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(54) Electric connector

(57) An electric connector (1) having an insulating enclosure (3) defining a number of cavities (4) parallel to a connection direction (A) of the connector (1) to a complementary connector (1') and for housing respective male electric terminals (5); primary retaining means (26) for retaining the terminals (5) inside the respective cavities (4) and preventing withdrawal of the terminals; and a secondary retaining device (30), which in turn has a first and a second member (31, 42) fittable to the enclosure (3) in the connection direction (A), and having respective through seats (41, 43) engaged in sliding manner by respective contact portions (22) of the terminals (5), and a number of connecting members (44) for connecting the first and second member (31, 42) facing each other and so as to move, with respect to each other and in the connection direction (A), between a first work configuration in which the first and second member (31, 42) are parallel and a given distance apart, and a second work configuration in which the first and second member (31, 42) are gripped together by the thrust exerted by the complementary connector (1') engaging the connector (1).

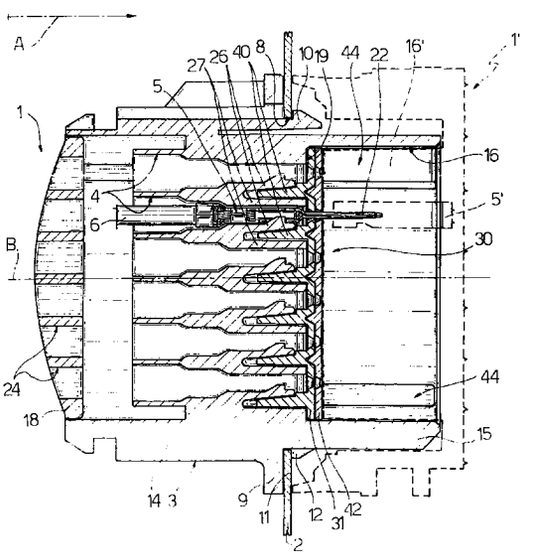

Fig.2

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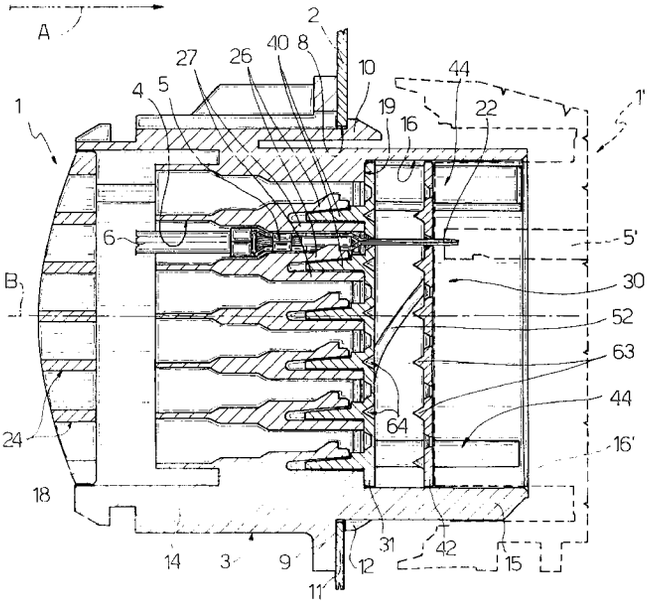
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Fig. 5

Description

[0001] The present invention relates to an electric connector, and in particular to an electric connector of the type supporting a number of male electric terminals connected to respective electric cables.

[0002] Connectors of the above type are known, which comprise an insulating enclosure defining a number of cavities having respective axes parallel to the connection direction of the connector to a complementary connector, and for housing the terminals, which are retained inside the cavities by primary retaining means.

[0003] Such connectors also comprise a secondary retaining device for determining correct insertion and further ensuring retention of the terminals inside the respective cavities.

[0004] The device normally comprises a movable plate fittable in a closed position to the front of the enclosure in said connection direction, and having a number of through seats engaged in sliding manner by respective contact portions of the terminals, which project from the plate in said closed position.

[0005] The movable plate can only be fitted to the enclosure when all the terminals are correctly inserted and retained inside the respective cavities by the primary retaining means, which are normally defined by an elastically deformable lance forming part of the enclosure. In the event of incorrect or incomplete insertion of any one of the terminals, the primary retaining means remain deformed, thus preventing assembly of the movable plate and enabling detection of the fault.

[0006] Known connectors of the type briefly described above have several drawbacks.

[0007] In particular, when connecting such connectors to complementary connectors, the contact portions of the male terminals, which, as commonly known, are fairly long, may be deformed accidentally, thus possibly resulting in impaired efficiency.

[0008] Moreover, the contact portions of the male terminals are often housed inside a hollow front portion of the enclosure, which is a possible receptacle for dust and dirt, which may impair electrical contact between the male and corresponding female terminals.

[0009] It is an object of the present invention to provide an electric connector designed to eliminate in a straightforward, reliable manner the aforementioned drawbacks typically associated with known connectors.

[0010] According to the present invention, there is provided an electric connector comprising:

- an insulating enclosure defining a number of cavities for housing respective male electric terminals and having respective axes parallel to a connection direction of said connector to a complementary connector;
- primary retaining means for retaining said terminals inside the respective said cavities and preventing withdrawal of the terminals; and
- secondary retaining means comprising at least a first member, which mates with said enclosure, in said connection direction, in a closed position, and cooperates in said closed position with said primary retaining means to determine correct engagement and prevent release of said terminals by the primary retaining means; said first member having a number of through first seats engaged in sliding manner by respective contact portions of said terminals;

  characterized in that said secondary retaining means comprise a second member having a number of through second seats for respective said contact portions of said terminals; and connecting means for connecting said first and second members facing each other and in such a manner as to move, with respect to each other and in said connection direction, between a first work configuration in which said first and second members are positioned parallel and a given distance apart, and a second work configuration in which said first and second members are gripped together by the thrust exerted by said complementary connector engaging said connector.

[0011] 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 view in perspective of an electric connector in accordance with the present invention;
Figure 2 shows a larger-scale longitudinal section of the Figure 1 connector connected to a complementary connector;
Figures 3 and 4 show respective larger-scale longitudinal sections, in parallel planes and with parts removed for clarity, of the Figure 1 connector in a preassembly position;
Figures 5 and 6 show respective larger-scale longitudinal sections, in parallel planes and with parts removed for clarity, of the Figure 1 connector in a fully assembled positioned prior to connection to the complementary connector;
Figure 7 shows a larger-scale view in perspective of a detail of the connector in the above Figures;
Figure 8 shows an exploded view in perspective, in the opposite direction, of the Figure 7 detail.

[0012] Number 1 in Figures 1 to 6 indicates as a whole an electric connector in accordance with the present invention.

[0013] In the example shown, connector 1 is fittable to a substantially flat wall 2, and is connectable, in a lock position and in a direction A perpendicular to wall 2, to a complementary electric connector 1' (shown schematically by the dash line in Figures 2 and 5) to define a "fit-through" electric connecting unit for connecting electric devices (not shown) located on opposite sides of wall 2.

[0014] Connector 1 comprises a substantially cylindrical insulating enclosure 3 having an axis B parallel to direction A, and defining a number of transverse rows of longitudinal cavities 4 having respective axes parallel to direction A and to axis B, and for receiving respective male blade-type electric terminals 5 (only one shown in Figures 2 to 6) connected to respective electric cables 6 (only one shown partly in Figures 2, 3 and 5) and retained inside cavities 4 by known primary retaining means described later on. More specifically, enclosure 3 defines six rows of cavities 4 : two central rows, each defined by eight cavities; two end rows located on opposite sides of the central rows and each defined by three cavities; and two intermediate rows, each interposed between a respective central row and a respective end row and defined by six cavities.

[0015] Enclosure 3 engages a circular through hole 8 formed in wall 2, and is connected to wall 2 as follows. In particular, enclosure 3 comprises an outer annular flange 9 which, in use, rests against wall 2; a pair of elastic retaining lances 10 spaced angularly about axis B and which click onto a peripheral edge 11 of hole 8 to secure enclosure 3 axially to wall 2; and a number of radial projections 12 which engage respective seats (not shown) formed in peripheral edge 11 to prevent connector 1 from rotating either way with respect to wall 2.

[0016] Enclosure 3 comprises a rear portion 14 having cavities 4 for terminals 5, and from which flange 9, lances 10 and projections 12 extend outwards; and a hollow front portion 15 projecting axially from hole 8, on the opposite side to flange 9, and which communicates with cavities 4 and defines a substantially parallelepiped recess 16 for housing a correspondingly-shaped portion 16' of complementary connector 1'.

[0017] With reference to Figures 2 to 6, each terminal 5 comprises a box-shaped intermediate portion 20 having a retaining seat 21 for the primary retaining means; a blade-type contact portion 22 projecting frontwards from intermediate portion 20 and which mates with a corresponding female electric terminal 5' (shown schematically by the dash line in Figures 2 and 5) of connector 1'; and a rear portion 23 for connection to an electric cable 6.

[0018] Each terminal 5 is inserted inside respective cavity 4 through a rear opening 24 of the cavity formed in a rear wall 18 of portion 14 of enclosure 3, so that contact portion 22 projects axially inside recess 16 through a front opening 25 of cavity 4 formed in an end wall 19 of recess 16 opposite wall 18. In use, cables 6 project from portion 14 of enclosure 3 through respective openings 24.

[0019] The primary retaining means comprise, for each terminal 5, an elastic lance 26, which projects inside respective cavity 4, substantially in direction A and towards front opening 25, from a partition 27 separating the respective row of cavities 4 from the adjacent row. On the surface facing inwards of cavity 4, lance 26 comprises a tooth 28 substantially in the form of a rectangular trapezium, and which clicks onto retaining seat 21 of respective terminal 5.

[0020] More specifically, tooth 28 permits insertion of terminal 5, which, sliding along an oblique side of tooth 28 facing opening 24, deforms lance 26 elastically towards partition 27. Once terminal 5 is inserted fully inside cavity 4 (Figures 2 to 4), lance 26 springs back into the undeformed position by tooth 28 clicking inside retaining seat 21 of terminal 5 to define, with a side of the tooth perpendicular to axis B and opposite the oblique side, a stop preventing withdrawal of terminal 5.

[0021] Connector 1 also comprises a secondary retaining device for retaining terminals 5 and indicated as a whole by 30 (Figures 7 and 8).

[0022] Device 30 comprises a first plate 31 formed separately from enclosure 3, and which is fitted, in direction A, to the front of enclosure 3 in a closed position (Figures 2, 5 and 6) to determine correct insertion of terminals 5 inside respective cavities 4 and prevent withdrawal of the terminals.

[0023] In particular, plate 31 has a substantially convex rectangular peripheral edge 32 defined by two straight parallel sides 33, and by two curved, outwardly-convex sides 34 connecting respective opposite ends of sides 33.

[0024] Plate 31 is insertable frontally inside recess 16 of front portion 15 of enclosure 3, and comprises, integrally, a number of wedges 40 - one for each row of cavities 4 - projecting longitudinally from plate 31, and each of which is insertable inside the respective row of cavities 4, between lances 26 and respective wall 27 from which lances 26 originate, so as to prevent deformation of lances 26 (Figures 2 to 8). Plate 31 also comprises a number of through seats 41, which, in use, are aligned with respective cavities 4 and engaged in sliding manner by contact portions 22 of terminals 5. More specifically, seats 41 are arranged in a number of transverse rows corresponding to rows of cavities 4.

[0025] According to the present invention, device 30 comprises a second plate 42 having a number of transverse rows of through seats 43 for contact portions 22 of respective terminals 5; and a pair of connecting members 44 for connecting plates 31 and 42 facing each other and so as to move, with respect to each other in direction A, between a first work configuration (Figures 3 to 7) in which plates 31, 42 are parallel and a given distance apart, and a second work configuration (Figure 2) in which plates 31, 42 are gripped together by the thrust exerted by complementary electric connector 1' engaging connector 1.

[0026] With particular reference to Figures 7 and 8, connecting members 44 extend parallel to direction A and axis B, and are located at opposite ends of one of the diagonals of plate 31. Each connecting member 44 comprises a substantially triangular-section first bar 45 projecting from a respective vertex portion of plate 31 in the opposite direction to wedges 40, and having

towards the other connecting member 44, a V-shaped longitudinal slot 46; and a substantially triangular-section second bar 47 projecting from plate 42 and engaging in sliding manner slot 46.

[0027] More specifically, plate 42 has a peripheral edge 48 similar to peripheral edge 32 of plate 31 and which mainly differs from edge 32 by comprising, at bars 45, a pair of L-shaped recesses 49 enabling bars 45 to slide beyond plate 42 in said first and second work configurations of device 30; and a respective bar 47 extends over one of the sides of each recess 49, and projects, in direction A, with respect to and from both sides of plate 42.

[0028] Slot 46 of each bar 45 comes out at the front, on the wedge 40 side, through a substantially triangular through opening 50 formed in plate 31 and which is engaged in sliding manner by respective bar 47 as plates 31 and 42 are gripped together. Slot 46 of each bar 45 is defined, on the opposite side of opening 50, by a rear edge 51, which, as explained in detail later on, defines a one-way stop for respective bar 47 of plate 42, and therefore defines the first work configuration of plates 31 and 42.

[0029] Device 30 also comprises a pair of flexible blades 52, which project from respective opposite sides 33 of plate 31, extend along sides 33 and towards plate 42, and are deformed elastically on contacting plate 42. More specifically, blades 52 extend from plate 31 close to respective bars 45 so as to define, when viewed from the side, an X-shaped cross.

[0030] In the first work configuration of device 30, blades 52 are bent slightly between plates 31 and 42 and exert an elastic reaction on plate 42 to bring the rear ends of bars 47 into contact with respective rear edges 51 of respective slots 46.

[0031] Portion 15 of enclosure 3 also comprises, inside recess 16, three longitudinal ribs 53, 54 (Figure 1), which are parallel to direction A, have rounded outer edges, and provide for guiding device 30 in direction A. More specifically, two (53) of the ribs engage respective slots 55 formed in bars 45 on the opposite side to slots 46, while the third rib (54) engages respective U-shaped grooves 56 formed in peripheral edges 32, 48 of respective plates 31, 42.

[0032] With reference to Figures 4, 6, 7 and 8, plate 31 also comprises a pair of elastic retaining lances 58 projecting, on the wedge 40 side, from respective vertex portions of plate 31 from which bars 45 substantially extend, and each having a tooth 59 which clicks onto a respective pair of teeth 60, 61 carried by portion 14 of enclosure 3 to respectively define a preassembly position and a full-assembly position of device 30 inside enclosure 3.

[0033] More specifically, teeth 60, 61 in each pair are formed in a respective lateral recess 62 of portion 14 of enclosure 3, are located successively in direction A from wall 19 towards wall 18, are offset crosswise to direction A, and have a profile substantially in the form of a rectangular trapezium with the oblique side facing recess 16.

[0034] Tooth 59 of each lance 58 has a profile substantially in the form of a rectangular trapezium with the oblique side facing wall 18 of enclosure 3, is of such a width as to interact simultaneously with both respective teeth 60, 61, and clicks between teeth 60, 61 to define the preassembly position of device 30 (Figures 3 and 4), or behind tooth 61 towards wall 18 to define the full-assembly position of device 30 (Figures 5 and 6).

[0035] More specifically, in the preassembly position, plate 31 of device 30, in the first work configuration, is detached from wall 19 so that wedges 40 do not interact with lances 26, and contact portions 22 of terminals 5 are engaged exclusively in respective seats 41 of plate 31.

[0036] In the full-assembly position, device 30, still in the first work configuration, is positioned with plate 31 resting against wall 19 in the closed position, so that contact portions 22 of terminals 5 are engaged in respective seats 43 of both plates 31, 42, and are therefore supported by the plates.

[0037] Finally, plate 42 comprises a number of substantially triangular-section transverse strengthening ribs 63 extending perpendicular to direction A, located at respective rows of seats 43, and projecting from the face of plate 42 facing plate 31. In the second work configuration of device 30, ribs 63 of plate 42 engage respective complementary-shaped transverse grooves 64 formed on the face of plate 31 facing plate 42.

[0038] Connector 1 is assembled as described below, commencing from an initial condition in which plates 31 and 42 of device 30, in the first work configuration, are housed inside recess 16 of enclosure 3 in the preassembly position, and terminals 5 are housed inside respective cavities 4.

[0039] If one of terminals 5 is not correctly inserted inside respective cavity 4, the corresponding lance 26 remains deformed and prevents the corresponding wedge 40 of plate 31 from being inserted fully inside cavity 4 between lance 26 and wall 27, thus preventing device 30 from being set to the full-assembly position, and connection of connector 1 and complementary connector 1'.

[0040] Conversely, if terminals 5 are all correctly engaged by respective lances 26, wedges 40 of plate 31 may all be moved into the closed position and device 30 into the full-assembly position, thus enabling connection of connector 1 and complementary connector 1'.

[0041] More specifically as portion 16' of connector 1' is inserted inside recess 16 of connector 1, portion 16' pushes and grips plate 42 to plate 31 in direction A, thus flexing blades 52. At the same time, female terminals 5' of connector 1' mate with contact portions 22 of respective male terminals 5, which are maintained in the correct connection position by being supported by both plates 31 and 42.

[0042] The second work configuration of plates 31, 42

corresponds to the lock position of connectors 1 and 1'.

[0043] The advantages of connector 1 according to the present invention will be clear from the foregoing description.

[0044] In particular, plate 42 defines an additional front support for contact portions 22 of terminals 5 during connection to corresponding female terminals 5' of connector 1', thus preventing accidental deformation of contact portions 22, and is gripped to plate 31, i.e. constitutes no noticeable increase in overall size, in the lock position of connectors 1, 1', i.e. when said supporting action is no longer required.

[0045] Moreover, in the full-assembly position of plates 31 and 42, plate 42 "closes" the front of recess 16 to keep out dust and dirt.

[0046] 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 enclosure (3) defining a number of cavities (4) for housing respective male electric terminals (5) and having respective axes parallel to a connection direction (A) of said connector (1) to a complementary connector (1');
   - primary retaining means (26) for retaining said terminals (5) inside the respective said cavities (4) and preventing withdrawal of the terminals; and
   - secondary retaining means (30) comprising at least a first member (31), which mates with said enclosure (3), in said connection direction (A), in a closed position, and cooperates in said closed position with said primary retaining means (26) to determine correct engagement and prevent release of said terminals (5) by the primary retaining means; said first member (31) having a number of through first seats (41) engaged in sliding manner by respective contact portions (22) of said terminals (5);

     characterized in that said secondary retaining means (30) comprise a second member (42) having a number of through second seats (43) for respective said contact portions (22) of said terminals (5); and connecting means (44) for connecting said first and second member (31, 42) facing each other and in such a manner as to move, with respect to each other and in said connection direction (A), between a first work configuration in which said first and second member (31, 42) are positioned parallel and a given distance apart, and a second work configuration in which said first and second member (31, 42) are gripped together by the thrust exerted by said complementary connector (1') engaging said connector (1).

2. A connector as claimed in Claim 1, characterized in that said connecting means (44) comprise guide means (45) carried by one of said first and second member (31, 42) and extending parallel to said connection direction (A); and engaging means (47) carried by the other of said first and second member (31, 42) and connected in sliding manner to said guide means (45).

3. A connector as claimed in Claim 2, characterized in that said first and second member (31, 42) are defined by respective plates perpendicular to said connection direction (A); and in that said guide means comprise a number of first bars (45) projecting from one of said first and second member (31, 42) and extending parallel to said connection direction (A).

4. A connector as claimed in Claim 3, characterized in that said first bars (45) have respective longitudinal slots (46); and in that said engaging means comprise a number of second bars (47) which slide along respective said slots (46).

5. A connector as claimed in any one of the foregoing Claims from 2 to 4, characterized in that said first member (31) comprises interacting means (40) interacting with said primary retaining means (26); and in that said guide means (45) are carried by said first member (31) on the opposite side to said interacting means (40).

6. A connector as claimed in any one of the foregoing Claims, characterized in that said secondary retaining means (30) comprise elastic means (52) interposed between said first and second member (31, 42); and one-way stop means (51) acting on said second member (42) in opposition to said elastic means (52) to keep the second member (42) at said given distance from said first member (31) in said first work configuration.

7. A connector as claimed in Claim 6, characterized in that said elastic means comprise a pair of flexible blades (52) projecting from opposite sides of one of said first and second member (31, 42).

8. A connector as claimed in Claim 7, characterized in that said flexible blades (52) are so arranged as to form an X-shaped cross when viewed laterally.

9. A connector as claimed in any one of the foregoing Claims from 6 to 8, characterized in that said stop means (51) are carried by said slots (46) of said first

bars (45).

10. A connector as claimed in Claim 9, characterized in that said stop means comprise, for each said second bar (47), a transverse end edge (51) of the respective said slot (46).

11. A connector as claimed in any one of the foregoing Claims, characterized in that said enclosure (3) comprises a rear portion (14) defining said cavities (4) for said terminals (5), and a hollow front portion (15) communicating with said cavities (4) and which houses said contact portions (22) of said terminals (5) and defines a recess (16) for receiving said complementary connector (1'); said first and second member (31, 42), in said first work configuration, being movable, inside said recess (16) of said enclosure (3), between a preassembly position in which said first member (31) does not interact with said primary retaining means (26), and a full-assembly position in which said first member (31) is in said closed position and supports, together with said second member (42), said contact portions (22) of said terminals (5); said first and second member (31, 42) being settable to said second work configuration as of said full-assembly position and by the thrust exerted by said complementary connector (1') engaging said connector (1).

12. A connector as claimed in Claim 11, characterized by comprising retaining means (58, 59, 60, 61) interposed between said secondary retaining means (30) and said enclosure (3), and defining said preassembly and full-assembly positions of said first and second member (31, 42).

13. A connector as claimed in Claim 12, characterized in that said retaining means comprise at least a first and a second tooth (60, 61) carried by said enclosure (3) and arranged successively in said connection direction (A); and at least one elastic lance (58) carried by said first member (31) and having a third tooth (59) which clicks between said first and said second tooth (60, 61) to define said preassembly position of said secondary retaining means (30), and behind said second tooth (61) to define said full-assembly position of the secondary retaining means (30).

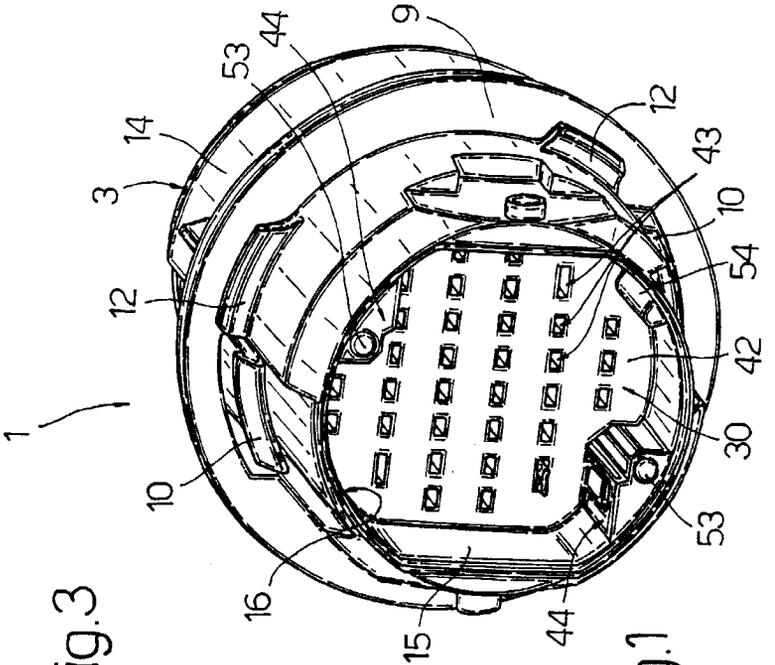
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Fig.3

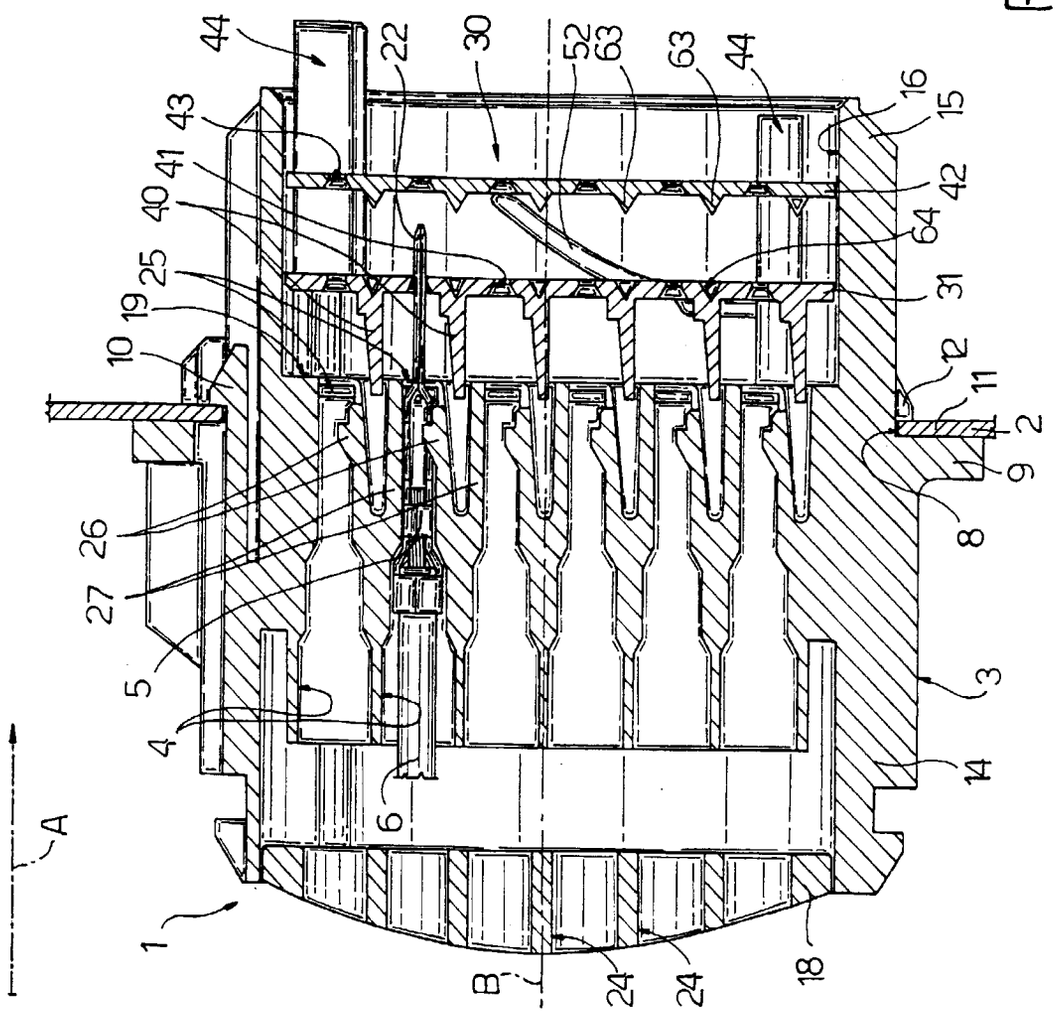
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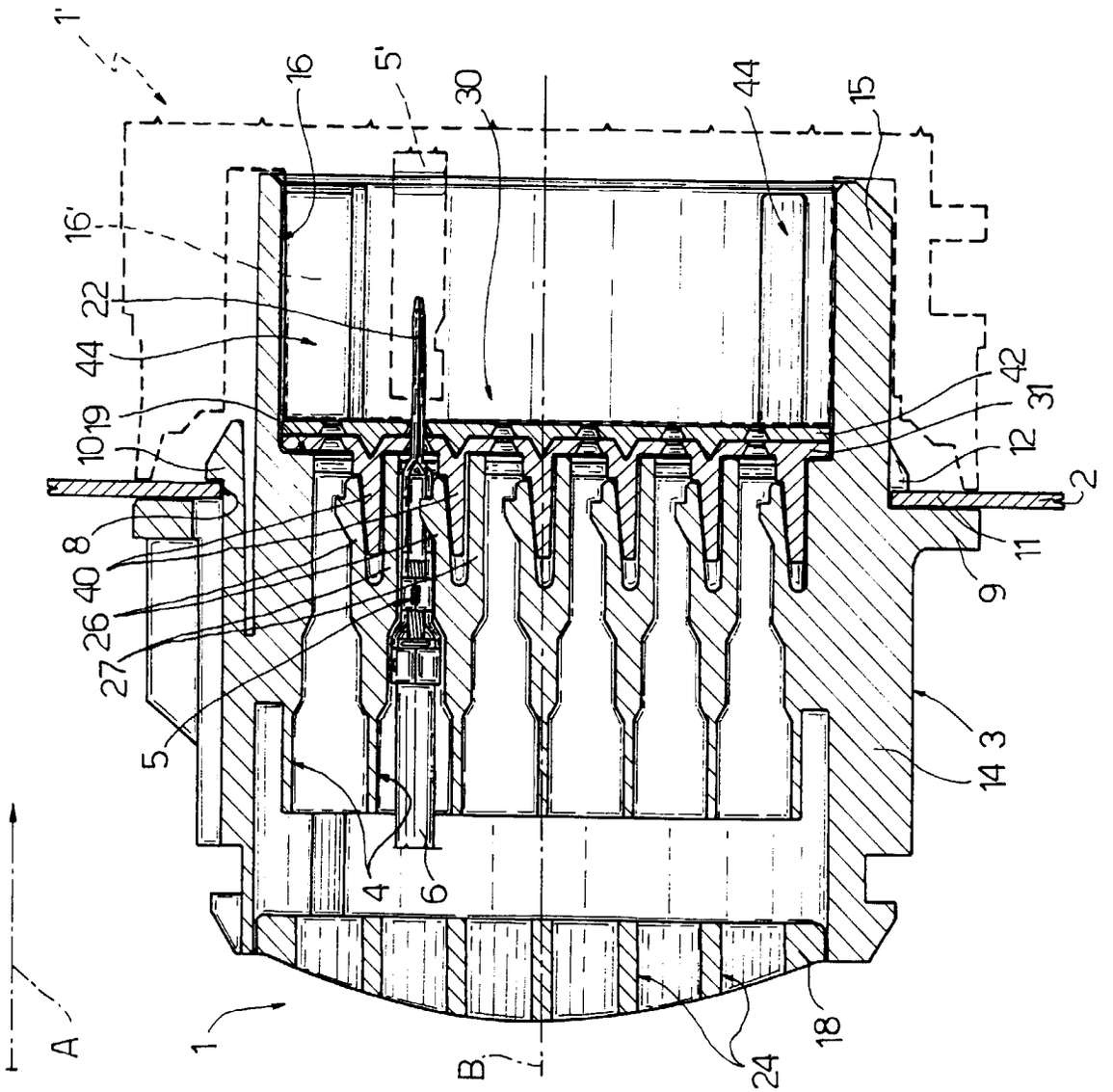
Fig.1

Fig.2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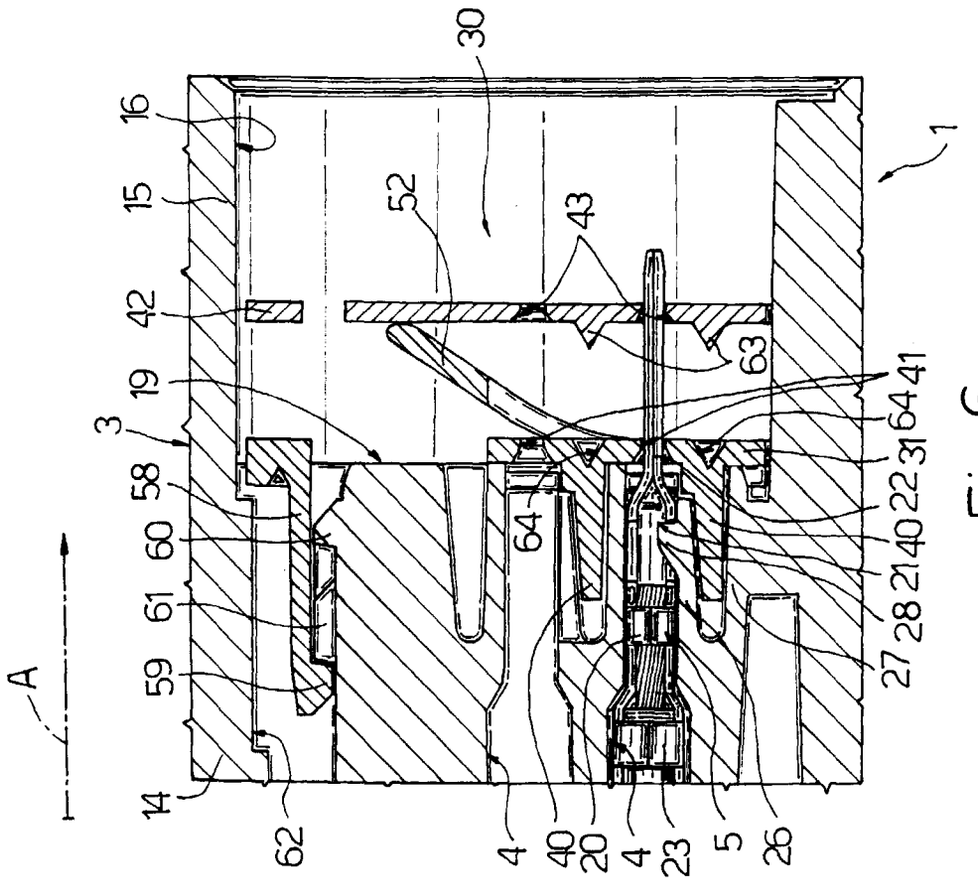
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Fig.6

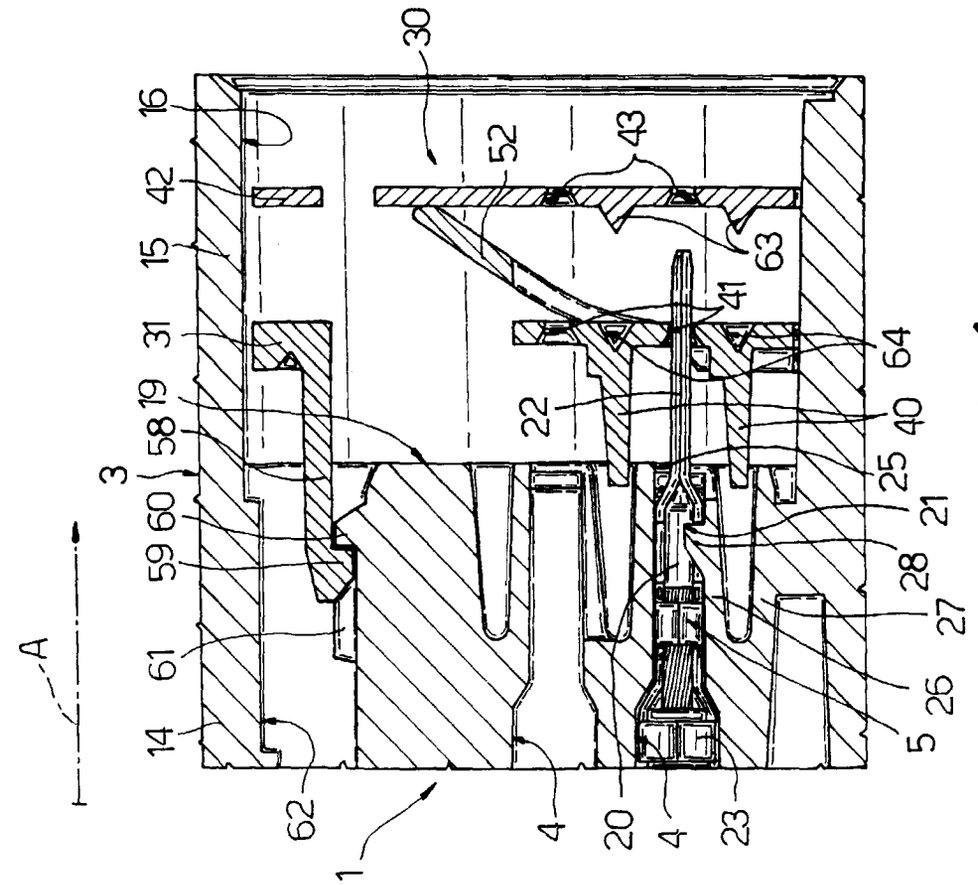
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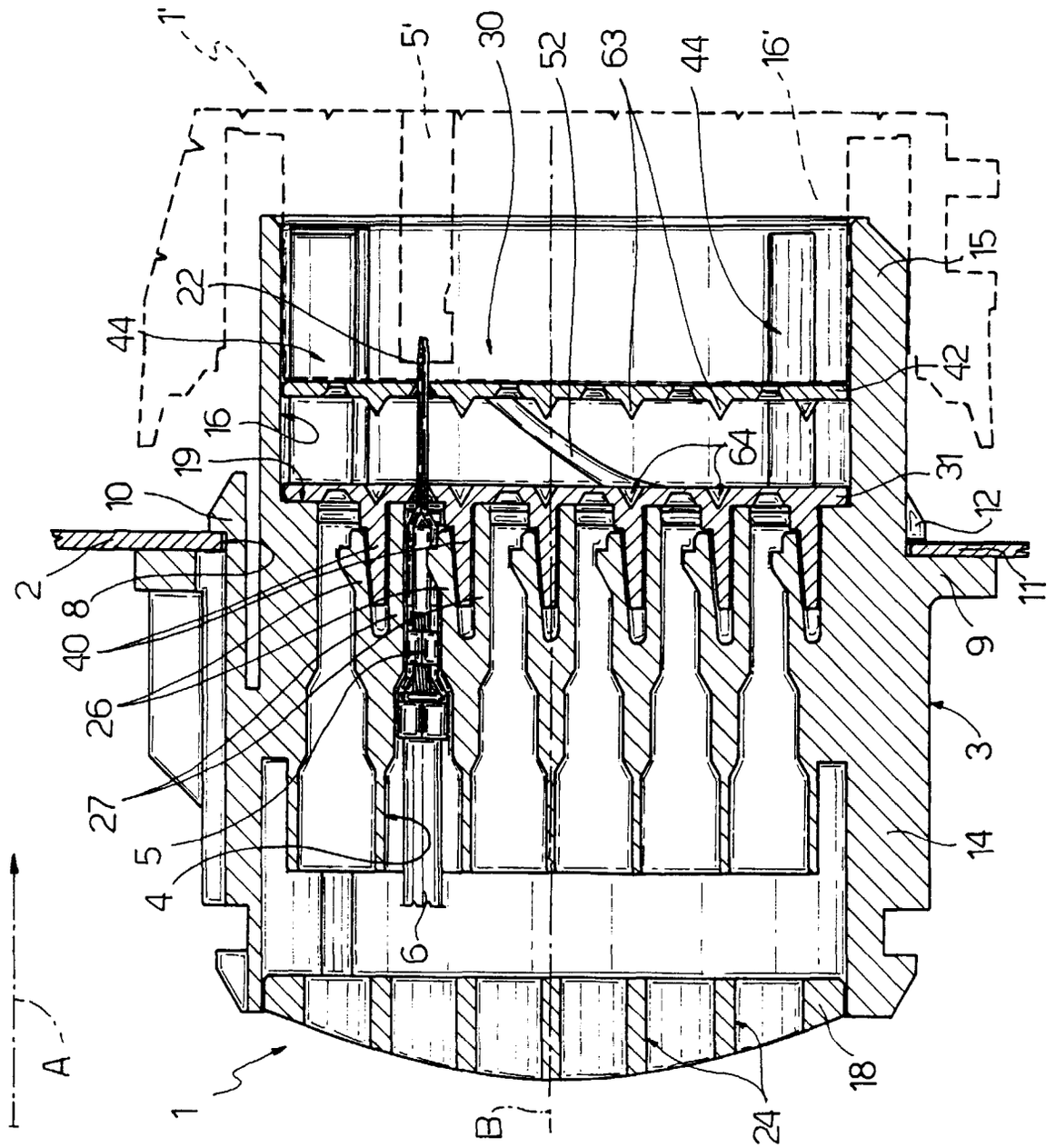
Fig.4

Fig. 5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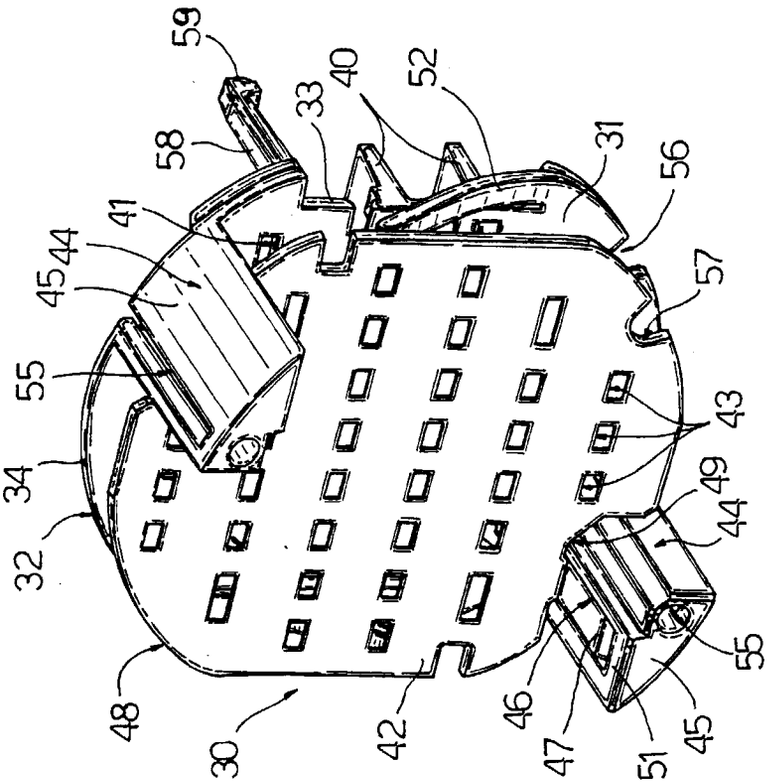
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Fig.7

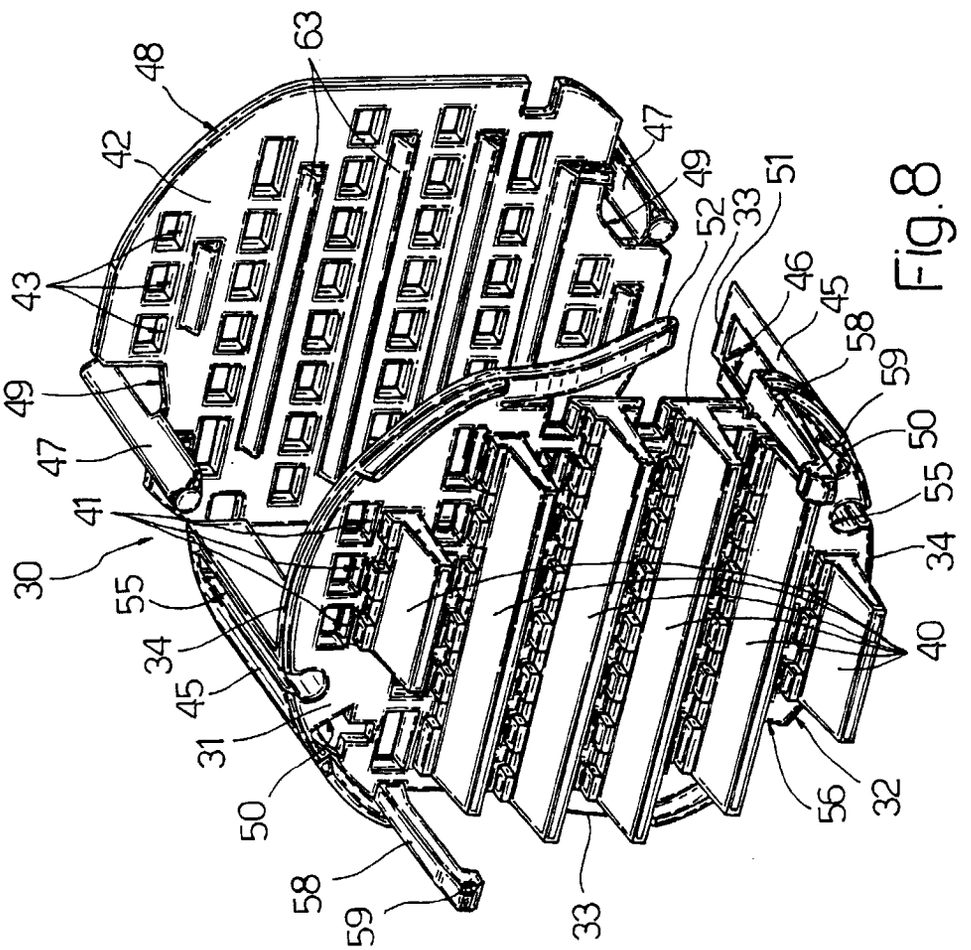
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Fig.8