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(54) CONNECTOR FOR HIGH-SPEED TRANSMISSION

(57) According to an embodiment of the present disclosure, a connector for high-speed transmission is provided. A host connector (CNH) includes: a housing (1H) and a plurality of contacts (3H). The housing (1H) has a plurality of slots (10H). The plurality of contacts (3H) include signal contacts (3H) and ground contacts (3H) and are arranged in the slots (10H) along a Y direction which is a first direction orthogonal to the fitting direction of the connector. Partition walls (15H) are provided between the adjacent contacts (3H) in the slots (10H). The height of the partition walls (15H) between the signal contacts (3H) and the ground contacts (3H) in the fitting direction is lower than the height of other partition walls (15H) in the fitting direction.

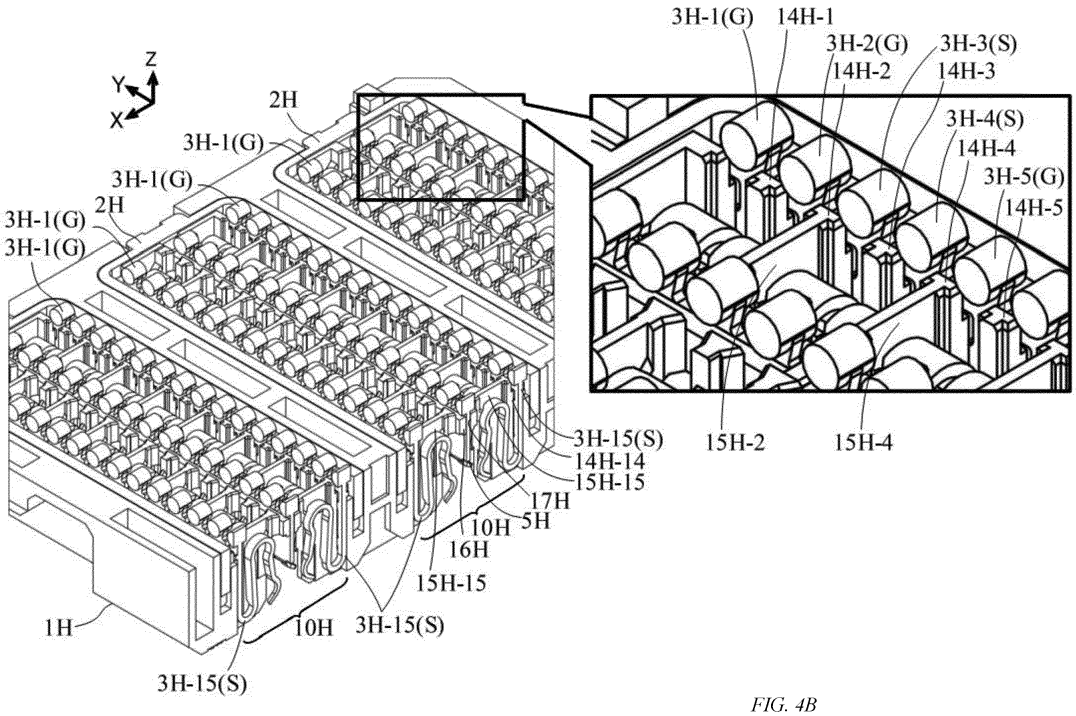


FIG. 4A

FIG. 4B

EP 3 836 314 A1

Description

Technical Field

[0001] The present invention relates to a connector for high-speed transmission mounted on a circuit board.

Background of the Invention

[0002] Many of the connectors for high-speed transmission mounted on circuit boards are formed by arranging a plurality of sets of terminal arrays including signal terminals and ground terminals in the housing. As an example of documents disclosing a technique related to this type of connector, Japanese Patent Application Publication No. 2018-156936 (hereinafter referred to as "Patent Document 1") can be taken up. The connector described in Patent Document 1 has a signal terminal receiving groove which is an opening portion penetrating the bottom wall of the housing from the upper portion to the lower portions of the bottom wall. Ground terminals and signal terminals are alternately inserted in the signal terminal receiving groove. The tale portion of the lower end of the signal terminal is soldered to the mounting surface of the circuit board with a solder ball, and the terminal of a counterpart connector is held by the elastic contact portion thereof.

[0003] Incidentally, in order to increase the speed of signal transmission, it is necessary to reduce crosstalk between adjacent terminals. However, this type of conventional connector has a problem that the paired signal terminal and the ground terminal are completely separated by a resin wall, and it is difficult to reduce crosstalk.

Summary of the Invention

[0004] It is an object of the present invention to provide a connector for high-speed transmission capable of reducing crosstalk.

[0005] A first independent aspect for solving this task relates to a connector for high-speed transmission to be fitted with an external counterpart connector. The connector of the first independent aspect includes a housing and a plurality of terminals. The housing has at least one slot. The plurality of terminals include ground terminals and signal terminals, and are arranged in the slot along a first direction orthogonal to a fitting direction of the connector. Partition walls are provided between adjacent terminals in the slot. A height of the partition walls between the ground terminals and the signal terminals in the fitting direction is lower than a height of other partition walls in the fitting direction.

[0006] In this aspect, upper ends of the partition walls between the ground terminals and upper ends of the partition walls between the signal terminals may be located at substantially the same positions as upper surface of the housing, and upper ends of the partition walls between the ground terminals and the signal terminals may be below the upper surface of the housing.

[0007] Further, the terminal may have a linear portion extending along the fitting direction and a curved portion curved from a tip end of the linear portion on a side of a second direction orthogonal to the fitting direction and the first direction. The curved portion of the ground terminal and the curved portion of the signal terminal may not be separated by the partition wall. Thus, an air layer may be formed between the curved portions.

[0008] Further, the terminal may have a linear portion extending along the fitting direction and a curved portion curved from a tip end of the linear portion on a side of a second direction orthogonal to the fitting direction and the first direction. The linear portion of the ground terminal and the linear portion of the signal terminal may be separated by the partition wall.

[0009] Further, a plurality of ribs may be arranged at intervals in the first direction on inner wall surfaces facing each other in the slot, and the plurality of terminals may be accommodated in gaps between adjacent ribs in the slot one by one in an arrangement order in which two ground terminals and two signal terminals are set as a group and the two signal terminals are interposed between two ground terminals..

[0010] Further, the terminal may have a fork portion, a solder may be sandwiched and crimped in the fork portion. The solder of the terminal may be supported by the upper end of the rib.

[0011] Further, the terminal may have a contact portion to contact an external counterpart connector. A portion of the partition wall between the ground terminal and the signal terminal just beside the contact portion may be cut out.

[0012] Further, the slot may be provided with a support to support a shield plate as another terminal, and the partition wall may be bridged between the rib and the support.

[0013] Further, a long hole may be bored in the support, and the shield plate may be pressed into the long hole.

Brief description of the Drawings

[0014]

Fig. 1A and Fig. 1B are perspective views of a host connector CNH according to an embodiment of the present invention as viewed from two directions;

Fig. 1C and Fig. 1D are perspective views of a plug connector CNP according to an embodiment of the present invention as viewed from two directions;

Fig. 2 is a diagram showing a cut surface parallel to the XZ plane between the contact 3H-3(S)and the contact 3H-4(S) of an assembly constituted by fitting the host connector CNH into the plug connector CNP shown in Figs. 1A - 1D;

Fig. 3 is an exploded perspective view of the host connector CNH of Fig. 1B;

Fig. 4A is a perspective view including a cut surface

of the host connector CNH of Fig. 1B, the cut surface passing through the center of the contact 3H-15(S) in the Y direction;
Fig. 4B is a partially enlarged view of Fig. 4A;
Fig. 5 is a perspective view of the housing 1H of Fig. 3;
Fig. 6B is a partially enlarged view of the front view of Fig. 6A;
Fig. 7A is a rear view of the housing 1H of Fig. 3;
Fig. 7B is a partially enlarged view of the rear view of Fig. 7A;
Fig. 8A is a perspective view of a conductive resin 2HA in the center of Fig. 3;
Fig. 8B is a perspective view of the conductive resin 2HB on both sides of the conductive resin 2HA shown in Fig. 8B;
Fig. 9 is a perspective view of the contact 3H-j of Fig. 3;
Fig. 10A to Fig. 10C are diagrams showing a working process of the contact 3H-j of Fig. 3;
Fig. 11 is a perspective view of the shield plate 5H-m of Fig. 3;
Fig. 12 is an exploded perspective view of the plug connector CNP of Fig. 1D;
Fig. 13 is a perspective view of the housing 1P of Fig. 12;
Fig. 14A shows a front view of the housing 1P of Fig. 13 and side views thereof as viewed from all sides;
Fig. 14B is a partially enlarged view of the front view of Fig. 14A;
Fig. 15A is a rear view of the housing 1P of Fig. 13;
Fig. 15B is a partially enlarged view of the rear view of Fig. 13A;
Fig. 16A is a perspective view of the conductive resin 2PA of Fig. 1C;
Fig. 16B is a perspective view of the conductive resin 2PB on both sides of the conductive resin 2PB of Fig. 16A;
Fig. 17 is a perspective view of the contact 3P-j of Fig. 12;
Fig. 18 is a perspective view of the shield contact 4P-m of Fig. 12;
Fig. 19 is a perspective view of the shield plate 5P-m of Fig. 12.
Fig. 20 is a perspective view including a cut surface passing through the center of the contact 3P-15 in the Y direction in Fig. 1D;
Fig. 21 is a cross-section view of the fitting portion of the shield plate 5P-4 and the shield contact 4P-4 in Fig. 1D; and
Fig. 22 is a diagram showing shield contacts 4PA-m and 4PB-m of a plug connector CNP according to another embodiment of the present invention.

Detailed Description of Embodiments

[0015] Hereinafter, a host connector CNH and a plug connector CNP, which are connectors for high-speed transmission according to an embodiment of the present invention, will be described with reference to the drawings. The host connector CNH and the plug connector CNP are used by soldering to the pads of an electronic substrate 90 and an extension substrate 91, respectively. The plug connector CNP is mounted on the extension substrate 91 while the host connector CNH is mounted on the electronic substrate 90. When the host connector CNH and the plug connector CNP are brought close to each other in the bold arrow direction shown in Fig. 1 and fitted, the terminal of the host connector CNH and the terminal of the plug connector CNP are electrically connected to each other, and high-speed transmission of up to 3.2Tbps between the electronic substrate 90 and extension substrate 91 becomes possible.

[0016] In the following description, the fitting direction of the host connector CNH and the plug connector CNP is appropriately referred to as the Z direction, a direction orthogonal to the Z direction is appropriately referred to as the X direction and the direction orthogonal to the Z direction and the X direction is appropriately referred to as the Y direction. Further, the side where the host connector CNH is located as viewed from the plug connector CNP in the Z direction may be referred to as the upper side and the side where the plug connector CNP is located as viewed from the host connector CNH may be referred to as the lower side.

[0017] As shown in Fig. 3, the host connector CNH is provided with three slots 10H arranged in the X direction in the housing 1H. Conductive resins 2HA and 2HB, two rows of twenty-eight contacts 3H-j (j=1 to 28), and rows of four shield plates 5H-m (m=1 to 7) are mounted in each of the three slots 10H. All the contacts 3H-j (j=1 to 28) mounted in each slot 10H have the same shape. Further, the shapes of the shield plates 5H-m (m=1 to 7) mounted in each slot 10H are also all the same.

[0018] As shown in Fig. 5 and Fig. 6, each of the three slots 10H of the housing 1H vertically penetrates three table portions 12H rising from the bottom portion 11H of the housing 1H. As shown in Fig. 6A, a plurality of reinforcing plates 13H are bridged between the adjacent table portions 12H. Three depressions 111H are formed on the outside of the table portion 12H on the +X side of the bottom portion 11H of the housing 1H. Two depressions 112H are formed on the outside of the table portion 12H on the -X side of the bottom portion 11H of the housing 1H.

[0019] As shown in Fig. 7A and Fig. 7B, a groove 19H is provided around each of the three slots 10H on the upper surface of the housing 1H. The groove 19H is formed in a rectangular frame shape that is horizontally long in the Y direction. Both sides of the groove 19H in the Y direction are open to the outside as open portions 18H.

[0020] The conductive resin 2HA shown in Fig. 8A is embedded in the groove 19H around the central slot 10H. The conductive resin 2HA has a rectangular frame shape whose dimensions make it possible to be contained in

the groove 19H. A plurality of projections 23HA are formed on the inner wall surface of the side wall 21 HA facing the X direction in the conductive resin 2HA. An extension portion 24HA protruding outward in the Y direction is formed on the side wall 22HA facing the Y direction in the conductive resin 2HA. In a state where the conductive resin 2HA is contained in the groove 19H around the central slot 10H, the extension portion 24HA is fitted into the open portion 18H of the groove 19H. Further, the upper surface of the conductive resin 2HA is flush with the upper surface of the housing 1H.

[0021] The conductive resin 2HB shown in Fig. 8B is embedded in the groove 19H around the slot 10H on both sides in the X direction. The conductive resin 2HB has a rectangular frame shape whose dimensions make it possible to be contained in the groove 19H. A plurality of projections 23HB are formed on the inner wall surface of the side wall 21HB facing the X direction in the conductive resin 2HB. An extension portion 24HB protruding outward in the Y direction is formed on the side wall 22HB facing the Y direction in the conductive resin 2HB. In a state where the conductive resin 2HB is contained in the groove 19H around the central slot 10H on both sides in the X direction, the extension portion 24HB is fitted into the open portion 18H of the groove 19H. Further, the upper surface of the conductive resin 2HB is flush with the upper surface of the housing 1H.

[0022] As shown in Fig. 4A, Fig. 6B, and Fig. 7B, twenty-seven ribs 14H-k (k=1 to 27) are provided on the inner wall surfaces of the housing 1H facing each other in the X direction and sandwiching the slot 10H in the table portion 12H. The ribs 14H-k protrude inwardly from the inner wall surface. The ribs 14H-k (k=1 to 27) are aligned in the Y direction at the same interval. The interval between the adjacent ribs 14H-k among the ribs 14H-k (k=1 to 27) is approximately the same as the width of the contact 3H-j in the Y direction.

[0023] On the upper side (+Z side) of the slot 10H in the table portion 12H of the housing 1H there is located a plate support 16H extending in the Y direction. A partition wall 15H-k (k=1 to 27) is provided between the plate support 16H and the rib 14H-k (k=1 to 27) of the slot 10H. As shown in Fig. 4A, Fig. 6B, and Fig. 7B, the partition wall 15H-k rises from the end surface on the inner side of the rib 14H-k toward the side of the plate support 16H. The plate support 16H is supported by the end portion of the partition wall 15H-k on the inner side opposite to the rib 14H-k. Seven long holes 17H-m (m=1 to 7) vertically penetrating the plate support 16H are bored in the plate support 16H.

[0024] As shown in Fig. 9, the contact 3H-j includes; a first linear portion 31H extending in the Z direction; a second linear portion 32H extending in parallel with the first linear portion 31H away from the first linear portion 31H on the -X side; a fork portion 30H bifurcated and extending from one end of the first linear portion 31H; a first curved portion 33H curved from an end portion opposite to the fork portion 30H side of the first linear portion 31H to the side of the second linear portion 32H in the X direction and connected to one end of the second linear portion 32H; a second curved portion 34H curved from the other end of the second linear portion 32H to the side opposite to the first linear portion 31H in the X direction; an inclined portion 35H extending slightly inclined from the end portion of the second curved portion 34H to a side away from the second linear portion 32H; and a contact portion 37H bending and extending in a hook-shape from the tip end of the inclined portion 35H.

[0025] Convex portions 39aH, 39bH, and 39cH protruding outward in the Y direction are formed on the side surface of the first linear portion 31H. The contact portion 37H is further inclined and extends from the base end connected to the inclined portion 35H toward the side opposite to the second linear portion 32H, and then bends and extends in a dogleg shape. The tip end of the contact portion 37H faces the first curved portion 33H. The width of the contact portion 37H in the Y direction is narrowed from the vicinity of the base end of the contact portion 37H. The width of tip end of the contact portion 37H in the Y direction is approximately half the width of the base end of the contact portion 37H in the Y direction.

[0026] The fork portion 30H of the contact 3H-j is a soldering terminal portion soldered to the pad of the electronic substrate 90 which is a mounting destination. Solder is sandwiched and crimped in the fork portion 30H of the contact 3H-j. The solder is fixed to the fork portion 30H by the following procedure. First, as shown in Fig. 10A, a cut piece 300 of a wire solder is prepared by cutting the wire solder into a piece longer than the width of the fork portion 30H in the X direction. Next, as shown in Fig. 10B, the cut piece 300 of the wire solder is pushed in between the tines of the fork portion 30H. After the cut piece 300 of the wire solder is pressed in between the tines of the fork portion 30H, both ends of the cut piece 300 of the wire solder are sandwiched by a tool and crimped to the fork portion 30H.

[0027] The cutting of the solder and the pushing of the solder in between the tines of the fork portion 30H may be performed collectively for a plurality of contacts 3H-j. In that case, it is advisable to pass a long wire solder through the fork portion 30H of a plurality of contacts 3H-j obtained in a state of being continuously connected by press molding, and then to cut the wire solder into an appropriate length.

[0028] As shown in Fig. 10C, the solder fixed by the above procedure spreads up to the surface on the outer side of the fork portion 30H, a part of the outer surface on the outer side of the sandwiching surface of the fork portion 30H is then covered by the solder, thus the solder is integrated with the fork portion 30H.

[0029] Here, the contacts 3H-j (j=1 to 28) of each slot 10H include contacts 3H-j serving as ground terminals and contacts 3H-j serving as signal terminals. Hereinafter, as appropriate, a letter (G) is attached to the ground contact 3H-j and a letter (S) is attached to the signal contact 3H-j to distinguish between the two.

[0030] As shown in Fig. 4B, two rows of contacts 3H-j (j=1 to 28) on the +X side and the -X side in the long holes 17H-m (m=1 to 7) in each slot 10H are contained one by one in the gap between the adjacent partition walls 15H-k in the slot 10H in such a manner that two ground contacts and two signal contacts are aligned alternately. For example, on the +X side of the long hole 17H-1 shown in Fig. 6B and Fig. 7B, the ground contact 3H-1(G) is contained in the gap between the inner wall of the table portion 12H on the +Y side and the partition wall 15H-1, and the ground contact 3H-2(G) is contained in the gap between the partition wall 15H-1 and the partition wall 15H-2. The signal contact 3H-3(S) is contained in the gap between the partition wall 15H-2 and the partition wall 15H-3, and the signal contact 3H-4(S) is contained in the gap between the partition wall 15H-3 and the partition wall 15H-4. The same applies to the -X side of the long hole 17H-1.

[0031] The solder fixed to the fork portion 30H of the contact 3H-j faces upward, and the contact portion 37H of the contact 3H-j faces downward. The solder of the contact 3H-j is supported by the upper end of the rib 14H-k and the solder is exposed above the upper surface of the housing 1H.

[0032] Of the partition walls 15H-k (k=1 to 28) in the slot 10H, a first height of the partition walls 15H-k between the ground contacts 3H-j(G) and the signal contacts 3H-j(S) in the Z direction is lower than a second height of the partition walls 15H-k between the ground contacts 3H-j(G) in the Z direction and is lower than a third height of the partition walls 15H-k between the signal contacts 3H-j(S), in the Z direction, in which the partition walls 15H-k of the second and third heights are the other partition walls 15H-k.

[0033] More specifically, as shown in Fig. 2, the partition wall 15H-k between the ground contacts 3H-j (G) (in the cross section of Fig. 2, the partition wall 15H-1 at the back in the Y direction) has a lower end at substantially the same position as the lower surface of the housing 1H, and an upper end at substantially the same position as the upper surface of the housing 1H. The same applies to the partition wall 15H-k between the signal contacts 3H-j(S).

[0034] In contrast, regarding the partition wall 15H-k between the ground contact 3H-j(G) and the signal contact 3H-j(S) (in the cross section of Fig. 2, the partition wall 15H-2 in front of the Y direction), a lower end thereof locates at substantially the same position as the lower surface of the housing 1H, and an upper end thereof locates below the upper surface of the housing 1H and around the boundary between the first linear portion 31H and the second curved portion 34H of the contact 3H-j. Further, the upper end of the partition wall 15H-k between the ground contact 3H-j (G) and the signal contact 3H-j(S) is formed in a slope shape that becomes lower as the distance from the central plate support 16H increases.

[0035] Further, the substantially rectangular portion of the partition wall 15H-k between the ground contact 3H-j(G) and the signal contact 3H-j(S) just beside the contact portion 37H of the contact 3H-j is cut out so as to form a notch portion 110H.

[0036] Therefore, although the first linear portion 31H and the second linear portion 32H of the ground contact 3H-j(G) are separated from the first linear portion 31H and the second linear portion 32H of the signal contact 3H-j(S) by the partition wall 15H-k, the first curved portion 33H, the second curved portion 34H, and the contact portion 37H of the ground contact 3H-j are not separated from the first curved portion 33H, the second curved portion 34H, and the contact portion 37H of the signal contact 3H-j(G) by the partition wall 15H-k. An air layer are formed between the first curved portion 33H, the second curved portion 34H, the contact portion 37H of the ground contact 3H-j(G) and the first curved portion 33H, the second curved portion 34H, the contact portion 37H of the signal contact 3H-j(S).

[0037] As shown in Fig. 11, the shield plate 5H-m includes: a main body portion 51H; four fork portions 50aH, 50bH, 50cH, 50dH bifurcated and extending from four locations, separated in the Y direction, at the upper end of the main body portion 51H; contact portions 57aH, 57bH, 57cH protruding from locations sandwiching two grooves at the lower end of the main body portion 51H. Convex portions 59aH, 59bH protruding outward in the Y direction are formed on the side surface of the main body portion 51H.

[0038] The fork portions 50aH, 50bH, 50cH, 50dH of the contact 3H-j are a soldering terminal portions soldered to the pads of the electronic substrate 90 which is a mounting destination. Solders are sandwiched and crimped in the fork portions 50aH, 50bH, 50cH, 50dH of the shield plate 5H-m. The procedure for fixing the solders to the fork portions 50aH, 50bH, 50cH, 50dH is the same with the procedure for fixing the solder to the fork portion 30H of the contact 3H-j.

[0039] The shield plate 5H-m is pressed into the long hole 17H-m of the plate support 16H in the slot 10H from the upper side. The solders fixed to the fork portions 50aH, 50bH, 50cH, 50dH of the shield plate 5H-m are exposed on the upper side of the upper surface of the housing 1H.

[0040] As shown in Fig. 12, the plug connector CNP is provided with three headers 10P corresponding to the slots 10H of the host connector CNH in the housing 1P, and conductive resin 2PA and 2PB, two rows of twenty-eight contacts 3P-j (j=1 to 28), rows of seven shield contacts 4P-m (m=1 to 7), and rows of seven shield plates 5P-m (m=1 to 7) are mounted to each of the three headers 10P. All the contacts 3P-j (j=1 to 28) mounted to each header 10P have the same shape. Further, all the shield contacts 4P-m (m=1 to 7) mounted to each header 10P have the same shape, and all the shield plates 5P-m (m=1 to 7) also have the same shape.

[0041] As shown in Fig. 20, the outer wall surfaces on both sides of the header 10P in the X direction are pro-

vided with twenty-seven ribs 14P-k (k=1 to 27). The ribs 14P-k are formed in a thin rectangular shape. The ribs 14P-k are aligned in the Y direction at the same interval. The interval between the adjacent ribs 14P-k among the ribs 14P-k (k=1 to 27) is approximately the same as the width of the contact 3P-j in the Y direction.

[0042] A groove 16P is provided at a position on the bottom wall 12P of the housing 1P on the side opposite to the header 10P. The upper end of the header 10P is located slightly lower than the upper edges of the side walls 11Pon both sides of the housing 1P in the X direction. The lower end of the header 10P protrudes below the lower surface of the groove 16P.

[0043] As shown in Fig. 14A and Fig. 14B, seven long holes 17P-m (m=1 to 7) vertically penetrating the header 10P are bored in the header 10P. The width of the lower portion of the long hole 17P-m in the X direction is narrower than the width of the upper portion in the X direction. Further, as shown in Fig. 14A, Fig. 14B, and Fig. 20, twenty-eight long holes 18P-j(j=1 to 28) are bored in the bottom wall 12P at positions directly below between the adjacent ribs 14P-k on both sides of the base end of the header 10P in the X direction. The long holes 18P-j (j=1 to 28) penetrate between the upper surface of the bottom wall 12P and the bottom surface of the groove 16P on the back side thereof.

[0044] The conductive resin 2PA shown in Fig. 16A is fitted into the lower end of the central header 10P in the groove 16P. The conductive resin 2PA has two long plates 21PA facing each other with a slight gap therebetween and both ends of the two long plates 21PA in the Y direction are connected to each other via the connection pieces 22PA. Seven long holes 27P-m (m=1 to 7) divided by the division pieces 23PA are formed in the gap between the two long plates 21PA. In a state where the conductive resin 2PA is fitted in the lower end of the central header 10P, the lower surface of the conductive resin 2PA is flush with the lower surface of the 1P.

[0045] The conductive resin 2PB shown in Fig. 16B is fitted into the lower ends of the headers 10P on both sides of the groove 16P in the X direction. The conductive resin 2PB has two long plates 21PB facing each other with a slight gap therebetween and both ends of the two long plates 21PB in the Y direction are connected via the connection pieces 22PB. Seven long holes 27P-m (m=1 to 7) divided by the division pieces 23PB are formed in the gap between the two long plates 21PB. In a state where the conductive resin 2PB is fitted in the lower end of the central header 10P, the lower surface of the conductive resin 2PB is flush with the lower surface of the 1P.

[0046] As shown in Fig. 17, the contact 3P-j includes: a contact portion 37P extending linearly in the Z direction; a bent portion 33P bending and extending from the base end of the contact portion 37P to one side of the X direction; and a fork portion 30P bifurcated and extending from the end portion opposite to the contact portion 37P at the bent portion 33P. Convex portions 39aP, 39bP protruding outward in the Y direction are formed on the side surface of the contact portion 37P. A hole 38 is bored in the center of the bent portion 33P in the Y direction.

[0047] The fork portion 30P of the contact 3P-j is a soldering terminal portion soldered to the pad of the extension substrate 91 which is a mounting destination. Solder is sandwiched and crimped in the fork portion 30P of the contact 3P-j. The procedure for fixing the solder to the fork portion 30P is the same as the procedure for fixing the solder to the fork portion 30H of the contact 3H-j shown in Figs 11A-11C.

[0048] As shown in Fig. 2 and Fig. 20, the contacts 3P-j fixed with solders pass through the long hole 18P-j of the header 10P from the lower side and are contained one by one in the gaps between the adjacent ribs 14P-k in the header 10P. The bent portion 33P of the contact 3P-j is supported by the edge portion of the long hole 18P-j in the bottom wall 12P of the housing 1P, and the solder of the contact 3P-j is exposed on the lower side of the lower surface of the housing 1P.

[0049] As shown in Fig. 18, the shield contact 4P-m includes: a main body portion 41P; contact portions 47aP, 47bP, 47cP, 47dP bending and extending in a dog-leg shape from four locations separated in the Y direction at the lower end of the main body portion 41P; and convex portions 42aP, 42bP protruding from two locations at the upper end of the main body portion 41P on the opposite side of, and between the contact portion 47aP and the contact portion 47bP, and the opposite side of, and between the contact portion 47cP and the contact portion 47dP. Convex portions 49aP, 49bP protruding outward in the Y direction are formed on the side surface of the main body portion 41P.

[0050] Of the contact portions 47aP, 47bP, 47cP, 47dP, the bending orientation of two contact portions 47aP and 47dP on the outer side and the bending orientation of two contact portions 47bP and 47cP on the inner side in the Y direction, which is the arrangement direction of the contact portions, are reversed. The upper ends of the two contact portions 47aP and 47dP on the outer side and the upper ends of the two contact portions 47bP and 47cP on the inner side are inclined in directions away from each other and open in a Y shape when viewed from the Y direction. The lower ends of the convex portions 42aP, 42bP are rounded.

[0051] As shown in Fig. 19, the shield plate 5P-m includes: a main body portion 51P; convex portions 52aP, 52bP, 25cP, 52dP protruding from four locations separated in the Y direction at the lower end of the main body portion 51P; and fork portions 50aP, 50bP, 50cP, 50dP bifurcated and extending four locations separated in the Y direction at the lower end of the main body portion 51P. Convex portions 59aP, 59bP, 59cP protruding outward in the Y direction are formed on the side surfaces of the main body portion 51P and the convex portions 52aP and 52dP. At the upper end of the main body portion 51P recess portions 56aP and 56bP are formed. The recess portions 56aP are gouged downward between the convex portion 52aP and the convex portion 52bP, and The

recess portions 56bP are gouged downward between the convex portion 52cP and the convex portion 52dP.

[0052] The fork portions 50aP, 50bP, 50cP, 50dP of the shield plate 5P-m are soldering terminal portions soldered to the pads of the extension substrate 91 which is a mounting destination. Solders are sandwiched and crimped in the fork portions 50aP, 50bP, 50cP, 50dP of the shield plate 5P-m. The procedure for fixing the solders to the fork portions 50aP, 50bP, 50cP, 50dP is the same as the procedure for fixing the solder to the fork portion 30P of the contact 3P-j.

[0053] As shown in Fig. 2 and Fig. 20, the shield contact 4P-m is pressed into the long hole 17P-m of the header 10P from the upper side, and the shield plate 5P-m fixed with solders is pressed into the long hole 17P-m of the header 10P from the lower side through the long hole 27P-m of the conductive resin 2PA (or 2PB). The end portion of the shield contact 4P-m and the end portion of the shield plate 5P-m abut on each other in the long hole 17P-m. More specifically, as shown in Fig. 21, a rectangular locking piece 177P-m is bridged between the inner wall surfaces of the long hole 17P-m of the header 10P facing each other in the X direction, and the shield contact 4P-m and the shield plate 5P-m are positioned by this locking piece 177P-m. In this disclosure, the end portion of the shield contact 4P-m and the end portion of the shield plate 5P-m are appropriately referred to as "the first end portion" and "the second end portion", respectively.

[0054] The locking piece 177P-m is fitted in a depression between the convex portion 52bP and the convex portion 52cP of the shield plate 5P-m. Further, the convex portion 42aP of the shield contact 4P-m is fitted in a depression between the convex portion 52aP and the convex portion 52bP of the shield plate 5P-m, and the convex portion 42bP of the shield contact 4P-m is fitted in a depression between the convex portion 52cP and the convex portion 52dP of the shield plate 5P-m. Further, notches are provided in the inner wall surfaces of the long hole 17P-m of the header 10P facing each other in the Y direction. The convex portions 49aP and 49bP of the shield contact 4P-m and the convex portions 59aP, 59bP, 59cP of the shield plate 5P-m are engaged with the notches to prevent the shield contact 4P-m and shield plate 5P-m from coming off. The long hole 17H-m of the slot 10H of the host connector CNH also has notches which play a similar role.

[0055] In a case where the plug connector CNP is fitted with the host connector CNH which is a mating connector, the contact portions 47aP, 47bP, 47cP, 47dP of the shield contact 4P-m of the plug connector CNP are in contact with the contact portions 57aH, 57bH, 57cH of the shield plate 5H-m of the host connector CNH, and the contact portion 37P of the contact 3P-j of the plug connector CNP is in contact with the contact portion 37H of the contact 3H-j of the host connector CNH.

[0056] The above is the details of the configuration of the present embodiment, and according to the present embodiment, the following effects can be obtained.

[0057] The plug connector CNP of the present embodiment includes: a housing 1P having a long hole 17P-m extending in one direction; and a plurality of terminals arranged in the long hole 17P-m, each of which having contact portions 37P, 47aP, 47bP, 47cP, 47dP in contact with the mating connector and soldering terminal portions soldered to a mounting target substrate. Then, among these terminals, the terminals interposed between the shield plate 5H-m of the host connector CNH and the pad of the extension substrate 91 are divided into shield contacts 4P-m which are components having the contact portions 47aP, 47bP, 47cP, 47dP and shield plates 5P-m which are components having soldering terminal portions. The first end portion of the shield contact 4P-m on the side opposite to the side of the contact portions 47aP, 47bP, 47cP, 47dP and the second end portion of shield plate 5P-m on the side opposite to the side of the soldering terminal portions are pressed into the long hole 17P-m from directions opposite to each other, and the first and second end portions abut on each other in the long hole 17P-m. Thus, by dividing the contact portions 37P, 47aP, 47bP, 47cP, 47dP of the shield contact 4P-m and the soldering terminal portions, the opening portion of the long hole 17P-m of the housing 1P can be minimized, and the rigidity of the housing 1P can be ensured. Further, by pressing and fitting the respective components, the same performance as that of the single piece structure can be ensured. Therefore, it is possible to provide a connector for high-speed transmission capable of reducing the width of the
opening portion of the housing 1P and ensuring the rigidity of the housing.

[0058] Further, the host connector CNH of the present embodiment includes: a housing 1H having a plurality of slots 10H; and a plurality of contacts 3H-j including contacts 3H-j (G) which are ground terminals and contacts 3H-j(S) which are signal terminals, in which the plurality of contacts 3H-j are arranged in the slots 10H along the Y direction as a first direction orthogonal to the fitting direction of the connector. Partition walls 15H-k are provided between the adjacent contacts 3H-j in the slots 10H, and the height of the partition walls 15H-k between the ground contacts 3H-j(G) and the signal contacts 3H-j(S) in the fitting direction is lower than the height of the other partition walls 15H-k in the fitting direction. Thus, an air layer, which is a layer of a space with a smaller dielectric constant than that of a resin partition wall 15H-k is formed between the signal contact 3H-j(S) and the ground contact 3H-j(G). Therefore, it is possible to provide a connector for high-speed transmission capable of reducing the crosstalk between the adjacent channels.

[0059] Further, the host connector CNH of the present embodiment includes: a housing 1H; and a plurality of contacts 3H-j having a contact portion 37H in contact with the mating connector and a soldering terminal portion soldered to the mounting target substrate, in which the plurality of contacts 3H-j are arranged in the housing 1H

with the contact portion 37H and the soldering terminal portion facing each other. The soldering terminal portion is a fork portion 30H, and a cut piece 300 of a wire solder is sandwiched and crimped in the fork portion 30H. Thus, the heating process of the terminal in the reflow layer, which is required in the conventional solder ball type soldering, can be reduced, and the influence of heat treatment can be reduced. Therefore, it is possible to provide a connector that can reduce the overheating process of the terminal in the reflow and reduce the adverse effect on the finished product due to the heat treatment.

[0060] The embodiments of the present invention have been described above, however, the following modifications may be added to these embodiments.

(1)In the above embodiments, there were three slots 10H in the housing 1H of the host connector CNH, and there were three headers 10P in the housing 1P of the plug connector CNP. However, the number of the slots 10H and the headers 10P may be one, two, or four or more.

(2)In the above embodiment, the contact portions 47aP, 47bP, 47cP, 47dP of the shield contact 4P-m of the plug connector CNP were described as being bent and extended in a dogleg shape from four locations at the lower end of the main body portion 41P separated in the Y direction. However, like the shield contact 4PA-m of Fig. 22A, the contact portions 47aP, 47bP, 47cP, 47dP may be replaced by contact portions 147aP, 147bP composed of a pair of plate bodies in which the cross sections viewed from the Y direction are formed in dogleg shapes in directions opposite to each other, and the shield plate 5P-m of the host connector CNH may be inserted between the contact portions 147aP and 147bP. Furthermore, like the shield contact 4PB-m of Fig. 22B, the terminal of the plug connector CNP to be pressed into the long hole 17P-m of the header 10P may not be divided into the shield contact 4P-m and the shield plate 5P-m, and may be configured by a single plate component having a contact portion and soldering terminal portion.

(3)In the above embodiment, the number of the contacts 3H-j, 3P-j forming a row may be less than two or may be more than two. Further, the number of the shield plates 4H-m, the shield contacts 4P-m, and the shield plates 5P-m may be less than seven or may be more than seven. Moreover, the number of the ribs 14H-k, ribs 14H-k, partition walls 15H-k may be less than twenty-seven or may be larger than twenty-seven.

List of reference numerals

[0061]

1H housing
1P housing
2HA, 2HA conductive resin
2P conductive resin
3H contact
3P contact
4H shield plate
4P shield contact
4PA shield contact
4PB shield contact
5H shield plate
5P shield plate
10H slot
10P header
11H bottom portion
11P side wall
12H table portion
12P bottom wall
13H reinforcing plate
14H rib
14P rib
15H partition wall
16H plate support
16P groove
17H long hole
17P long hole
18H open portion
18P long hole
19H groove
21 HA, 21 HA, 22HA, 22HB side wall
21PA, 21PB long plate
22PA, 22PB connection piece
23HA, 23HB projection
23PA 23PB division piece
24HA, 24HB extension portion
27P long hole
30H fork portion
30P fork portion
31H the first linear portion
32H the second linear portion
33H the first curved portion
33P bent portion
34H the second curved portion
35H inclined portion
37H contact portion
37P contact portion
39aH convex portion
39aP convex portion
39bH convex portion
39bP convex portion
39cH convex portion
41P main body portion
42aP convex portion
42bP convex portion
47aP contact portion
47bP contact portion
47cP contact portion
47dP contact portion
49aP convex portion
49bP convex portion

50aH fork portion
50aP fork portion
50bH fork portion
50bP fork portion
50cH fork portion
50cP fork portion
50dH fork portion
50dP fork portion
51H main body portion
51P main body portion
52aP convex portion
52bP convex portion
52cP convex portion
52dP convex portion
56aP recess portion
57aH contact portion
57bH contact portion
57cH contact portion
59aH convex portion
59aP convex portion
59bH convex portion
59bP convex portion
59cP convex portion
90 electronic substrate
91 extension substrate
110H notch portion
111H, 112H depression
147aP contact portion
147bP contact portion
177P locking piece
300 cut piece

Claims

1. A connector (CHN) for high-speed transmission to be fitted with an external counterpart connector (CNP), the connector (CHN) for high-speed transmission comprising:

a housing (1H) with at least one slot (10H);
a plurality of terminals (3H-j) which comprise ground terminals (3H-j(S)) and signal terminals (3H-j (G)), and are arranged in the slot (10H) along a first direction orthogonal to a fitting direction of the connector; and
partition walls (15H-k) provided between adjacent terminals (3H-j) in the slot (10H),
wherein
a height of the partition walls (15H-k) between the ground terminals (3H-j (G)) and the signal terminals (3H-j(S)) in the fitting direction is lower than a height of other partition walls (15H-k) in the fitting direction.

2. The connector (CHN) for high-speed transmission according to claim 1, wherein
upper ends of the partition walls (15H-k) between the ground terminals (3H-j(G)) and upper ends of the partition walls between the signal terminals (3H-j(S)) are located at substantially the same positions as upper surface of the housing,
upper ends of the partition walls between the ground terminals (3H-j (G)) and the signal terminals (3H-j(S)) are below the upper surface of the housing.

3. The connector (CHN) for high-speed transmission according to claim 1, wherein
the terminal (3H-j) comprises:

a linear portion (31H) extending along the fitting direction and a curved portion (33H) curved from a tip end of the linear portion (31H) toward a side of a second direction orthogonal to the fitting direction and the first direction,
no partition wall separates the curved portion (33H) of the ground terminal (3H-j(G)) and the curved portion (33H) of the signal terminal(3H-j(S)), and an air layer is formed between the curved portions (33H).

4. The connector (CHN) or high-speed transmission according to claim 1 or 2, wherein
the terminal (3H-j) comprises:

a linear portion (32H) extending along the fitting direction and a curved portion (33H) curved from a tip end of the linear portion (32H) toward a side of a second direction orthogonal to the fitting direction and the first direction,
the linear portion (32H) of the ground terminal (3H-j (G)) and the linear portion (32H) of the signal terminal (3H-j(S)) are separated by the partition wall (15H-k).

5. The connector (CHN) for high-speed transmission according to claim 1, further comprises:

a plurality of ribs (14H-k) arranged at intervals in the first direction on inner wall surfaces facing each other in the slot (10H),
wherein
the plurality of terminals (3H-j) are accommodated in gaps between adjacent ribs (14H-k) in the slot (10H) one by one in an arrangement order in which two ground terminals (3H-j(G)) and two signal terminals (3H-j(S)) are set as a group and the two signal terminals (3H-j(S)) are interposed between two ground terminals (3H-j(G)).

6. The connector (CHN) for high-speed transmission according to claim 5, wherein
the terminal (3H-j) comprises a fork portion (30H) and a solder is sandwiched and clamped in the fork portion (30H),

the solder of the terminal (3H-j) is supported by an upper end of the rib (14H-k).

7. The connector (CHN) for high-speed transmission according to claim 1, wherein
the terminal (3H-j) comprises a contact portion to contact an external counterpart connector (CNP),
a portion of the partition wall (15H-k) between the ground terminal (3H-j (G)) and the signal terminal (3H-j(S)) just beside the contact portion (37H) is cut out.

8. The connector (CHN) for high-speed transmission according to claim 5, wherein
the slot (10H) is provided with a support (16H) to support a shield plate (5H-m) as another terminal, and the partition wall (15H-k) is bridged between the rib (14H-k) and the support (16H).

9. The connector (CHN) for high-speed transmission according to claim 8, wherein
a long hole (17H-m) is bored in the support (16H), and the shield plate (5H-m) is pressed into the long hole (17H-m).

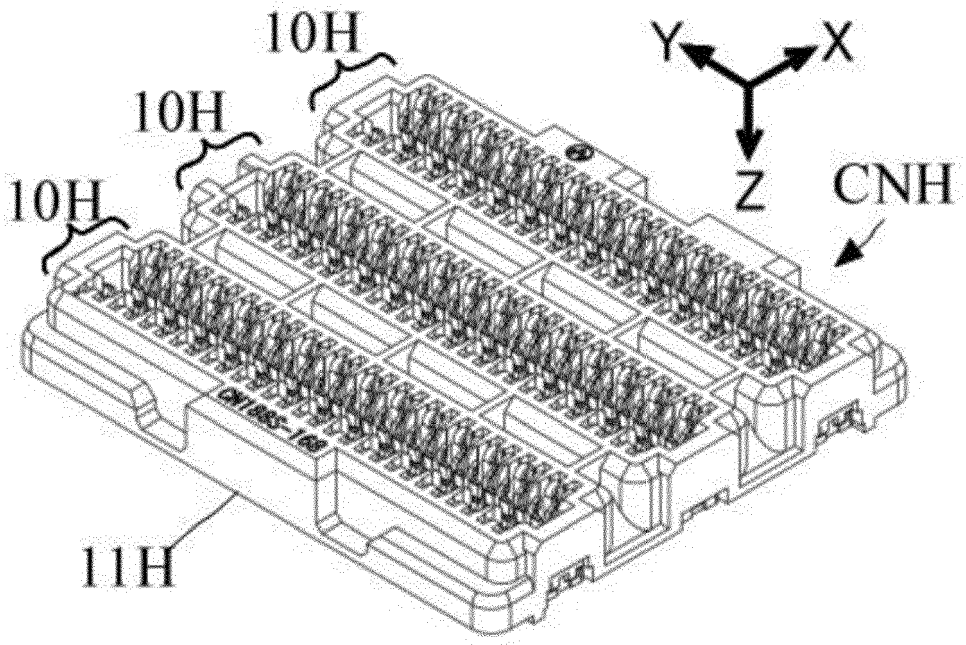


FIG. 1A

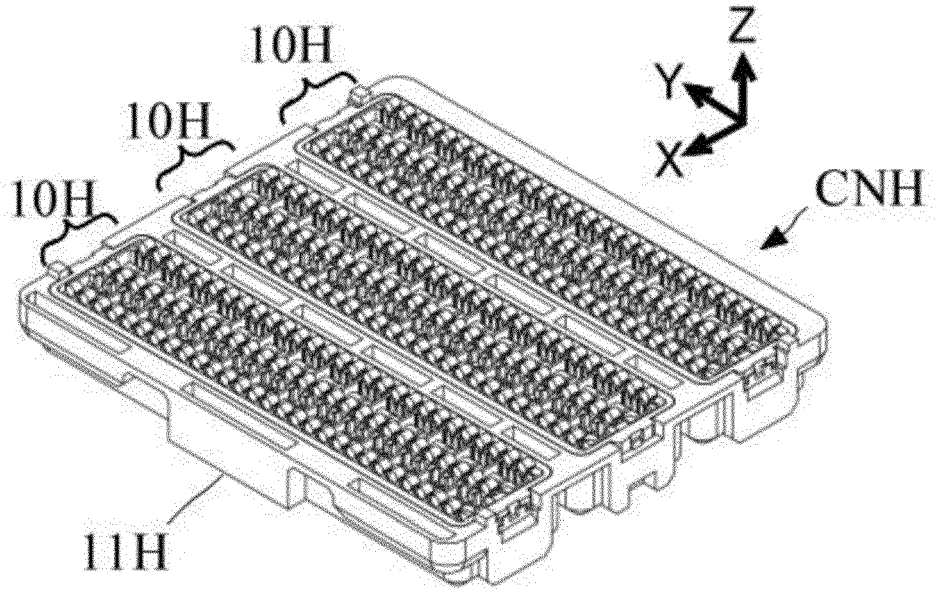


FIG. 1B

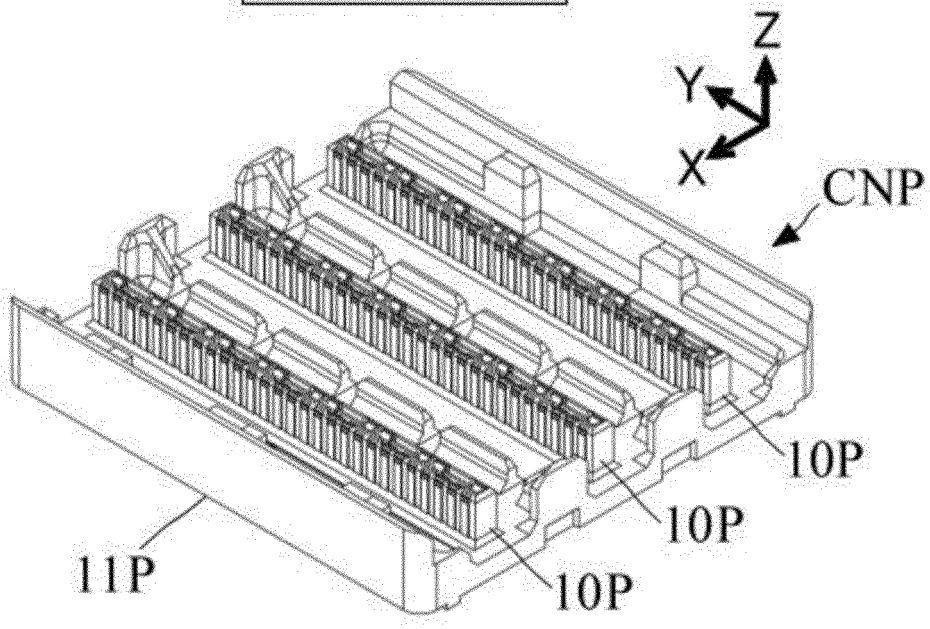


FIG. 1C

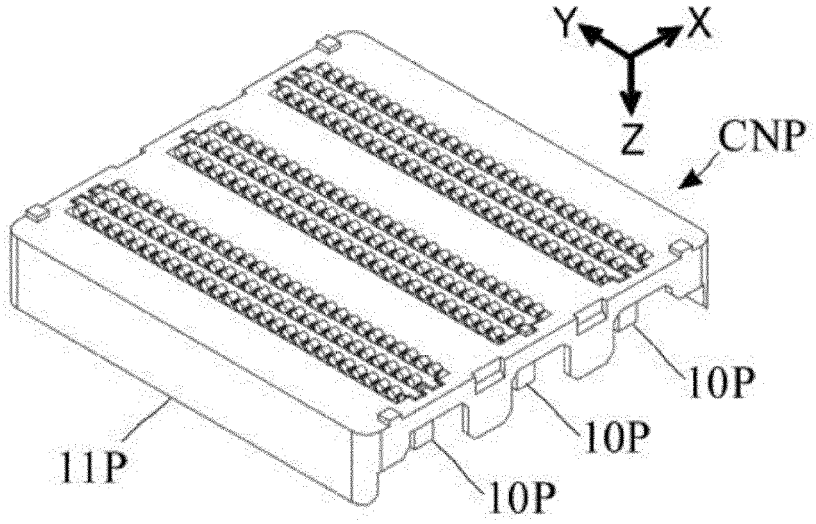
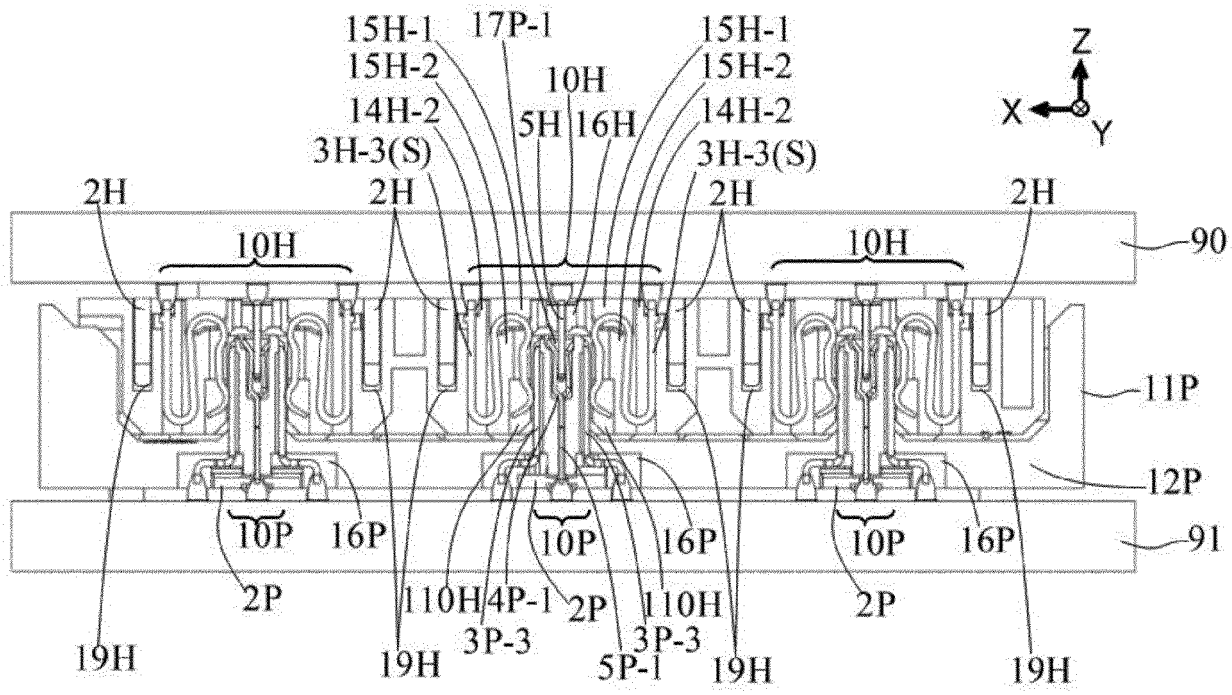

Y
X
Z
CNP
10P
10P
10P
11P

FIG. 1D


15H-1
17P-1
15H-1
15H-2
10H
15H-2
14H-2
5H
16H
14H-2
3H-3(S)
3H-3(S)
2H
2H
2H
2H
10H
10H
90
11P
12P
91
10P
16P
10P
16P
10P
16P
2P
110H
4P-1
2P
110H
2P
3P-3
3P-3
19H
19H
5P-1
19H
19H
Z
X
Y

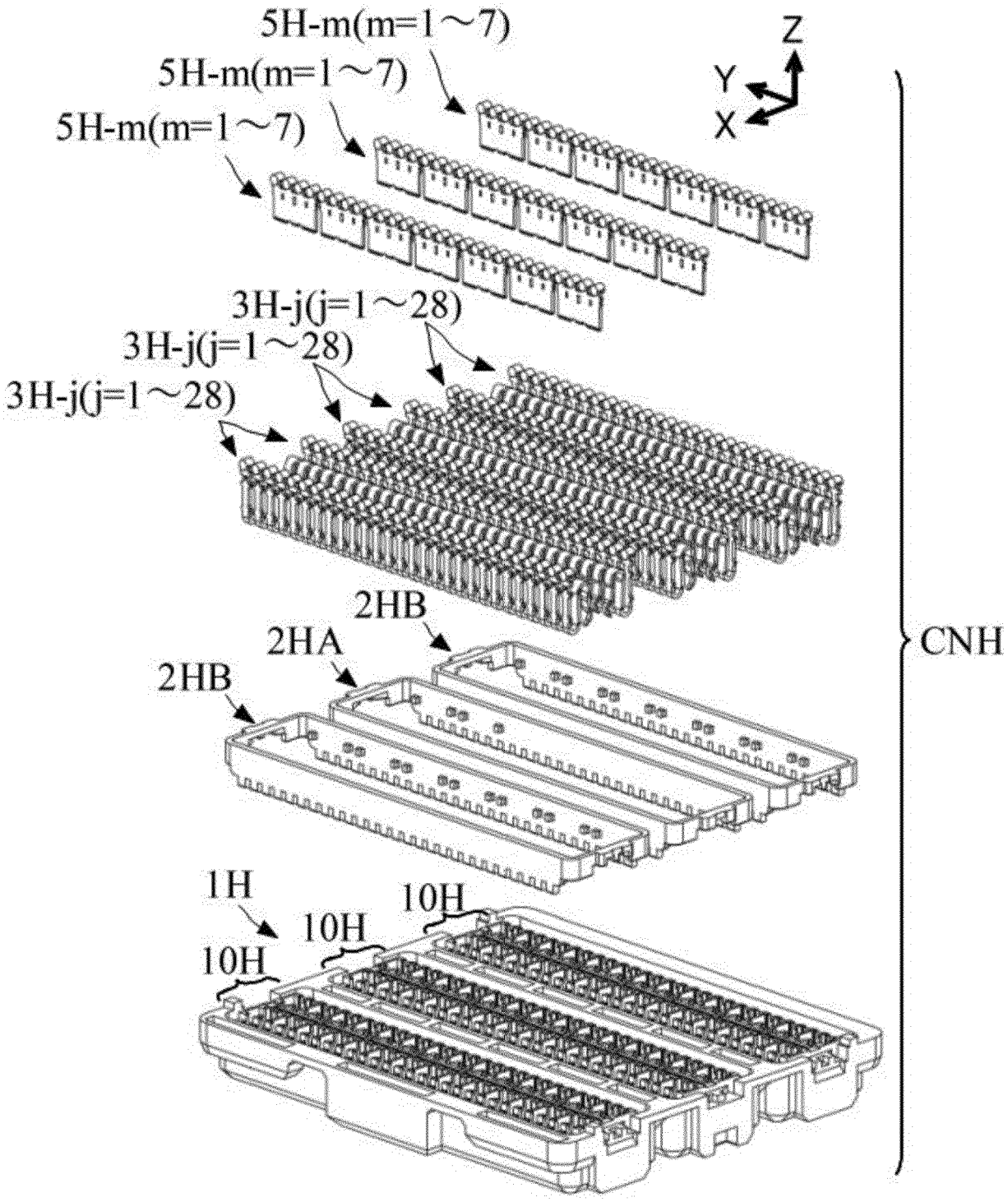

5H-m(m=1～7)
5H-m(m=1～7)
5H-m(m=1～7)
Z
Y
X
3H-j(j=1～28)
3H-j(j=1～28)
3H-j(j=1～28)
2HB
2HA
2HB
1H
10H
10H
10H
CNH

FIG. 3

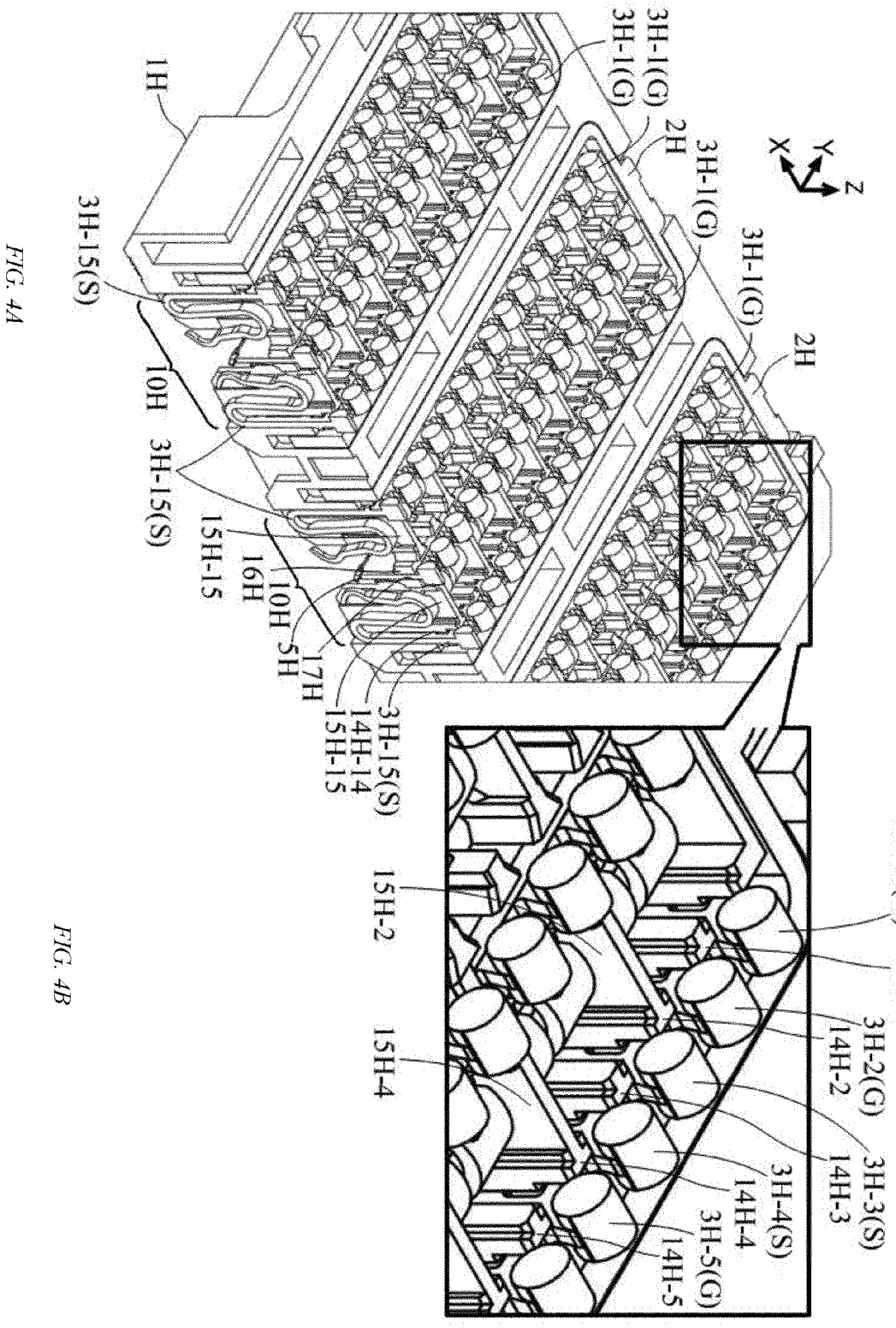

1H
3H-1(G)
3H-1(G)
2H
3H-1(G)
3H-15(S)
10H
3H-15(S)
15H-15
16H
10H
5H
17H
14H-14
15H-15
3H-15(S)
Y
X
Z
3H-1(G)
2H
15H-2
15H-4
3H-1(G)
14H-1
3H-2(G)
14H-2
3H-3(S)
14H-3
3H-4(S)
14H-4
3H-5(G)
14H-5

FIG. 4A

FIG. 4B

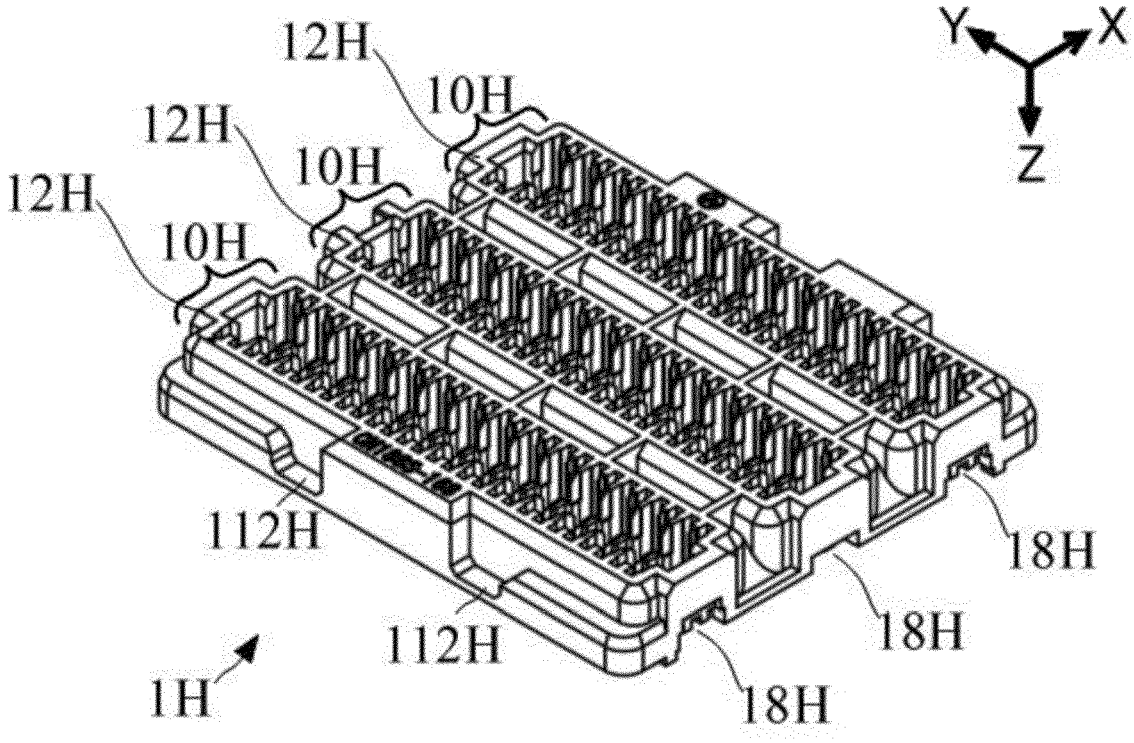


FIG. 5

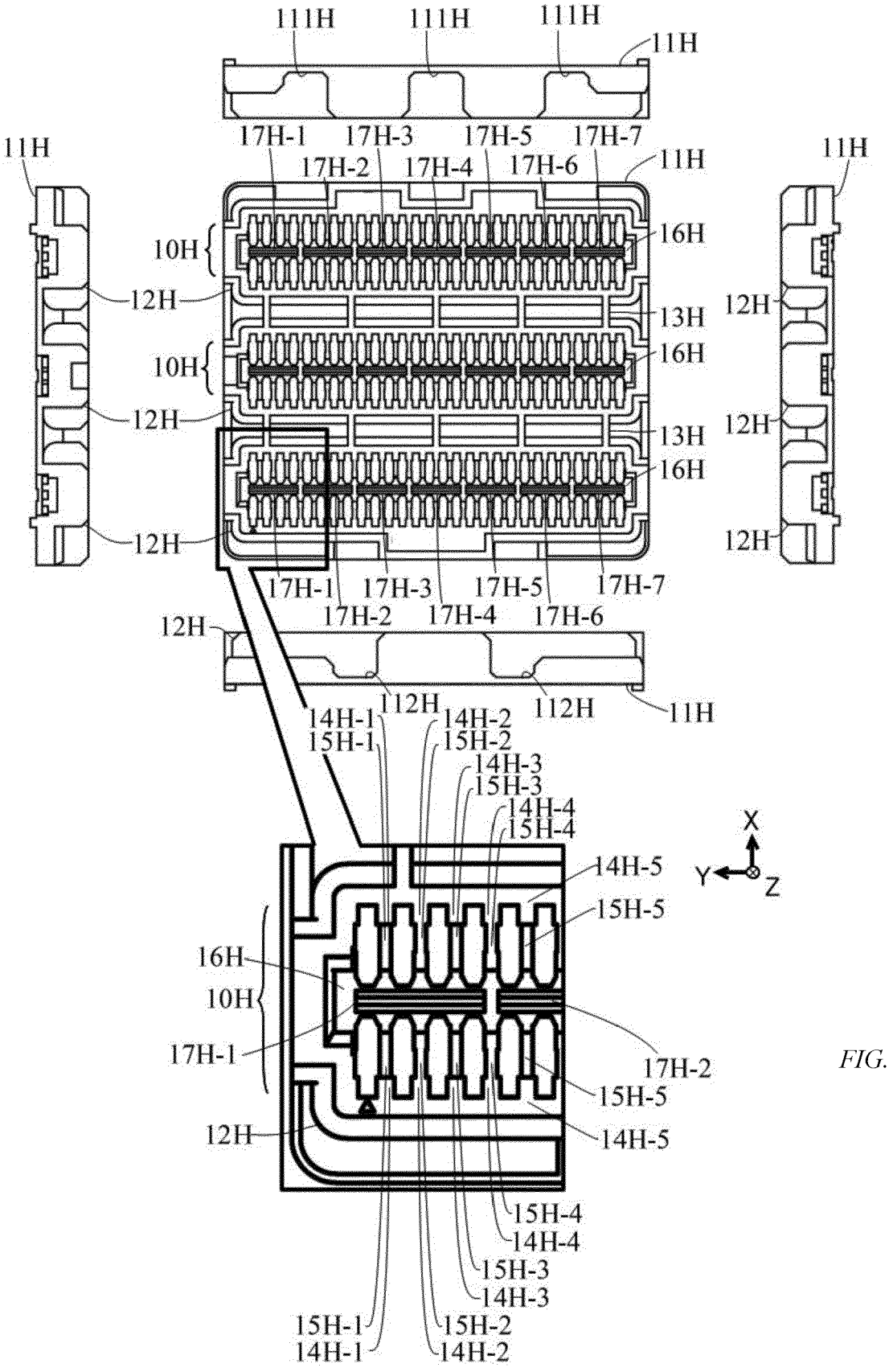

111H
111H
111H
11H
17H-1
17H-3
17H-5
17H-7
17H-2
17H-4
17H-6
11H
11H
11H
10H
16H
12H
13H
10H
16H
12H
13H
12H
16H
12H
12H
12H
17H-1
17H-3
17H-5
17H-7
17H-2
17H-4
17H-6
12H
112H
112H
11H
14H-1
15H-1
14H-2
15H-2
14H-3
15H-3
14H-4
15H-4
14H-5
15H-5
X
Y
Z
16H
10H
17H-1
17H-2
15H-5
14H-5
12H
15H-4
14H-4
15H-3
14H-3
15H-1
14H-1
15H-2
14H-2

FIG. 6A

FIG. 6B

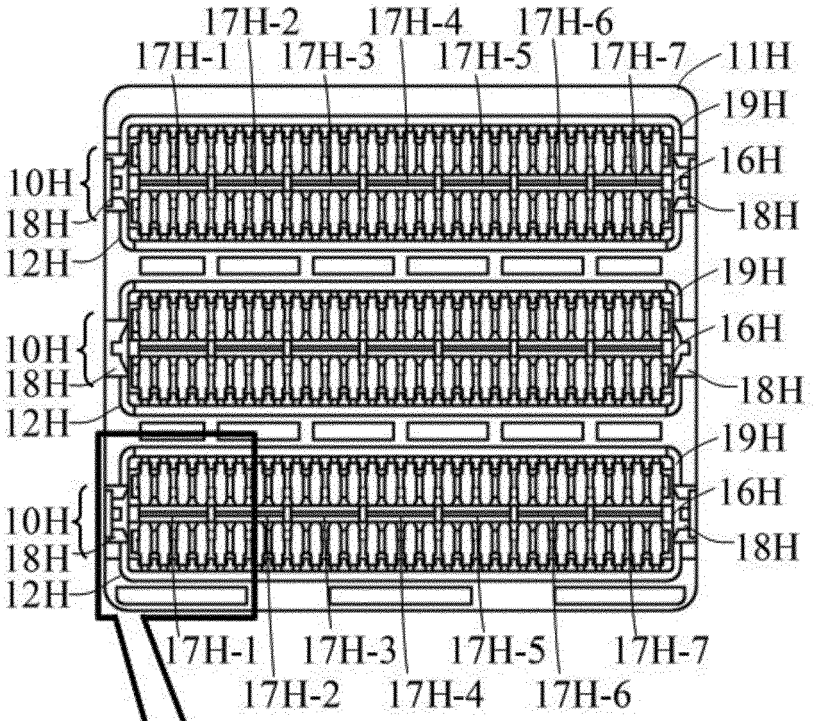

17H-2
17H-4
17H-6
17H-1
17H-3
17H-5
17H-7
11H
19H
16H
18H
10H
18H
12H
19H
16H
18H
10H
18H
12H
19H
16H
18H
10H
18H
12H
17H-1
17H-3
17H-5
17H-7
17H-2
17H-4
17H-6

FIG. 7A

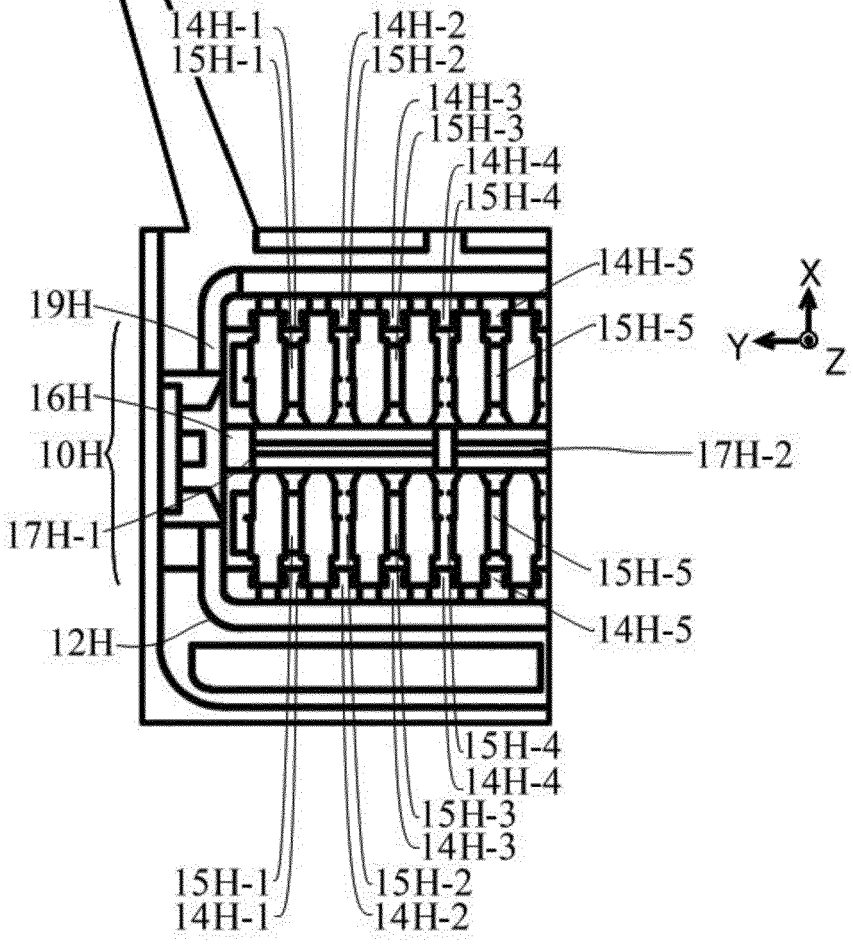

14H-1
15H-1
14H-2
15H-2
14H-3
15H-3
14H-4
15H-4
14H-5
15H-5
19H
16H
10H
17H-2
17H-1
15H-5
14H-5
12H
15H-4
14H-4
15H-3
14H-3
15H-1
14H-1
15H-2
14H-2
X
Y
Z

FIG. 7B

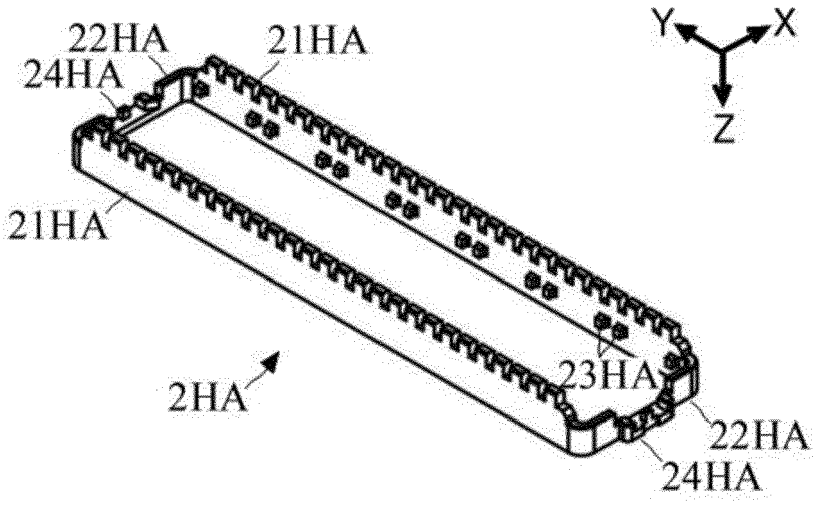

22HA
21HA
24HA
Y
X
Z
21HA
23HA
2HA
22HA
24HA

FIG. 8A

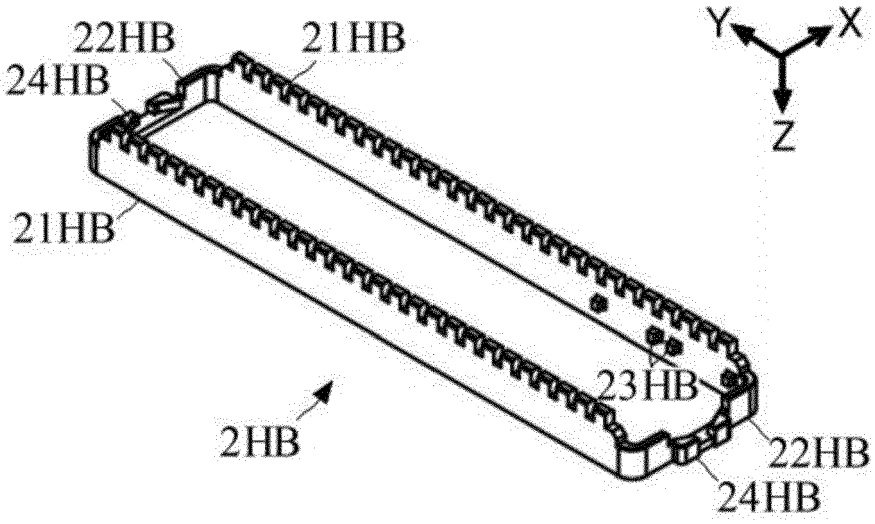

22HB
21HB
24HB
Y
X
Z
21HB
23HB
2HB
22HB
24HB

FIG. 8B

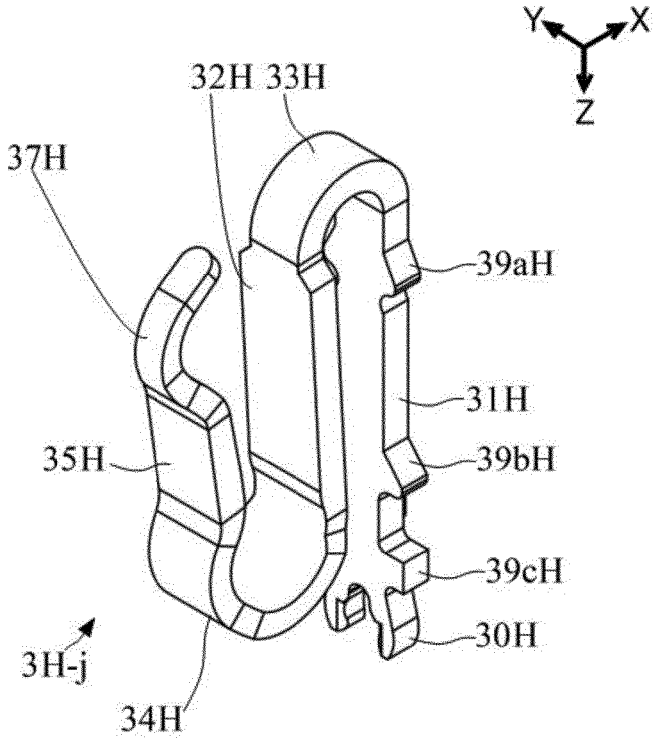


FIG. 9

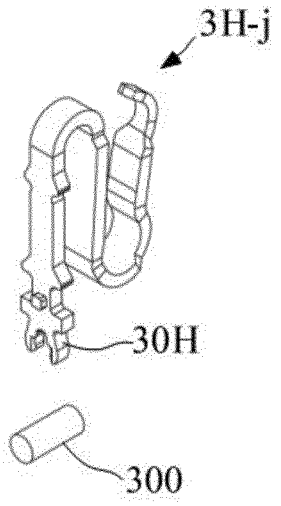


FIG. 10A

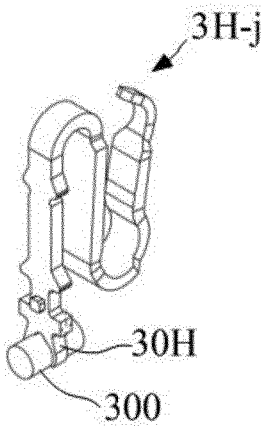


FIG. 10B

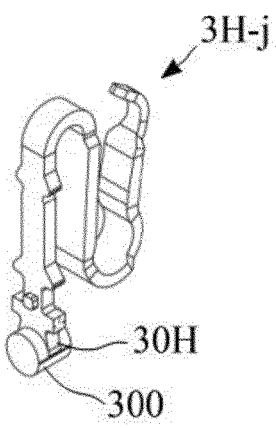


FIG. 10C

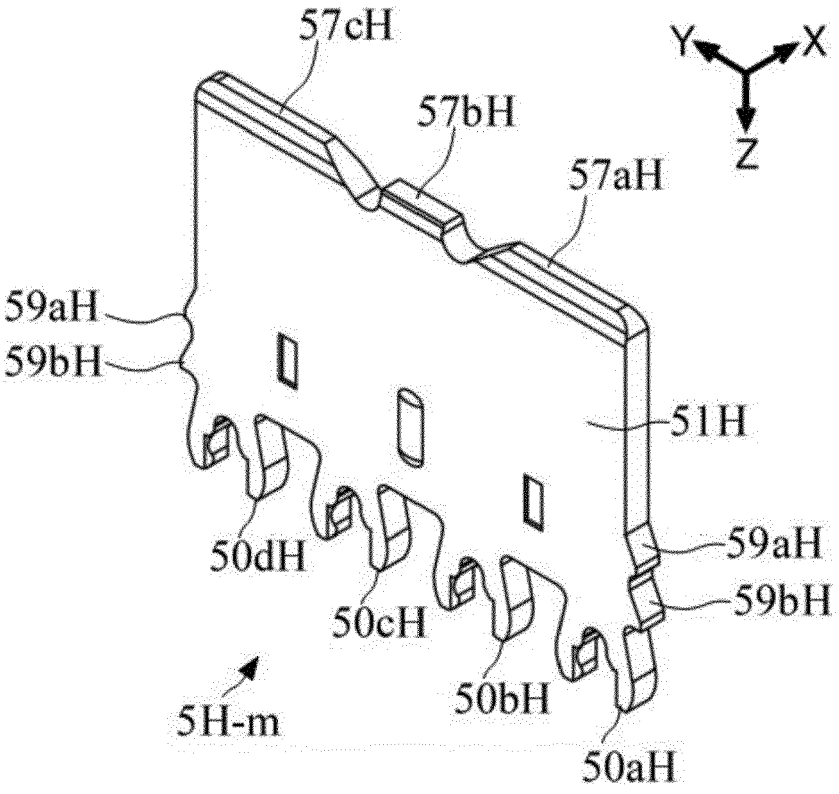

57cH
57bH
57aH
Y
X
Z
59aH
59bH
51H
50dH
50cH
59aH
59bH
5H-m
50bH
50aH

FIG. 11

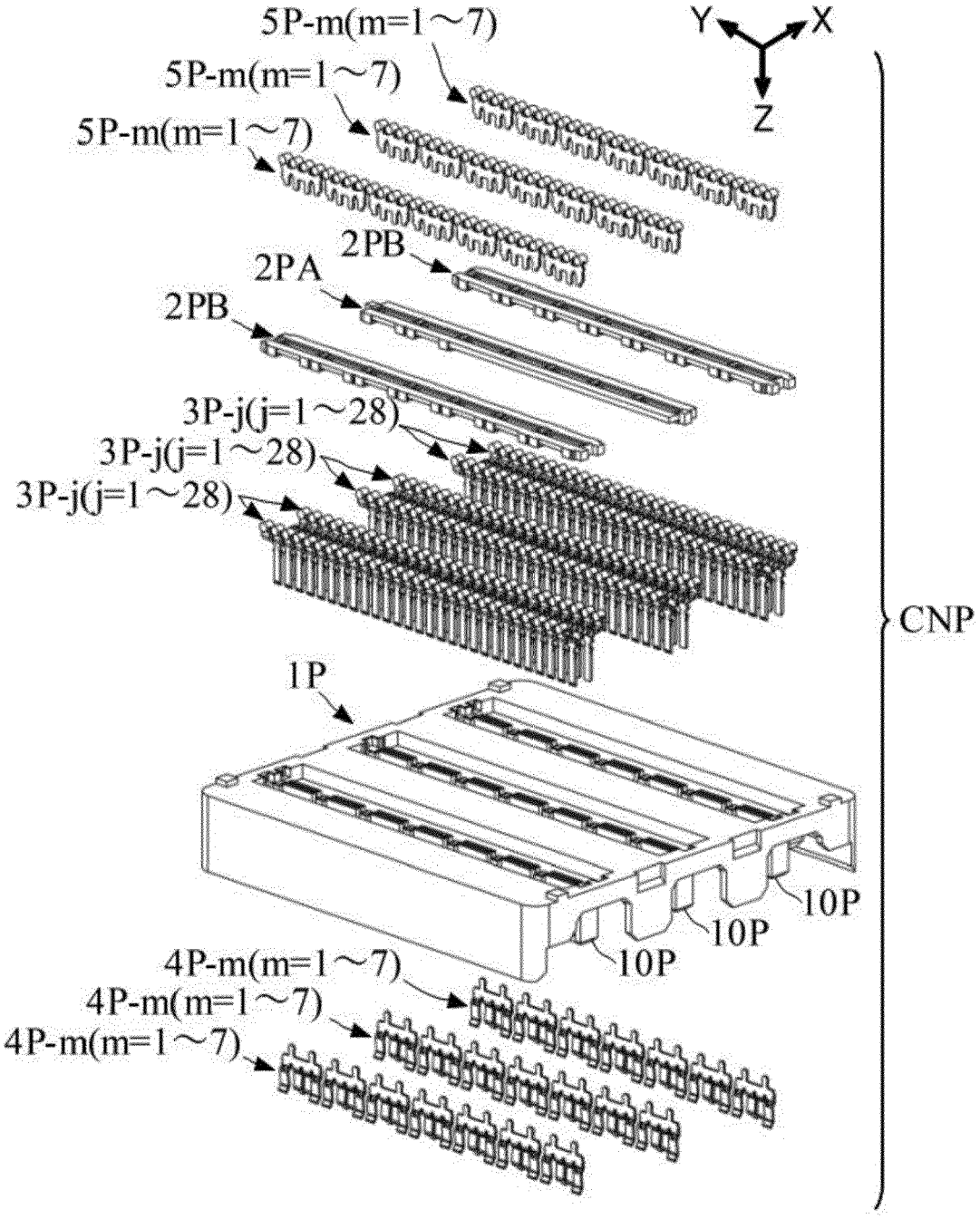

5P-m(m=1～7)
5P-m(m=1～7)
5P-m(m=1～7)
2PB
2PA
2PB
3P-j(j=1～28)
3P-j(j=1～28)
3P-j(j=1～28)
1P
10P
10P
10P
4P-m(m=1～7)
4P-m(m=1～7)
4P-m(m=1～7)
CNP
Y
X
Z

FIG. 12

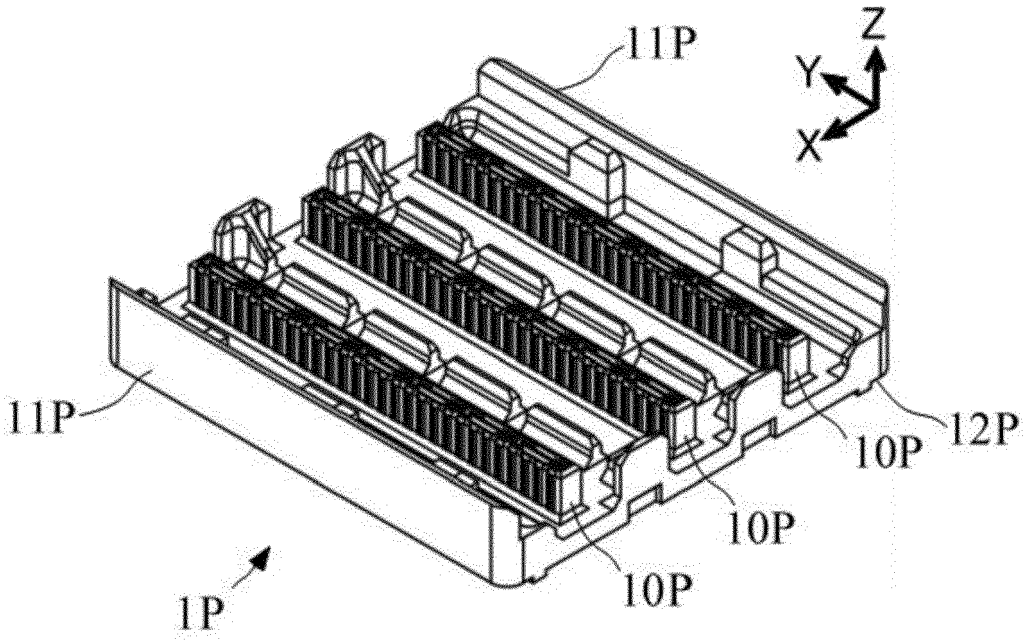


FIG. 13

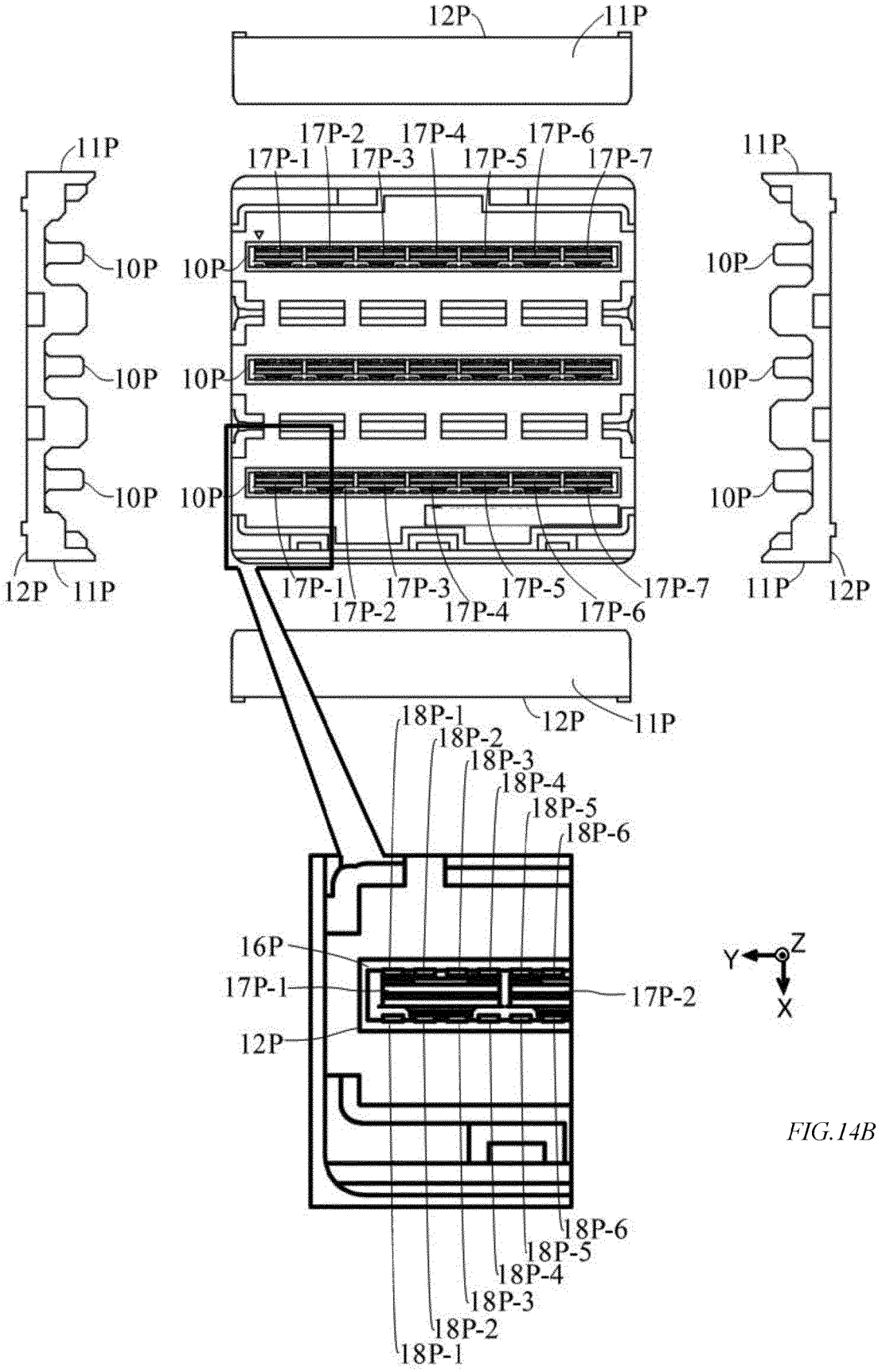


FIG. 14A

FIG.14B

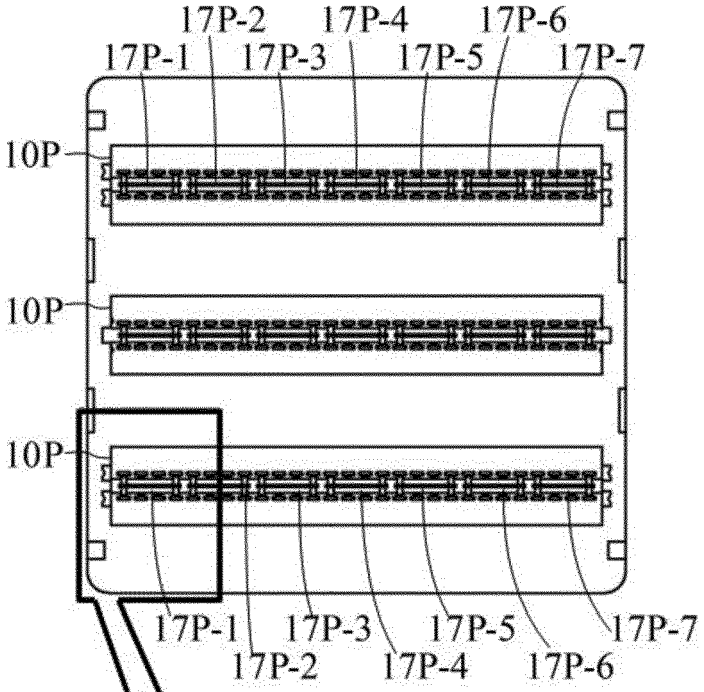


FIG. 15A

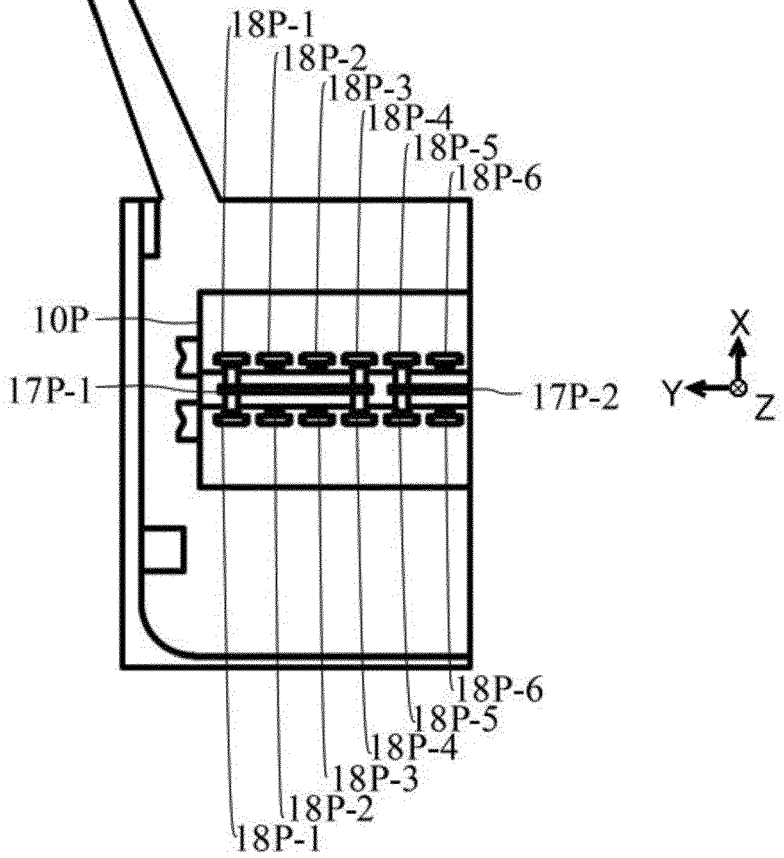


FIG. 15B

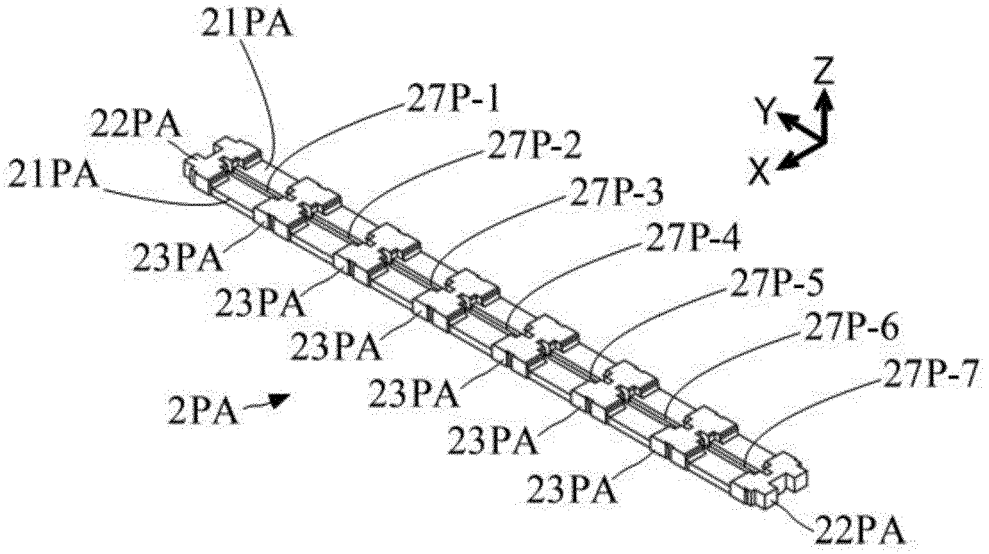


FIG. 16A

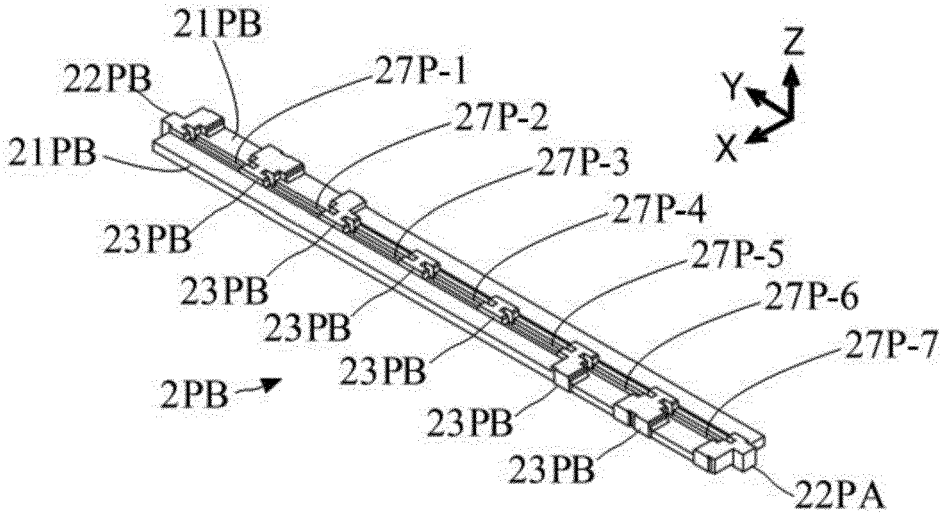


FIG. 16B

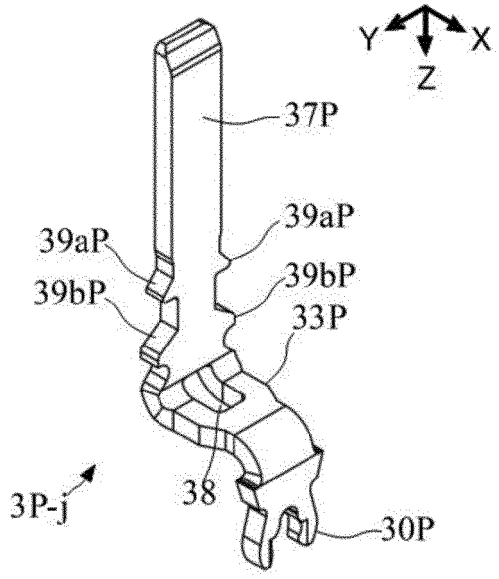

Y
X
Z
37P
39aP
39aP
39bP
39bP
33P
3P-j
38
30P

FIG. 17

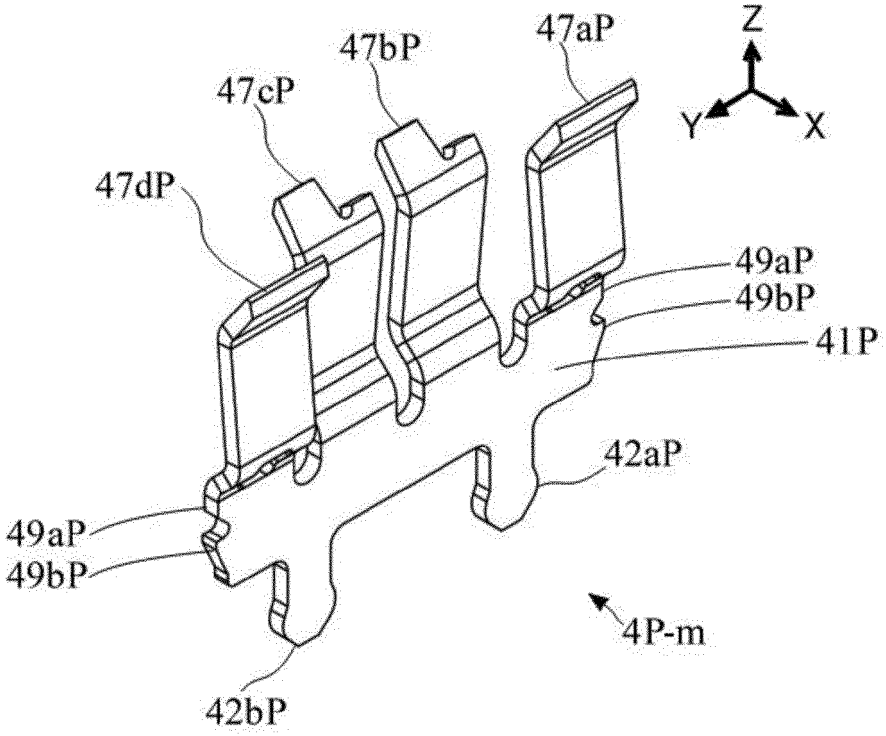

47aP
47bP
47cP
47dP
Z
Y
X
49aP
49bP
41P
42aP
49aP
49bP
4P-m
42bP

FIG. 18

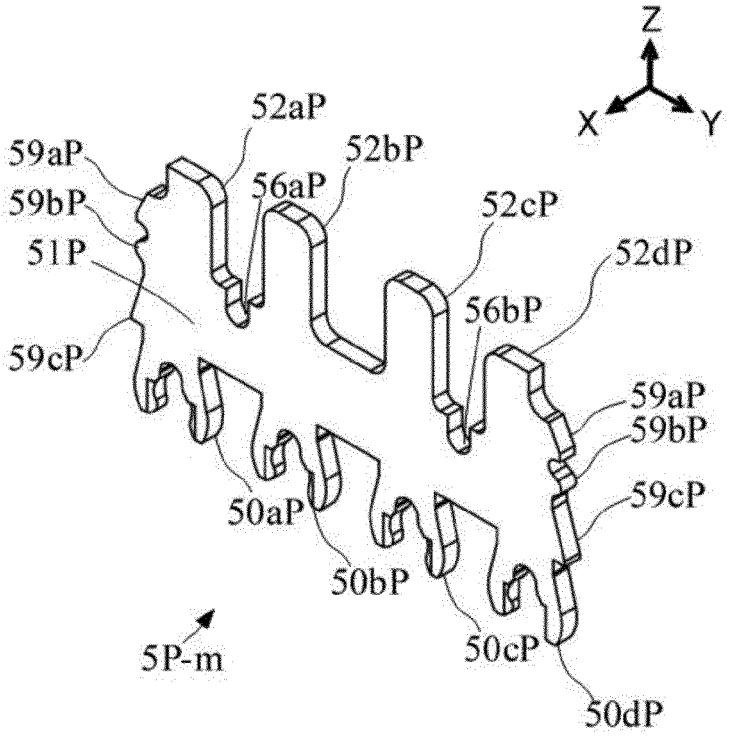

Z
X
Y
52aP
59aP
52bP
59bP
56aP
52cP
51P
52dP
56bP
59cP
59aP
59bP
59cP
50aP
50bP
5P-m
50cP
50dP

FIG. 19

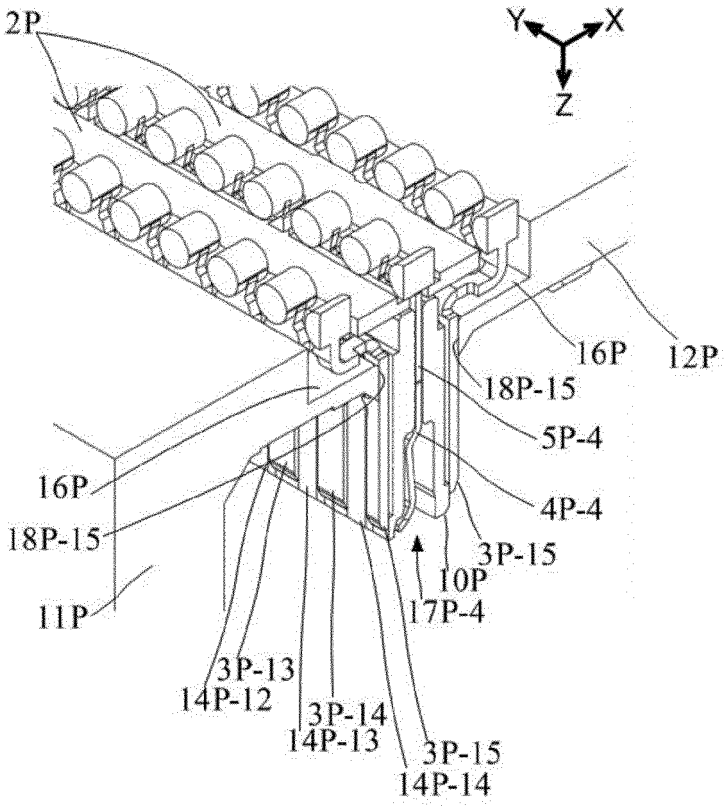

2P
Y
X
Z
16P
12P
18P-15
5P-4
16P
4P-4
18P-15
3P-15
10P
11P
17P-4
3P-13
14P-12
3P-14
14P-13
3P-15
14P-14

FIG. 20

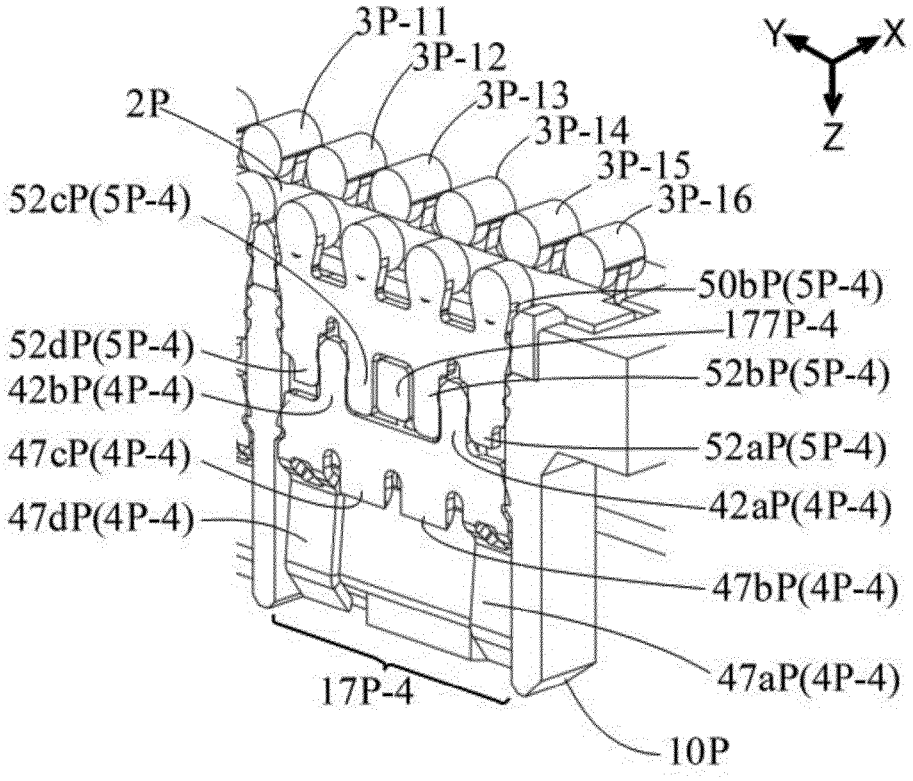


FIG. 21

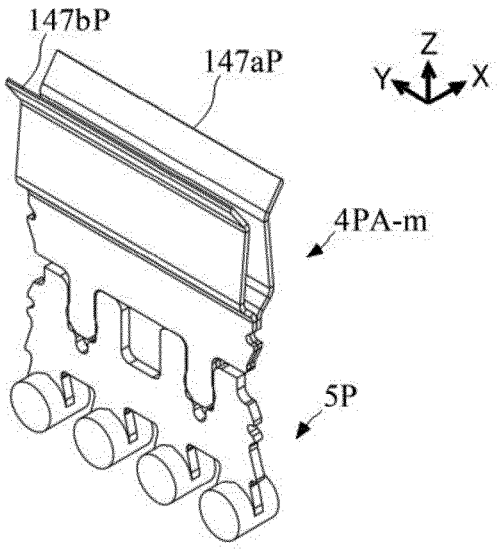


FIG. 22A

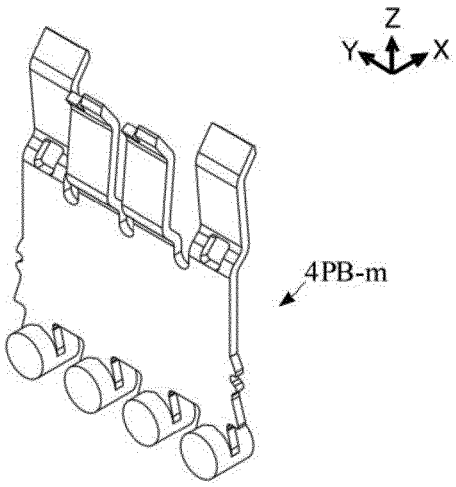


FIG. 22B

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EUROPEAN SEARCH REPORT

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Place of search	Date of completion of the search	Examiner
The Hague	20 April 2021	Jiménez, Jesús

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