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(54) Electric connector

(57) An electric connector (1) having an insulating casing (3) defining a number of cavities (4) for housing respective electric terminals (5); primary retaining means (17) for retaining the terminals (5) inside the respective cavities (4); secondary retaining means (20) having a movable member (21) connectable to the casing (3) in a first direction (C) to determine correct engagement of the terminals (5) by the primary retaining means (17), and to prevent release of the terminals; and lock means (25) interposed between the casing (3) and the movable member (21) to respectively define, in the first direction (C), a preassembly position wherein the movable member (21) permits insertion of the terminals (5) inside the respective cavities (4), and a fully assembled position achievable when the terminals (5) are engaged correctly by the primary retaining means (17); the lock means (25) having at least a first and a second opening (28, 29) formed on the movable member (21), and at least one tooth (26) carried by the casing (3) and which selectively engages the first and the second. opening (28, 29) to define the preassembly position and the fully assembled position of the movable member (21) respectively; the first opening (28) and the tooth (26) defining a lock joint (31) in a second direction (B) opposite the first direction (C), to prevent full removal of the movable member (21) from the casing (3).

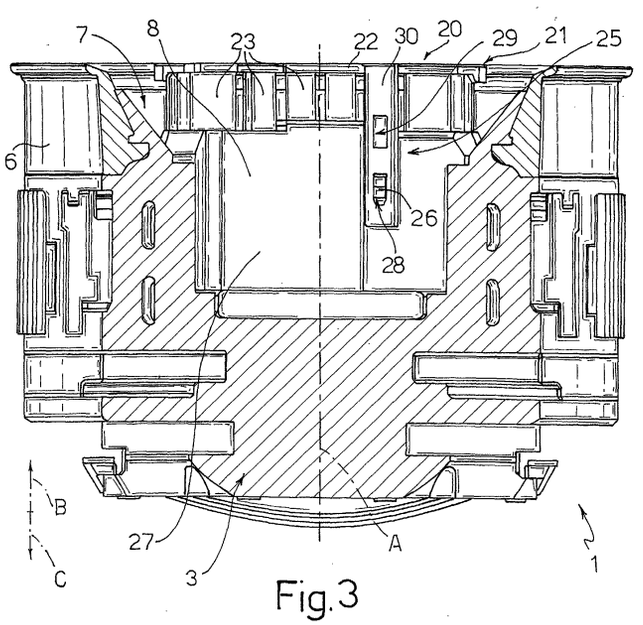

Fig.3

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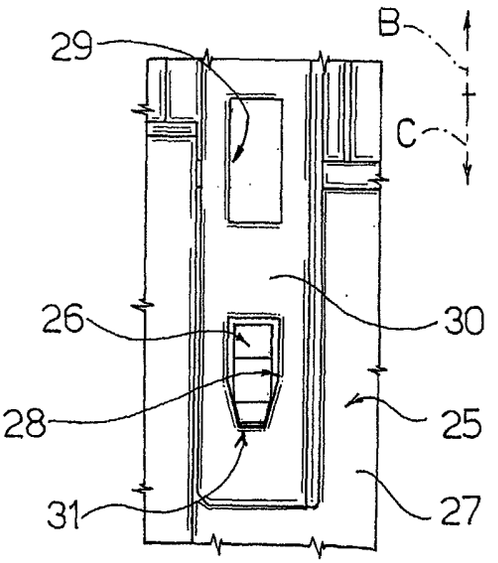


Fig.4

Description

[0001] The present invention relates to an electric connector, and in particular to an electric connector of the type comprising an insulating casing defining a number of cavities having respective parallel axes and for housing respective electric terminals retained inside the cavities by primary retaining means.

[0002] Such connectors also comprise a secondary retaining device for determining correct insertion, and further ensuring retention, of the terminals inside the respective cavities.

[0003] The secondary retaining device normally comprises a movable plate, which is made separately from the casing, has a number of projecting wedges interacting with the primary retaining -means, and fits frontally into a fully assembled position on the casing, in a direction parallel to the axes of the cavities.

[0004] The fully assembled position of the movable plate is only achievable when the terminals are all inserted correctly and retained inside the respective cavities by the primary retaining means, which are normally defined by flexible lances forming part of the casing. In the event any one of the terminals is not correctly or fully inserted, the primary retaining means remain flexed, and prevent the wedges on the movable plate from being inserted fully inside the casing, thus permitting detection of the anomaly.

[0005] The movable plate is normally connected to the casing in a preassembly position permitting insertion of the electric terminals inside the respective cavities, and from which it is slid axially along the casing into the fully assembled position.

[0006] The fully assembled and preassembly positions of the movable plate on the casing are normally reversible. That is, by overcoming the retaining load exerted by the casing, the movable plate can be moved easily from one position to the other, or be detached completely from the casing.

[0007] Given the particularly small size of electric connectors, full removal of the movable plate from the casing could result in loss of the plate, or, by requiring the handling of two separate bodies, could seriously penalize assembly time.

[0008] It is an object of the present invention to provide an electric connector designed to provide a straightforward, reliable solution to the aforementioned drawback typically associated with known connectors.

[0009] According to the present invention, there is provided an electric connector comprising:

- an insulating casing defining a number of cavities for housing respective electric terminals;
- primary retaining means for retaining said terminals inside, and preventing withdrawal of the terminals from, the respective said cavities;
- secondary retaining means comprising at least one movable member connectable to said casing in a first direction to determine correct engagement of said terminals by said primary retaining means, and to prevent release of the terminals; and
- lock means interposed between said casing and said movable member to respectively define, in said first direction, a preassembly position wherein said movable member permits insertion of said terminals inside the respective said cavities, and a fully assembled position achievable when said terminals are engaged correctly by said primary retaining means;

said lock means comprising at least a first and a second lock member carried by one of said casing and said movable member, and at least a third lock member carried by the other of said casing and said movable member and which selectively engages said first and said second lock member to define said preassembly position and said fully assembled position of said movable member respectively;

characterized in that said first and said third lock member define a lock joint in a second direction opposite said first direction, to prevent full removal of said movable member from said casing.

[0010] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a front view of an electric connector in accordance with the present invention;
Figure 2 shows a larger-scale section along line II-II in Figure 1;
Figure 3 shows a larger-scale section along line III-III in Figure 1 of the connector according to the invention in a different operating condition;
Figures 4 and 5 show a larger-scale detail of the Figure 3 connector in two different operating conditions.

[0011] Number 1 in Figures 1 to 3 indicates as a whole an electric connector in accordance with the present invention.

[0012] Connector 1 comprises a substantially cylindrical insulating casing 3 having an axis A parallel to a coupling direction B of connector 1 to a complementary connector (not shown), and defining a number of transverse rows of longitudinal cavities 4 having respective axes parallel to axis A and for receiving respective electric terminals 5 (only one shown in Figure 2) retained inside cavities 4 by known primary retaining means described later on.

[0013] Casing 3 comprises a cylindrical annular outer portion 6 defining a housing 7 for an engaging portion of the complementary connector; and a prismatic inner portion 8, which comprises a rear wall 9 integral with outer portion 6 and perpendicular to axis A, projects inside housing 7, and defines cavities 4 of terminals 5.

[0014] With reference to Figure 2, each terminal 5

substantially comprises a rear connecting portion 10 for connection to a relative electric cable 11; and a box-shaped front contact portion 12, which mates with a contact portion of a complementary electric terminal (not shown), and laterally defines a seat 13 for the primary retaining means.

[0015] Each terminal 5 is inserted inside respective cavity 4 through a rear opening 14 of the cavity formed in rear wall 9 of casing 3, and, once fitted inside casing 3, is positioned with contact portion 12 facing a front opening 15 of respective cavity 4 communicating with housing 7 and formed in a front wall 16 of inner portion 8. In use, cables 11 project from casing 3 through respective openings 14.

[0016] The primary retaining means comprise, for each terminal 5, a flexible lance 17 projecting inside respective cavity 4 substantially in direction B and towards front opening 15; and the surface of lance 17 facing inwards of cavity 4 has a tooth 19 with a profile substantially in the form of a right trapezium, and which clicks into seat 13 of relative terminal 5.

[0017] More specifically, tooth 19 permits insertion of terminal 5, which, sliding along an oblique side of tooth 19 facing opening 14, flexes lance 17 towards the wall defining relative cavity 4. Once terminal 5 is inserted fully inside cavity 4, lance 17 springs back to the undeformed position by tooth 19 clicking inside seat 13 of terminal 5, so that a side of tooth 19 substantially perpendicular to axis A and opposite the oblique side defines a stop preventing withdrawal of terminal 5.

[0018] Connector 1 also comprises a secondary retaining device, indicated as a whole by 20, for retaining terminals 5.

[0019] Device 20 comprises a movable member 21 formed separately from casing 3, and which, in a direction C opposite direction B, engages inner portion 8 of casing 3 to determine correct engagement of terminals 5 by the primary retaining means, and to prevent release of the terminals.

[0020] More specifically, movable member 21 is inserted frontally in direction C inside housing 7 of casing 3, and comprises, integrally, a plate 22, which engages casing 3 in a position perpendicular to direction C, and has substantially the same lateral profile as inner portion 8 of casing 3; and a number of wedges 23 - one for each cavity 4 - projecting perpendicularly from plate 22, and each insertable inside relative cavity 4 by sliding along the side of respective lance 17 opposite tooth 19, so as prevent lance 17 from flexing (Figure 2). Plate 22 also comprises a number of through seats 24, which, in use, are aligned with respective cavities 4, and are engaged in sliding manner by the contact portions of the complementary connector terminals. More specifically, seats 24 are arranged in a number of transverse rows corresponding with the rows of cavities 4.

[0021] Connector 1 also comprises lock means 25 interposed between the outer portion of casing 3 and movable member 21 to respectively define, in succession in direction C, a preassembly position (Figures 3 and 4) wherein movable member 21 permits insertion of terminals 5 inside respective cavities 4, and a fully assembled position (Figures 1, 2 and 5) achievable when terminals 5 are engaged correctly by lances 17.

[0022] Lock means 25 comprise two teeth 26 positioned symmetrically with respect to axis A and projecting from a lateral wall 27 of inner portion 8 of casing 3; and, for each tooth 26, a pair of retaining openings 28, 29 formed on a relative flexible arm 30 projecting perpendicularly from plate 22 and extending parallel to wedges 23.

[0023] Openings 28, 29 on each arm 30 of movable member 21 are engaged successively in direction C by the relative tooth 26 on casing 3 to define the preassembly position and fully assembled position of movable member 21 respectively.

[0024] More specifically, teeth 26 are aligned with each other in a direction perpendicular to axis A, while openings 28, 29 on each arm 30 are aligned with each other in a direction parallel to direction C, and are located respectively at the free end of arm 30 (opening 28 defining the preassembly position of movable member 21) and adjacent to plate 22 (opening 29 defining the fully assembled position of movable member 21).

[0025] An important aspect of the present invention is that each opening 28 and respective tooth 26 define a lock joint 31 in direction B (Figure 4) for preventing full removal of movable member 21 from inner portion 8 of casing 3.

[0026] With particular reference to Figures 4 and 5, each opening 28 comprises, towards the free end of relative arm 30, an end portion 32 tapering in section in direction C to lock relative tooth 26 in direction B.

[0027] More specifically, end portion 32 of each opening 28 is defined by two lateral walls 33 sloping with respect to direction B and C and converging with each other in direction C.

[0028] Each opening 28 also comprises, towards plate 22, a rectangular main portion 34 from which end portion 32 extends.

[0029] Each tooth 26 (Figure 5) is defined, at the top, by a flat surface 35 parallel to the plane of relative arm 30, and, towards rear wall 9 and front wall 16 of inner portion 8, by respective ramp-shaped end surfaces 36, 37 sloping and diverging with respect to each other from opposite ends of surface 35. The ramp-shaped end surfaces 36, 37 of teeth 26 allow movable member 21 to move between the preassembly and fully assembled positions.

[0030] Each tooth 26 is also defined by two opposite lateral sides 38, which extend, parallel to each other, along most of the length of tooth 26, and comprise, towards rear wall 9 of inner portion 8, respective end portions 39 converging with each other and having the same slope as respective lateral walls 33 of end portion 32 of relative opening 28, so that each tooth 26 comprises, towards rear wall 9 of inner portion 8 of casing

3, an end portion 40 tapering in cross section and which fits inside end portion 32 of respective opening 28 when movable member 21 is moved in direction B from the preassembly position.

[0031] Each opening 29 has a constant rectangular cross section.

[0032] Connector 1 is assembled as described below, starting from an initial condition in which terminals 5 are housed inside respective cavities 4, and movable member 21 of secondary retaining device 20 is set to the preassembly position (Figures 3 and 4), i.e. with teeth 26 of inner portion 8 of casing 3 engaging respective openings 28 on arms 30 of movable member 21.

[0033] In the above condition, any attempt to remove movable member 21 from casing 3 in direction B has the effect of fitting end portions 40 of teeth 26 increasingly firmly inside end portions 32 of respective openings 28.

[0034] If any one of terminals 5 is not inserted correctly inside relative cavity 4, the corresponding lance 17 remains flexed, thus preventing the corresponding wedge 23 of movable member 21 from being inserted fully inside cavity 4 along lance 17, and so preventing movable member 21 from moving into the fully assembled position, and connection of connector 1 to the complementary connector.

[0035] Conversely, if terminals 5 are all engaged correctly by respective lances 17, wedges 23 of movable member 21 can slide along lances 17, on the opposite side to teeth 19, to move movable member 21 into the fully assembled position (Figures 1, 2 and 5) on inner portion 8 of casing 3, thus permitting connection of connector 1 to the complementary connector.

[0036] More specifically, by virtue of the ramp shape of front end surfaces 37 of teeth 26, when movable member 21 is moved in direction C from the preassembly position, teeth 26 release openings 28 and engage openings 29.

[0037] The advantages of connector 1 according to the present invention will be clear from the foregoing description.

[0038] In particular, any attempt to remove movable member 21, in the preassembly position, from casing 3 has the effect of fitting end portions 40 of teeth 26 more firmly inside end portions 32 of respective openings 28. The preassembly position is therefore irreversible, thus preventing loss of movable member 21, and enabling casing 3 and movable member 21 to be dealt with as a single body as opposed to two separate bodies.

[0039] Clearly, changes may be made to connector 1 without, however, departing from the scope of the present invention.

Claims

1. An electric connector (1) comprising:

- an insulating casing (3) defining a number of cavities (4) for housing respective electric terminals (5);
- primary retaining means (17) for retaining said terminals (5) inside, and preventing withdrawal of the terminals from, the respective said cavities (4);
- secondary retaining means (20) comprising at least one movable member (21) connectable to said casing (3) in a first direction (C) to determine correct engagement of said terminals (5) by said primary retaining means (17), and to prevent release of the terminals; and
- lock means (25) interposed between said casing (3) and said movable member (21) to respectively define, in said first direction (C), a preassembly position wherein said movable member (21) permits insertion of said terminals (5) inside the respective said cavities (4), and a fully assembled position achievable when said terminals (5) are engaged correctly by said primary retaining means (17);

said lock means (25) comprising at least a first and a second lock member (28, 29) carried by one of said casing (3) and said movable member (21), and at least a third lock member (26) carried by the other of said casing (3) and said movable member (21) and which selectively engages said first and said second lock member (28, 29) to define said preassembly position and said fully assembled position of said movable member (21) respectively;

characterized in that said first and said third lock member (28, 26) define a lock joint (31) in a second direction (B) opposite said first direction (C), to prevent full removal of said movable member (21) from said casing (3).

2. A connector as claimed in Claim 1, **characterized in that** said first and said second lock member (28, 29) are carried by said movable member (21); and **in that** said third lock member (26) is carried by a wall (27) of said casing (3).

3. A connector as claimed in Claim 2, **characterized in that** said movable member (21) comprises a plate (22) which engages said casing (3) in said first direction (C) and in a position perpendicular to the first direction (C); and **in that** said first and said second lock member (28, 29) are carried by an arm (30) projecting perpendicularly from said plate (22).

4. A connector as claimed in Claim 2 or 3, **characterized in that** said first and said third lock member comprise a first opening (28) and a tooth (26) respectively; and **in that** said lock joint (31) comprises an end portion (32) of said first opening (28) tapering in section in said first direction (C) to lock said

tooth (26) in said second direction (B).

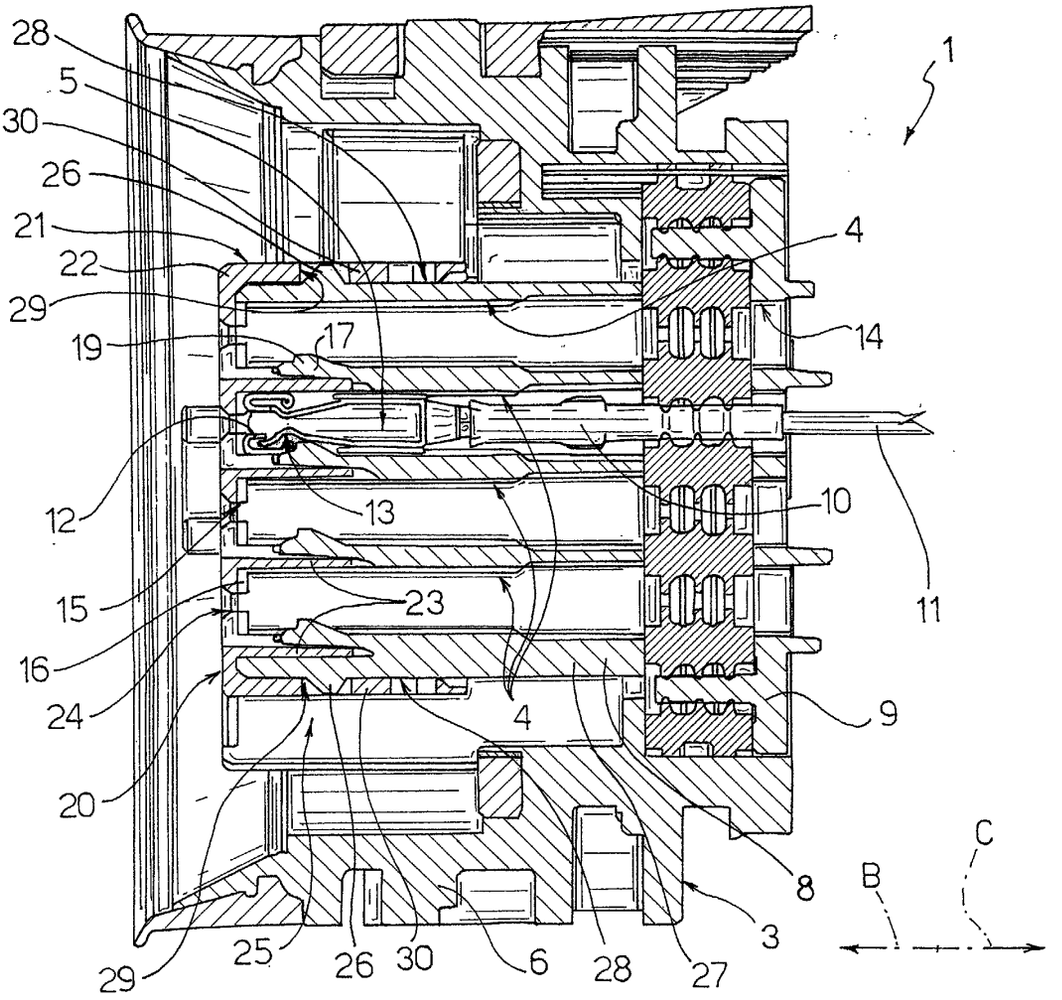
5. A connector as claimed in Claim 4, **characterized in that** said end portion (32) of said first opening (28) is defined by two lateral walls (33) sloping with respect to said first and second direction (C, B) and converging with each other in the first direction (C).

6. A connector as claimed in Claim 4 or 5, **characterized in that** said tooth (26) comprises an end portion (40) having a section complementary to the section of said end portion (32) of said first opening (28).

7. A connector as claimed in Claim 6, **characterized in that** said end portion (40) of said tooth (26) is defined by two sloping lateral surfaces (39) having the same slope as the respective said lateral walls (33) defining said end portion (32) of said first opening (28).

8. A connector as claimed in any one of Claims 4 to 7, **characterized in that** said tooth (26) is defined by opposite ramp-shaped end surfaces (36, 37) to allow said movable member (21) to move between said preassembly position and said fully assembled position.

9. A connector as claimed in any one of the foregoing Claims, **characterized in that** said second lock member is defined by a second opening (29).


28
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8
B
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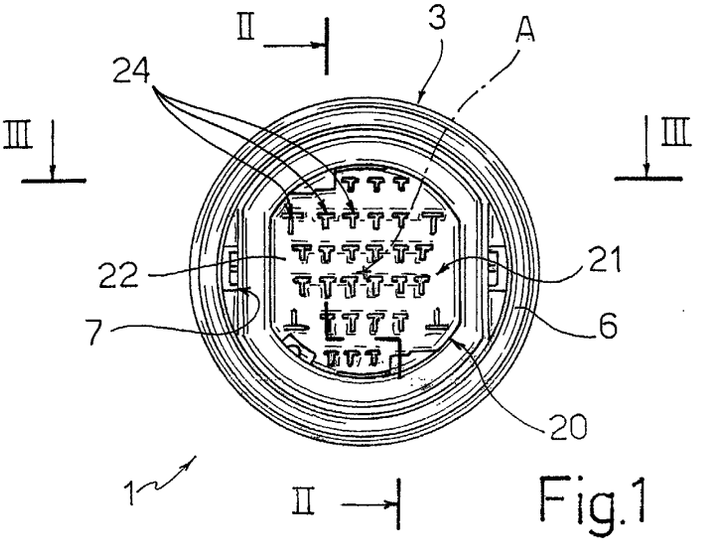
Fig.2


II
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A
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III
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20
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II

Fig.1

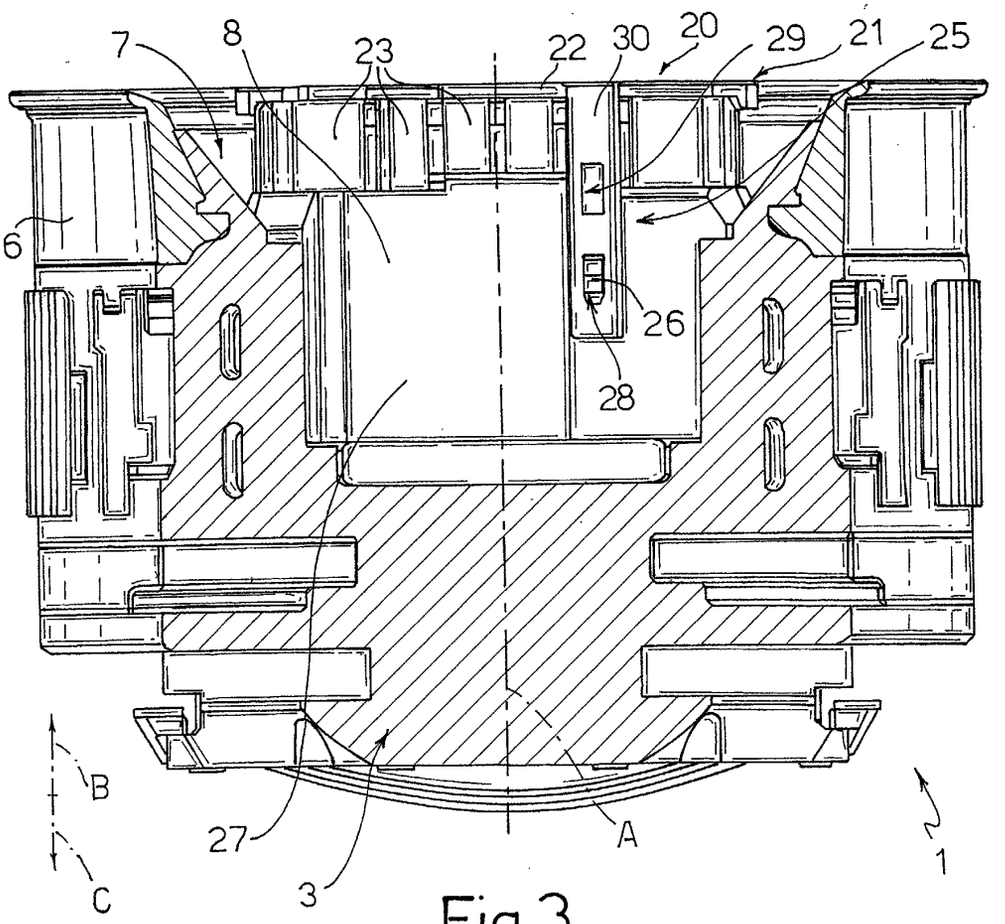

Fig.3

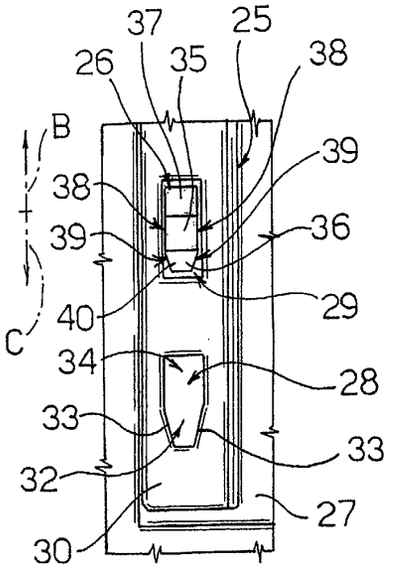

Fig.5

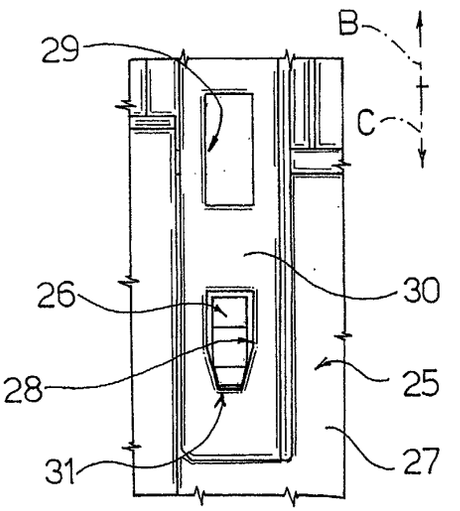

Fig.4