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(54) Contact actuating apparatus

(57) A contact actuating apparatus comprising a housing (1) with a wall (2) and an interior space and an actuating element (3, 4) for actuating the contact (6), the contact (6) being located in the interior space of the housing (1), the actuating element (3, 4) comprising an upper part (3) which is accessible from outside the housing (1) and a lower part (4) which is elongated in the direction of the contact (6) and is provided to actuate the contact (6), wherein the actuating element (3, 4) and the wall (2) of the housing (1) are constructed in one piece, the upper part (3) being connected to the wall (2) of the housing (1) via a flexible joint (9), which permits a rocking movement of the actuating element (3, 4) with respect to the housing (1).

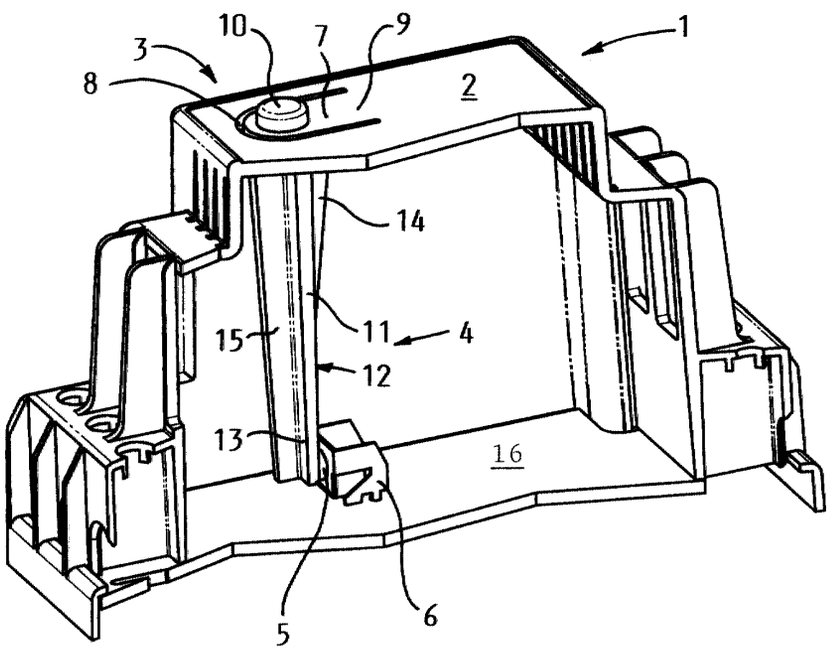

FIG. 1

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Description

[0001] The present invention relates to a contact actuating apparatus comprising a housing with a wall and an interior space and an actuating element for actuating the contact, the contact being located in the interior space of the housing, the actuating element comprising an upper part which is accessible from outside the housing and a lower part which is elongated in the direction of the contact and is provided to actuate the contact.

[0002] The contact which is actuated by the apparatus of the invention is for example an electrical or mechanical contact, with which an electrical or electronic connection can be realised, or an electrical switch.

[0003] A contact actuating apparatus is for example known from US-A-4,181,826. The apparatus described therein comprises a housing with an interior space and an outer wall in which an opening is provided. The apparatus also comprises an actuating element for actuating a contact which is mounted in the interior space. The actuating element extends through the opening in the housing, so that it is accessible from the outside, and is movable through the opening. The actuating element is elongated in the direction of the contact. On opposite sides of the actuating element, two arms are provided, which extend through openings in the printed circuit board for improving the stability of the actuating element. The bottom of the actuating element rests on an elastic member, which is located between the arms and rests on the printed circuit board. A pin of smaller diameter than the elongated part is located on the bottom of the actuating element and extends through an opening in the elastic member to above the contact.

[0004] The contact is actuated by applying a force on the actuating element in the direction of the wall of the housing, by which the pin of the actuating element is moved against the contact and actuates it. Due to the presence of the arms on the sides of the actuating element, the movement of the actuating element is mainly limited to a sliding in its longitudinal direction in the direction of the contact. As a result of this sliding movement, the pin is brought against the contact, so that this is actuated. Simultaneously with the movement of the actuating element, the elastic member is compressed between the bottom and the printed circuit board. When the actuating element is released by the user, the actuating element is moved back to its original position by the spring force of the elastic member.

[0005] However, the apparatus described in US-A-4,181,826 shows the disadvantage that it comprises a lot of elements which require assembly, namely the actuating element, the elastic member, the housing, the contact and the printed circuit board. This means that during construction of the apparatus, all these elements have to be mounted into and onto each other, which can lead to an expensive and time-consuming production process.

[0006] It is an object of the present invention to provide a contact actuating apparatus which can be constructed in a simple way.

[0007] This object is achieved according to the invention in that the actuating element and the wall of the housing are constructed in one piece, the upper part being connected to the wall of the housing via a flexible joint, which permits a rocking movement of the actuating element with respect to the housing.

[0008] Because the actuating element and the housing are constructed in one piece, no assembly of different elements is required upon construction of the apparatus. During the production process, only a mounting of the contact within the housing is required.

[0009] The one-piece construction of the actuating element and the housing allows only a small displacement of the actuating element, as the stiffness of the material in which the wall of the housing is made counteracts the pushing in of the upper part of the actuating element. The actuation of the contact however requires a larger displacement of the lower part of the actuating element. In the apparatus of the invention, this problem is solved by the flexible joint between the actuating element and the housing, as the flexibility permits a rocking movement of the actuating element. Upon occurrence of a pressure force, the actuating element will slightly pivot about the flexible joint. Because the actuating element is elongated in the direction of the contact, the end of the lower part of the actuating element will at the same time be moved over a distance long enough to make actuation of the contact possible. Furthermore, the flexible joint makes sure that the actuating element returns to its original position after the pressure force has ended. This has the advantage, that the use of a separate elastic member for returning the actuating element to its original position can be avoided. The apparatus of the invention further has the advantage that the movement of the actuating element is limited to a pivotal movement about the flexible joint. As a result, the use of means for stabilising the movement of the actuating element, such as the arms on the sides of the lower part of the known apparatus, can be avoided.

[0010] The flexible joint is obtained by a suitable choice of the material in which the housing and the actuating element are made, and possibly by making the material thickness of the joint thinner with respect to the material thickness of the wall of the housing. The material is preferably a plastic material with one the one hand sufficient stiffness to prevent fissures in the actuating element or the joint with the housing, and on the other hand sufficient flexibility to obtain the flexible joint between the actuating element and the housing. Such a material is for example a plastic material such as a thermosetting resin or a thermoplastic, for example polycarbonate, or any other material deemed suitable by the person skilled in the art. The use of polycarbonate further has the advantage that the housing and the actuating element can be made using an injection moulding technique, which is known to the person skilled in the art.

[0011] In a preferred embodiment of the apparatus of the invention, the upper part of the actuating element comprises a lip, which is connected to the wall of the housing via a flexible joint. The lower part of the actuating element is elongated to bridge the distance between the lip and the contact and has a greater length than the lip. In this way it can be obtained that the actuating element upon occurrence of a pressure force functions as a lever and that, upon pivotal movement of the actuating element in the direction of the interior space within the housing, the end of the lower part of the actuating element is moved over a longer distance than the lip. As the lip can only be moved over a small distance due to the one-piece construction with the housing, it can be obtained with the lever effect that a small displacement of the lip suffices to obtain a sufficiently large displacement of the lower end of the lower part.

[0012] The lip is preferably included in a cut-out of the wall of the housing and on one side connected therewith. The cut-out is preferably U-shaped, but may also have any other shape.

[0013] The lower part preferably extends in a direction substantially perpendicular to the direction of the lip. This allows a positioning of the contact at the bottom of the housing, which can facilitate the mounting of the contact in the housing. Furthermore, with the perpendicular arrangement it can be obtained that, when the actuating element pivots about the flexible joint, the end of the lower part is moved in a direction substantially perpendicular to the direction of the pressure force. Amongst others this means that, (i) in case of a horizontal arrangement of the lip, a substantially vertical movement of the lip causes a substantially horizontal movement of the end of the lower part, or that (ii) in case of a vertical arrangement of the lip, a substantially horizontal movement of the lip causes a substantially vertical movement of the end of the lower part. In other words, as the lower part of the actuating element is substantially perpendicular to the lip, it can be obtained that the contact can be actuated in a direction substantially perpendicular to the direction of the pressure force. This can lead to an improved actuation of the contact.

[0014] The lower part of the actuating element preferably extends over almost the entire height of the housing. This has the advantage that the contact can be placed in the housing on a long distance from the lip. For example, when the lip is located on the top side of the housing, the contact can be mounted completely at the bottom of the housing. This can facilitate mounting the contact in the housing, which can lead to a simpler manufacturing of the apparatus. Furthermore, the greater length of the lower part leads to the fact that, upon pivotal movement of the actuating element, the end of the lower part is moved over a long distance. This has the advantage that a less sensitive contact is needed in the apparatus of the invention.

[0015] In the apparatus of the invention, the contact is preferably arranged in such a way that it is actuated by the lower part in a direction substantially perpendicular to the direction in which the upper part of the actuating element is actuated by the user. This has the advantage that the actuating element can be constructed in the way described in the previous paragraphs, with the advantages mentioned above.

[0016] The lip preferably has a top side on which a protrusion is provided. This protrusion preferably has a round shape with a concave top surface, but it may also have any other shape known to the person skilled in the art. Providing the protrusion has the advantage that from a pressure force exerted on the lip substantially only the force component perpendicular to the lip is transferred to the actuating element. In this way a better directed movement of the actuating element can be obtained. Providing the protrusion further has the advantage that the accessibility of the actuating element is improved for the user.

[0017] Further advantages of the contact actuating apparatus according to the invention will appear from the description given below and the annexed figure.

[0018] Figure 1 shows a preferred embodiment of the contact actuating apparatus according to the invention.

[0019] The contact actuating apparatus shown in figure 1 comprises a housing 1 with a wall 2 and an interior space. The apparatus further comprises an actuating element 3, 4 which is constructed in one piece with the wall of the housing. A contact 6 is located in the interior space of the housing 1. The actuating element 3, 4 comprises an upper part 3 which is accessible from the outside and a lower part 4 which is elongated in the direction of the contact 6 and which is provided to actuate this contact. The upper part 3 of the actuating element is connected to the wall 2 of the housing 1 via a flexible joint 9. This flexible joint permits a pivotal movement of the actuating element 3, 4 with respect to the housing 1.

[0020] The contact 6 is for example an electrical or mechanical contact, with which an electrical or electronic connection can be realised, or an electrical switch, or any other contact known to the person skilled in the art. The contact 6 is for example located on a printed circuit board 16, which is mounted in the bottom of the housing 1 in vertical direction. The contact 6 may however also be mounted inside the housing 1 in any other way known to the person skilled in the art.

[0021] The actuating element 3, 4 is preferably connected to a top side 2 of the housing, but may also be connected to a side wall or any other part of the housing. It preferably extends in vertical direction, but it may also extend in any other direction.

[0022] In the apparatus of figure 1, the top part 3 comprises a lip 7, which is included in a cut-out 8 of the top side 2 of the housing 1 and is connected to the housing 1 on one side. The cut-out 8 is preferably U-shaped, but may also have any other shape. The lower part 4 of the actuating element is preferably perpendicular to the lip 7, but may also enclose an acute to obtuse angle with the lip 7. The lower part 4 preferably has a straight

shape, but may also have an arched or angled shape.

[0023] The lower part 4 preferably has a greater length than the lip 7 and preferably extends over substantially the entire height of the housing 1. In this way, the contact may be located at the bottom of the housing.

[0024] On the top side of the lip 7, preferably a protrusion 10 is provided. The protrusion 10 preferably has a round shape with a concave top surface, but may also have a spherical shape or any other shape known to the person skilled in the art.

[0025] The flexible joint 9 of the lip 7 with the top side 2 may be weakened or not. A weakened joint means that it is thinner than the top side 2 of the housing 1. By weakening the joint 9, a better directed movement of the actuating element 3, 4 can be achieved, as the axis about which the actuating element pivots is determined by the weakness. This can facilitate the actuation of the contact 6.

[0026] In the apparatus of figure 1, the lower part 4 comprises an oblong part 11, which extends substantially perpendicularly to the lip 7 and has a greater length than the lip 7. This oblong part 11 comprises first and second flat planes 12 and 13, of which the first plane 12 faces the contact element 5 of the contact 6 and the second plane 13 is located on the opposite side of the oblong part 11. To obtain sufficient rigidity, preferably a rib 14, 15 is provided in the middle of each flat plane 12, 13 in longitudinal direction, the rib being substantially perpendicular to the flat plane. The rib 14 on the first flat plane 14, which faces the contact element 5, preferably extends over at least the upper half of the first flat plane 12, the rib 14 having a sloping course, so that it disappears towards the bottom into the first flat plane 12, leaving a flat part of sufficient size to enable an easy actuation of the contact. The rib 13 on the second flat plane preferably extends over the entire length of the second flat plane 14. By providing the ribs 14, 15 it can be achieved, that the deflection of the oblong part 11 is minimised, when a pressure force exerted on the lip 7 pushes the lower part of the oblong part 11 against the contact. In other words, by providing the ribs 14, 15 it can be achieved that the pressure force exerted on the lip 7 is substantially completely transferred to the lower end of the oblong part.

[0027] The contact actuating apparatus shown in figure 1 operates as follows. In order to actuate the contact 6, a user exerts a pressure force onto the lip 7. This pressure force can be caused by the user in a simple way, due to the provision of the protrusion 10 on the top side of the lip 7. In response of the pressure force, the lip 7 pivots about the flexible joint 9 with the top side 2 of the housing, the protrusion 10 being moved substantially in vertical direction. Because of the pivotal movement of the lip 7, the lower end of the lower part 4 is substantially moved in horizontal direction, the lower end of the first flat plane 12 being brought against the contact element 5 of the contact 6. Due to the presence of the ribs 14, 15 on the flat planes 12, 13 of the lower part 4, the deflection of the lower part 4 is limited to a minimum, so that the pressure force exerted on the lip 7 is substantially completely transferred to the lower end of the first flat plane 12. As a result, this lower end of the first flat plane 12 exerts a force onto the contact element 5 of the contact 6, which force is large enough to actuate the contact 6. Because of the flexibility of the joint 9, the actuating element 3, 4 returns to its original position after the pressure force has ended.

[0028] The geometry of the lower part 4 of the actuating element 3, 4 is preferably such that upon exertion of a pressure force onto the lip 7 the actuation of the contact 6 can be ensured. To this end, the first flat plane 12 below needs to be wide enough to ensure that it is still pressed against the contact element 5 if the horizontal movement of the lower end diverges somewhat from the direction perpendicular to the contact element 5. Furthermore, the lower part 4 needs to have sufficient rigidity to ensure the transfer of the pressure force towards the lower end and to prevent a breaking of the lower part 4. On the other hand, the lower part 4 needs to be flexible enough to permit a deflection of the lower part 4 if a too large pressure force is exerted onto the lip. This is because a pressure force which is too large causes a too large displacement of the lip 7, while the lower end of the lower part 4 is stopped by the contact 6. So if the lower part 4 does not have sufficient flexibility, this too large pressure force would cause a too large force onto the contact 6, which could damage the contact 6.

[0029] The apparatus of figure 1 can be constructed in a simple way, in that the actuating element 3, 4 is constructed in one piece with the housing 1. The construction can for example be performed by means of injection moulding of a plastic material, for example polycarbonate, in a suitable mould, or by means of another technique known to the person skilled in the art. Because the actuating element 3, 4 is constructed in one piece with the housing, furthermore no assembly of different parts is required to obtain the actuating element 3, 4. This can lead to a saving of costs and time in constructing the apparatus according to the invention.

[0030] In a further preferred embodiment of the apparatus according to the invention, a protective foil (not shown) is attached to the top side of the housing, the foil having an opening for admitting the protrusion 10. In this way it can be obtained, that the user gets the impression that, upon actuating the contact, he presses a conventional pushbutton, as he cannot see the lip 7 or the U-shaped cut-out 8 due to the presence of the foil. The user merely sees the protrusion 10 on the lip 7, which can enhance the attractiveness of the apparatus.

[0031] The foil is attached to the top side of the housing 1 in a manner known to the person skilled in the art, for example by gluing by means of a glue, or in any other way. Preferably, it is made sure that, in gluing the foil onto the housing, no glue is present on the top side 2 in the region of the lip 7, so that later on the moving ability

of the lip in response of a pressure force can be ensured.

Claims

1. A contact actuating apparatus comprising a housing (1) with a wall (2) and an interior space and an actuating element (3, 4) for actuating the contact (6), the contact (6) being located in the interior space of the housing (1), the actuating element (3, 4) comprising an upper part (3) which is accessible from outside the housing (1) and a lower part (4) which is elongated in the direction of the contact (6) and is provided to actuate the contact (6), **characterised in that** the actuating element (3, 4) and the wall (2) of the housing (1) are constructed in one piece, the upper part (3) being connected to the wall (2) of the housing (1) via a flexible joint (9), which permits a rocking movement of the actuating element (3, 4) with respect to the housing (1).

2. Apparatus according to claim 1, **characterised in that** the upper part (3) of the actuating element comprises a lip (7), which is connected to the wall (2) of the housing (1) via the flexible joint (9), the lower part (4) for actuating the contact (6) having a greater length than the lip (7).

3. Apparatus according to claim 2, **characterised in that** the lip (7) is included in a cut-out (8) in the wall (2) of the housing (1) and is connected to the wall (2) of the housing (1) on one side.

4. Apparatus according to claim 2 or 3, **characterised in that** the lower part (4) extends in a direction substantially perpendicular to the direction of the lip (7).

5. Apparatus according to any one of claims 1-4, **characterised in that** the lower part (4) extends over substantially the entire height of the housing (1).

6. Apparatus according to any one of claims 1-6, **characterised in that** the contact (6) is arranged such that it is actuated by the lower part (4) in a direction substantially perpendicular to the direction in which the upper part (3) is actuated.

7. Apparatus according to any one of claims 2-6, **characterised in that** the lip (7) has a top side on which a protrusion (10) is located for actuating the lip.

8. Apparatus according to any one of claims 2-7, **characterised in that** the lower part (4) comprises an oblong part (11) with two opposite side planes (12, 13), of which the first plane (12) faces the contact (6) and of which the second plane (13) is located on the opposite side of the oblong part, each flat plane being provided with a rib (14, 15) for reinforcement of the oblong part (11).

9. Apparatus according to any one of claims 1-8, **characterised in that** a protective foil is attached to the wall (2) of the housing (1).

10. Apparatus according to claim 9, **characterised in that** the protective foil shows an opening for admitting the protrusion (10) on the lip (7).

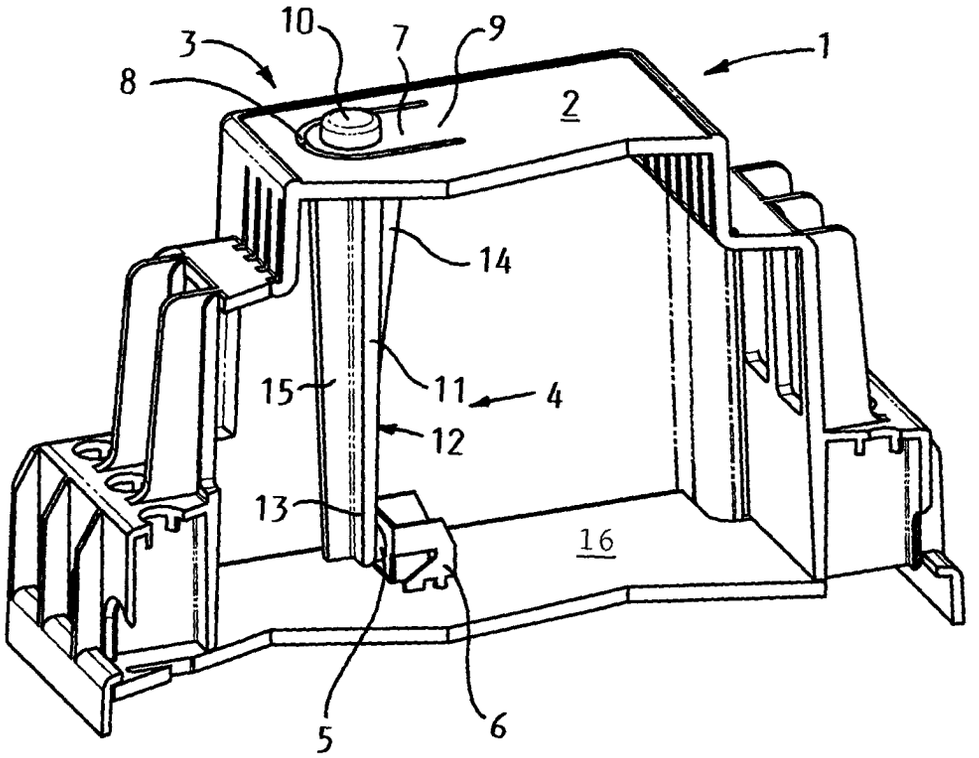

FIG. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 87 0154

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 4 582 967 A (WATKINS RICHARD R ET AL) 15 April 1986 (1986-04-15) * column 3, paragraph 3 - paragraph 5; figures 3,5 *	1-4	H01H13/14
Y	US 4 323 740 A (BALASH FREDERICK A) 6 April 1982 (1982-04-06) * figures 1,2 *	1-4	
Y	EP 0 407 754 A (GRUNDIG EMV) 16 January 1991 (1991-01-16)	1	
A	* abstract; figure 1 *	5	
A	US 4 701 581 A (WODNICKI GLEN G ET AL) 20 October 1987 (1987-10-20) * column 3, paragraph 5 - paragraph 6; figures 1,5 *	1-5	
A	EP 0 278 018 A (WEISS HANS) 17 August 1988 (1988-08-17) * abstract; figure 3 *	1,5	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	US 4 160 887 A (VAN BUREN JR HAROLD S) 10 July 1979 (1979-07-10) * figure 3 *	1	H01H
A	US 5 408 044 A (SPIEGEL ALAN M) 18 April 1995 (1995-04-18) * figure 4A *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 November 2000	Janssens De Vroom, P

CATEGORY OF CITED DOCUMENTS

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22-11-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4582967 A	15-04-1986	NONE	
US 4323740 A	06-04-1982	BE 887349 A	01-06-1981
		CA 1179749 A	18-12-1984
		DE 3103768 A	28-01-1982
		FR 2475288 A	07-08-1981
		GB 2068643 A,B	12-08-1981
		JP 56123629 A	28-09-1981
EP 0407754 A	16-01-1991	DE 8908429 U	24-08-1989
		AT 112412 T	15-10-1994
		DE 59007311 D	03-11-1994
US 4701581 A	20-10-1987	CA 1297142 A	10-03-1992
		EP 0261052 A	23-03-1988
		IT 1222589 B	05-09-1990
EP 0278018 A	17-08-1988	AT 44125 T	15-06-1989
		DE 3760258 D	20-07-1989
		GR 3000076 T	31-10-1990
US 4160887 A	10-07-1979	BR 7805048 A	02-05-1979
		GB 2002592 A,B	21-02-1979
		JP 54044782 A	09-04-1979
US 5408044 A	18-04-1995	NONE	

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