one strip (4, 8) parallel to said auxiliary strip; characterized in that said parallel strip comprises an intermediate transverse cut to form a pair of blades (9) connected respectively in projecting manner to said supporting strips, and having abutting free ends (10a, 10b) at said cut; and in that said auxiliary strip comprises a loop-shaped bend (15, 40) to shorten the auxiliary strip and bring said supporting strips closer together by a sufficient length to superimpose predetermined end portions of said blades and form an electric leaf spring switch.

5. A switch as claimed in Claim 4, characterized in that said electric circuit is injection molded into a flat wall (19, 44) of a container (18, 46) of electrically insulating resin; in that said supporting strips and/or auxiliary strip are interrupted at at least one point (22, 49) to electrically separate said blades and said auxiliary strip; and in that a rotary shaft (24, 48) is fitted to said container, and comprises at least one cam (25, 47), which, via an opening (23) in said wall, contacts and flexes one (9a) of said blades to open and close said electric switch.

6. A switch as claimed in Claim 5, characterized in that said container (18, 46) comprises members for removable fitment of the container to a casing of an electric household appliance; said members comprising T-shaped tabs (50) formed in one piece on the outer surface of a wall (20, 51) of the container (18, 46), on a wall facing the rotary shaft (24, 48); the tabs (50) being parallel to and a small distance from said wall (20, 51), and being fitted on to respective projections on the household appliance, or inside through openings, to form a bayonet connection; a retaining tooth (52) being formed at one end of said wall (20, 51), and which flexes past a fixed stop on the casing of the appliance, e.g. an edge of one of said through openings, to prevent free withdrawal of the switch.

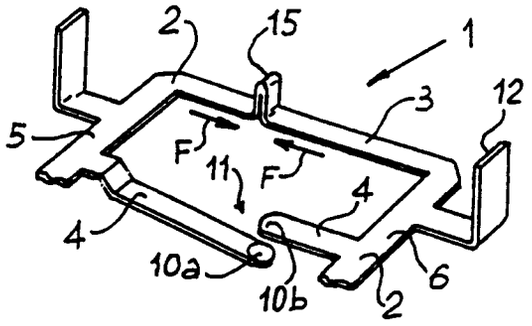

FIG. 1

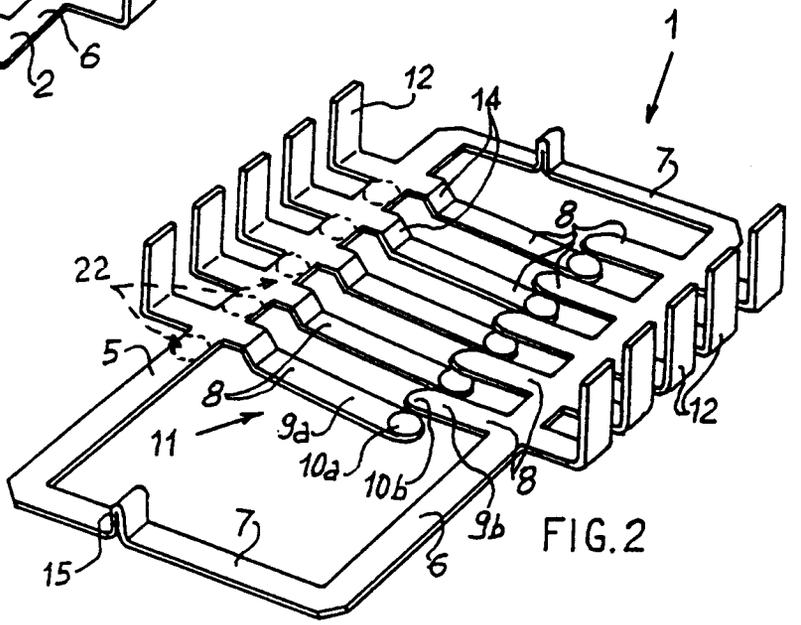

FIG. 2

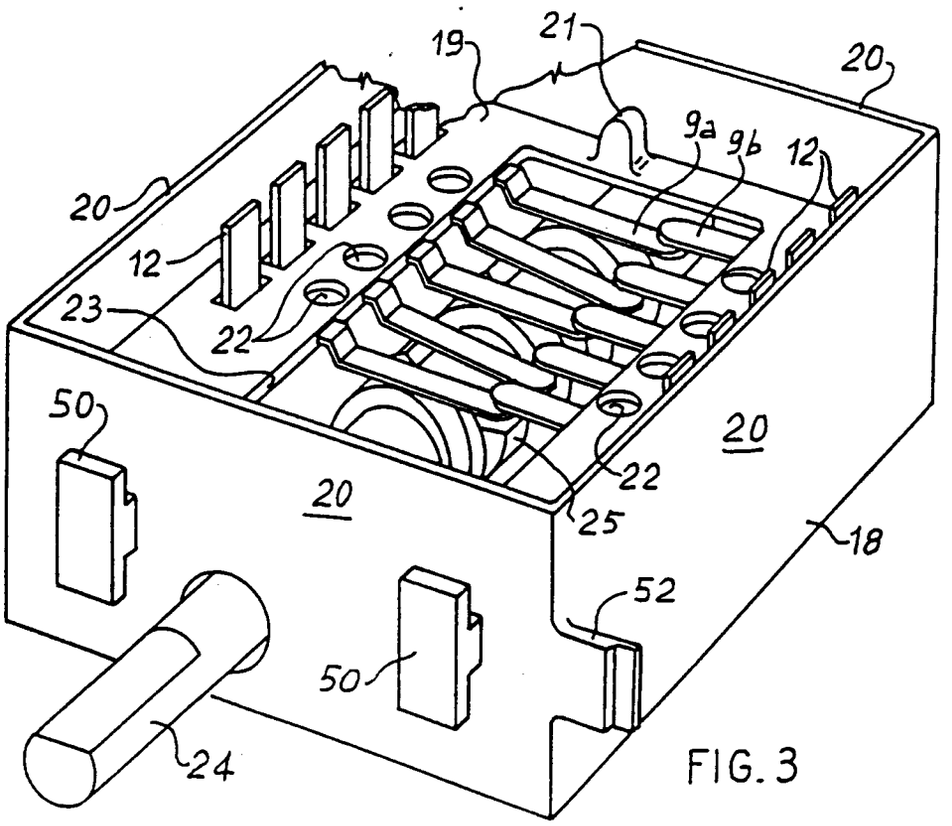

FIG. 3

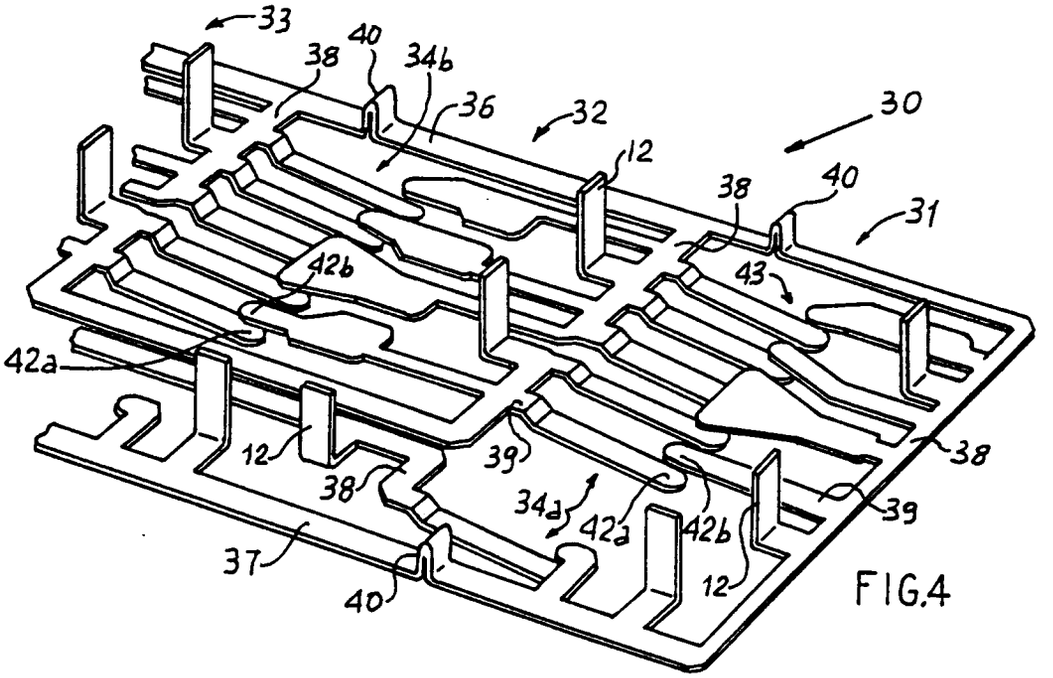
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FIG.4

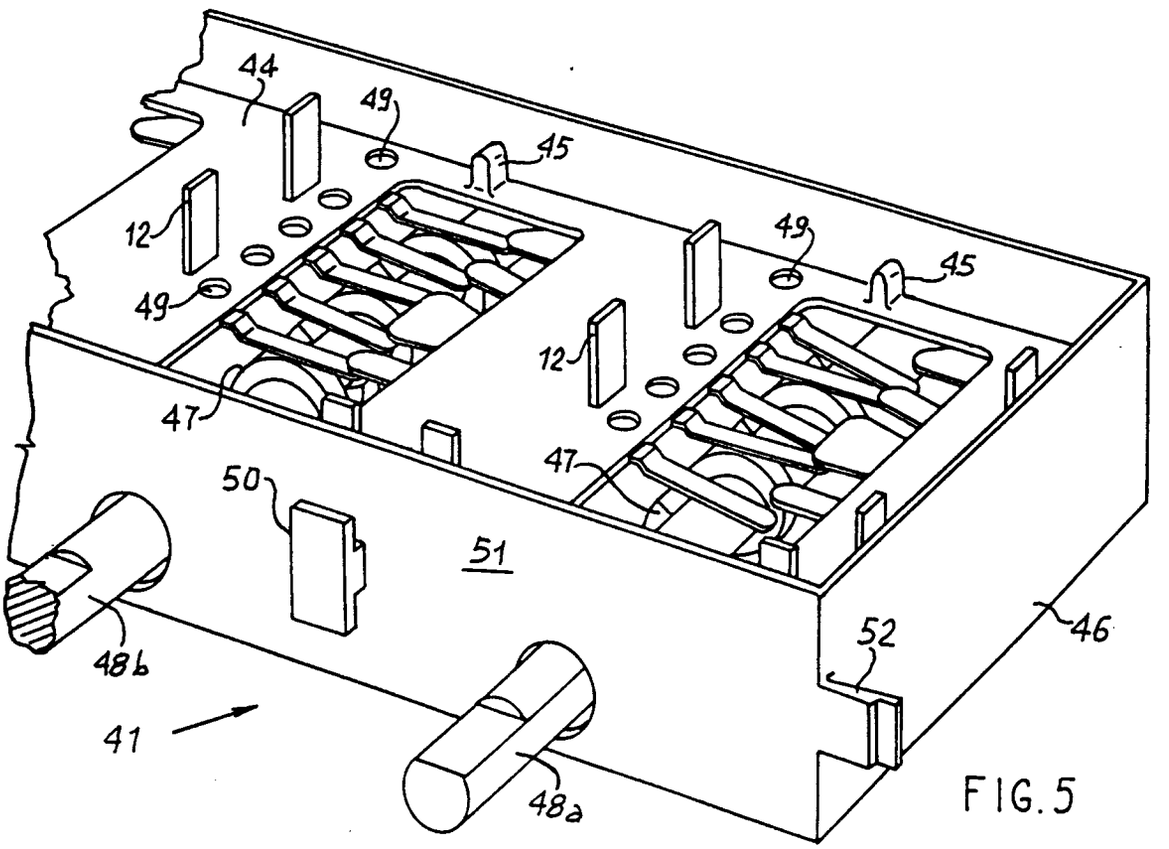
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FIG.5