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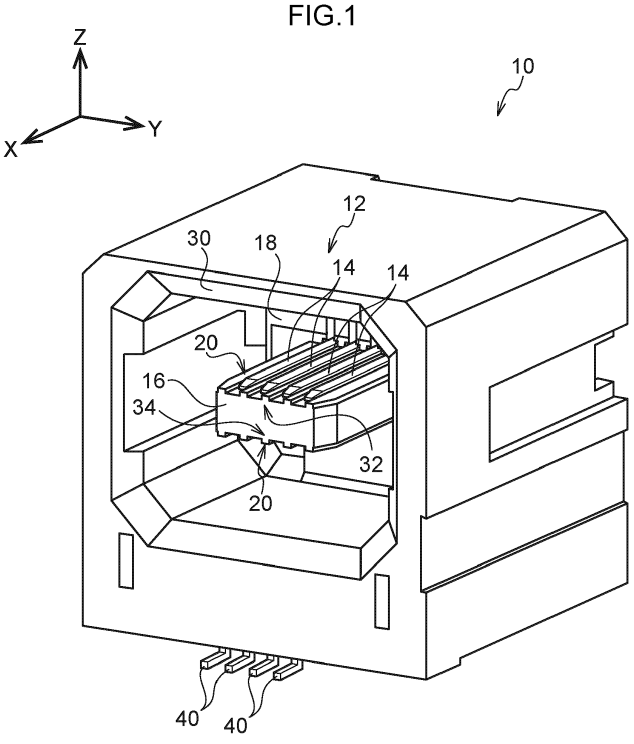
(54) **CONNECTOR**

(57) A connector is provided. The connector includes a terminal having a contact surface that is in electrical contact with a connection target, a housing that is placed on a substrate, the housing including a fitting portion that fits with the connection target in the fitting direction, and an accommodating portion for accommodating the terminal in a state where a displacement of the terminal can be regulated by a regulating surface that at least partially faces a portion of the terminal different from the contact surface, and a recess that is provided on the regulating surface of the accommodating portion such that a space is formed between the recess and the terminal.

FIG.1



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Description

BACKGROUND

Technical Field

[0001] The present disclosure relates to connectors.

Related Art

[0002] Japanese Patent Application Laid-Open Publication No. 2010-33714 (Patent Document 1) discloses an invention relating to a connector. The connector includes a terminal that is in electrical contact with a connection target, and a housing that houses the terminal. The terminal is provided with a terminal contact portion that comes into contact with the connection target and tends to have a low impedance, and a recess provided on a surface opposite to the terminal contact portion. Thus, an air layer having a low dielectric constant is formed between the terminal and the housing. Therefore, it is possible to increase the impedance at the terminal contact portion that contacts the connection target of the terminal.

[0003] However, in the configuration disclosed in the above-mentioned patent document, since a recess is formed in the terminal itself, high processing accuracy may be required in order to suppress an adverse effect on contact with the connection target. When the connector is downsized to be installed in a limited space, the width of the terminal may be reduced, and in this case, the recess may not be formed. Therefore, the above prior art has room for improvement in this respect.

SUMMARY

[0004] The present disclosure has been made in view of the above-described circumstances, and has as its object to obtain a connector that can easily increase terminal impedance.

[0005] A connector according to first aspect includes: a terminal having a contact surface that is in electrical contact with a connection target; a housing that is placed on a substrate, the housing including: a fitting portion and fits with the connection target in the fitting direction; and an accommodating portion for accommodating the terminal in a state where a displacement of the terminal can be regulated by a regulating surface that at least partially faces a portion of the terminal different from the contact surface; and a recess that is provided on the regulating surface of the accommodating portion such that a space is formed between the recess and the terminal.

[0006] In the first aspect, the connector has a terminal and a housing. The terminal is housed in the housing and has a contact surface that makes electrical contact with the connection target. The housing is placed on the substrate and has a fitting portion and an accommodating portion, and the fitting portion fits with the connection target along the fitting direction. The accommodating portion accommodates the terminal in a state where displacement of the terminal can be regulated by a regulating surface at least partially opposed to a portion different from the contact surface of the terminal. Since the regulating surface is provided with a recess forming a space between the terminal and the terminal, an air layer having a lower dielectric constant than other portions can be provided in the recess on the housing side instead of the terminal side. In other words, since the recess is provided on the housing side where it is easy to secure a wider surface than the terminal, an air layer can be easily provided, and the impedance of the terminal accommodated in the accommodating portion can be increased by the air layer.

[0007] Here, "opposite" includes a state where at least a part of the terminal and the regulating surface are in contact with each other, and a state where the terminal is not in contact with the regulating surface.

[0008] The connector according to second aspect is the connector according to the first aspect, wherein the recess is formed in a part of the regulating surface that contacts a surface of the terminal opposite to the contact surface in the thickness direction of the terminal.

[0009] In the second aspect, since the recess is provided in a part of the regulating surface that comes into contact with the contact surface of the terminal and the surface on the opposite side in the plate thickness direction, it is difficult to recognize the recess from the outside. Further, the regulating surface corresponding to the surface of the terminal opposite to the contact surface is a dead space, so that the space can be used effectively.

[0010] The connector according to third aspect is the connector according to the second aspect, wherein, the regulating surface, which is in contact with the surface of the terminal opposite to the contact surface in the thickness direction of the terminal, is provided in a pair, with the recess being disposed therebetween, in a direction orthogonal to both a contact direction along which the connection target contacts the contact surface and the fitting direction.

[0011] In the third aspect, the regulating surface is provided as a pair, with the recess being disposed therebetween, in a direction orthogonal to both the fitting direction of the terminal and the contact direction along which the connection target contacts the contact surface (hereinafter, simply referred to as "width direction"). For this reason, widthwise ends of the terminal are supported by the regulating surface. Therefore, even when a force is applied to the terminal along the contact direction when the connection target comes into contact with the contact surface of the terminal, the inclination and deformation of the terminal can be suppressed. Thereby, connection reliability can be ensured.

[0012] The connector according to fourth aspect is the connector according to the second aspect, wherein, the regulating surface, which is in contact with the surface of the terminal opposite to the contact surface in the thick-

ness direction of the terminal, is provided between a pair of recesses that are formed in a direction orthogonal to both a contact direction along which the connection target contacts the contact surface and the fitting direction.

[0013] In the fourth aspect, since the regulating surface is provided between the pair of recesses formed in the width direction of the terminal, the recess forming a space between itself and the terminal is provided as a pair at different locations on the contact surface of the terminal and the opposite surface in the thickness direction. Therefore, since air layers having a low dielectric constant can be provided at plural positions on the surface of the terminal, the impedance can be more appropriately increased when electricity flows on the surface of the terminal due to the skin effect.

[0014] The connector according to fifth aspect is the connector according to any one of the first to the fourth aspect, wherein an end of the recess in the fitting direction is covered from the outside by the terminal,

[0015] In the fifth aspect, the end of the recess in the fitting direction is covered from the outside by the terminal. Therefore, when the connection target and the connector are fitted, the connection target can be prevented from being fitted into the recess before contacting the terminal and damaged. That is, it is possible to suppress the occurrence of a insufficient electrical contact at the time of fitting with the connection target.

[0016] As described above, the present disclosure has an effect that the impedance of the terminal can be easily increased.

BRIEF DESCRIPTION OF DRAWINGS

[0017]

FIG. 1 is a perspective view of a connector according to the first embodiment.

FIG. 2 is an enlarged perspective view showing a fitting portion of the connector according to the first embodiment.

FIG. 3 is a perspective view when a fitting portion is viewed in a W direction in FIG. 2;

FIG. 4 is a cross-sectional view showing a state cut along the line AA in FIG. 3;

FIG. 5 is a cross-sectional view corresponding to FIG. 4, illustrating a fitting portion of the connector according to the second embodiment.

DETAILED DESCRIPTION

(First Embodiment)

[0018] A first embodiment of the present disclosure will be described with reference to the figures.

[0019] In the following description, the arrow X shown in each figure is described as the front direction of the connector, the arrow Y is described as one side (right side) in the connector width direction, and the arrow Z is described as the upward direction of the connector. Unless otherwise specified, the terms front and rear, up and down, and width (left and right) are used to indicate front and rear in the connector front and rear direction, up and down in the connector vertical direction, and width (left and right) in the connector width direction (lateral direction). These directions are independent of the direction during the connector use. In some drawings, some reference numerals may be omitted in order to make the drawings easy to see.

(Overall structure)

[0020] As shown in FIG. 1, the connector 10 according to the present embodiment is a so-called plug, which includes a housing 12 and plural terminals 14, and whose lower side is fixed to a circuit board (not shown). The connector 10 can be fitted in a socket (not shown) as a connection target in the X direction. In the present embodiment, the fitting direction X coincides with the front-rear direction of the connector 10, and in the following description, the fitting direction X may be referred to as "front-rear direction".

(Housing)

[0021] The housing 12 is formed in a substantially rectangular cylindrical shape (a substantially rectangular parallelepiped shape). The housing 12 is made of, for example, an insulating material such as a synthetic resin. In addition, the dimension of the housing 12 in the lateral direction is appropriately changed depending on the number of the terminals 14.

[0022] A fitting portion 16 is provided inside the housing 12. The fitting portion 16 is provided substantially at the center of the bottom surface 18 of the housing 12 in the lateral direction and the vertical direction, and protrudes forward from the bottom surface 18. The fitting portion 16 is formed in a substantially rectangular parallelepiped shape whose longitudinal direction is the lateral direction, and plural accommodating portions 22 (see FIG. 2) are equidistantly arranged side-by-side in the lateral direction on each of a pair of side wall portions 20 in the vertical direction. The accommodation portion 22 extends in the front-rear direction, and has a shape that opens toward a vertical direction outside via a pair of left and right side regulation surfaces 24 as cross-sections orthogonal to the longitudinal direction as regulation surfaces, and a bottom regulating surface 26 serving as a regulating surface that connects a vertical inner end of the pair of left and right side regulation surfaces 24 to the lateral direction (see FIG. 4), such that its rear end portion is connected to the insertion hole 28 that communicates in the front-rear direction of the bottom surface 18 (see FIG. 2).

[0023] Extending wall portions 30 are integrally provided outside the fitting portion 16 in the lateral direction and the vertical direction. The extension wall portion 30 protrudes forward from outer ends of the bottom surface 18

of the housing 12 in the lateral direction and the vertical direction. The projecting amount of the extension wall portion 30 from the bottom surface 18 is set larger than the projecting amount of the fitting portion 16 from the bottom surface 18. Thus, the housing 12 is formed in a substantially rectangular cylindrical shape in which the fitting portion 16 is housed.

(Terminal)

[0024] The plural terminals 14 are manufactured by punching a conductive metal plate into a predetermined shape, and form a pair of upper and lower terminal rows 32 and 34. Each of the upper and lower terminal rows 32 and 34 has a configuration in which plural terminals 14 are arranged at equal intervals in the lateral direction so that the thickness direction of the terminals 14 is along the vertical direction. The plurality of terminals 14 included in the upper terminal row 32 and the plural terminals 14 included in the lower terminal row 34 are arranged so as to face each other in a vertical direction. The plurality of terminals 14 of the upper terminal row 32 are provided on the side wall portion 20 above the fitting portion 16, and the plural terminals 14 of the lower terminal row 34 are provided on the lower side of the fitting portion 16.

[0025] Each terminal 14 is accommodated (arranged) in the accommodating portion 22 of the fitting portion 16. As shown in FIG. 2, each terminal 13 includes an exposed portion 38 located between the fitting portion 16 and the extension wall portion 30, a second accommodating portion 22 extending rearward from the exposed portion 38 and being partially inserted into the terminal insertion hole 28, and a connection portion 40 (see FIG. 1) in a state of extending downward from an end of the second accommodating portion 22 opposite to the exposed portion 38 to thereby be fixed to the circuit board. In FIGS. 2 and 3, one terminal 14 of the plural terminals 14 is omitted for easier understanding of the inside of the accommodating portion 22.

[0026] The exposed portion 38 has a part of the front side of the terminal 14 exposed to the outside, and a contact surface 42 that is in electrical contact with a mating terminal (not shown) provided on the socket. In addition, from the mating terminal, contact is made with the vertical direction as the contact direction.

[0027] As shown in FIG. 4, a contact surface 42 of the terminal 14 and a back surface 44 as a surface opposite to the plate thickness direction are partially in contact with the bottom regulating surface 26 of the accommodating portion 22. Further, a pair of left and right side surfaces 48 of the terminal 14 are arranged so as to be capable of contacting the side regulating surfaces 24 of the accommodating portion 22 respectively. As a result, the terminal 14 is accommodated in a predetermined position with limited displacement in the vertical direction inside and in the width direction. The depth of the accommodating portion 22 in the vertical direction is set slightly smaller than the vertical dimension of the terminal 14, and when the terminal 14 is accommodated in the accommodating portion 22, the contact surface 42 project from the side wall portion 20 of the fitting portion 16 to the outside in the vertical direction.

[0028] As shown in FIG. 3, the front end 52 of the terminal 14 has a guide-shaped portion 54. The guide-shaped portion 54 has an inclined wall surface 56 inclined toward the bottom regulating surface 26 of the accommodating portion 22 from the front edge of the contact surface 42 toward the front side, such that when the socket is fitted to the connector 10, the mating terminal can be smoothly moved to the contact surface 42.

(Recess)

[0029] As shown in FIG. 2, recesses 58 are respectively formed in the bottom regulating surfaces 26 of the plural accommodating portion 22. As shown in FIG. 4, the recess 58 is opened outward in the vertical direction by a pair of lateral recess surfaces 60 and a bottom recess surface 64 connecting the vertical inner ends of the pair of lateral recess surfaces 60 in the horizontal direction. The recess 58 is formed at a substantially central portion in the lateral direction on the bottom regulating surface 26. In other words, the bottom regulating surface 26 is formed in a pair on the left and right with the recess 58 interposed therebetween, and supports the ends of the terminals 14 in the lateral direction (width direction).

[0030] The recess 58 has a rear end in the front-rear direction in the fitting direction disposed at a selected position corresponding to the terminal insertion hole 28 on the bottom regulating surface 26 (not shown). On the other hand, as shown in FIG. 3, the front end 62, which is the end of the recess 58 in the fitting direction (front-rear direction), is located behind the front end 52 of the terminal 14. That is, the recess 58 is configured to be invisible from the outside when the terminal 14 is accommodated in the accommodating portion 22.

(Operation and Effect of First Embodiment)

[0031] Next, the operation and the effect of the present embodiment will be described.

[0032] In the embodiment, the connector 10 has the terminal 14 and the housing 12. The terminal 14 is housed in the housing 12 and has a contact surface 42 that makes electrical contact with the connection target. The housing 12 is placed on the substrate and has a fitting portion 16 and an accommodating portion 22. The fitting portion 16 fits with the connection target in the fitting direction. The accommodating portion 22 accommodates the terminal 13 in a state where the displacement of the terminal 14 is regulated by a pair of left and right side regulating surfaces 24, which at least partially opposes the portions of the terminal 14 different from the contact surface 42, and a bottom regulating surface 26. Since the bottom regulating surface 26 is provided with the recess 58 forming a space between itself and the terminal 14, the air layer

having a lower dielectric constant than other portions is formed not in the terminal 14 but in the recess of the housing 12. That is, since the recess 58 is provided on the housing 12 side where it is easy to secure a wider surface than the terminal 14, an air layer can be easily provided. The impedance of the terminal 14 that is accommodated in the accommodating section 22 can thereby be easily increased due to the air layer. Therefore, the impedance of the terminal 14 can be easily increased.

[0033] In addition, since the recess 58 is provided in a part of the bottom regulating surface 26 that is in contact with the contact surface 42 of the terminal 14 and the back surface 44 on the opposite side in the thickness direction, it is difficult to recognize the recess 58 from the outside. Further, the bottom regulating surface 26 corresponding to the back surface 44 of the terminal 14 opposite to the contact surface 42 is a dead space, so that the space can be effectively used.

[0034] Furthermore, since the bottom regulating surface 26 is provided as a pair with the recess 58 interposed therebetween in the width direction of the terminal 14, both ends 68 in the width direction of the terminal 14 are supported by the bottom regulating surface 26. Therefore, even when a force is applied to the terminal 14 in the contact direction when the connection target comes into contact with the contact surface 42 of the terminal 14, the inclination and deformation of the terminal 14 can be suppressed. Thereby, connection reliability can be ensured.

[0035] Further, since the front end portion 62 of the recess 58 in the fitting direction is covered with the terminal 14 from the outside, when the connection target and the connector 10 are fitted, it is possible to suppress the connection target from being fitted into the recess 58 before coming into contact with the terminal 14 and damaged. That is, it is possible to suppress the occurrence of insufficient electrical contact at the time of fitting with the connection target.

(Second Embodiment)

[0036] Next, a connector according to a second embodiment of the present disclosure will be described with reference to FIG. 5. Note that the same components as those of the above-described first embodiment and the like are denoted by the same reference numerals and description thereof will be omitted.

[0037] The connector 80 according to the second embodiment has a basic configuration similar to that of the first embodiment, and has a feature in that a pair of left and right recesses 84 is provided.

[0038] That is, as shown in FIG. 5, a pair of left and right recesses 84 are formed on the bottom regulating surface 82 as the regulating surface of the plural accommodating portions 22. The recess 84 has a concave shape that is opened outward in the vertical direction by a pair of left and right side recess surfaces 86 and a bottom recess surface 88 that connects the vertical inner ends of the pair of side recess surfaces 86 to each other in the horizontal direction. Further, the recesses 84 are formed at both ends in the lateral direction of the regulating surface 82, respectively. In other words, the bottom regulating surface 82 is formed between a pair of recesses 84 provided on the left and right sides, and supports the central portion of the terminal 14 in the lateral direction (width direction). One side of the pair of left and right side recess surfaces 86 of the recess 84 extends vertically with the side regulating surface 24 of the accommodating portion 22.

[0039] The pair of left and right recesses 84 has rear ends in the front-rear direction arranged at arbitrary positions on the bottom regulating surface 26 corresponding to the terminal insertion holes 28 (not shown). On the other hand, a front end (not shown) of the recess 84 in the front-rear direction is disposed behind the front end 52 (see FIG. 3) of the terminal 14 as in the first embodiment. That is, the recess 84 is configured to be invisible from outside when the terminal 14 is accommodated in the accommodating portion 22.

(Operation and Effect of Second Embodiment)

[0040] Next, the operation and effect of the second embodiment will be described.

[0041] Even with the above configuration, the configuration is the same as that of the connector 10 of the first embodiment except that the recesses 84 are provided as a pair on the left and the right, so that the same effects as those of the first embodiment can be obtained. Further, since the bottom regulating surface 26 is provided between the pair of recesses 58 formed in the width direction of the terminal 14, the recess 58 that forms a space between the terminal 14 is formed in a pair at a different location on the contact surface 42 of the terminal 14 and the back surface 44 on the opposite side of the terminal 14 in the plate thickness direction. Therefore, since air layers having a low dielectric constant can be provided at plural positions on the surface of the terminal 14, impedance can be more appropriately increased when electricity flows on the surface of the terminal 14 due to the skin effect.

[0042] In the above-described second embodiment, a configuration in which the recesses 84 are provided in a pair on the left and right is shown. However, the present disclosure is not limited to this, and a configuration with three or more recesses along the lateral direction can also be adopted.

[0043] In the first and second embodiments described above, the terminal 14 is formed in a plate shape. However, the present disclosure is not limited to this. The terminal 14 may be formed in a columnar shape or another shape. Moreover, the cross-sectional shape of the terminal 14 may be another shape such as a semicircular shape in accordance with the cross-sectional shape of the accommodating portion 22.

[0044] Further, the recesses 58 and 84 are configured to be provided on the bottom regulating surfaces 26 and 82 of the accommodating portion 22, but are not limited thereto, and they may be formed on the pair of left and right side regulating surfaces 24 of the accommodating portion 22 to open toward the lateral direction.

[0045] Furthermore, in accordance with the impedance that changes for each portion in the longitudinal direction of the terminal 14, a configuration can be adopted that combines a part where the recess 58 is provided at the center in the lateral direction of the bottom regulating surface 26 and a part where the recess 84 is provided at both ends of the bottom regulating surface 26 in the lateral direction.

[0046] As described above, the embodiments of the present disclosure have been described. However, the present disclosure is not limited to the above, and can be variously modified and implemented in addition to the above without departing from the gist of the present disclosure.

Claims

1. A connector comprising:

a terminal (14) having a contact surface (50) that is in electrical contact with a connection target;
a housing (12) that is placed on a substrate, the housing (12) including:

a fitting portion (16) that fits with the connection target in the fitting direction; and
an accommodating portion (22) for accommodating the terminal in a state where a displacement of the terminal (14) can be regulated by a regulating surface (24, 26, 82) that at least partially faces a portion of the terminal (14) different from the contact surface (50); and

a recess (58, 84) that is provided on the regulating surface (24, 26, 82) of the accommodating portion (22) such that a space is formed between the recess (58, 84) and the terminal (14).

2. The connector according to claim 1, wherein the recess (58, 84) is formed in a part of the regulating surface (26, 82) that contacts a surface of the terminal (14) opposite to the contact surface (50) in the thickness direction of the terminal (14).

3. The connector according to claim 2, wherein, the regulating surface (26), which is in contact with the surface of the terminal (14) opposite to the contact surface (50) in the thickness direction of the terminal (14), is provided in a pair, with the recess (58) being disposed therebetween, in a direction orthogonal to both a contact direction along which the connection target contacts the contact surface (50) and the fitting direction.

4. The connector according to claim 2, wherein, the regulating surface (82), which is in contact with the surface of the terminal (14) opposite to the contact surface (50) in the thickness direction of the terminal, is provided between a pair of recesses (84) that are formed in a direction orthogonal to both a contact direction along which the connection target contacts the contact surface (50) and the fitting direction.

5. The connector according to any one of claims 1 to 4, wherein an end of the recess (58, 82) in the fitting direction is covered from the outside by the terminal (14).

FIG.1

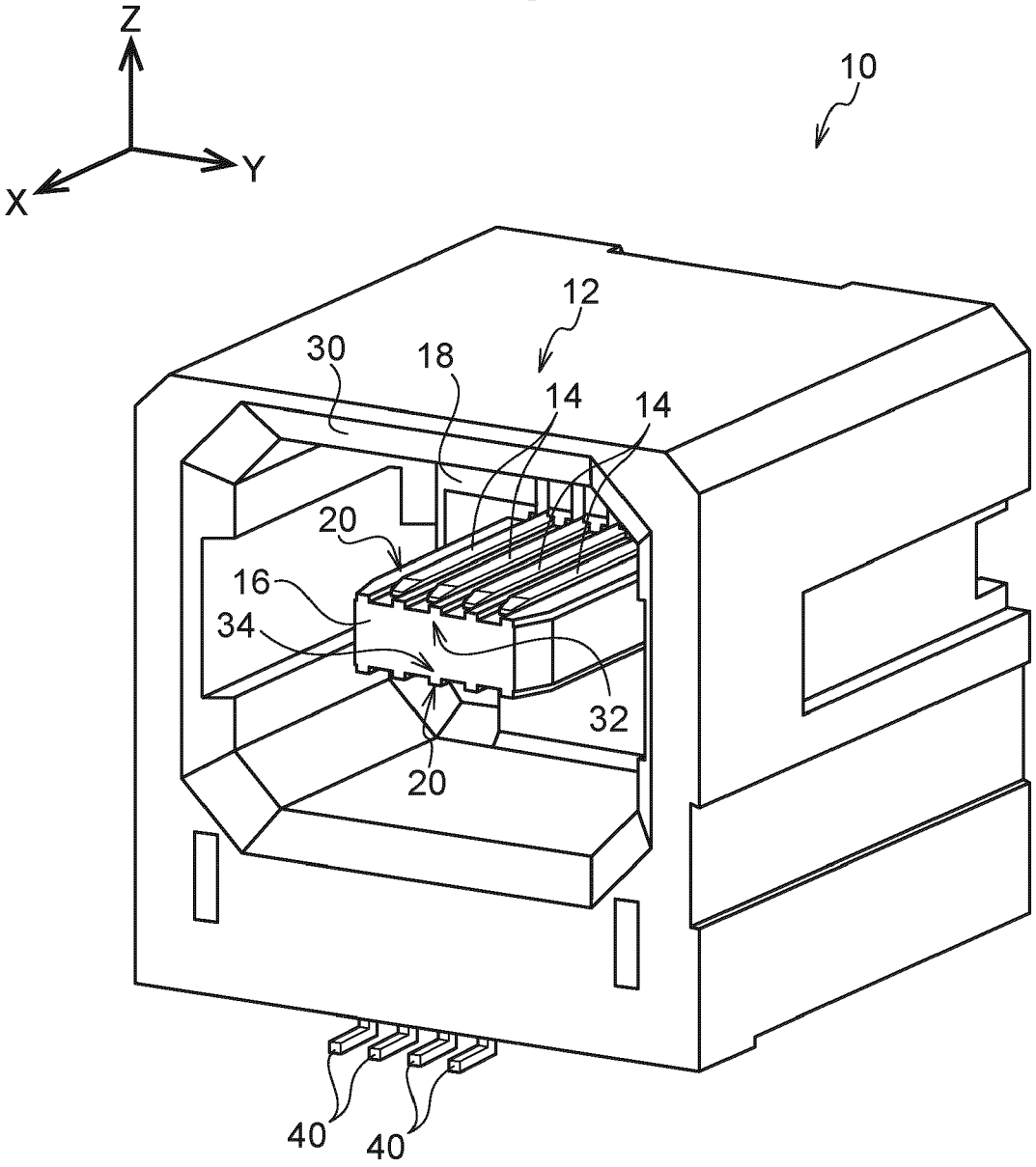

FIG.2

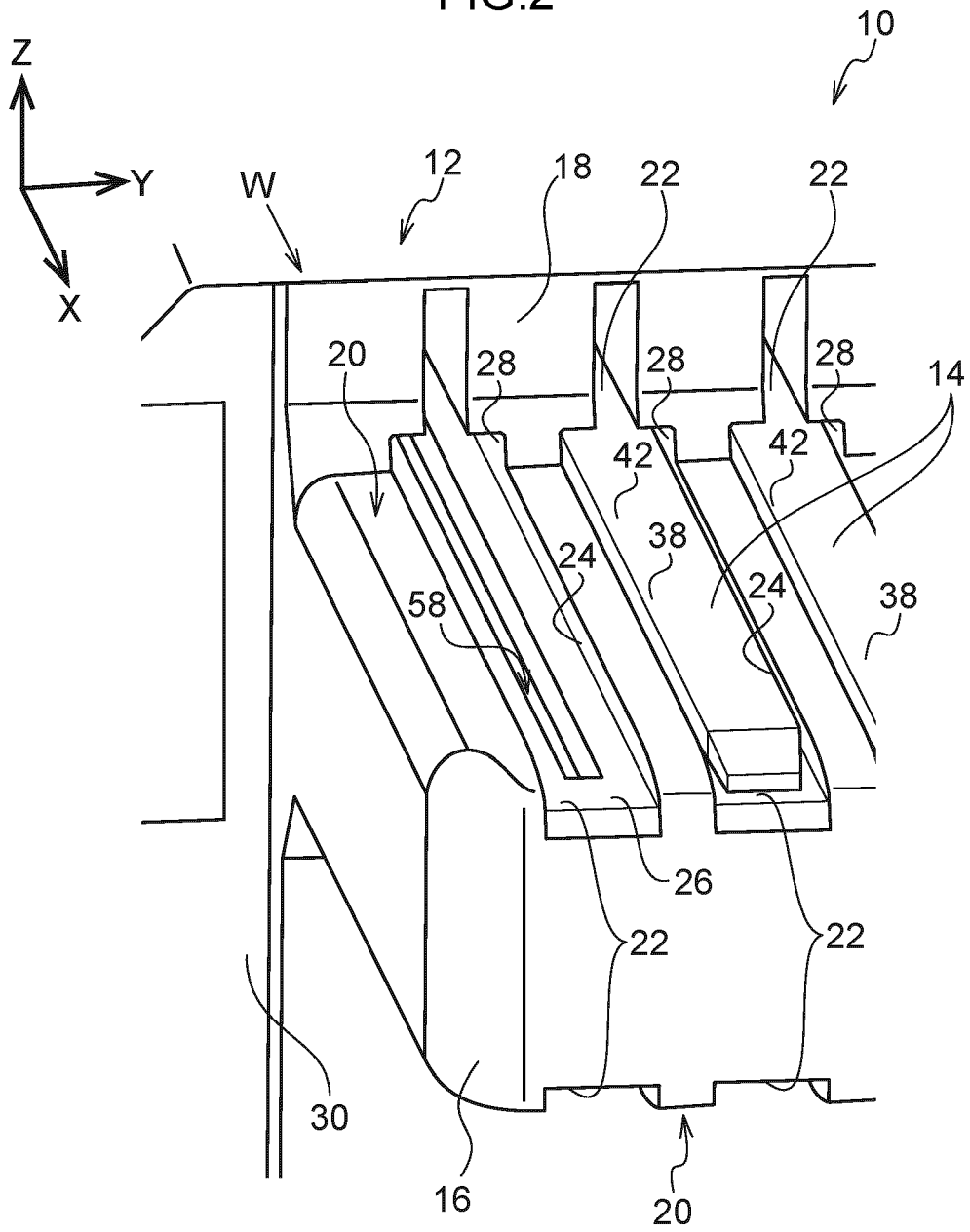
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FIG.3

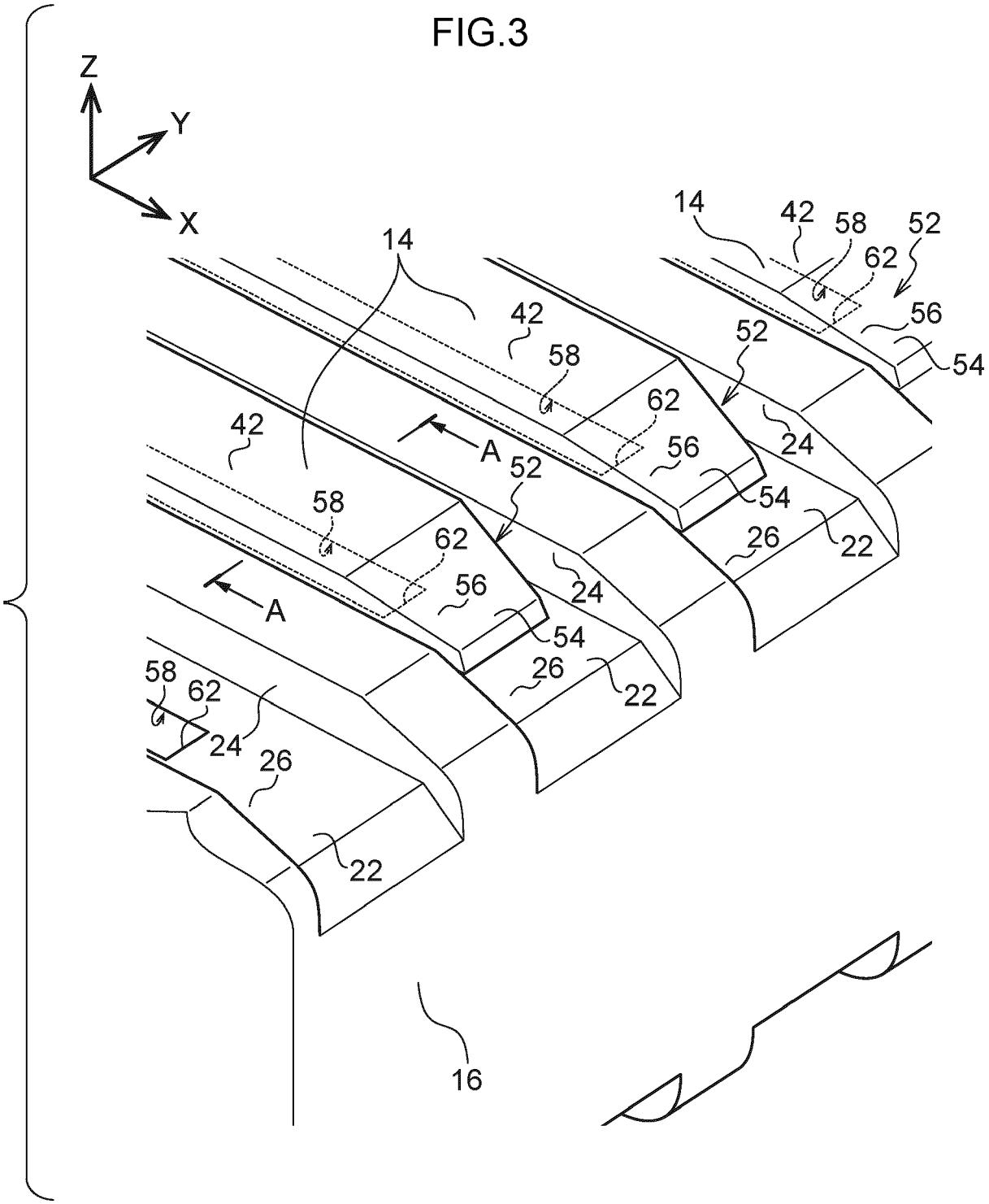


FIG.4

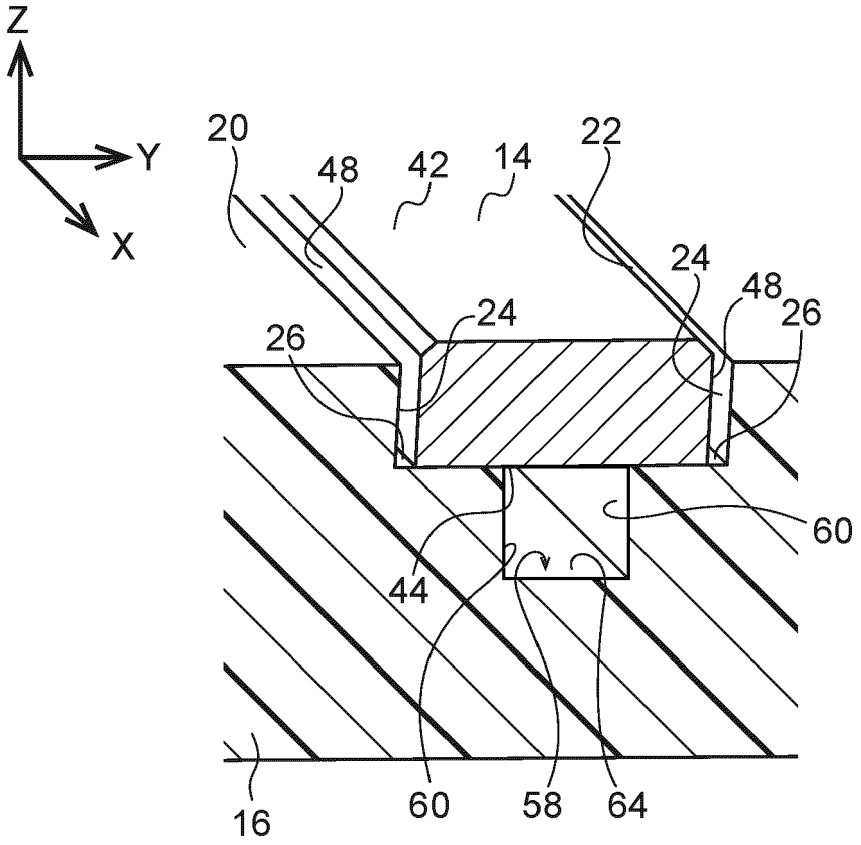
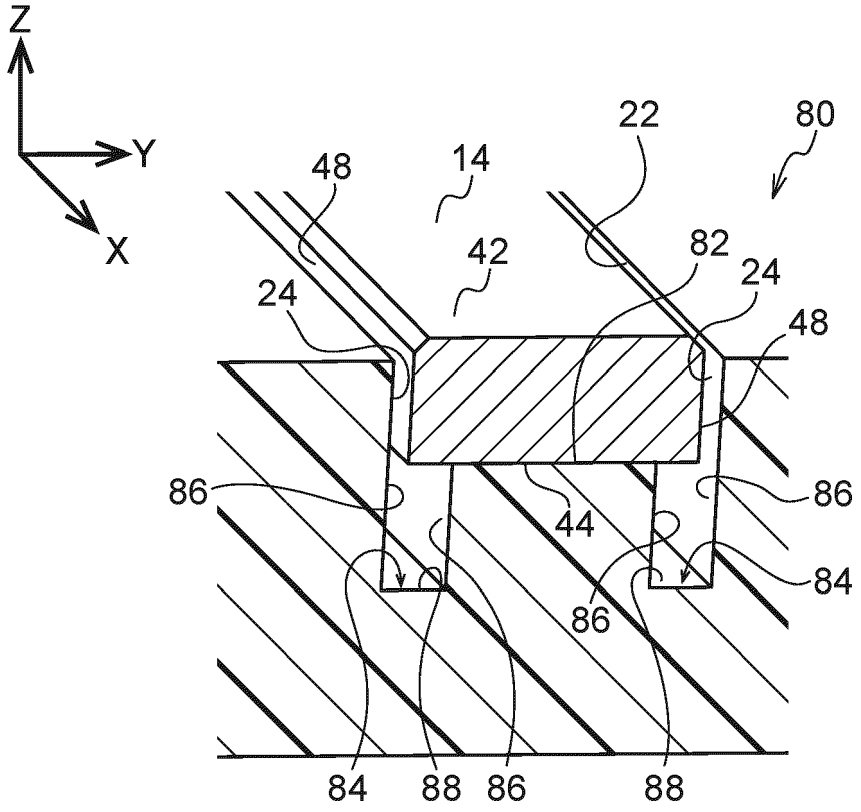


FIG.5



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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 6613

DOCUMENTS CONSIDERED TO BE RELEVANT

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TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 June 2020	Mateo Segura, C

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 6613

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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