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Sato et al.

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[54] **METHOD OF MAKING MICROSWITCHES**

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[51] **Int. Cl.²** **H01H 11/00**

[58] **Field of Search** ..... 264/272, 153, 250, 263, 264/295; 29/622, 630 C, 630 B, 527.1

[56] **References Cited**

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[57] **ABSTRACT**

A method of continuously making microswitches, wherein a main metal strip of a material adapted to making parts of the microswitch to be formed mostly by punching operation is supplied along a main production line, wherein at least one subsidiary metal strip of a material different from that of the main strip and adapted to making parts to be formed substantially by such special operation as bending process is supplied from lateral side to the main line, and wherein both semi-products made from the respective strips are combined integrally by a molding.

8 Claims, 5 Drawing Figures

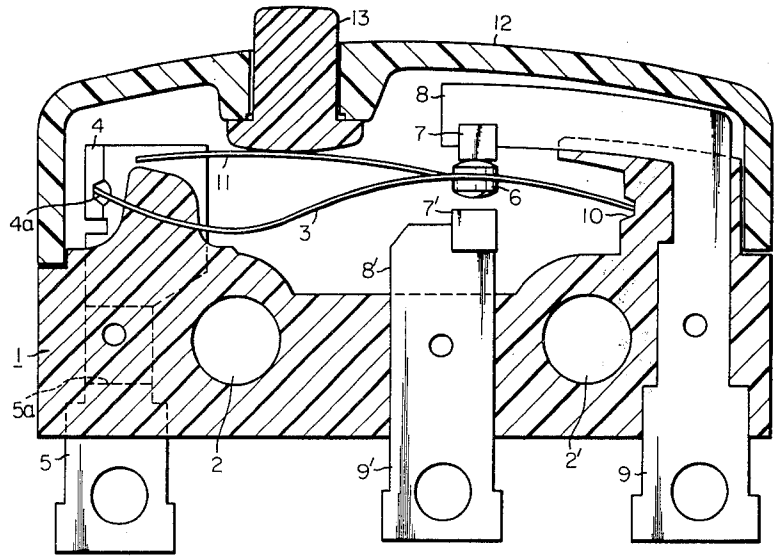


Fig. 1

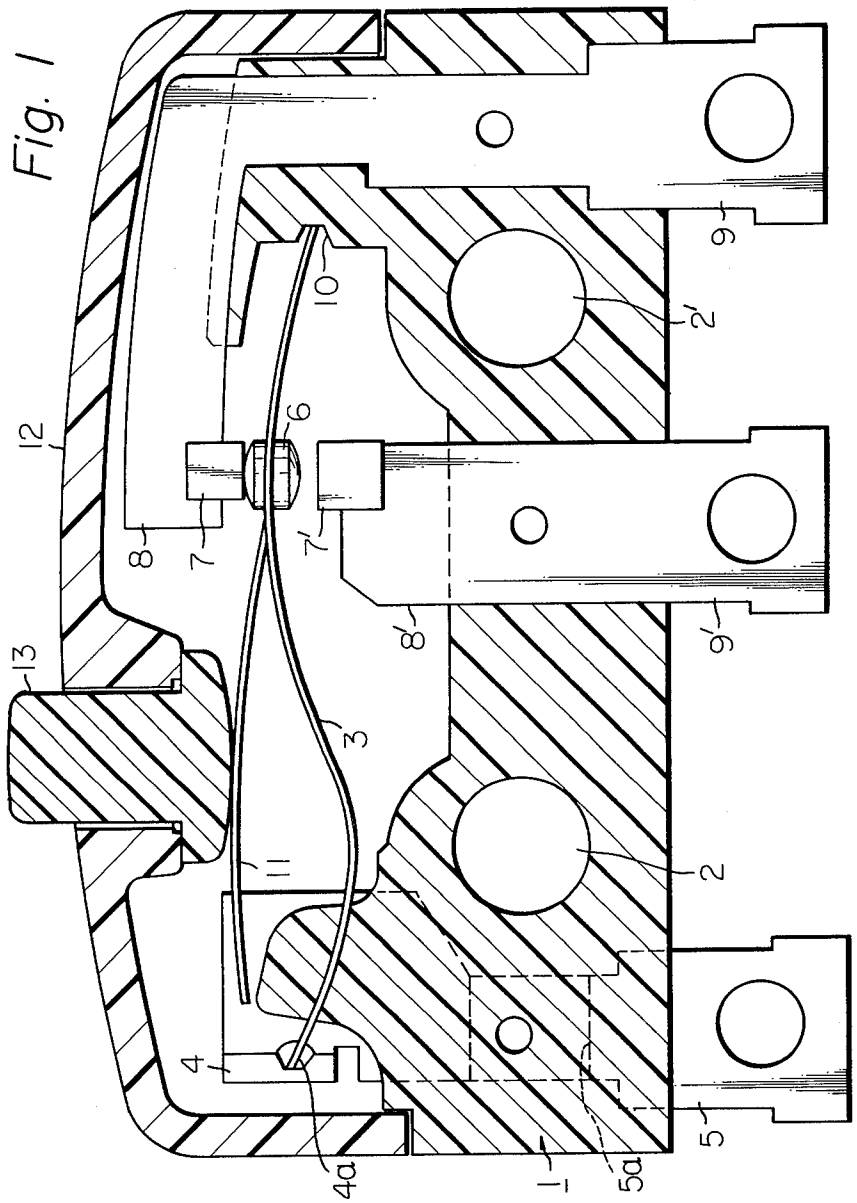


Fig. 2

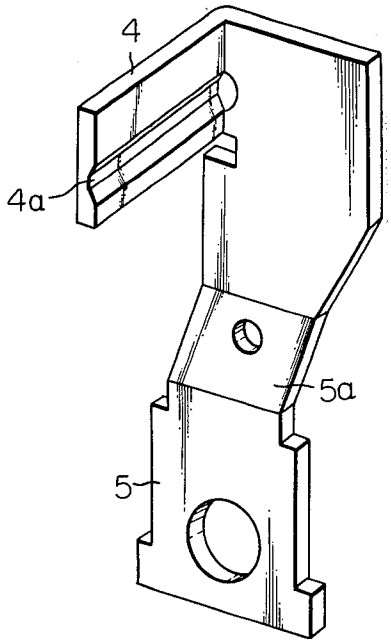
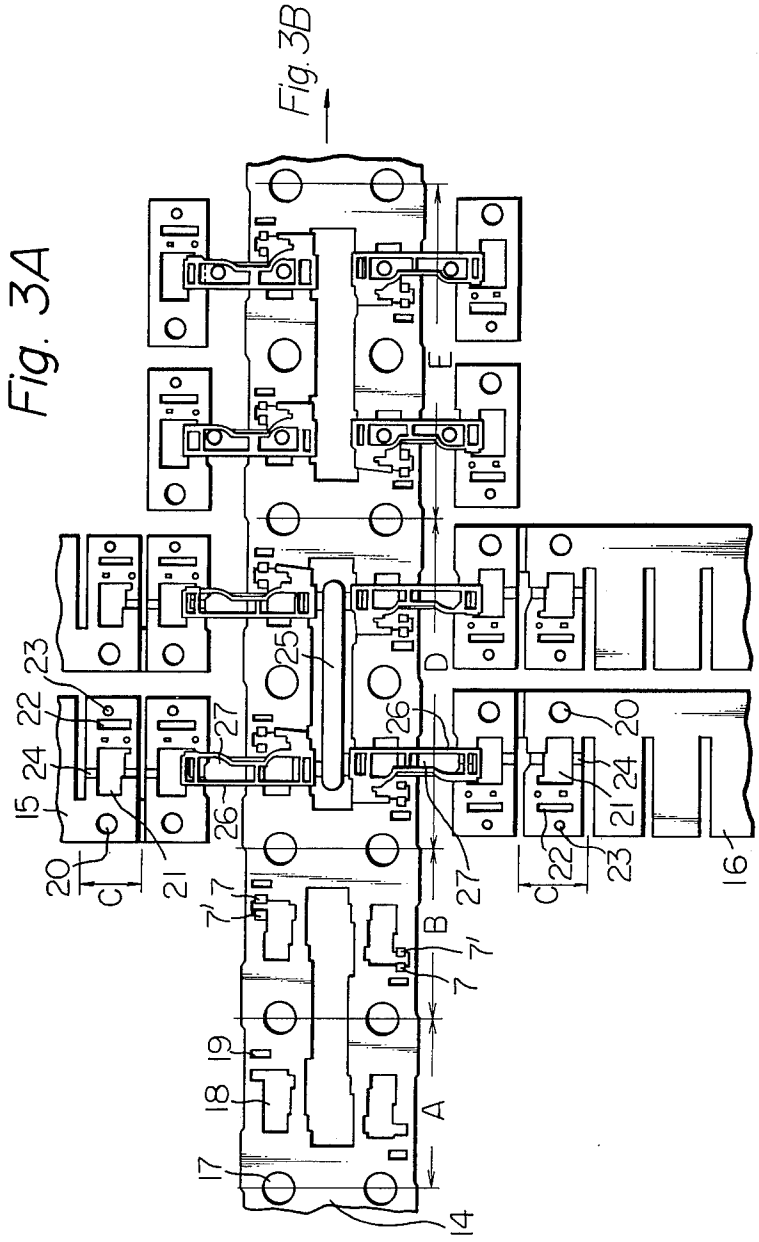


Fig. 3A



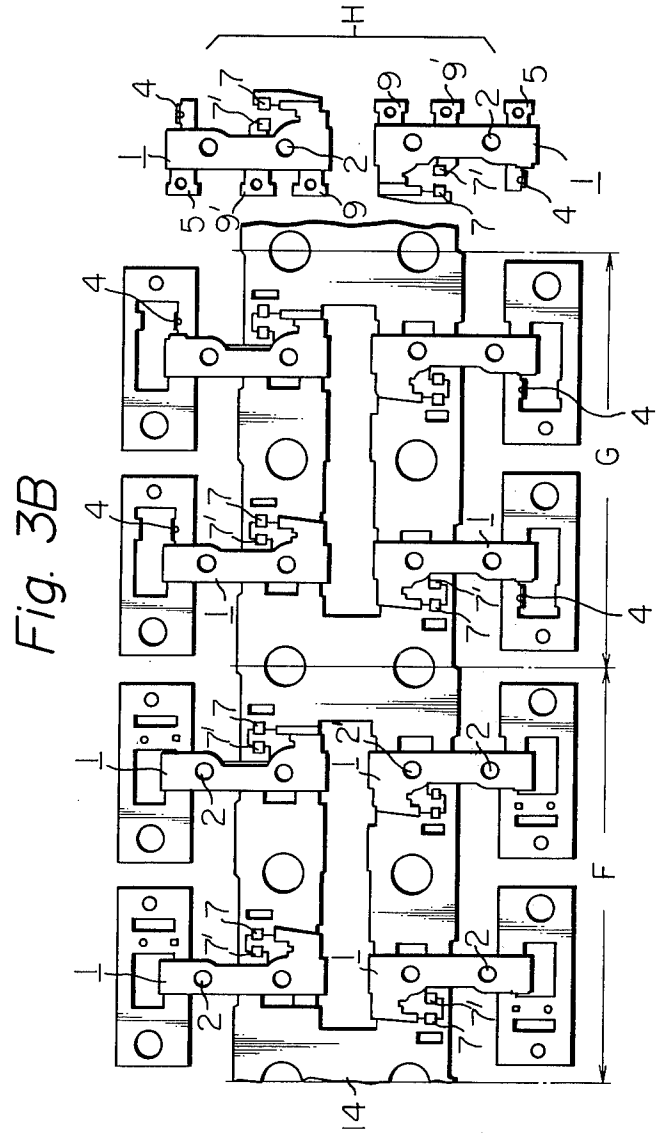


Fig. 3B

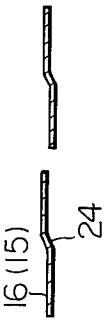


Fig. 4

METHOD OF MAKING MICROSWITCHES

This invention relates to a method of making microswitches.

As a method of continuously producing microswitches, there is suggested, for example, U.S. Pat. No. 3,189,705. This is a method of making many switch units each including terminals to connect external electric wires and supporting or mounting members to mount thereto movable spring and fixed side contacts by first punching successively a strip of metal material so that many units as well as their elements will be in a continuous strip shape in which the units are coupled by ribs, then forming an insulating base of a synthetic resin molding integrally with respect to the strip for each switch unit and lastly cutting off the ribs so that the respective units are separated from one another. In such conventional methods, however, there are defects in that, unless the terminals and mounting members are formed in the same plane, the microswitches will be difficult to manufacture at a high efficiency and precision and the kinds of the units to be manufactured will be limited and, as the switch units including all the unit are punched from one strip material, the metallic material has to be limited and, therefore, it will be impossible to use a material of a high conductivity for only one of the unit elements. The present invention is suggested to remove such defects of the conventional methods.

A main object of the present invention is to provide a method which enables one to produce as many microswitches as desired in a continuous manner.

Another object of the present invention is to provide a method of making microswitches wherein a metal strip bent in advance to a desired form corresponding to desired portions in the respective elements can be used.

A further object of the present invention is to provide a method of making microswitches wherein molding flashes can be easily removed even in the case where complicated bent terminal parts and insulators are integrally molded.

The present invention shall be explained with reference to a preferred embodiment in conjunction with accompanying drawings, in which:

FIG. 1 shows in section a microswitch made according to the method of the present invention;

FIG. 2 is a perspective view of a movable spring supporting member used in the microswitch to be made by the present invention;

FIGS. 3A and 3B show the respective steps in an embodiment of the present invention; and

FIG. 4 shows a cross-sectioned view of subsidiary metal strips employed in the method according to the present invention.

In FIG. 1, a base member 1 of a microswitch is provided with a pair of through holes 2 and 2' for fitting the microswitch to any frame or device with which the microswitch is to be used and with such a terminal 5 as shown in FIG. 2 having a supporting part 4 for a movable spring 3 at one end and a stepped bent part 5*a*, and terminals 9 and 9' having respective parts 8 and 8' for respectively supporting normally-closed fixed contact 7 and normally-opened fixed contact 7' which are arranged as opposed to each other on both sides (above and below in the illustrated case) of a movable contact 6 fitted to the movable spring 3, which terminals 5, 9 and 9' are integrally embedded in the base member 1 when the latter is molded.

Further, the supporting part 4 formed on the terminal 5 is bent at right angles with respect to the surface of the terminal body and is provided with an engaging part 4*a* on one surface so that the movable spring 3 will be engaged at one end with said engaging part 4*a* and at the other end with a concave part 10 provided on the other side of the base member 1. When the movable spring 3 is fitted between these engaging parts 4*a* and 10, the movable contact 6 provided on the movable spring 3 will contact the fixed contact 7 so that the terminals 5 and 9 will conduct with each other. A lever 11 is provided integrally with the movable spring 3 so that, when said lever 11 is pressed with a push button 13, the movable contact 6 will separate from the fixed contact 7 and shift into contact with the fixed contact 7'. A cover member 12 is fitted above the base member 1 so that the push button 13 will be slidably fitted in the cover member 12.

With reference to FIGS. 3A and 3B, the respective steps of an embodiment of the method according to the present invention shall be explained, wherein the steps are represented by references A through H defining sequential sections of a line production. In the drawings, 14 is a main metal strip, at both sides of which subsidiary metal strips 15 and 16 are fed additionally to the main production line along which the main strip 14 is fed, from left to right in the drawings. It is possible to employ, as the subsidiary metal strips 15 and 16, such preliminarily bent strips as shown in FIG. 4 in section.

In the step A of punching the main strip 14 which is, in the present instance, of a tin plated brass plate embodiment, and is to later constitute the terminals 9 and 9', the strip is punched with holes and apertures 17, 18 and 19. The holes 17 are for feeding and positioning the strip along the production line, and apertures 18 and 19 are defining the sections which will be the terminals 9 and 9' later. In the next step B, the fixed contacts 7 and 7' are welded to said sections to be the terminals later.

In the step C, the subsidiary metal strips 15 and 16 consisting of plates of such a highly conductive material as, for example, German silver, which are to be utilized as the common terminals 5 at the later stage, are punched to form holes and apertures 20 to 23. Holes 20 and 23 are for positioning and feeding the subsidiary strips towards the main line, and apertures 21 and 22 are defining a section which is to be the common terminal 5 later. At this step, the stepped bent part 5*a* is simultaneously formed at a section 24. This stepped part 5*a* is provided for the purpose of arranging the supporting part 4 substantially in alinement at its center with parts 8 and 8' of the other terminals 9 and 9'. The subsidiary strips 15 and 16 are to be of the same material and the required four elements for the microswitch are simultaneously combined together in the next primary molding step D. In the step D, hollow-molding frames 26 of such a thermoplastic synthetic resin generally high in molding performance causing less fins to be produced as, for example, glass-fiber reinforced nylon, are molded through a gate 25. 27 is a hollow part made in each frame 26, which is to be filled with such a thermosetting resin generally high in electric performance as, for example, a phenol resin, at a later described step F.

The step E is a gate removing step, at which step the frames **26** are also subjected to a preparation for the next step.

Referring next to FIG. 3B, the step F is a secondary molding step in which the hollow frames **26** are filled with the above described thermosetting resin so that the bases **1** will be formed. The fitting holes **2** and **2'** are also formed in the base **1** at this step.

In the step G, the tip of the section to form such terminal **5** as shown in FIG. **1** is bent at right angles to form the supporting part **4**, the sections to form the respective terminals **5, 9** and **9'** are subjected to a punching to form these terminals and the rest of the parts of the respective strips are removed, so that finished products will be obtained at the step H.

As described above, the present invention is featured in respect that the main metal strip is fed to the main production line, the subsidiary metal strips are fed from both sides of the main metal strip and, after desired punching steps, semi-products made from the main metal strip and semi-products made from the subsidiary metal strips are combined with each other through a synthetic resin molding. In the present method, therefore, it is possible to use, as the main strip, a material which is suitable for forming such parts generally to be arranged in the same plane and to be made by punching such as the terminals **9** and **9'** and, as the subsidiary strips, a material which is suitable for forming such parts requiring right-angle bending process or step-forming process, and it is possible to perform an accurate and precise bending process after combining the parts made from the main metal strip and the parts made from the subsidiary metal strips together in the base **1.** Since it is thus possible to use different materials for the main metal strip and subsidiary metal strips, one is enabled to employ optionally a high conductivity material, or another material which is plated with the high conductivity material, as for example the common terminal **5** and its supporting part **4.**

In molding the base **1,** a hollow molding frame is first formed of a thermoplastic material and then the hollow chamber is filled with a thermosetting material. Therefore, a base that is effectively prevented from causing molding fins and is high in the electric characteristics can be made.

It will be appreciated that, while the molding operation generally requires a longer time due to the setting of plastics relative to any other punching operation, the method according to the present embodiment shows such effects that the above disadvantage of the molding operation is compensated for and, moreover, the manufacturing efficiency can be remarkably improved by increasing the number of elements for the microswitches to be obtained at each molding operation.

To summarize the method described above, a main strip of metal **14** is punched with openings at regular intervals to define successive sets of spaced first and second legs **9, 9'** having marginal connecting portions. Similarly, openings are punched in a subsidiary strip of metal at regular intervals to define spaced third legs **5** having marginal connecting portions. The main strip **14** is fed with indexed movement into a molding station indicated at D in FIG. 3A. The subsidiary strip **15** is also fed with indexed movement into the same molding station D at right angles to the main strip. In the molding station the two strips are positioned so that the three legs are properly spaced with respect to one another. Plastic is then molded about the legs, following which the third leg is severed from the subsidiary strip so that the third leg is free to move with the main strip out of the molding station. The main strip is then indexed out of the molding station, as indicated at E. Finally, the marginal connecting portions are punched away to separate the first and second legs **9, 9'** from the main strip and to electrically isolate the legs from one another.

That is the basic procedure. The preferred procedure includes two additional elements, one is the performance of the molding step in two successive molding stations, station D in which the parts are interconnected with thermoplastic material and F in which the molding is completed by injection of thermosetting material. Moreover, the third leg preferably includes a wing portion **4** which is bent out of the plane of the third leg, and thus out of the plane of the assembly, prior to the final severence of the assembly from the main strip.

It is one of the distinguishing features of the present procedure that the subsidiary strip is fed in, to join the main strip, (in station D) in a direction which is at right angles to the main strip. It is a further feature of the invention, as disclosed, that the third leg is the only leg which includes a bent-out wing portion.

What we claim is:

1. The method of making a micro type switch assembly which comprises the steps of supplying a main metal strip having openings at regular intervals to define a first set of switch elements arranged substantially in the same plane, supplying at right angles to said main strip a subsidiary metal strip having openings at regular intervals to define a switch element including a wing portion requiring bending out of said plane, performing a molding operation so as to integrally join the leading end of the subsidiary metal strip with the main metal strip in spaced relation, severing the subsidiary strip to free the switch element which includes the wing portion, and bending the wing portion out of the plane of the assembly.

2. The method according to claim **1,** which further comprises a step of, after said mold performing step, separating said assembly from the main strip by a punching operation.

3. A method according to claim **1,** wherein said mold performing step comprises a primary molding operation of molding a hollow mold member with a thermoplastic synthetic resin and a secondary molding operation of filling the hollow part of said hollow mold member with a thermosetting synthetic resin.

4. A method according to claim **1,** wherein terminal members having normally closed and normally opened contacts respectively are made from said main metal strip, and a terminal member having a common contact is made from the wing portion.

5. The method of making a micro type switch assembly formed of first, second and third legs laterally spaced and generally coplanar in a molded body, which comprises punching openings in a main strip of metal at regular intervals to define successive sets of spaced first and second legs having marginal connecting portions, punching openings in a subsidiary strip of metal at regular intervals to define spaced third legs having marginal connecting portions, feeding the main strip with indexed movement into a molding station, feeding the subsidiary strip with indexed movement into the

same molding station at right angles to the main strip, positioning the two strips so that the three legs in the station are properly spaced with respect to one another, molding about the three legs a body of insulating material, severing the third leg from the subsidiary strip so that it is free to move with the main strip, indexing the main strip out of the molding station, and then punching away the marginal connecting portions to separate the first and second legs from the main strip and to electrically isolate the legs from one another.

6. The method as claimed in claim **5** in which the main strip is punched to define two sets of first and second legs in inverted relation side by side, in which two subsidiary strips with third leg in inverted relation are fed into the molding station from opposite sides, and in which two bodies of insulating material are simultaneously molded for simultaneous production of two switch assemblies.

7. The method as claimed in claim **5** in which the first and second legs have opposed contacts which are integral with one another during the molding step and which are isolated by a punching operation following the molding step.

8. The method of making a micro type switch assembly formed of first and second legs laterally spaced and presenting opposed contacts and a third leg coplanar therewith in a molded body having an inwardly facing recess at one end, a spring being interposed between the third leg and the recess, which comprises punching openings in a main strip of metal at regular intervals to define successive sets of spaced first and second legs presenting opposed contacts and having marginal connecting portions, punching openings in a subsidiary strip of metal at regular intervals to define spaced third legs having marginal connecting portions and a wing portion, feeding the main strip with indexed movement into a molding station, feeding the subsidiary strip with indexed movement into the same molding station at right angles to the main strip, positioning the two strips so that the three legs in the station are properly spaced with respect to one another, molding about the three legs a body of insulating material, severing the third leg from the subsidiary strip so that it is free to move with the main strip, indexing the main strip out of the molding station, punching away the marginal connecting portions to separate the first and second legs from the main strip and to electrically isolate the legs from one another, bending over the wing portion of the third leg to provide physical support and electrical connection to the presented end of the spring, and then inserting between the wing portion and the recess a spring movable between the contacts on the respective first and second legs.

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