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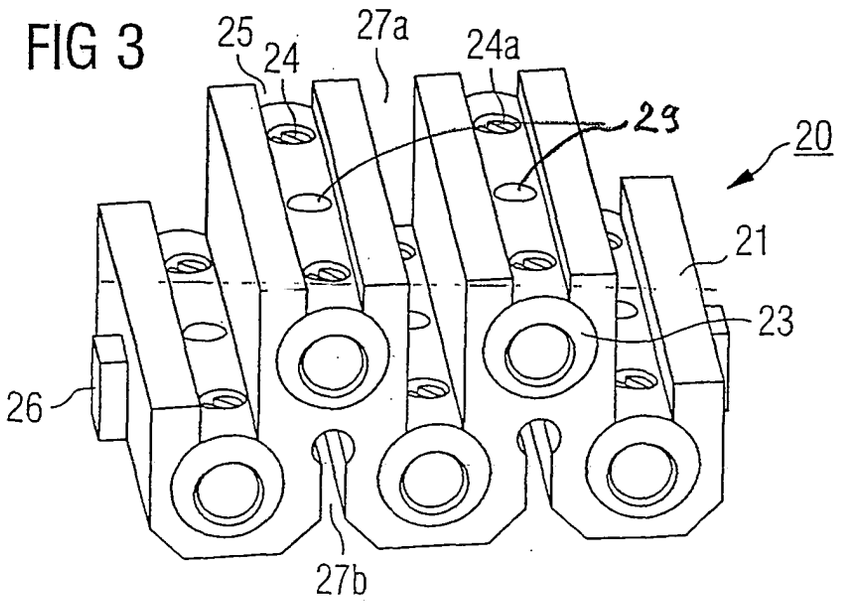
(54) Cable-junction block

(57) A cable-junction block (20) is provided for forming a low-voltage cable junction for cables incorporating five or mote cores. The block (20) comprises connector sections (21) moulded integrally with one another. Each of the connector sections (21) comprises a hollow, substantially cylindrical interior space (22) with a likewise substantially cylindrical contact piece (23) that is disposed in the interior space. In each case the contact piece (23) is insulated from the contact pieces (23) in the other connector sections (21) and can receive two opposed cable-core ends. Each contact piece (23) has at least one fixation element (24) that can be moved radially into the interior space (22) of the contact piece (23) in order to retain the cable ends in their inserted state. The cable block (20) comprises m connector sections (21) that are disposed in a first plane and *n* connector sections (21) that are disposed in a second plane, such that $m > 2$ and $n > 3$. These connector sections (21) are connected to one another in such a way that engagement sections (24a) of the fixation elements (24) are accessible from one side of the cable-junction block (20), as also are inspection openings if present.

FIG 3



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Description

[0001] The present invention relates to a cable-junction block for a gel-filled low-voltage cable connection.

[0002] Cable-junction blocks of this kind are known in the form of specially configured polypropylene housings, and such housings are used to insulate and seal off the junctions of low-voltage single- or multiple-core cables.

[0003] Figure 1 shows a known cable-junction block (10) for this type of low-voltage cable junction as seen in perspective from the front. This example is designed for five-core cables, and accordingly comprises five connector sections (11). Here these are arranged in a star shape around a central axis (not individually identified here). It can also be seen that in each of the connecting sections (11) are disposed a cylindrical opening (12) and a contact piece (13) to receive the associated cable cores; near each of the two opposed ends of each contact piece is provided a fixing screw (14) with an engagement section in the form of a groove (14a). into which a screwdriver can be inserted, so that the screw can be rotated into the interior of that contact piece.

[0004] Around this arrangement, moulded to the block (10), are four fixation wings (16) by means of which the block (10) can be fixed within an outer housing (not shown).

[0005] To achieve a water-tight sealing of the junction that is as complete and reliable in the long term as possible, the gel must surround each cable core as well as the contact piece as closely as possible and fill up any intervening spaces. Furthermore, it is a requirement that such cable junctions be produced on site as easily as possible, provide sufficient insulation between the individual cable cores, and of course also be as compact as possible.

[0006] The known cable-junction blocks, as shown for example in Fig. 1, do not entirely fulfil these requirements.

[0007] It is thus the object of the present invention to provide a cable-junction block that is an improvement with respect to at least some of the requirements mentioned above.

[0008] According to the present invention there is provided a cable-junction block for forming a low-voltage cable junction for cables incorporating five or more cores, comprising connector sections moulded integrally with one another, each of which connector sections comprises a hollow, substantially cylindrical interior space with a likewise substantially cylindrical contact piece that is disposed in the interior space and in each case is insulated from the contact pieces in the other connector sections, to receive two opposed cable-core ends, wherein each contact piece has at least one fixation element that can be moved radially into the interior space of the contact piece in order to retain the cable ends in their inserted state, characterized in that m connector sections are disposed in a first plane and *n* connector sections in a second plane, such that $m \geq 2$ and $n \geq 3$, and these are connected to one another in such a way that engagement sections of the fixation elements are accessible from one side of the cable-junction block.

[0009] The invention was designed with five-core low-voltage cables, in particular, in mind but can also in principle be applied to cables with a larger number of cores. In all cases the connector sections that form the cable-junction block and constitute an integral unit are disposed in two planes and the engagement sections of fixation elements (e.g. the grooves in fixation screws) of the contact pieces contained therein are all accessible from one side of the block. In cases where inspection openings are provided in the connector sections, the same applies to these inspection openings as well.

[0010] This measure makes production of the junctions of the individual cable cores particularly easy and rapid for the assembler, and an analogous advantage pertains to testing the junctions. Furthermore, the proposed arrangement enables a compact construction of the block and hence of the entire gel-filled connection region, and at the same time (in comparison to the compact external configuration) the central regions of the contact pieces are spaced far apart, ensuring good insulation between them.

[0011] Hence, the connector sections are disposed in two planes substantially parallel to one another, such that at least two of the connector sections are in one of the planes and at least three of the connector sections are in the other plane. The fixation elements are oriented in substantially the same lateral direction with respect to the planes, and the connector sections are spaced apart and stacked in such a way that they permit a fixation tool to be inserted in order to actuate the fixation elements of the connector sections in one of the planes by guiding the tool between the connector sections in the other plane.

[0012] The cable-junction block is designed to be a component in a gel-filled or gel-sealed cable junction and the connector sections are spaced apart and shaped in such a way that when an electrically insulating gel is pressed into the space around the block, this gel penetrates into the structure and additionally seals off and electrically insulates the contact pieces and the cable-core ends from the surroundings of the cable-junction block.

[0013] Preferably, therefore, between every two connector sections that are disposed in the same plane there are provided channels which run, in particular, substantially parallel to the long axes of the connector sections and contact pieces. As a result, it is ensured that the gel provided in the connection region can flow sufficiently through and around the block, and closely encloses all the relevant surfaces.

[0014] Preferably also, each connector section comprises a slot that passes entirely through the section, within which the internally disposed contact piece lies freely and by way of which the engagement sections of

the fixation screws are accessible.

[0015] Preferably also, the external shape of the connector sections is substantially prismatic or cuboid. In particular, at least one free edge of each of these prisms or cuboid structures is bevelled or rounded. Together, these features contribute to the compact structure of the cable junction while ensuring that the individual contact pieces or cable cores are spaced far apart, and moreover they enable the cable-junction block to be easily inserted into the outer case or sheath of the junction block. The above-mentioned bevelled (chamfered) or rounded edges can also form additional "fluid channels", which further optimize flowing of the gel around the block.

[0016] In addition, a further measure in the interest of a compact structure is that the slot passing through some of the connector sections is preferably disposed in a side surface of the prism or cuboid, whereas in other connector sections it is disposed off-centre, oriented at an angle from an edge region into the interior. This enables an especially close-packed arrangement of the connector sections in the two planes, without making it more difficult to tighten the fixation screws.

[0017] Preferably also, at narrow side surfaces of the block there are provided engagement means, in particular ribs, to engage a correspondingly shaped interior wall section of a cable-junction sheath. Thus insertion into the outer case can be accomplished relatively easily, and nevertheless the cable-junction block is then securely retained therein.

[0018] Preferably also, within the connector sections structures are provided to serve as abutments or lugs for positioning the contact pieces, which enable these to be kept securely in place within the junction block. It is particularly advantageous for these structures to be formed as abutments at one end of the connector sections and at the other end as catch means, within or behind which the contact piece is locked.

[0019] As mentioned above, the cable-junction block is suitable for five- or multiple-core cables; the preferred designs are for cables with an odd number of cores, in which case the number of connector sections in the one plane is always larger by one than the number in the other plane. In this case the above-mentioned aspects of the invention prove especially advantageous.

[0020] The invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a cable-junction block according to the state of the art;

Figs. 2 is a perspective view of a cable-junction block according to one embodiment of the invention;

Fig 3 is a modification of the cable-block junction shown in Fig. 2;

Figs. 4A to 4C are side, front and plan views respectively of a cable-junction block similar to that shown in Fig. 2 but with modifications as described below, Fig. 4B being in partial cross-section along the dot-dash line shown in Fig. 4C;

Fig. 5 is view to an enlarged scale of the encircled detail in Fig. 4B;

and Fig. 6 is a cross section view of a modified contact piece for securely accommodating more than 2 wires.

[0021] In the following description, for all of the Figures 2 to 6 the same reference numerals are used for identical parts of the cable-junction block. The cable-junction block (20) in this example comprises five connector sections (21) disposed in two planes substantially parallel with one another, such that two of the connector sections (21) are in one of the planes and of the connector sections (21) are in the other plane. Each of the connector sections (21) has an approximately cuboid shape and preferably at least one free edge section of the prismatic or cuboid connector sections (21) is bevelled or rounded. The connector sections (21) are moulded in one piece, and each contains a substantially cylindrical opening (22) passing through it in the long direction. Into each of these longitudinal openings (22) is inserted a likewise substantially cylindrical contact piece (23) to receive cores of the cables (not shown) that are to be connected. The contact piece (23) is, as a preference, made from metal to allow for a good Ohmic contact between the two wires held within. Close to its end faces each contact piece, in the same way as in the contact pieces according to the state of the art, is provided with fixation screws (24), which have grooves (24a) to serve as engagement sections for a tool such as a screwdriver and by means of which the screws can be advanced radially into the interior of the contact pieces (23).

[0022] All the connector sections (21) have on one side of the cuboid structure a slot (25) that extends in the long direction and there opens up the associated connector section substantially completely as far as the surface of the contact piece (23). The embodiments shown in Figs. 2 and 3 differ slightly from one another insofar as the slots (25) in the embodiment according to Fig. 3 are open at both ends, whereas in the embodiment according to Fig. 2 the wall at the end faces of the associated connector section remains intact. It should be explicitly pointed out that all of the slots are open towards the same one of the broad sides of the junction block (20), and hence all engagement sections (24a) of the fixation screws (24) can be actuated from this side.

[0023] Also shown in the contact piece (23) of figure 3, are inspection holes (29). These holes (29) are provided through the wall of the contact piece (23), at the same circumferential position as the fixation screws, so

that it is possible for a user of the cable-junction block (20) to see whether the wires (not shown in the figure) are sufficiently well inserted within the contact piece. Such holes (29), are preferably positioned toward the centre of the contact piece (23), as this means that it is possible to ensure that both wires to be connected are fully inserted. It is further possible to provide a screw thread on the inside surface of this inspection hole, so that a further fixation screw (24) can be inserted.

[0024] As is shown in the modified contact piece (23) of figure 6, which is shown in cross section in the figure, the contact piece (23) is provided with a plurality of threaded fixation screw points (33a-c). This modification is similar to that discussed above, wherein the middle inspection hole (29) is provided with a screw thread for fixation of a further screw (24). Such an adaptation, is particularly suited to the interconnection of more than two wires within the contact piece (29). As is shown in the figure, the first cable (30), which is considered as a branching conductor, is held in place by a screw (24) through the centre threaded fixation point (33b). The two threaded holes (33a & c) provide visible inspection points into the body of the contact piece (23), to ensure that the first branching cable (30) is in position prior to being fixed. A second main connector cable (31) can then be positioned over the first cable (30), and slid into the contact piece (23) as far as the screw(24) in the central bore (33b) will allow. This second cable (31) is then held in position by a fixation screw (24) passing through the left threaded bore (33a). Finally, the third main connector cable (32) is slid into the contact piece (23) until it abuts with the first branching cable (30). Once in this position, a final screw (24) passing through the right bore (33c) will fix this third cable (32) in position.

[0025] On both of the narrow sides of the junction block (20) there are provided ribs (26) to engage with correspondingly shaped structures formed on a case (not shown) that will enclose the junction block (20).

[0026] Between the two connector sections (21) disposed on the upper side of the junction block (20) is provided a broad channel (27a), which firstly provides access to the connector section lying directly below it, thus making it possible to actuate the fixation screws situated there, and secondly is filled up with the gel filling when the cable junction has been completed. On the underside, between the three connector sections (21) located there, are disposed two narrower channels (27b), which are widened toward their end and serve to make the flow of gel around the associated connector sections as widespread as possible.

[0027] Figures 4A to 4C show a modified cable-junction block (20) in greater detail from the side, the front and above so that the relative size relationships of the individual sections is clearer. In other respects, however, the above description also applies here. In these drawings can be seen structures (28a, 28b) that are formed in the connector sections and serve to restrict the positions of the contact pieces (omitted in these drawings).

[0028] In the modification, a slot (25') is provided in the two outermost connector sections in the lower row; as also shown in the detail drawing of Fig. 5, this slot is situated off-centre and is slanted. This enables a "denser packing" of the connector sections and thus allows the overall dimensions of the cable-junction block to be further reduced.

Claims

1. A cable-junction block (20) for forming a low-voltage cable junction for cables incorporating five or more cores, comprising connector sections (21) moulded integrally with one another, each of which connector sections (21) comprises a hollow, substantially cylindrical interior space (22) with a likewise substantially cylindrical contact piece (23) that is disposed in the interior space and in each case is insulated from the contact pieces (23) in the other connector sections (21), to receive two opposed cable-core ends, wherein each contact piece (23) has at least one fixation element (24) that can be moved radially into the interior space of the contact piece (23) in order to retain the cable ends in their inserted state, **characterized in that**
connector sections (21) are disposed in a first plane and *n* connector sections (21) in a second plane, such that $m \geq 2$ and $n \geq 3$, and these are connected to one another in such a way that engagement sections (24a) of the fixation elements (24) are accessible from one side of the cable-junction block (20).

2. A cable-junction block (20) according to Claim 1, **characterized in that** the connector sections (21) in the plane adjacent to one side of the block are spaced apart and/or shaped in such a way that a fixation tool can be guided between them in order to reach the fixation elements (24) of the contact pieces (23) in the connector sections (21) of the second plane in order to ensure that the engagement sections (24a) in all of the contact pieces (23) are accessible from said one side of the cable-junction block (20).

3. A cable-junction block (20) according to Claim 1 or Claim 2, **characterized in that** between every two connector sections (21) disposed in a single plane is provided a channel (27a, 27b) running substantially parallel to long axes of the connector sections in such a way that gel flows around most of the surface of the connector sections in the gel-filled cable junction, so that the contact pieces (23) and cable-core ends are sealed off from the surroundings and electrically insulated.

4. A cable-junction block (20) according to any of

Claims 1 to 3, **characterized in that** each connector section (21) comprises a slot (25, 25') passing through it, the contact piece (23) being freely disposed in the interior space of the connector section (21) and the engagement section (24a) of the fixation element (24) being accessible via the slot (25,25').

5. A cable-junction block (20) according to any of Claims 1 to 4, **characterized in that** the external shape of the connector sections (21) is substantially prismatic or cuboid.

6. A cable-junction block (20) according to Claim 5, **characterized in that** at least one free edge section of the prismatic or cuboid connector sections (21) is bevelled or rounded.

7. A cable-junction block (20) according to Claim 5 or Claim 6 when dependent on Claim 4, **characterized in that** in some of the connector sections (21) the slot (25) is disposed in a side surface of the prismatic or cuboid connector section (21), whereas in other connector sections (21) the slot (25') is disposed off-centre and is oriented at an angle, from one edge region into the interior space of the connector section (21).

8. A cable-junction block (20) according to any of Claims 3 to 7 when dependent on Claim 3, **characterized in that** at least one of the channels (27b) between the connector sections (21) is expanded at the bottom.

9. A cable-junction block (20) according to any of Claims 1 to 8, **characterized in that** the total number of connector sections (21) is an odd number, such that $n \geq m + 1$.

10. A cable-junction block (20) according to any of Claims 1 to 9, **characterized in that** on side surfaces of the block ribs (26) are provided to engage a correspondingly shaped section of the interior wall of a cable-junction sheath.

11. A cable-junction block (20) according to any of Claims 1 to 10, **characterized in that** within the connector sections (21) structures (28a, 28b) are provided to fix the position of the contact pieces (23).

12. A cable-junction block (20), according to any claims 1 to 11, **characterised in that** there is provided at least one inspection hole through the connector sections (21), which allows visual inspection into the cavity through the contact piece (23), the inspection hole being sited such that it is visible from the same side of the contact piece (23) as the fixation elements (24) are accessed.

13. A cable-junction block (20), in particular according to any of claims 1 to 12, **characterised in that**:

the contact piece (23) is provided with at least one inspection hole, with this inspection hole being provided with a threaded interior for accommodation of a further fixation element (24).

14. A cable-junction block (20) according to any of claims 1 to 13, **characterised in that** the contact piece (23) is made from metal.

15. A contact piece (23) for a cable-junction block (20), in particular according to any of the claims 1 to 14, **characterised in that**:

the contact piece (23) is provided with a plurality of holes (33a-c) allowing visual access to the centre of the contact piece (23), wherein each of the holes (33a-c) has a threaded interior for accommodation of a fixation element (24).

16. A contact piece (23) according to claim 15, **characterised in that** it is made from metal.

17. A contact piece (23) according to claims 15 and 16, **characterised in that** three cables (30-32) are to be held, and three fixation elements (24), one per cable (30-32) are provided to ensure a secure connection, through the three holes (33a-c).

FIG 1

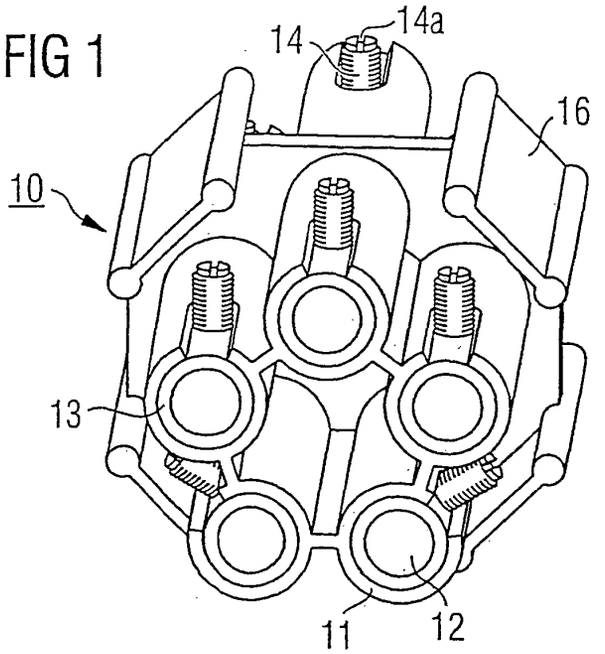


FIG 2

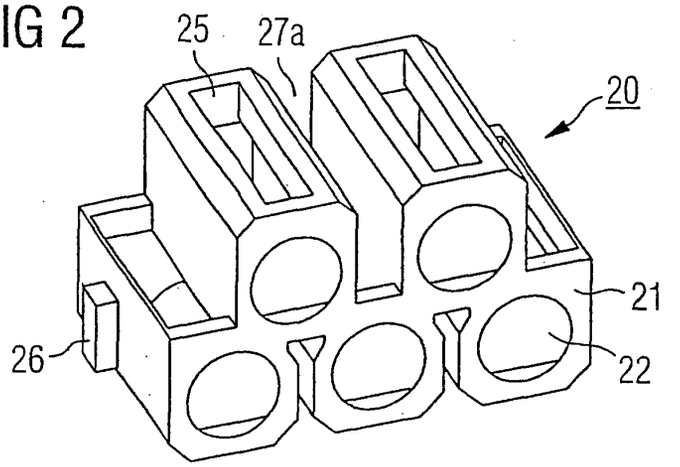
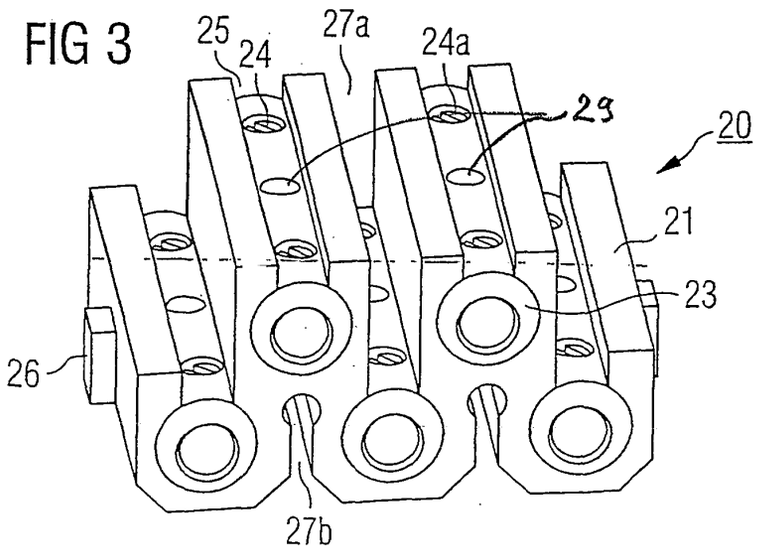


FIG 3



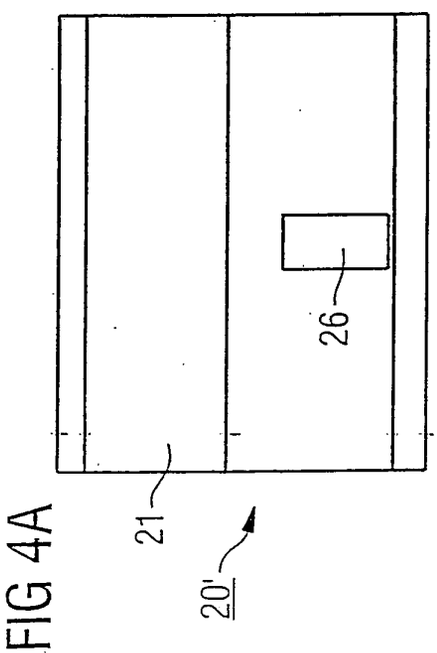


FIG 4A

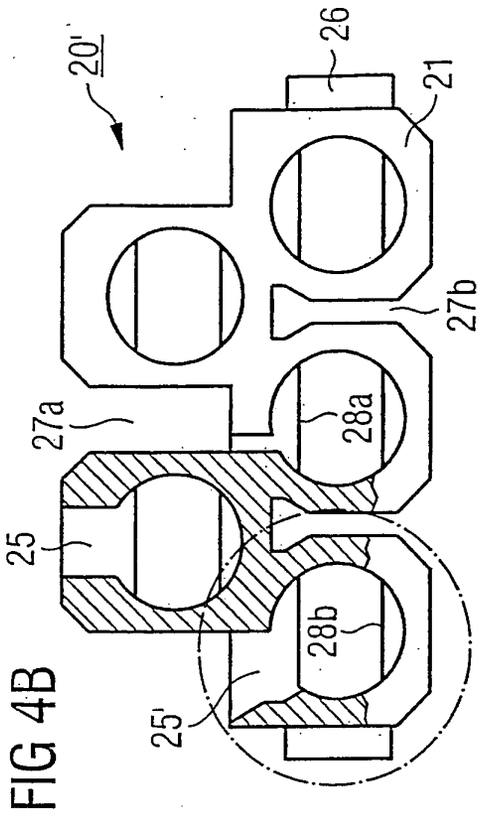


FIG 4B

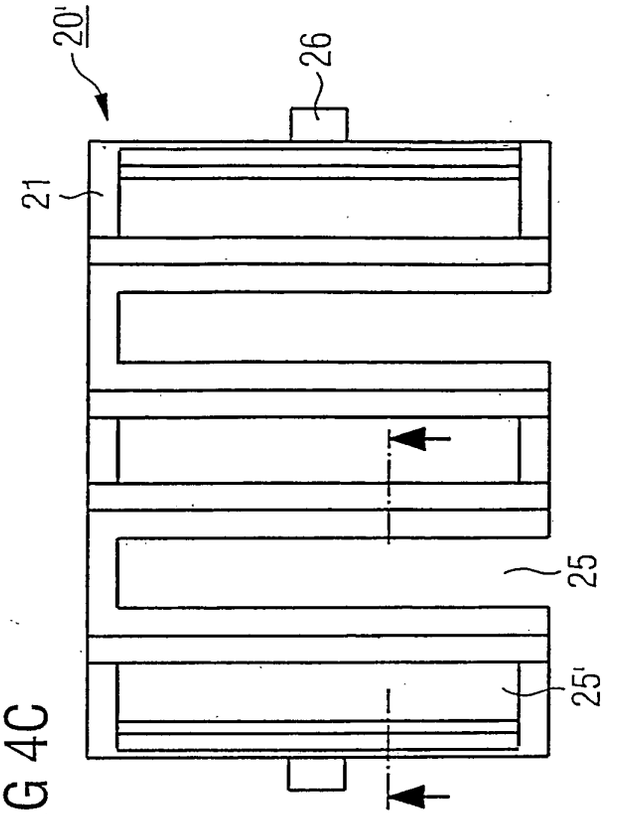


FIG 4C

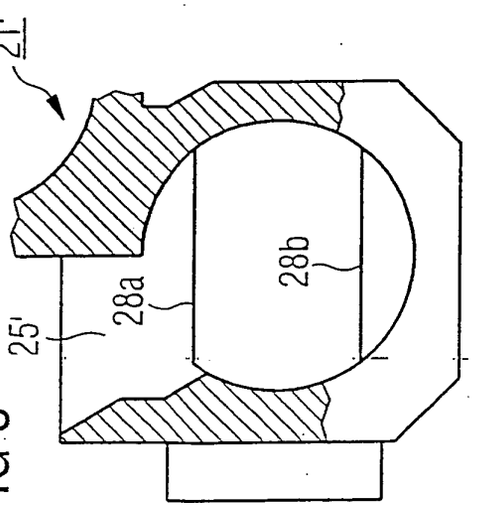


FIG 5

FIG 6