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(54) Electrical track and connector assembly for electrical systems with track-type distribution

(57) In an electrical track (10) and a complementary connector (11) assembly for the distribution of electric power in a track-type electrical system, the track comprises an external casing which is generically U-shaped to define a channel (13) internally provided with electric contact lines (17) and an inlet (14) on one face of the track to receive a coupling portion (15) of the complementary connector (11). The coupling portion of the connector comprises electric contact elements (18, 19, 20) for connection to the electric contact lines (17) inside the channel. The outer surface (12) of one of the two arms of the U constitutes a side for fastening the track, the aperture (14) of the channel opening out in a direction substantially parallel to the fastening side (12). The connector has an element (21) which hooks onto the track, which is disposed on the leading end of the coupling portion (17) of the connector to engage with an undercut (22) on the bottom of the channel.

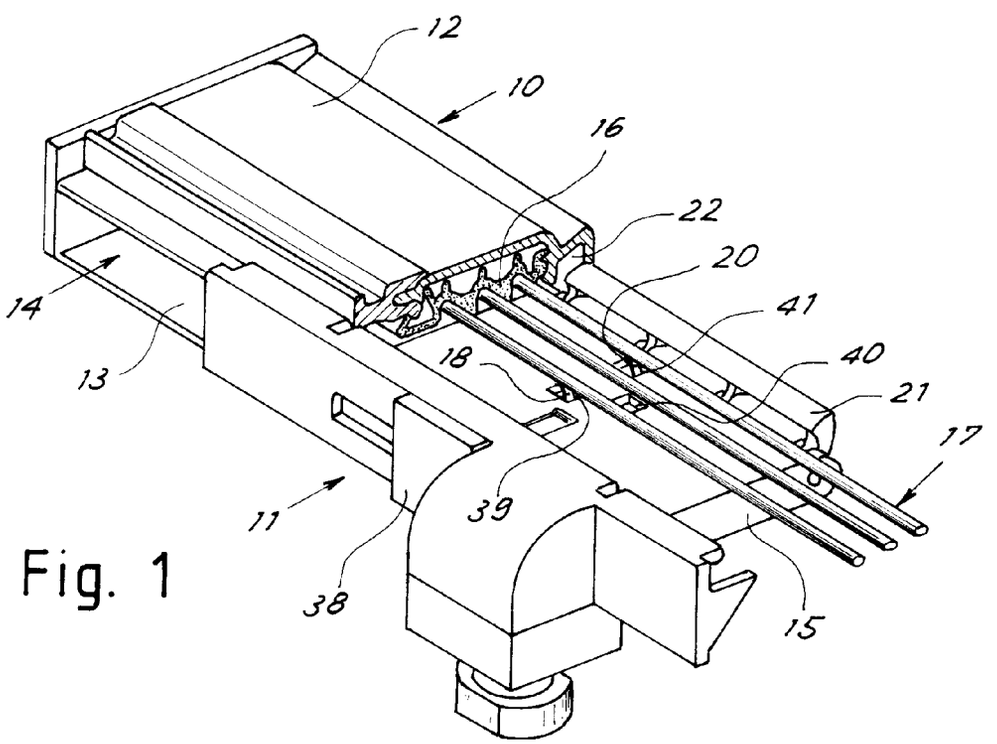

Fig. 1

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Description

This invention refers to a track and an electrical connector for constructing electrical systems with track-type distribution.

It is a well-known fact that there are elements in the known technique for constructing electrical systems with track-type distribution, that is to say systems in which one or more tracks create lines of contact to which electrical devices are electrically interconnected by inserting special connectors into the tracks. The track generally has a substantially square U-shaped cross-section which forms a channel to receive coupling members of the connectors. The bottom wall of the U constitutes a wall for fastening the track, while running along one side wall inside the channel are electric contact lines.

The coupling member of a connector comprises operating means which cause the lateral protrusion from it of springs which make contact with the electric lines in the track, and elements which mechanically fit into slots in the side walls of the track. The mechanical coupling elements enable the casing of the connector to be used for hanging electrical equipment such as spotlights directly from the track.

The direction of insertion of the connectors is always perpendicular to the fastening surface of the track. This results in a relatively large volume of space taken up by the track and the connector, which protrude considerably from the surface on which the track is fastened. To limit the protrusion, the channel is relatively ample in width, so as to obtain coupling members of sufficient mechanical sturdiness, despite the limited depth of the channel. The width of the channel, however, facilitates the introduction of foreign bodies and dust, with the risk of short circuits, electrocution, and unreliable contact between connector and electric lines. Due to the risk of electrocution, the tracks of known technique are not suitable for installing "within easy reach" and are usually installed high up. This makes these tracks generally suitable only for use in overhead lighting systems.

An additional problem, consisting of the generically square cross-section and the need to leave the wide entrance to the channel open, makes the track difficult to disguise in the environment.

Moreover, the coupling and uncoupling means are generally rotative elements which are relatively difficult to operate.

The scope of this invention is to obviate the aforementioned problems by providing an electrical track and connector assembly which offers greater flexibility and safety in use, together with improved performance and reliability compared to the known devices.

This scope is achieved, according to the invention, by providing a track and an electrical track (10) and a complementary connector (11) assembly for the distribution of electric power in a track-type electrical system, the track comprising a generically U-shaped outer casing which defines a channel (13) internally provided with electric contact lines (17) and an entrance (14) on one side of the track to receive a coupling portion (15) of the complementary connector (11), the coupling portion of the connector comprising electric contact elements (18, 19, 20) for connection with the electric contact lines (17) inside the channel, characterized by the fact that the external surface (12) of one of the two arms of the U constitutes a side for fastening the track, the aperture (14) of the channel opening out in a direction substantially parallel to the fastening side (12).

The innovative principles of this invention and its advantages with respect to the known technique will be more clearly evident from the following description of a possible exemplificative embodiment applying such principles, with reference to the accompanying drawings, in which:

- figure 1 shows a schematic, partially cutaway, rear perspective view of a track and connector assembly made according to the invention;
- figure 2 shows a partially cutaway perspective view of a connector element of figure 1;
- figure 3 shows a cross-sectional view of an assembly of figure 1 in the assembled condition;
- figure 4 shows a similar view to that of figure 3, but with the connector partially extracted from the track;
- figure 5 shows a plan view, with parts further removed, of the connector of figure 2;
- figure 6 shows a view along the line VI-VI of figure 5, of a detail of the connector in a first condition;
- figure 7 shows a view similar to that of figure 6, with the detail of the connector in a second condition.

With reference to the figures, figure 1 shows a track 10 (for example an aluminium extrusion) to which is coupled a connecting element 11 having a casing made of insulating material. The track 10 has a generically U-shaped cross-section, with the arms greater in length than their reciprocal distance (for example at least twice as long and, advantageously, at least four times as long) to define an internal channel 13. The aperture is also advantageously of such width as to prevent the introduction of a finger through it.

The track has an external surface 12 of one of the two arms which constitutes a side for fastening the track. The internal channel 13 has an aperture 14 which opens out on the side of the track, that is to say in a direction parallel to the fastening surface 12, to receive a coupling member 15 of the connector 11.

Disposed along an internal wall of the channel, (advantageously, the internal wall of the arm of the U which externally forms the fastening surface 12) are insulating housings 16 containing parallel electric wires or lines 17 whose bare lateral surface enters into contact with flexible electric contact tangs 18, 19, 20 protruding from the coupling member 15 through passageways 39, 40, 41.

Disposed on the leading edge (with reference to the

direction of insertion in the channel) of the coupling member 15 is a hooking element 21, which (as will be explained further on) engages with an undercut 22 on the bottom of the channel 13.

Figures 3 and 4 show a connector 11 respectively in a condition completely coupled to the track and in a condition of insertion or partial extraction.

Advantageously, the track is secured by its surface 12 to a fastening wall by means of a structural section 23 having holes 24 for the passage of fastening screws 25.

As can be clearly seen in figure 3, in order to improve the mechanical sturdiness of the connector-track assembly, the connector has a wing 26 protruding in the direction of the coupling in the track, to define a housing for a tooth 27 opposingly protruding from the structural section 23.

The connector 11 has an outer casing 28 which comprises a support 29 protruding from the connector in a direction opposite to that of the fastening surface of the track.

Electrical equipment, such as spotlights or the like (not shown) can be fastened, for example by means of screws, to the support 29. Alternatively, the support can comprise a simple shank for the entrance of electric wires.

Figures 2 and 5 show a connector element 11 with the cover partially removed to reveal the internal components. As can be seen in the figures, inside the outer casing 28, the connector 11 comprises terminals 30 (preferably of the known quick-coupling spring type) for connecting the stripped ends of electric cables with three conducting metal strips 31, 32, 33.

The strip 33 has an opposing end 34 which forms an electric spring contact (not shown) which protrudes permanently from the face of the coupling member 15 opposite the face from which the contacts 18, 19, 20 look out, to form an earth connection between the terminal of strip 33 and the metal structure of the track.

The strip 32 has an end opposite the terminal 30 shaped to form the electric spring contact 18. The strip 31 splits into two arms 35, 36 which have a free end respectively forming the electric spring contact 19 and the electric spring contact 20.

The electric spring contacts 18, 19, 20 are contained in a recess in the coupling member through which slides a cursor 37, made of insulating material, which is made to slide in the direction of the extension of the track by means of an operating end 38 protruding from the outer casing 28.

The cursor 37 has cams and countercams which induce or do not induce the contacts to face out from their respective holes 39, 40, 41 depending upon the position of the cursor along its stroke, so as to attain a position of inactivity or enablement to extract the connector from the track, in which the contacts are all retracted in the coupling member (figure 5), an intermediate position of extraction of the contact 18 and one of the two contacts 19 or 20 (figure 2), and a final position of extraction of the contact 18 and the other of the two contacts 20 or 19 (figure 1).

Between the three positions, further positions can be provided in which the electric spring contacts are retracted into the connector.

As can be clearly seen in figures 2 and 5, to achieve the movement of the spring contacts, the cursor 37 has cams and countercams for each spring contact. Each spring contact slides over the respective cams and countercams by means of sliding surfaces protruding laterally from its base. In particular, the contact 18 has sliding surfaces 42, 43 sliding respectively over an upper countercam 44 and a lower cam 45; the contact 19 has sliding surfaces 46, 47 sliding respectively over an upper countercam 48 and a lower cam 49; the contact 20 has sliding surfaces 50, 51 sliding respectively over an upper countercam 52 and a lower cam 53.

The sliding of the cursor thus gives rise to the aforementioned movements of extraction and retraction of the contacts from their respective holes in the coupling member 15.

Advantageously, the cursor comprises protective insulating surfaces 58, 59, 60, which come to rest over the spring contacts 18, 19, 20 when the cursor is in the initial position (figure 5) so as to close the passages 39, 40, 41 completely.

The movement of the cursor also controls means for enabling the coupling and uncoupling of the connector from the track, so as to prevent the connector from being extracted while the spring contacts are protruding from it to rest on the electric lines 17. Likewise, the contacts are prevented from being extracted when the connector is not plugged into the track.

The enabling means comprise a projection 54 which protrudes from the cursor 37 towards the hooking element 21 (removed in figure 2 for the sake of clarity).

As can be seen in figure 7, the hooking element (which rotates on an axis 55 perpendicular to the direction of introduction of the connector into the track) posteriorly comprises a surface 57 which rests on the protrusion 54 and maintains the hooking element in the hooking position shown in figures 3 and 7. As can be seen in figures 5 and 6, the surface 57 is interrupted by a slot 56 into which the projection 54 can fit when the cursor is in the initial position of figure 5.

Springs (not shown) tend to rotate the coupling element towards the position shown in figures 4 and 6.

When the connector is out of the track, the cursor is in the initial position of figure 5, referred to as the disconnected or released position. The springs maintain the hooking element in its extended position as shown in figure 4, the projection 54 of the cursor being received in the slot 56.

In this situation, the passages 39, 40, 41 are closed by the protective surfaces 58, 59, 60 so as to prevent any accidental contact with the electric contacts 18, 19, 20. This is important when the connector is a connector

supplying electric power to the track and consequently when the contacts are connected to the electric power supply mains by means of the cables connected to the terminals 30.

The connector is plugged into the track by simply inserting the coupling member 16 into the channel 13 as shown in figure 4, until the head of the hooking member 21 reaches the end 61 of the channel. The end 61 is curved so as to induce the hooking element to rotate on its own axis 55 upon continuation of the movement of introducing the connector into the tract. The rotation is aimed at shifting the hooking element to its hooking position shown in figure 3, with a coupling tooth 62 engaged in the undercut 22 of the track. At this moment the hooking element is still free to rotate in the opposite direction to permit the re-extraction of the connector from the track.

In the completely inserted condition, when the cursor 37 is shifted from its initial position the projection 54 interferes with the surface 57 of the hooking element and the latter is prevented from rotating towards the released position. The connector is consequently firmly coupled to the track. The cursor 37 can be shifted to one of its various positions, so as to achieve the protrusion of the spring contacts according to the desired combination among those permitted by the cams and countercams.

For example, in the case of a connector supplying power to the track, the cams can be made in such a way that all the contacts can be extracted simultaneously, whereas in the case of a connector drawing power from the track to supply external elements, the contact 18 and one of the two contacts 19, 20 can be extracted so as to select the desired power supply line in the track.

In order to re-extract the connector from the track, it is necessary to shift the cursor back to its initial position, so as to retract the electric contacts 18, 19, 20 and shift the projection 54 back in line with the slot 56 in order to free the movement of the hooking element.

At this point it is clear that the intended scopes have been achieved, by providing a contact track and connectors for it, which make it possible to achieve track-type electrical systems without the problems of the known technique.

In fact, thanks to its limited thickness, a track as described can be secured for example to a wall to simulate a simple aesthetical structural section. At the same time, the ample coupling surface for coupling the connectors makes the coupling extremely sturdy and enables the connector to withstand the weight of quite heavy electrical equipment.

The mechanical coupling and uncoupling device is sturdy and easy to operate, as is the electric contact selector.

The limited width of the channel eliminates problems of accidental contact with the internal electric wires and reduces the possibility of external polluting agents collecting in the channel. To improve the protection of the channel, it can also be provided along its entire length with a protection in the form of a pliable membrane, as shown, by way of example, by reference 63 in figure 4. The protection is shifted to one side when a connector is introduced into the channel.

The foregoing description of an embodiment applying the innovative principles of this invention is obviously given by way of example in order to illustrate such innovative principles and should not therefore be understood as a limitation to the sphere of the invention claimed herein.

For example, the aesthetical shape of the track can vary, as can vary the shape of the connector.

The cam selector for the contacts of the connector can be provided with different cams to provide different contact possibilities. For example, whenever the connector supplies power to the track, the cams can be shaped in such a way that all three electric contact elements protrude simultaneously to supply power to the lines in the track.

Claims

1. Electrical track (10) and a complementary connector (11) assembly for the distribution of electric power in a track-type electrical system, the track comprising a generically U-shaped outer casing which defines a channel (13) internally provided with electric contact lines (17) and an entrance (14) on one side of the track to receive a coupling portion (15) of the complementary connector (11), the coupling portion of the connector comprising electric contact elements (18, 19, 20) for connection with the electric contact lines (17) inside the channel,
characterized by the fact that the external surface (12) of one of the two arms of the U constitutes a side for fastening the track, the aperture (14) of the channel opening out in a direction substantially parallel to the fastening side (12).

2. Assembly as claimed in claim 1, characterized by the fact that the depth of the channel is greater than its width, advantageously at least twice its width.

3. Assembly as claimed in claim 1, characterized by the fact that the electric contact lines (17) are disposed along an internal wall of the arms of the U.

4. Assembly as claimed in claim 3, characterized by the fact that said internal wall is that of the arm of the U which constitutes a side (12) for fastening the track.

5. Assembly as claimed in claim 1, characterized by the fact that the connector has an element (21) which hooks onto the track disposed on the leading end of the coupling portion (15) of the connector to

engage with an undercut (22) on the bottom of the channel.

6. Assembly as claimed in claim 5, characterized by the fact that the hooking element (21) rotates on an axis (55) parallel to the extension of the track, to slide along the end (61) of the channel, which is made curved, and shift from an inactive position substantially aligned with the direction of insertion of the connector in the channel to a position in which it engages said undercut (22).

7. Assembly as claimed in claim 6, characterized by the fact that the connector comprises controllable means (54) for blocking the rotation of the hooking element (21) from the engaged position to the inactive position.

8. Assembly as claimed in claim 1, characterized by the fact that the connector comprises control means (37) for moving the electric contact elements (18, 19, 20) between a retracted or inactive position and a protruding position in which they make contact with electric lines (17) in the track.

9. Assembly as claimed in claim 8, characterized by the fact that the control means comprise a cursor (37) inside the connector, sliding in the direction of the extension of the track when actuated by a manually operated end (38), the cursor having cam means (44, 45, 49, 51, 53) which press against the contact elements to shift them to and from inactive and contact positions in a pre-established sequence.

10. Assembly as claimed in claim 9, characterized by the fact that in the contact position, the contact elements (18, 19, 20) protrude from apertures (39, 40, 41) in the casing of the connector, the cursor (37) comprising plugging surfaces (58, 59, 60) which slidingly close such apertures when the cursor is in a first position or position of complete retraction of all the contact elements.

11. Assembly as claimed in claims 7 and 9, characterized by the fact that the blocking means comprise a projection (54) on the cursor which prevents the rotation of the hooking element (21) when the cursor is not in an initial position or position of complete retraction of all the contact elements.

12. Assembly as claimed in claim 1, characterized by the fact that the electric lines (17) are three in number.

13. Assembly as claimed in claim 9, characterized by the fact that the contact elements (18, 19, 20) are three in number, two contact elements (19, 20) being interconnected and alternately movable into the contact position.

14. Track for the distribution of electric power comprising an outer casing generically shaped in the form of a U to define a channel (13) internally provided with electric contact lines (17) and an aperture (14) on one face of the track designed to receive a coupling portion of a complementary connector, characterized by the fact that the outer surface of one of the two arms of the U constitutes a side for fastening the track, the aperture (14) of the channel opening out in a direction substantially parallel to the fastening side (12).

15. Track as claimed in claim 14, characterized by the fact that the depth of the channel is greater than its width, advantageously at least twice its width.

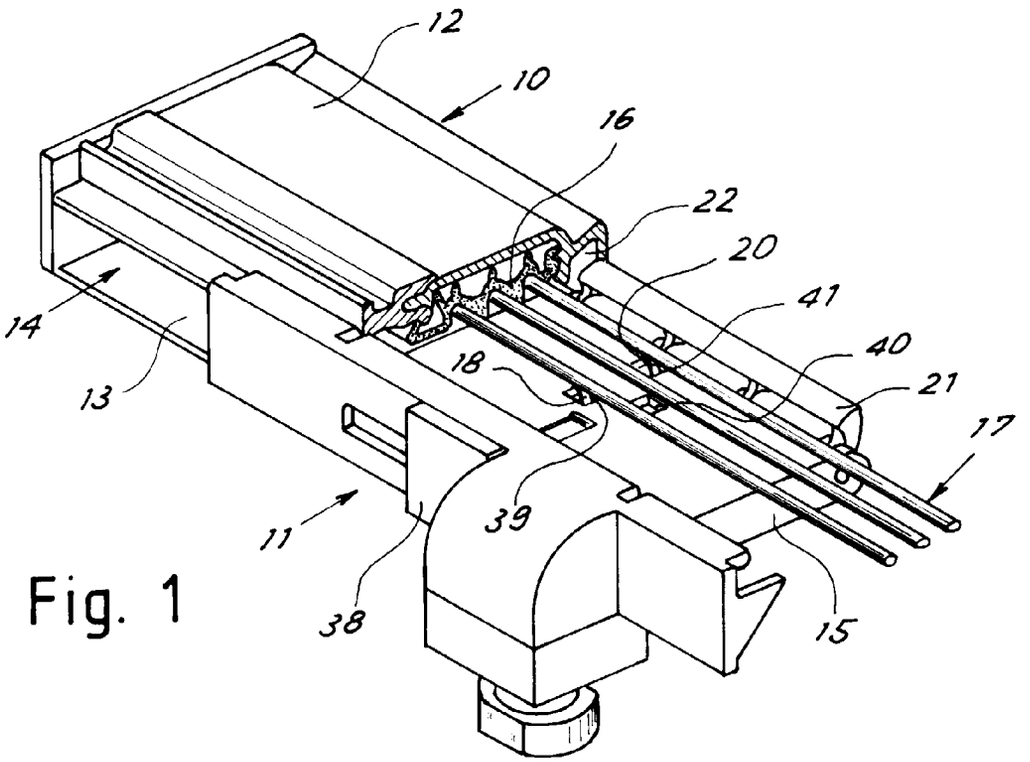
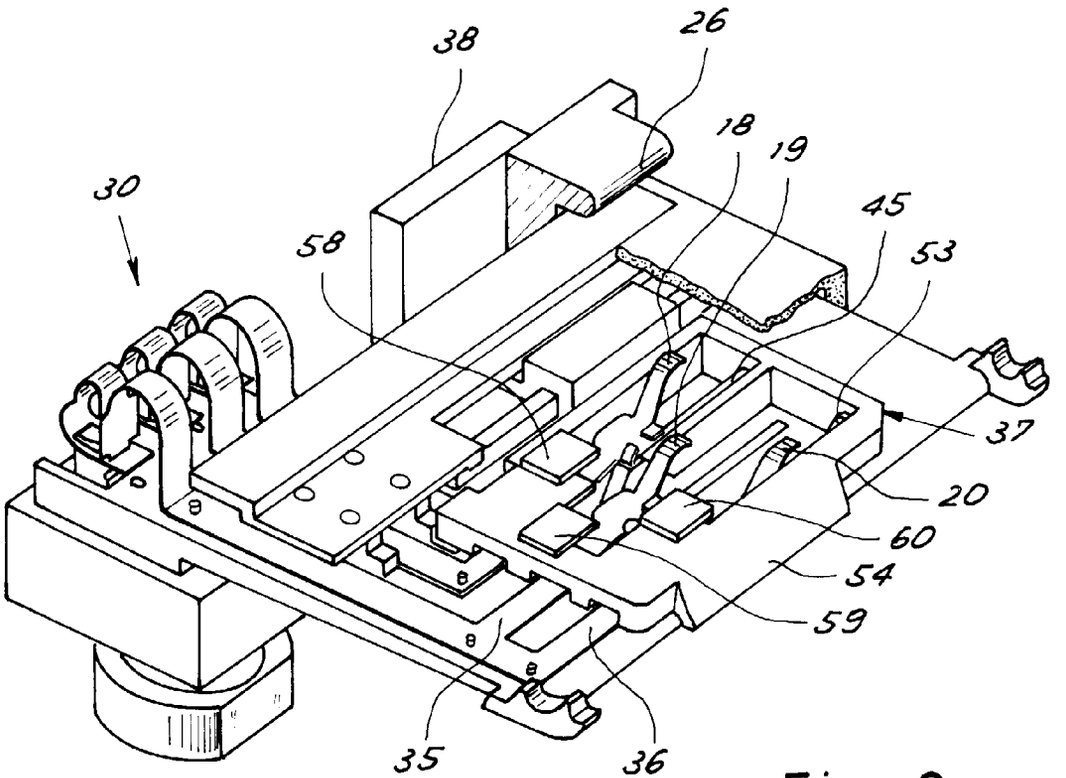

12
10
16
22
20
41
40
21
17
14
13
18
39
11
38
15

Fig. 1


38
26
18
19
45
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36

Fig. 2

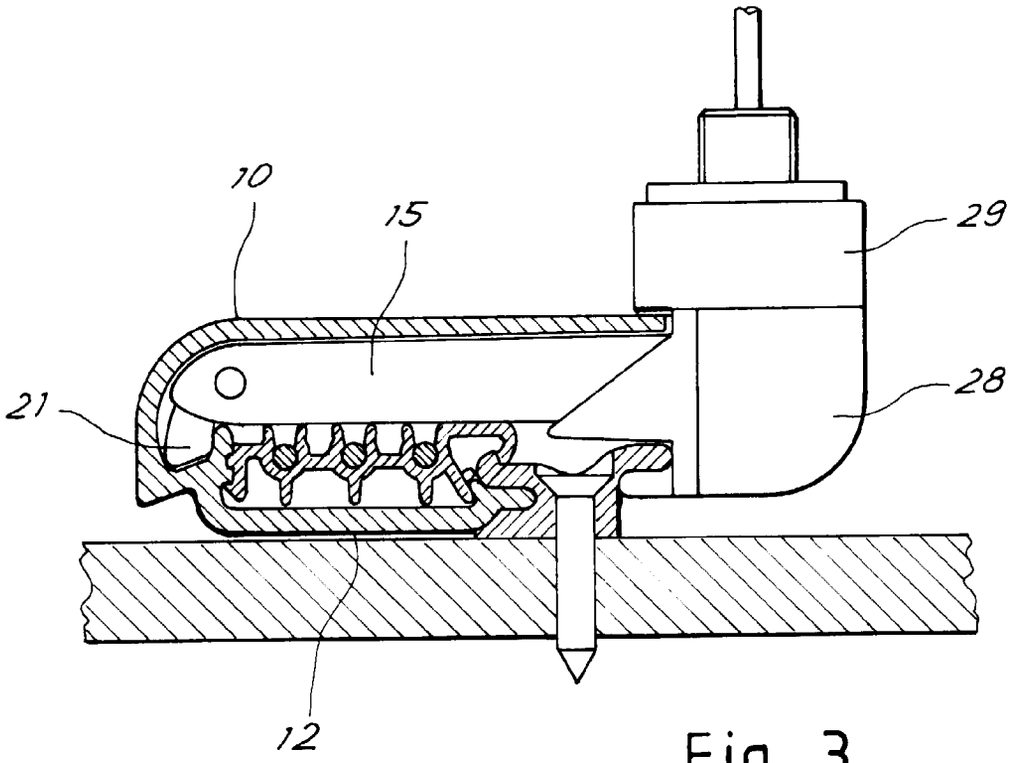

Fig. 3

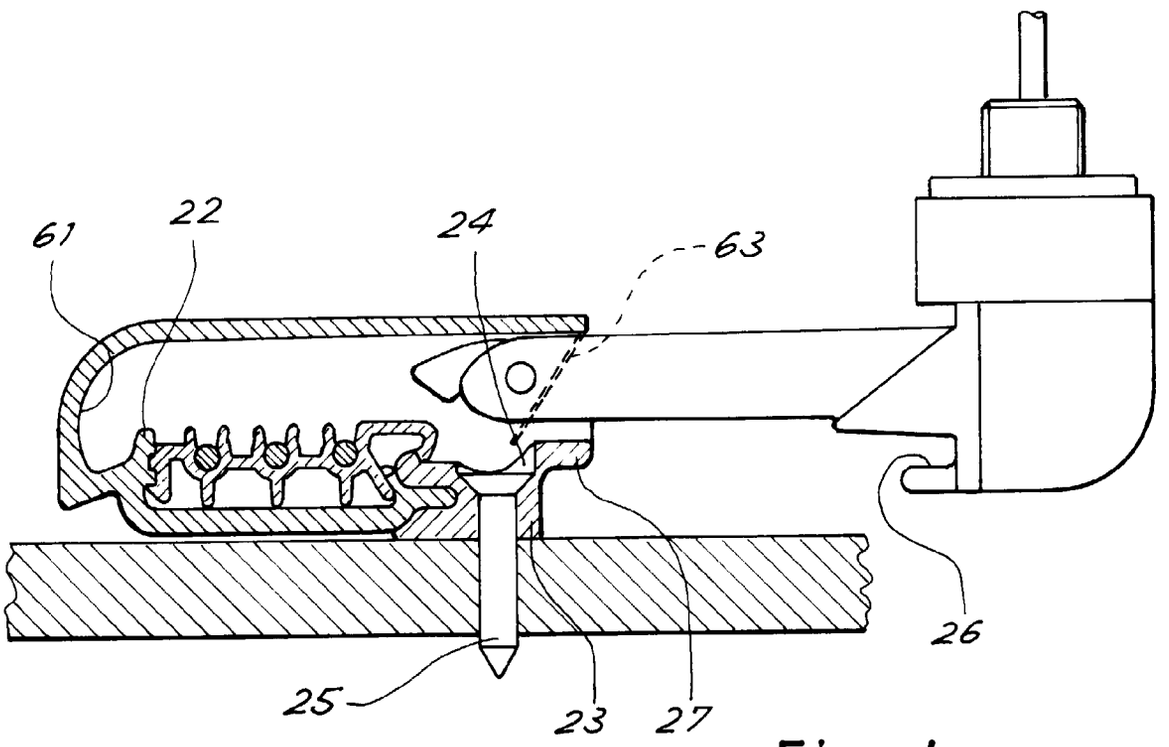

Fig. 4

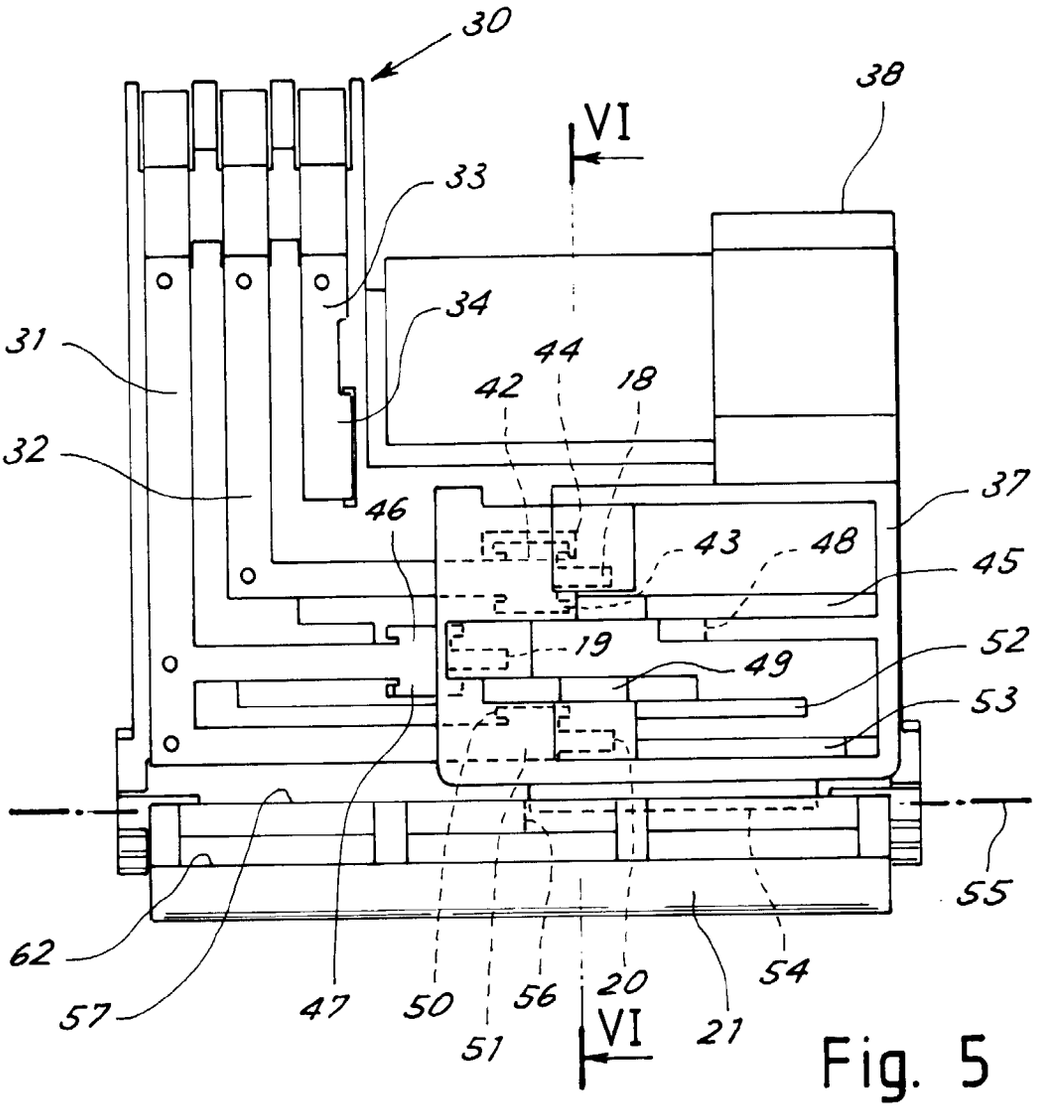

Fig. 5

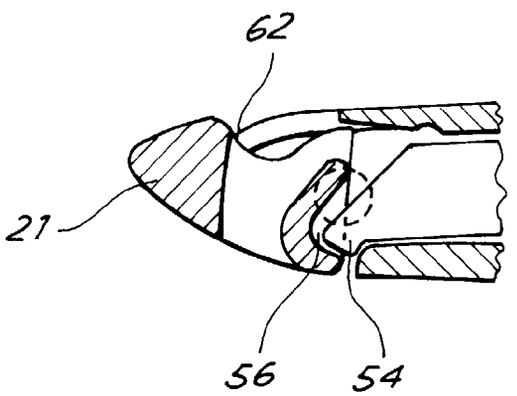

Fig. 6

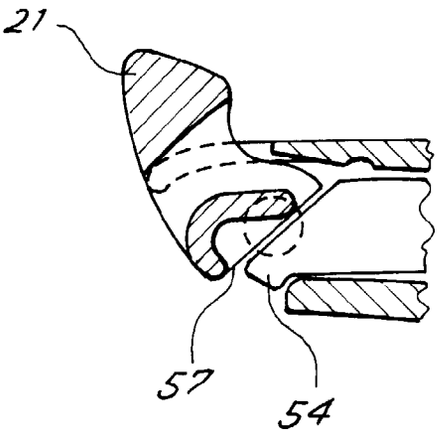

Fig. 7