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(54) **CONNECTOR ASSEMBLY**

(57) A connector assembly comprises a connector and a mating connector. The mating connector is mateable with and removable from the connector along an up-down direction. The mating connector comprises a force-receiving portion and a first pushing portion. The connector comprises a housing, a lever and a slider. The housing is provided with a housing regulating portion. The slider has a rack portion, a force-transmitting portion and a regulated portion. When the lever is positioned at

a first position under a state where the connector and the mating connector are not mated with each other, the housing regulating portion regulates a forward movement of the slider by engagement of the housing regulating portion with the regulated portion. When the mating connector and the connector are mated with each other, the first pushing portion pushes the housing regulating portion or the regulated portion to release regulation by the housing regulating portion.

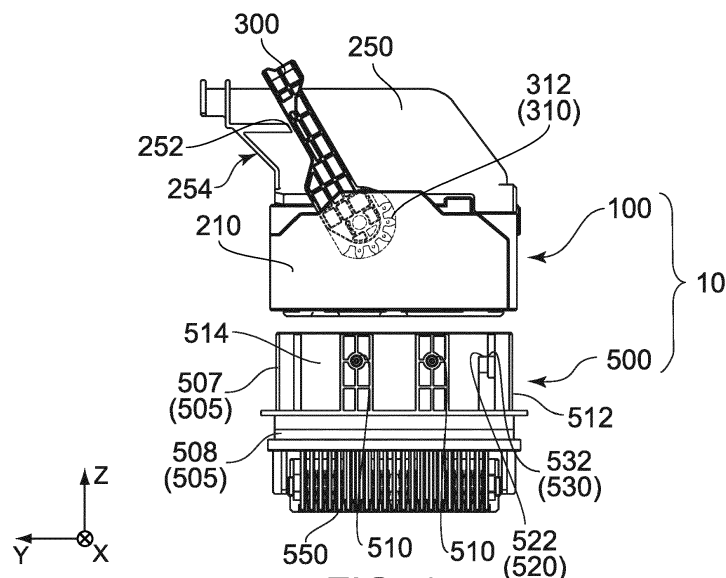


FIG. 1

Description

BACKGROUND OF THE INVENTION:

[0001] This invention relates to a connector assembly comprising a connector and a mating connector.

[0002] Referring to Figs. 25 and 26, JP-A2015-122182 (Patent Document 1) discloses a connector assembly 900 comprising a connector 910 and a mating connector 960 which is mateable with and removable from the connector 910. The mating connector 960 comprises bosses 965, namely, force-receiving portions 965. The connector 910 comprises a housing 920, a lever 930, a pair of sliders 940 and a wire cover 950. The lever 930 is attached to the wire cover 950 so as to be rotatable between a mating start position, or a first position, and a mating complete position, or a second position. Opposite side surfaces of the wire cover 950 are provided with protrusions 955, respectively. The lever 930 is temporarily engaged with the protrusions 955 when positioned at the mating start position, or the first position. The sliders 940 are provided with cam grooves 945, namely, force-transmitting portions 945. The force-receiving portions 965 correspond to the cam grooves 945, respectively. When the mating connector 960 is mated with the connector 910, each of the force-receiving portions 965 of the mating connector 960 is inserted into the corresponding cam groove 945 so that the cam grooves 945 are engaged with the mating connector 960. When the lever 930 is rotated from the first position and rides over the protrusions 955 to reach the second position, each of the sliders 940 is moved in a positive Y-direction of a Y-direction. When the lever 930 is rotated from the second position and rides over the protrusions 955 to reach the first position, each of the sliders 940 is moved in a negative Y-direction of the Y-direction. If the lever 930 is rotated from the first position and rides over the protrusions 955 to reach the second position when the connector 910 and the mating connector 960 are to be mated with each other, each of the force-transmitting portions 945 of the sliders 940 moves the corresponding force-receiving portion 965 of the mating connector 960 in a positive Z-direction of a Z-direction, so that the connector 910 and the mating connector 960 are mated with each other. If the lever 930 is rotated from the second position and rides over the protrusions 955 to reach the first position under a state where the connector 910 and the mating connector 960 are mated with each other, each of the force-transmitting portions 945 of the sliders 940 moves the corresponding force-receiving portion 965 of the mating connector 960 in a negative Z-direction of the Z-direction, so that the connector 910 and the mating connector 960 are in a state where the connector 910 and the mating connector 960 are removable from each other.

SUMMARY OF THE INVENTION:

[0003] In the connector assembly 900 of Patent Doc-

ument 1, the temporary engagement of the lever 930 with the protrusions 955 might be released in a case where an unintended external force is applied to the lever 930 during the wire cover 950 is attached to the housing 920.

Thus, in the aforementioned case, each of the sliders 940 might be moved in the positive Y-direction of the Y-direction. In addition, when the mating connector 960 and the connector 910 are mated with each other under a state where the temporary engagement is released, the mating connector 960 might be broken by the sliders 940 abutting against the force-receiving portions 965 of the mating connector 960.

[0004] It is therefore an object of the present invention to provide a connector assembly which regulates a movement of a slider even if an unintended external force is applied to a lever during a cover portion is attached to a housing main body and which prevents a mating connector from being broken when the mating connector and the connector are mated with each other.

[0005] One aspect (first aspect) of the present invention provides a connector assembly comprising a connector and a mating connector. The mating connector is mateable with and removable from the connector along an up-down direction. The mating connector comprises a force-receiving portion and a first pushing portion. The connector comprises a housing, a lever and a slider. The housing is provided with a housing regulating portion. The lever is attached to the housing so as to be rotatable between a first position and a second position. The slider is attached to the housing so as to be movable in a front-rear direction perpendicular to the up-down direction. The lever has a pinion portion having pinion teeth. The slider has a rack portion, a force-transmitting portion and a regulated portion. The rack portion has rack teeth. The pinion portion and the rack portion are meshed with each other to convert a rotational movement of the lever into a movement of the slider in the front-rear direction. The force-transmitting portion transmits a force in the up-down direction to the force-receiving portion of the mating connector by the movement of the slider in the front-rear direction. When the lever is rotated from the first position to the second position, the slider is moved forward in the front-rear direction while the force-transmitting portion moves the force-receiving portion of the mating connector upward in the up-down direction so that the connector and the mating connector are mated with each other. When the lever is rotated from the second position to the first position, the slider is moved rearward in the front-rear direction while the force-transmitting portion moves the force-receiving portion of the mating connector downward in the up-down direction so that the connector and the mating connector are in a state where the connector and the mating connector are removable from each other. When the lever is positioned at the first position under a state where the connector and the mating connector are not mated with each other, the housing regulating portion regulates a forward movement of the slider by engagement of the housing regulating portion with the regulated

portion. When the mating connector and the connector are mated with each other, the first pushing portion pushes the housing regulating portion or the regulated portion to release regulation by the housing regulating portion.

[0006] In the connector assembly of the present invention, when the lever is positioned at the first position under the state where the mating connector and the connector are not mated with each other, the housing regulating portion and the regulated portion are engaged with each other so that the forward movement of the slider is regulated. Accordingly, the slider is not moved even if an unintended external force is applied to the lever during a cover portion is attached to a housing main body. Thus, the mating connector can be prevented from being broken by the slider of the connector and the mating connector abutting against each other when the mating connector and the connector are mated with each other.

[0007] An appreciation of the objectives of the present invention and a more complete understanding of its structure may be had by studying the following description of the preferred embodiment and by referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0008]

Fig. 1 is a side view showing a connector assembly according to a first embodiment of the present invention, wherein a lever of a connector is positioned at a first position and a part of the lever is illustrated by dotted line.

Fig. 2 is a perspective view showing the connector which is included in the connector assembly of Fig. 1, wherein the lever of the connector is positioned at the first position.

Fig. 3 is a bottom view showing the connector of Fig. 2, wherein a part of the connector is illustrated enlarged.

Fig. 4 is a side view showing the connector of Fig. 2, wherein the part of the lever is illustrated by dotted line.

Fig. 5 is a cross-sectional view showing the connector of Fig. 4, taken along line A-A.

Fig. 6 is another perspective view showing the connector of Fig. 2, wherein the lever of the connector is positioned at a second position.

Fig. 7 is a bottom view showing the connector of Fig. 6, wherein a part of the connector is illustrated enlarged.

Fig. 8 is a side view showing the connector of Fig. 6.

Fig. 9 is a cross-sectional view showing the connector of Fig. 8, taken along line B-B.

Fig. 10 is a perspective view showing a mating connector which is included in the connector assembly of Fig. 1.

Fig. 11 is another perspective view showing the mating connector of Fig. 10.

Fig. 12 is a top view showing the mating connector of Fig. 10.

Fig. 13 is a side view showing the mating connector of Fig. 10.

Fig. 14 is a rear view showing the mating connector of Fig. 10.

Fig. 15 is yet another perspective view showing the mating connector of Fig. 10.

Fig. 16 is a perspective view showing a slider which is included in the connector of Fig. 2.

Fig. 17 is side view showing the slider of Fig. 16.

Fig. 18 is another perspective view showing the slider of Fig. 16.

Fig. 19 is a bottom view showing the slider of Fig. 16.

Fig. 20 is a rear view showing the slider of Fig. 16.

Fig. 21 is a side view showing a connector which is included in a connector assembly according to a second embodiment of the present invention, wherein a lever of the connector is positioned at a first position and a part of the lever is illustrated by dotted line.

Fig. 22 is a cross-sectional view showing the connector of Fig. 21, taken along line C-C.

Fig. 23 is another side view showing the connector of Fig. 21, wherein the lever of the connector is positioned at a second position.

Fig. 24 is a cross-sectional view showing the connector of Fig. 23, taken along line D-D.

Fig. 25 is a perspective view showing a connector assembly of Patent Document 1, wherein a connector and a mating connector, which are included in the connector assembly, are not mated with each other and a lever of the connector is positioned at a first position.

Fig. 26 is a perspective view showing the connector assembly of Fig. 25, wherein the connector and the mating connector are mated with each other and the lever of the connector is positioned at a second position.

[0009] While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DESCRIPTION OF PREFERRED EMBODIMENTS:

[First embodiment]

[0010] As shown in Fig. 1, a connector assembly 10 according to a first embodiment of the present invention comprises a connector 100 and a mating connector 500. The mating connector 500 is mateable with and remov-

able from the connector 100 along an up-down direction. In the present embodiment, the up-down direction is a Z-direction. Specifically, upward is a positive Z-direction, and downward is a negative Z-direction.

[0011] As shown in Figs. 10 to 15, the mating connector 500 according to the present embodiment comprises a mating connector housing 505 and a plurality of male terminals 550. The mating connector housing 505 of the present embodiment is integrally molded from resin. Each of the male terminals 550 is made of metal.

[0012] As shown in Figs. 10 to 15, the mating connector housing 505 has a surrounding portion 507, a terminal holding portion 508 and a bottom portion accommodating portion 509.

[0013] As shown in Figs. 10 to 15, the surrounding portion 507 is positioned above the terminal holding portion 508 in the up-down direction. The surrounding portion 507 surrounds the bottom portion accommodating portion 509 in a plane perpendicular to the up-down direction. In the present embodiment, the plane perpendicular to the up-down direction is an XY-plane. The surrounding portion 507 has two short wall portions 512 and two long wall portions 514. The two short wall portions 512 face each other in a front-rear direction perpendicular to the up-down direction. In the present embodiment, the front-rear direction is a Y-direction. Specifically, forward is a positive Y-direction, and rearward is a negative Y-direction. The two long wall portions 514 face each other in a lateral direction perpendicular to both the up-down direction and the front-rear direction. In the present embodiment, the lateral direction is an X-direction.

[0014] As shown in Figs. 10 to 15, an outer surface of each of the long wall portions 514 is provided with two bosses 510, or two force-receiving portions 510, a first pushing portion 520 and a second pushing portion 530.

[0015] As shown in Figs. 10 to 15, each of the bosses 510 functions as the force-receiving portion 510. Each of the bosses 510 protrudes outward in the lateral direction from the outer surface of the long wall portion 514 and has a substantially cylindrical shape. The first pushing portion 520 has a substantially trapezoid-like cross-section in a plane perpendicular to the front-rear direction and protrudes outward in the lateral direction from the outer surface of the long wall portion 514. In the present embodiment, the plane perpendicular to the front-rear direction is an XZ-plane. The first pushing portion 520 has a slope 522, or a first contact portion 522, which is oblique to both the up-down direction and the lateral direction. The slope 522 extends downward and laterally outward from an upper end of the first pushing portion 520. The second pushing portion 530 is a plane perpendicular to the up-down direction and has a front end 532 in the front-rear direction. The second pushing portion 530 protrudes outward in the lateral direction from the outer surface of the long wall portion 514. The first pushing portion 520 and the second pushing portion 530 are arranged in this order in the front-rear direction. Specifically, the first pushing portion 520 is positioned forward

of the second pushing portion 530 in the front-rear direction. Accordingly, the connector 100 can have a reduced size in the lateral direction as compared with a connector in which the first pushing portion 520 and the second pushing portion 530 are arranged in the lateral direction.

[0016] As shown in Figs. 10 to 15, the bottom portion accommodating portion 509 has a mating connector opening 516 which is positioned at an upper end thereof in the up-down direction.

[0017] As shown in Figs. 10 to 15, each of the male terminals 550 has a substantially L-like shape as a whole. Specifically, each of the male terminals 550 has a contact point 552 and a fixed portion 554. The contact point 552 is positioned in the vicinity of an upper end of the male terminal 550, and the fixed portion 554 is positioned at an end of the male terminal 550 in a positive X-direction. Each of the male terminals 550 is held by the terminal holding portion 508 of the mating connector housing 505. The fixed portion 554 is configured to be soldered on a circuit board (not shown).

[0018] As shown in Figs. 2 to 9, the connector 100 according to the present embodiment comprises a housing 200, a lever 300, a slider 400 and a plurality of female terminals 218. Each of the housing 200, the lever 300 and the slider 400 is made of resin. Each of the female terminals 218 is made of metal.

[0019] As shown in Figs. 2, 4, 6 and 8, the housing 200 comprises a housing main body 210 and a cover portion 250.

[0020] As shown in Figs. 2 to 9, the housing main body 210 is provided with an outer peripheral portion 219, a surrounding portion accommodating portion 211, a bottom portion 212, two housing regulating portions 220, two flat portions 230 and two cavities 240.

[0021] As shown in Figs. 2 to 9, the outer peripheral portion 219 defines an outer edge of the housing main body 210 in the plane perpendicular to the up-down direction. The outer peripheral portion 219 surrounds the surrounding portion accommodating portion 211 in the plane perpendicular to the up-down direction.

[0022] As shown in Figs. 1 to 16, the surrounding portion accommodating portion 211 is configured to accommodate the surrounding portion 507 of the mating connector 500. The surrounding portion accommodating portion 211 surrounds the bottom portion 212 in the plane perpendicular to the up-down direction.

[0023] As shown in Figs. 1 to 16, the bottom portion 212 is configured to be accommodated by the bottom portion accommodating portion 509 of the mating connector 500. The bottom portion 212 is positioned at a lower end of the housing main body 210 in the up-down direction. The bottom portion 212 is provided with a plurality of receiving portions 215. Each of the receiving portions 215 is a hole which pierces the bottom portion 212 in the up-down direction.

[0024] As shown in Figs. 5 and 9, a set of the housing regulating portion 220, the flat portion 230 and the cavity 240 is provided in the vicinity of each of laterally opposite

ends of the housing main body 210. The flat portion 230 is a plane perpendicular to the lateral direction and is positioned forward of the housing regulating portion 220 in the front-rear direction. The cavity 240 pierces the housing 200 in the lateral direction. Specifically, the cavity 240 communicates with the surrounding portion accommodating portion 211 in the lateral direction and is positioned forward of the flat portion 230 in the front-rear direction.

[0025] As shown in Figs. 2, 4, 6 and 8, the cover portion 250 is positioned above the housing main body 210 in the up-down direction and is attached to the housing main body 210. The cover portion 250 is provided with two initial position regulating portions 252 and a cover portion opening 254. The initial position regulating portions 252 extend rearward in the front-rear direction from opposite ends, respectively, of the cover portion opening 254 in the lateral direction. Each of the initial position regulating portions 252 protrudes outward in the lateral direction.

[0026] As understood from Figs. 2, 4, 6 and 8, the lever 300 is attached to the housing main body 210 of the housing 200 so as to be rotatable between a first position and a second position. Specifically, the first position is a position of the lever 300 shown in each of Figs. 2 and 4, and the second position is a position of the lever 300 shown in each of Figs. 6 and 8. The lever 300 has two pinion portions 310, two arms 314 and a coupling portion 316. Each of the pinion portions 310 has pinion teeth 312. The pinion portions 310 are connected with lower ends of the arms 314, respectively. The coupling portion 316 couples upper ends of the arms 314 with each other. When the lever 300 is positioned at the first position, each of the initial position regulating portions 252 of the cover portion 250 regulates a forward movement of the lever 300 in the front-rear direction. More specifically, rear ends of the initial position regulating portions 252 are arranged so as to be positioned just forward of front edges of the arms 314, respectively, when the lever 300 is positioned at the first position.

[0027] As shown in Figs. 2, 5, 6, 9 and 16 to 20, the slider 400 is attached to the housing main body 210 of the housing 200 so as to be movable in the front-rear direction. The slider 400 comprises a pair of side plate portions 410. Each of the side plate portions 410 is positioned inward of the outer peripheral portion 219 of the housing main body 210 in the lateral direction. Each of the side plate portions 410 is positioned outward of the surrounding portion accommodating portion 211 in the lateral direction. The side plate portions 410 correspond to the housing regulating portions 220, the flat portions 230 and the cavities 240, respectively. Each of the side plate portions 410 has a rack portion 420 having rack teeth 422, two cam grooves 430, an arm portion accommodating portion 444, an arm portion fixing portion 442, an arm portion 440, a slider pushed portion 470, a slider regulating portion 480 and a regulated portion 450. Each of the side plate portions 410 of the present embodiment is integrally molded from resin. Accordingly, the connec-

tor 100 can have a reduced number of parts.

[0028] As understood from Figs. 3, 4, 7 and 16 to 20, the pinion portion 310 and the rack portion 420 are meshed with each other to convert a rotational movement of the lever 300 into a movement of the slider 400 in the front-rear direction. Specifically, the side plate portions 410 correspond to the pinion portions 310, respectively, and the rack teeth 422 of the rack portion 420 of each of the side plate portions 410 of the slider 400 and the pinion teeth 312 of the corresponding pinion portion 310 of the lever 300 are meshed with each other to convert a rotational movement of the lever 300 into a movement of the slider 400 in the front-rear direction. Since the lever 300 is attached to the housing main body 210 as described above, the pinion portions 310 of the lever 300 regulate an upward movement of the slider 400.

[0029] As shown in Figs. 16 to 20, the two cam grooves (force-transmitting portions) 430 of the side plate portion 410 are arranged in the front-rear direction. Each of the cam grooves (force-transmitting portions) 430 has an opening portion 432 at a lower end thereof in the up-down direction. Each of the cam grooves 430 is a ditch which extends rearward and upward from the opening portion 432. Each of the cam grooves 430 functions as the force-transmitting portion 430. The side plate portions 410 correspond to the long wall portions 514, respectively. The cam grooves (force-transmitting portions) 430 of the side plate portion 410 correspond to the bosses (force-receiving portions) 510, respectively, of the corresponding long wall portion 514. Specifically, each of the cam grooves (force-transmitting portions) 430 transmits a force in the up-down direction to the corresponding boss (force-receiving portion) 510 of the mating connector 500 by a movement of the slider 400 in the front-rear direction. More specifically, each of the cam grooves (force-transmitting portions) 430 accommodates the corresponding boss (force-receiving portion) 510 of the mating connector 500 from the opening portion 432 by a forward movement of the slider 400. In addition, each of the cam grooves (force-transmitting portions) 430 moves the corresponding boss (force-receiving portion) 510 of the mating connector 500 toward the opening portion 432 by a rearward movement of the slider 400.

[0030] As shown in Figs. 16 to 20, the arm portion accommodating portion 444 is a recess which is recessed outward in the lateral direction.

[0031] As shown in Figs. 16 to 20, the arm portion 440 extends rearward from a rear end of the arm portion fixing portion 442 and is resiliently deformable. The arm portion 440 is positioned inward of an inner surface of the arm portion accommodating portion 444 in the lateral direction.

[0032] As shown in Figs. 16 to 20, the slider pushed portion 470 has a slope 472 oblique to both the up-down direction and the front-rear direction. More specifically, the slope 472 of the slider pushed portion 470 extends rearward and upward from a rear end of the arm portion accommodating portion 444.

[0033] As shown in Figs. 16 to 20, the slider regulating portion 480 has a plane 482 perpendicular to the up-down direction. The plane 482 of the slider regulating portion 480 has a front end 484 which is coupled with a rear end of the slope 472 of the slider pushed portion 470 in the front-rear direction.

[0034] As shown in Figs. 16 to 20, the regulated portion 450 is provided on a rear end of the arm portion 440 in the front-rear direction and is movable in the lateral direction. The regulated portion 450 has an engaging protrusion 460. The engaging protrusion 460 protrudes inward in the lateral direction. The engaging protrusion 460 has a lower surface 461, or a second contact portion 461, a rear surface 462, a front surface 463 and a side surface 464. The lower surface (second contact portion) 461 is positioned at a lower end of the engaging protrusion 460 in the up-down direction. The lower surface (second contact portion) 461 is oblique to both the up-down direction and the lateral direction. The rear surface 462 is positioned at a rear end of the engaging protrusion 460 in the front-rear direction. The rear surface 462 is oblique to both the front-rear direction and the lateral direction. The front surface 463 is a plane which intersects with the front-rear direction. The front surface 463 is positioned at a front end of the engaging protrusion 460 in the front-rear direction. The front surface 463 of the engaging protrusion 460 and the front-rear direction make an angle equal to or less than 90°. The side surface 464 is a plane perpendicular to the lateral direction. The side surface 464 is positioned at an inner end of the engaging protrusion 460 in the lateral direction.

[0035] As shown in Figs. 16 to 20, the regulated portion 450, the slider pushed portion 470, and the slider regulating portion 480 are arranged in this order in the front-rear direction. More specifically, the regulated portion 450 is positioned forward of the slider pushed portion 470 in the front-rear direction, and the slider pushed portion 470 is positioned forward of the slider regulating portion 480 in the front-rear direction. Accordingly, the connector 100 can have a reduced size in the lateral direction as compared with a connector in which the regulated portion 450, the slider pushed portion 470 and the slider regulating portion 480 are arranged in the lateral direction.

[0036] As shown in Figs. 1, 3, 5, 7 and 9, the female terminals 218 are connected with the contact points 552 of the male terminals 550, respectively, of the mating connector 500 when the mating connector 500 and the connector 100 are mated with each other. The female terminals 218 are held in the receiving portions 215, respectively, of the bottom portion 212 of the housing main body 210.

[0037] Referring to Figs. 1, 3, 5, 7, 9 to 11 and 16 to 20, a mating operation between the mating connector 500 and the connector 100 is performed as described below.

[0038] When the lever 300 is positioned at the first position under a state where the mating connector 500 and the connector 100 are not mated with each other, each

of the housing regulating portions 220 regulates the forward movement of the slider 400 by engagement of the housing regulating portion 220 with the corresponding regulated portion 450. In detail, when the lever 300 is positioned at the first position under the state where the mating connector 500 and the connector 100 are not mated with each other, a rear surface 222 of each of the housing regulating portions 220 is brought into contact with the front surface 463 of the engaging protrusion 460 of the corresponding regulated portion 450, so that a forward movement of the corresponding regulated portion 450 is regulated. Accordingly, the forward movement of the slider 400 is regulated.

[0039] Next, when the mating connector 500 is moved upward relative to the connector 100 to be manually inserted therein so that the surrounding portion 507 of the mating connector housing 505 of the mating connector 500 is accommodated by the surrounding portion accommodating portion 211 of the housing main body 210 of the connector 100, the slope (first contact portion) 522 of each of the first pushing portions 520 of the mating connector 500 pushes the lower surface (second contact portion) 461 of the engaging protrusion 460 of the corresponding regulated portion 450 to move the engaging protrusion 460 in an intersecting direction which intersects with the front-rear direction. Accordingly, the contact is lost between the front surface 463 of each of the engaging protrusions 460 and the rear surface 222 of the corresponding housing regulating portion 220, so that the regulation of the forward movement of the slider 400 by each of the housing regulating portions 220 is released. In the present embodiment, the intersecting direction is the lateral direction.

[0040] When the mating connector 500 is further moved upward relative to the connector 100 to be further manually inserted therein, each of the second pushing portions 530 pushes the slope 472 of the corresponding slider pushed portion 470 to move the slider 400 forward by a predetermined distance. More specifically, when the mating connector 500 is further moved upward relative to the connector 100 to be further manually inserted therein, the front end 532 of each of the second pushing portions 530 upwardly pushes the slope 472 of the corresponding slider pushed portion 470 to apply an upward force thereto. Since the upward movement of the slider 400 is regulated by the pinion portions 310 of the lever 300 as described above, the slope 472 of each of the slider pushed portions 470 converts the applied upward force into a forward force. Accordingly, the front end 532 of each of the second pushing portions 530 pushes the slope 472 of the corresponding slider pushed portion 470 at a point which is gradually moved from a lower end thereof to an upper end thereof, so that the slider 400 is moved forward by the predetermined distance. At that time, the regulated portion 450 and the corresponding flat portion 230 are arranged in the lateral direction while the arm portion 440 is resiliently deformed. More specifically, each of the lower surface 461, the rear surface

462, the front surface 463 and the side surface 464 of the engaging protrusion 460 of each of the regulated portions 450 is positioned outward of the corresponding flat portion 230 in the lateral direction, and the side surface 464 of the engaging protrusion 460 of each of the regulated portions 450 is brought into contact with the corresponding flat portion 230.

[0041] After that, an upward movement of the mating connector 500 is regulated by each of the second pushing portions 530 abutting against the plane 482 of the corresponding slider regulating portion 480. More specifically, the upward movement of the mating connector 500 is regulated by the front end 532 of each of the second pushing portions 530 abutting against the front end 484 of the plane 482 of the corresponding slider regulating portion 480. In particular, since the slider regulating portion 480 of the present embodiment has the plane 482 perpendicular to the up-down direction, a user can easily recognize that the manual insertion of the mating connector 500 into the connector 100 is completed. Meanwhile, each of the bosses (force-receiving portions) 510 of the mating connector 500 is positioned in the corresponding cam groove (force-transmitting portion) 430, and the lever 300 is in a state of being rotatable.

[0042] When the lever 300 is rotated from the first position to the second position after the slider 400 is moved forward by the predetermined distance, each of the regulated portions 450 is positioned in the corresponding cavity 240 in the front-rear direction while each of the arm portions 440 is not resiliently deformed. More specifically, when the lever 300 is rotated from the first position to the second position after the slider 400 is moved forward by the predetermined distance, the side surface 464 of the engaging protrusion 460 of each of the regulated portions 450 is positioned forward of the corresponding flat portion 230 and inward of the corresponding flat portion 230 in the lateral direction. When the lever 300 is rotated from the first position to the second position after the slider 400 is moved forward by the predetermined distance, the slider 400 is moved forward in the front-rear direction while each of the cam grooves (force-transmitting portions) 430 moves the corresponding boss (force-receiving portion) 510 of the mating connector 500 upward in the up-down direction so that the connector 100 and the mating connector 500 are mated with each other. Accordingly, the contact point 552 of each of the male terminals 550 of the mating connector 500 and the corresponding female terminal 218 of the connector 100 are connected with each other.

[0043] Referring to Figs. 1, 3, 5, 7, 9 to 11 and 16 to 20, a removal operation of the mating connector 500 and the connector 100 from each other is performed as described below.

[0044] When the lever 300 is rotated from the second position to the first position under a mated state where the connector 100 and the mating connector 500 are mated with each other, the slider 400 is moved rearward in the front-rear direction while each of the cam grooves

(force-transmitting portions) 430 moves the corresponding boss (force-receiving portion) 510 of the mating connector 500 downward in the up-down direction so that the connector 100 and the mating connector 500 are in a state where the connector 100 and the mating connector 500 are removable from each other. More specifically, when the lever 300 is rotated from the second position to the first position under the aforementioned mated state, each of the cam grooves (force-transmitting portions) 430 of the slider 400 of the connector 100 moves the corresponding boss (force-receiving portion) 510 of the mating connector 500, which is received in the cam groove (force-transmitting portion) 430 of the slider 400 of the connector 100, in close proximity to the opening portion 432 so that the connector 100 and the mating connector 500 are in the state where the connector 100 and the mating connector 500 are removable from each other. Meanwhile, the engaging protrusion 460 of each of the regulated portions 450 of the slider 400 rides over the corresponding flat portion 230 of the housing main body 210 to be moved rearward, so that the front surface 463 of the engaging protrusion 460 of each of the regulated portions 450 is engaged with the rear surface 222 of the corresponding housing regulating portion 220. In other words, each of the regulated portions 450 is prevented from being moved forward, so that the forward movement of the slider 400 is regulated. Since the rear surface 462 of the engaging protrusion 460 of each of the regulated portions 450 of the slider 400 is oblique to both the front-rear direction and the lateral direction, the engaging protrusion 460 of each of the regulated portions 450 of the slider 400 easily rides over the corresponding flat portion 230 when the slider 400 is moved rearward in the front-rear direction.

[0045] In the present embodiment, the regulated portion 450 has the lower surface (second contact portion) 461 which is configured to be brought into contact with the slope (first contact portion) 522 of the first pushing portion 520, and the first pushing portion 520 has the slope (first contact portion) 522 which is configured to be brought into contact with the lower surface (second contact portion) 461 of the regulated portion 450. In addition, in the present embodiment, each of the lower surface (second contact portion) 461 and the slope (first contact portion) 522 is oblique to both the up-down direction and the lateral direction. It is sufficient that at least one of the lower surface (second contact portion) 461 of the regulated portion 450 and the slope (first contact portion) 522 of the first pushing portion 520 has a slope which is inclined so that the regulated portion 450 is moved in an intersecting direction when the mating connector 500 is mated with the connector 100, wherein the intersecting direction intersects with the front-rear direction.

[Second embodiment]

[0046] Referring to Figs. 1 and 21 to 24, a connector assembly 10A according to a second embodiment of the

present invention has a structure same as that of the connector assembly 10 according to the aforementioned first embodiment as shown in Fig. 1 except for a connector 100A. Components of the connector 100A shown in Figs. 21 to 24 which are same as those of the connector 100 of the first embodiment are referred by using reference signs same as those of the connector 100 of the first embodiment. As for directions and orientations in the present embodiment, expressions same as those of the first embodiment will be used hereinbelow.

[0047] As shown in Figs. 21 to 24, the connector 100A according to the present embodiment has a housing 200A, a lever 300, a slider 400A and a plurality of female terminals 218. Each of the housing 200A and the slider 400A is made of resin. The lever 300 and the female terminal 218 of the connector 100A have structures same as those of the connector 100 of the aforementioned first embodiment. Accordingly, detailed explanation about those components is omitted.

[0048] As shown in Figs. 21 to 24, the housing 200A comprises a housing main body 210A and a cover portion 250. As for the aforementioned components of the housing 200A, the cover portion 250 has a structure same as that of the connector 100 of the aforementioned first embodiment. Accordingly, detailed explanation about the cover portion 250 is omitted.

[0049] As shown in Figs. 21 to 24, the housing main body 210A is provided with a surrounding portion accommodating portion 211, a bottom portion 212, an outer peripheral portion 219A, two housing regulating portions 220A and two arm portions 228A. As for the aforementioned components of the housing main body 210A, the surrounding portion accommodating portion 211 and the bottom portion 212 have structures same as those of the connector 100 of the aforementioned first embodiment. Accordingly, detailed explanation about those components is omitted.

[0050] As shown in Figs. 21 to 24, the outer peripheral portion 219A defines an outer edge of the housing main body 210A in a plane perpendicular to the up-down direction. The outer peripheral portion 219A surrounds the surrounding portion accommodating portion 211 in the plane perpendicular to the up-down direction. Each of the housing regulating portions 220A is a protrusion 224A which protrudes inward from an inner surface of the outer peripheral portion 219A in the lateral direction. The protrusions 224A correspond to the arm portions 228A, respectively. Each of the protrusions 224A is positioned in the vicinity of a rear end of the corresponding arm portion 228A. Each of the arm portions 228A is resiliently deformable, so that each of the protrusions 224A is movable in the lateral direction. The protrusion 224A consists of a conical portion 225A and a shank portion 226A. The conical portion 225A has a substantially conical shape and extends inward in the lateral direction from a laterally inner end of the shank portion 226A. The shank portion 226A has a constant outer dimension in a plane perpendicular to the lateral direction. In the present embodiment,

the plane perpendicular to the lateral direction is a YZ-plane.

[0051] As shown in Figs. 21 to 24, the slider 400A is attached to the housing main body 210A of the housing 200A so as to be movable in the front-rear direction. Specifically, the slider 400A comprises a pair of side plate portions 410A. The side plate portions 410A correspond to long wall portions 514, respectively. Each of the side plate portions 410A is positioned inward of the outer peripheral portion 219A of the housing main body 210A in the lateral direction. Each of the side plate portions 410A is positioned outward of the surrounding portion accommodating portion 211 in the lateral direction. Each of the side plate portions 410A has a rack portion 420 having rack teeth 422, two cam grooves 430, a slider pushed portion 470, a slider regulating portion 480 and a regulated portion 450A. As for the aforementioned components of the side plate portion 410A, the rack portion 420, the cam groove 430, the slider pushed portion 470 and the slider regulating portion 480 have structures same as those of the connector 100 of the aforementioned first embodiment. Accordingly, detailed explanation about those components is omitted. Each of the side plate portions 410A is integrally molded from resin. Accordingly, the connector 100A can have a reduced number of parts.

[0052] As shown in Figs. 21 to 24, the regulated portion 450A is a hole 452A which pierces the side plate portion 410A in the lateral direction. The hole 452A consists of a tapered portion 454A and a cylindrical inner peripheral portion 456A. The tapered portion 454A has a decreasing inner dimension as measured from a laterally outer end thereof to a laterally inner end thereof. The cylindrical inner peripheral portion 456A has a constant inner dimension in the plane perpendicular to the lateral direction and extends inward in the lateral direction from the laterally inner end of the tapered portion 454A. The housing regulating portions 220A correspond to the side plate portions 410A, respectively. In the plane perpendicular to the lateral direction, the inner dimension of the cylindrical inner peripheral portion 456A of the hole 452A of the regulated portion 450A of each of the side plate portions 410A is greater than the outer dimension of the shank portion 226A of the protrusion 224A of the corresponding housing regulating portion 220A.

[0053] Referring to Figs. 1 and 16 to 24, a mating operation between a mating connector 500 and the connector 100A is performed as described below.

[0054] When the lever 300 is positioned at a first position shown in Fig. 21 under a state where the mating connector 500 and the connector 100A are not mated with each other, each of the housing regulating portions 220A regulates a forward movement of the slider 400A by engagement of the housing regulating portion 220A with the corresponding regulated portion 450A. More specifically, when the lever 300 is positioned at the first position under the state where the mating connector 500 and the connector 100A are not mated with each other, the protrusion 224A of each of the housing regulating

portions 220A is inserted into the hole 452A of the corresponding regulated portion 450A so that the laterally inner end of the shank portion 226A of the protrusion 224A of each of the housing regulating portions 220A is positioned laterally inward of the laterally inner end of the tapered portion 454A of the hole 452A of the corresponding regulated portion 450A. Accordingly, each of the regulated portions 450A is prevented from being moved forward. Thus, the forward movement of the slider 400A is regulated.

[0055] Next, when the mating connector 500 is moved upward relative to the connector 100A to be manually inserted therein so that a surrounding portion 507 of a mating connector housing 505 of the mating connector 500 is accommodated by the surrounding portion accommodating portion 211 of the housing main body 210A of the connector 100A, a slope (first contact portion) 522 of each of first pushing portions 520 of the mating connector 500 pushes the protrusion 224A of the corresponding housing regulating portion 220A to move the protrusion 224A thereof in an intersecting direction which intersects with the front-rear direction. Accordingly, the laterally inner end of the shank portion 226A of the protrusion 224A of each of the housing regulating portions 220A is positioned laterally outward of the laterally inner end of the tapered portion 454A of the hole 452A of the corresponding regulated portion 450A. In other words, a laterally outer end of the conical portion 225A of the protrusion 224A of each of the housing regulating portions 220A is positioned laterally outward of a laterally outer end of the cylindrical inner peripheral portion 456A of the hole 452A of the corresponding regulated portion 450A. Accordingly, the protrusion 224A of each of the housing regulating portions 220A is in a state where the protrusion 224A of each of the housing regulating portions 220A is able to easily ride over the hole 452A of the corresponding regulated portion 450A when the slider 400A is moved forward. Thus, the regulation of the forward movement of the slider 400A by each of the housing regulating portions 220A is released. In the present embodiment, the intersecting direction is the lateral direction.

[0056] When the mating connector 500 is further moved upward relative to the connector 100A to be further manually inserted therein, each of second pushing portions 530 pushes a slope 472 of the corresponding slider pushed portion 470 to move the slider 400A forward by a predetermined distance. More specifically, when the mating connector 500 is further moved upward relative to the connector 100A to be further manually inserted therein, a front end 532 of each of the second pushing portions 530 upwardly pushes the slope 472 of the corresponding slider pushed portion 470 to apply an upward force thereto. Since an upward movement of the slider 400A is regulated by pinion portions 310 of the lever 300 similar to the slider 400, the slope 472 of each of the slider pushed portions 470 converts the applied upward force into a forward force. Accordingly, the front end 532 of each of the second pushing portions 530 pushes the

slope 472 of the corresponding slider pushed portion 470 at a point which is gradually moved from a lower end thereof to an upper end thereof, so that the slider 400A is moved forward by the predetermined distance. At that time, the protrusion 224A of each of the housing regulating portions 220A is positioned outward beyond the hole 452A of the corresponding regulated portion 450A in the lateral direction while each of the arm portions 228A is resiliently deformed.

[0057] After that, an upward movement of the mating connector 500 is regulated by each of the second pushing portions 530 abutting against a plane 482 of the corresponding slider regulating portion 480. More specifically, the upward movement of the mating connector 500 is regulated by the front end 532 of each of the second pushing portions 530 abutting against a front end 484 of the plane 482 of the corresponding slider regulating portion 480. Accordingly, a user can easily recognize that the manual insertion of the mating connector 500 into the connector 100A is completed. Meanwhile, each boss (force-receiving portion) 510 of the mating connector 500 is positioned in the corresponding cam groove (force-transmitting portion) 430, and the lever 300 is in a state of being rotatable.

[0058] When the lever 300 is rotated from the first position to a second position shown in Fig. 23 after the slider 400A is moved forward by the predetermined distance, the protrusion 224A of each of the housing regulating portions 220A is positioned rearward of a rear end of the slider 400A in the front-rear direction. Specifically, when the lever 300 is rotated from the first position to the second position after the slider 400A is moved forward by the predetermined distance, the slider 400A is moved forward in the front-rear direction while each of the cam grooves (force-transmitting portions) 430 moves the corresponding boss (force-receiving portion) 510 of the mating connector 500 upward in the up-down direction so that the connector 100A and the mating connector 500 are mated with each other. Accordingly, a contact point 552 of each of male terminals 550 of the mating connector 500 and the corresponding female terminal 218 of the connector 100A are connected with each other.

[0059] Referring to Figs. 1 and 16 to 24, a removal operation of the mating connector 500 and the connector 100A from each other is performed as described below.

[0060] When the lever 300 is rotated from the second position to the first position under a mated state where the connector 100A and the mating connector 500 are mated with each other, the slider 400A is moved rearward in the front-rear direction while each of the cam grooves (force-transmitting portions) 430 moves the corresponding boss (force-receiving portion) 510 of the mating connector 500 downward in the up-down direction so that the connector 100A and the mating connector 500 are in a state where the connector 100A and the mating connector 500 are removable from each other. More specifically, when the lever 300 is rotated from the second position to the first position under the aforementioned mated

state, each of the cam grooves (force-transmitting portions) 430 of the slider 400A of the connector 100A moves the corresponding boss (force-receiving portion) 510 of the mating connector 500, which is received in the cam groove (force-transmitting portion) 430 of the slider 400A of the connector 100A, in close proximity to the opening portion 432 so that the connector 100A and the mating connector 500 are in the state where the connector 100A and the mating connector 500 are removable from each other. Meanwhile, the protrusion 224A of each of the housing regulating portions 220A rides over a laterally outer surface of the slider 400A and is then inserted into the hole 452A of the corresponding regulated portion 450A. In other words, each of the regulated portions 450A is prevented from being moved forward, so that the forward movement of the slider 400A is regulated.

[0061] While the present invention has been described with specific embodiments, the present invention is not limited to the aforementioned embodiments.

[0062] Although the mating connector housing 505 of the mating connector 500 of the present embodiment is integrally molded from resin, the mating connector housing 505 may be formed by combining individual parts.

[0063] Although the side plate portion 410, 410A of the connector 100, 100A of the present embodiment is integrally molded from resin, the side plate portion 410, 410A may be formed by combining individual parts.

[0064] While there has been described what is believed to be the preferred embodiment of the invention, those skilled in the art will recognize that other and further modifications may be made thereto without departing from the spirit of the invention, and it is intended to claim all such embodiments that fall within the true scope of the invention.

Claims

1. A connector assembly comprising a connector and a mating connector, wherein:

the mating connector is mateable with and removable from the connector along an up-down direction;
the mating connector comprises a force-receiving portion and a first pushing portion;
the connector comprises a housing, a lever and a slider;
the housing is provided with a housing regulating portion;
the lever is attached to the housing so as to be rotatable between a first position and a second position;
the slider is attached to the housing so as to be movable in a front-rear direction perpendicular to the up-down direction;
the lever has a pinion portion having pinion teeth;

the slider has a rack portion, a force-transmitting portion and a regulated portion;
the rack portion has rack teeth;
the pinion portion and the rack portion are meshed with each other to convert a rotational movement of the lever into a movement of the slider in the front-rear direction;
the force-transmitting portion transmits a force in the up-down direction to the force-receiving portion of the mating connector by the movement of the slider in the front-rear direction;
when the lever is rotated from the first position to the second position, the slider is moved forward in the front-rear direction while the force-transmitting portion moves the force-receiving portion of the mating connector upward in the up-down direction so that the connector and the mating connector are mated with each other;
when the lever is rotated from the second position to the first position, the slider is moved rearward in the front-rear direction while the force-transmitting portion moves the force-receiving portion of the mating connector downward in the up-down direction so that the connector and the mating connector are in a state where the connector and the mating connector are removable from each other;
when the lever is positioned at the first position under a state where the connector and the mating connector are not mated with each other, the housing regulating portion regulates a forward movement of the slider by engagement of the housing regulating portion with the regulated portion; and
when the mating connector and the connector are mated with each other, the first pushing portion pushes the housing regulating portion or the regulated portion to release regulation by the housing regulating portion.

2. The connector assembly as recited in claim 1, wherein the first pushing portion pushes the regulated portion when the mating connector and the connector are mated with each other.

3. The connector assembly as recited in claim 2, wherein:

the slider further has an arm portion which is resiliently deformable;
the arm portion has an end in the front-rear direction; and
the regulated portion is provided on the end of the arm portion and is movable in a lateral direction perpendicular to both the front-rear direction and the up-down direction.

4. The connector assembly as recited in claim 3, where-

in the arm portion extends rearward in the front-rear direction.

5. The connector assembly as recited in one of claims 2 to 4, wherein:

the mating connector further comprises a boss and a second pushing portion;
the boss functions as the force-receiving portion;
the slider further has a slider pushed portion and a cam groove;
the slider pushed portion has a slope oblique to both the up-down direction and the front-rear direction;
the cam groove functions as the force-transmitting portion; and
when the mating connector is moved upward in a case where the mating connector and the connector are mated with each other, the second pushing portion moves the slider forward by pushing the slope of the slider pushed portion after the regulation by the housing regulating portion is released.

6. The connector assembly as recited in claim 3 or 4, wherein:

the mating connector further comprises a second pushing portion;
the slider further has a slider regulating portion;
the slider regulating portion has a plane perpendicular to the up-down direction; and
when the mating connector is moved upward in a case where the mating connector and the connector are mated with each other, an upward movement of the mating connector is regulated by the second pushing portion abutting against the plane of the slider regulating portion after the regulation by the housing regulating portion is released and the slider is then moved forward by a predetermined distance.

7. The connector assembly as recited in claim 6, wherein:

the housing has a flat portion;
the flat portion is positioned forward of the housing regulating portion in the front-rear direction; and
when the slider is moved forward by the predetermined distance, the regulated portion and the flat portion are arranged in the lateral direction while the arm portion is resiliently deformed.

8. The connector assembly as recited in claim 7, wherein:

the housing has a cavity which pierces the housing in the lateral direction;
the cavity is positioned forward of the flat portion in the front-rear direction; and
when the lever is rotated from the first position to the second position after the slider is moved forward by the predetermined distance, the regulated portion is positioned in the cavity in the front-rear direction while the arm portion is not resiliently deformed.

9. The connector assembly as recited in one of claims 2 to 4, wherein:

the mating connector further comprises a second pushing portion;
the slider further has a slider pushed portion and a slider regulating portion;
the regulated portion, the slider pushed portion and the slider regulating portion are arranged in this order in the front-rear direction;
the first pushing portion and the second pushing portion are arranged in this order in the front-rear direction;
when the mating connector is moved upward in a case where the mating connector and the connector are mated with each other, the second pushing portion moves the slider forward by a predetermined distance by pushing the slider pushed portion after the regulation by the housing regulating portion is released; and
an upward movement of the mating connector is regulated by the second pushing portion abutting against the slider regulating portion after the slider is moved forward by the predetermined distance.

10. The connector assembly as recited in claim 5, wherein:

the slider comprises a pair of side plate portions;
each of the side plate portions is provided with two of the cam grooves; and
the two cam grooves are arranged in the front-rear direction.

11. The connector assembly as recited in one of claims 2 to 10, wherein:

the first pushing portion has a first contact portion;
the regulated portion has a second contact portion;
the first contact portion of the first pushing portion and the second contact portion of the regulated portion are brought into contact with each other when the mating connector and the connector are mated with each other;

at least one of the first contact portion of the first pushing portion and the second contact portion of the regulated portion has a slope; and the slope is inclined so that the regulated portion is moved in an intersecting direction when the mating connector is mated with the connector, the intersecting direction intersecting with the front-rear direction. 5

12. The connector assembly as recited in one of claims 2 to 10, wherein: 10

the regulated portion has an engaging protrusion; the engaging protrusion protrudes inward in a lateral direction perpendicular to both the front-rear direction and the up-down direction; the engaging protrusion has a lower surface in the up-down direction; and the lower surface is oblique to both the up-down direction and the lateral direction. 15 20

13. The connector assembly as recited in claim 12, wherein: 25

the engaging protrusion has a rear surface in the front-rear direction; and the rear surface is oblique to both the front-rear direction and the lateral direction. 30

14. The connector assembly as recited in claim 12 or 13, wherein:

the engaging protrusion has a front surface in the front-rear direction; and the front surface of the engaging protrusion and the front-rear direction make an angle equal to or less than 90°. 35

15. The connector assembly as recited in one of claims 1 to 14, wherein: 40

the housing comprises a housing main body and a cover portion; the cover portion is attached to the housing main body; and each of the lever and the slider is attached to the housing main body. 45

16. The connector assembly as recited in claim 15, wherein: 50

the cover portion is provided with an initial position regulating portion; and when the lever is positioned at the first position, the initial position regulating portion regulates a forward movement of the lever in the front-rear direction. 55

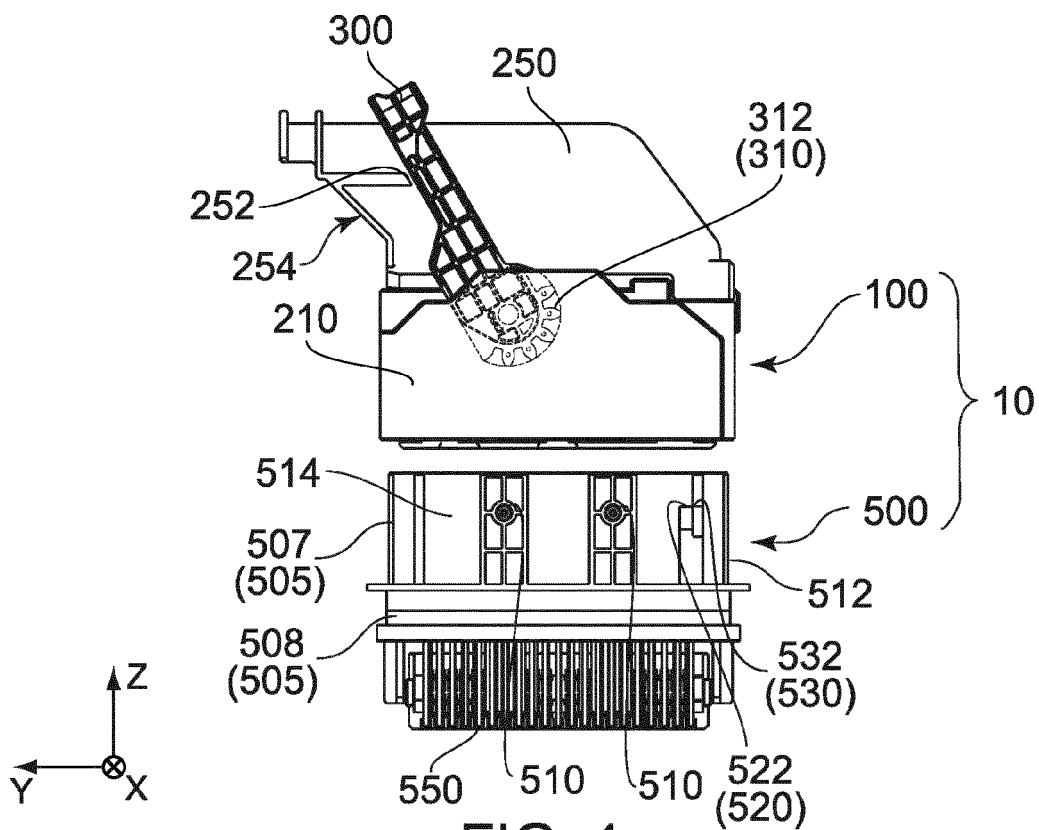


FIG. 1

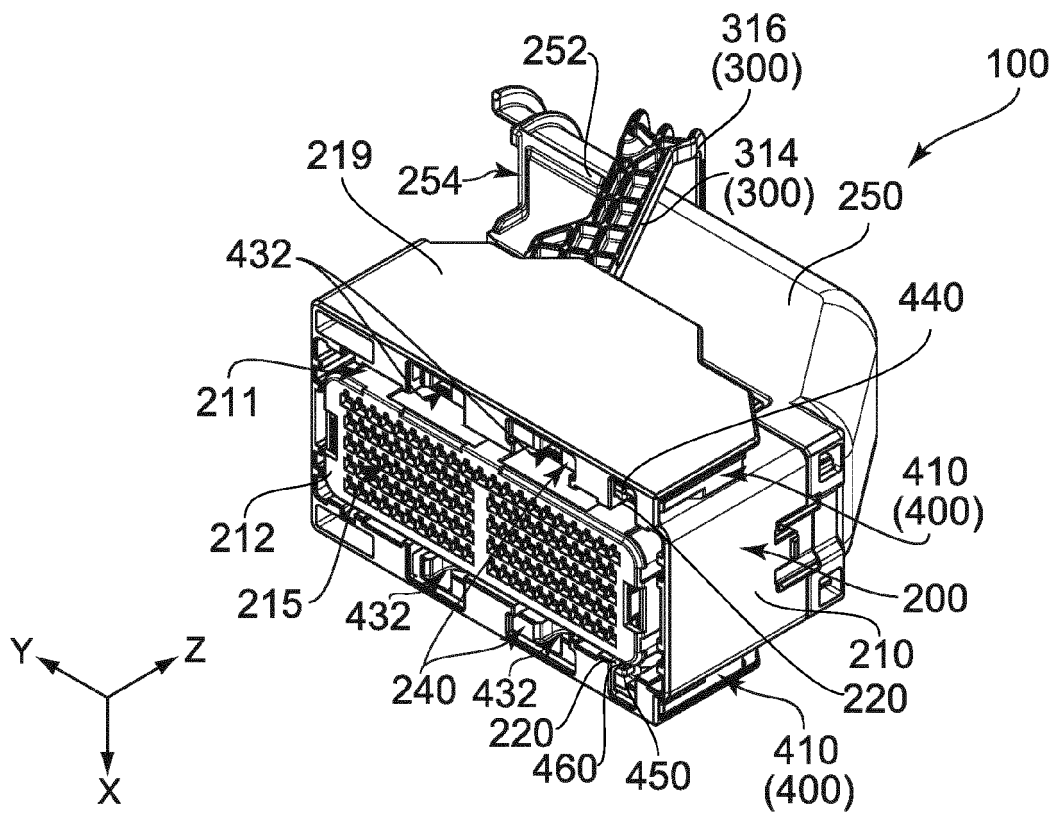


FIG. 2

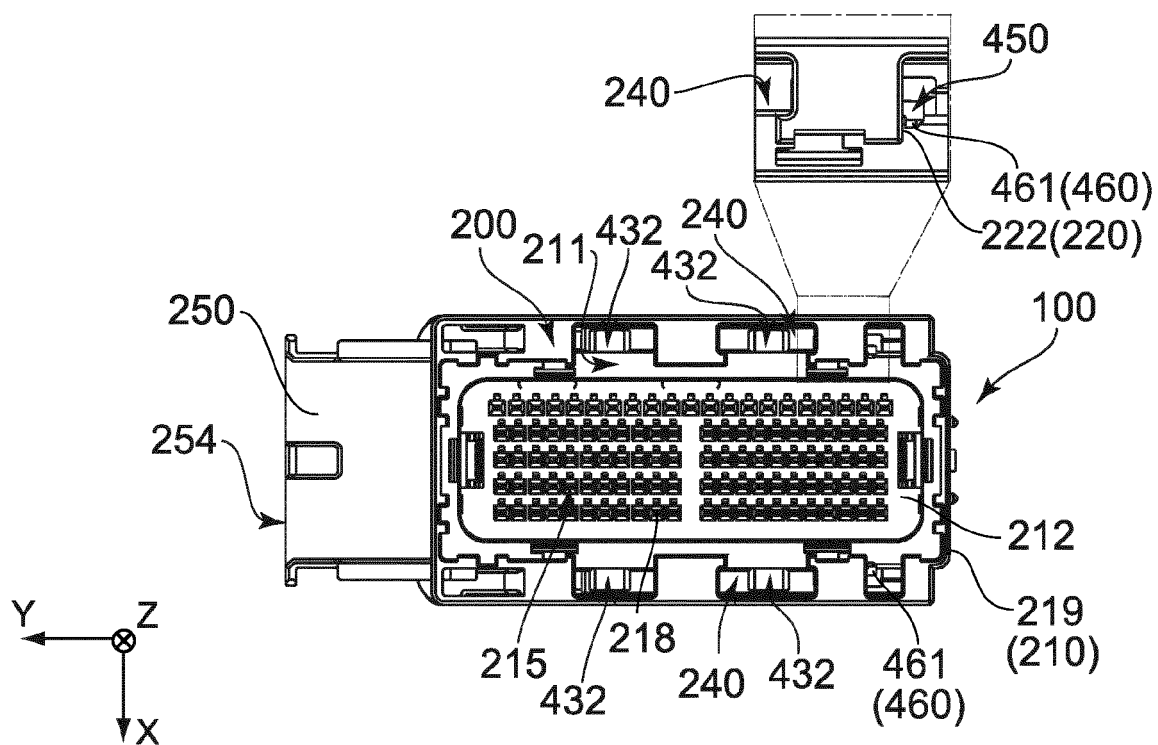


FIG. 3

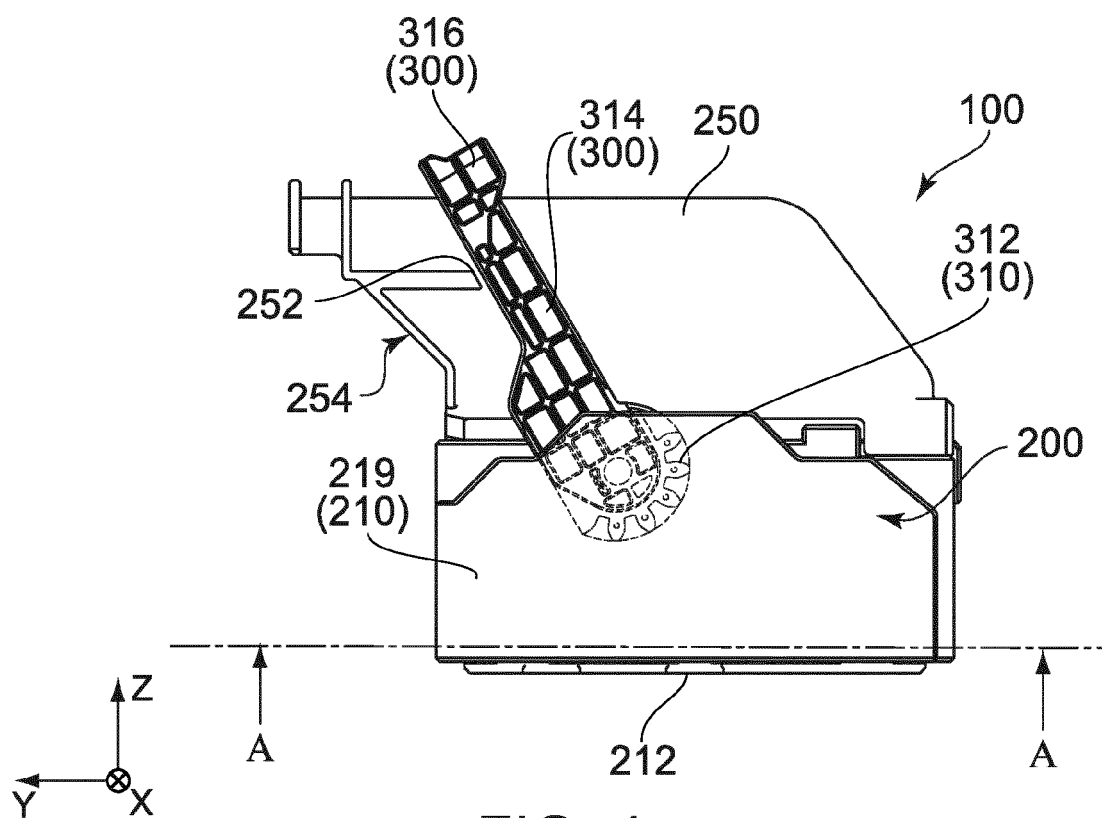


FIG. 4

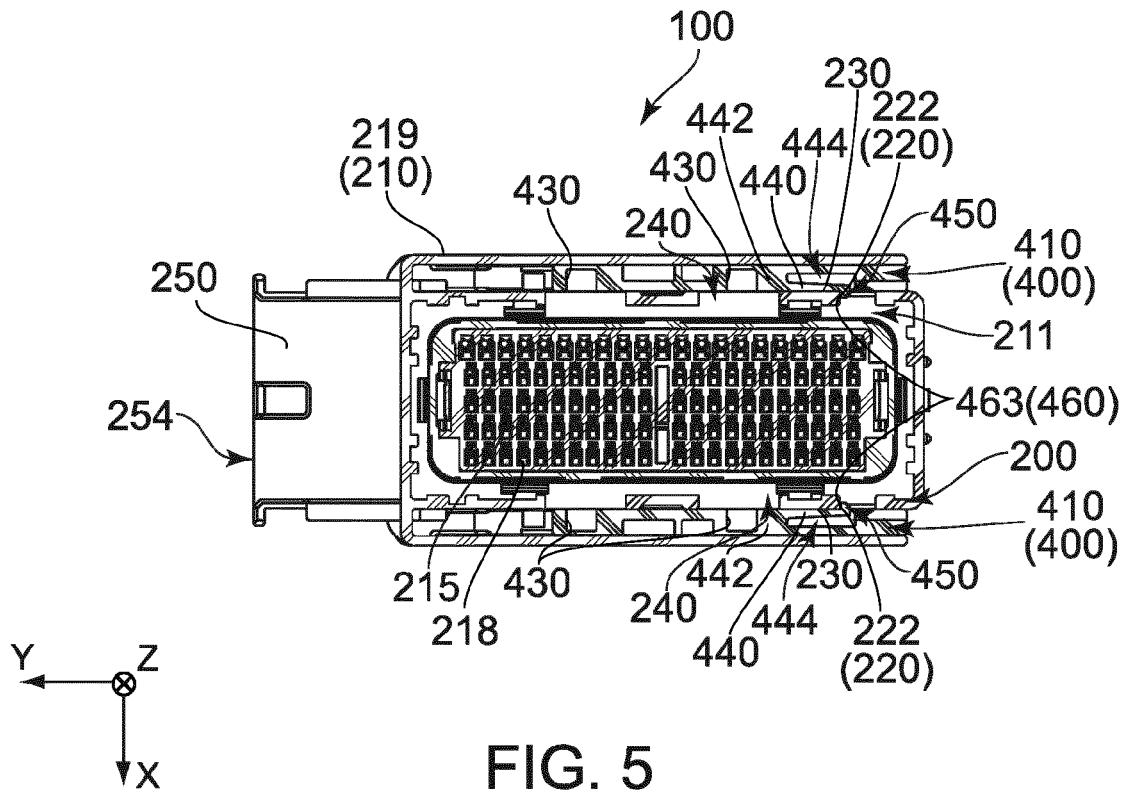


FIG. 5

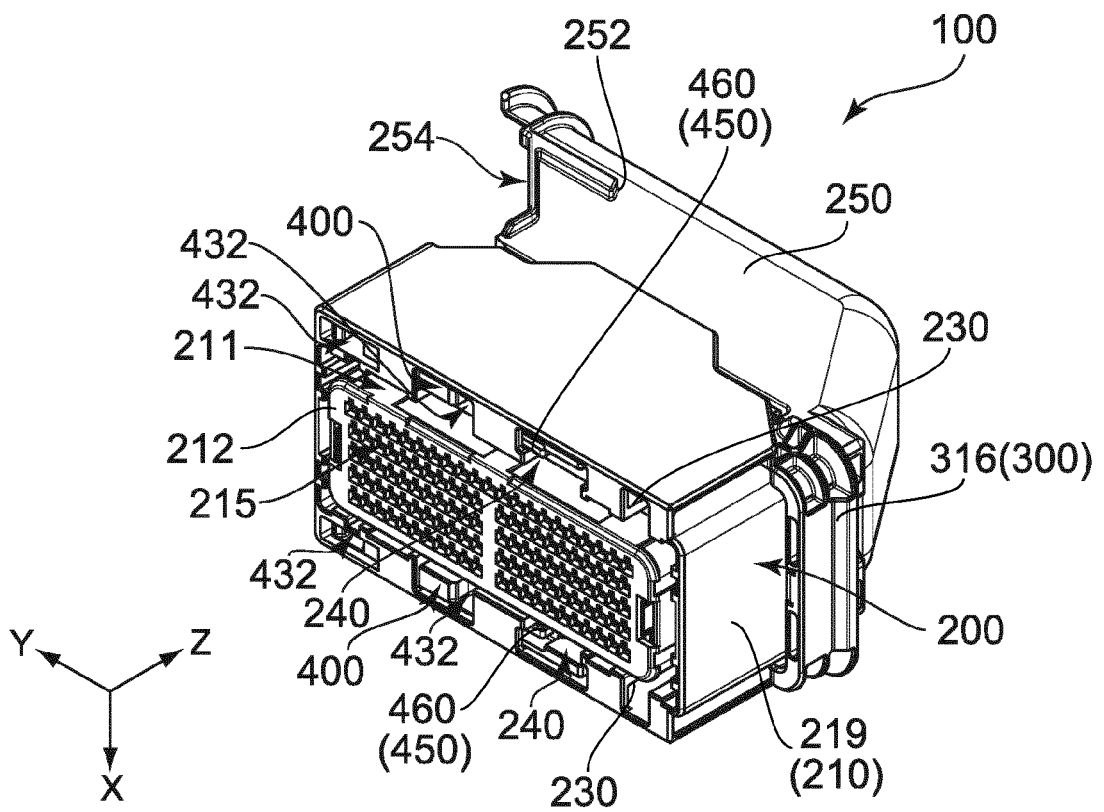


FIG. 6

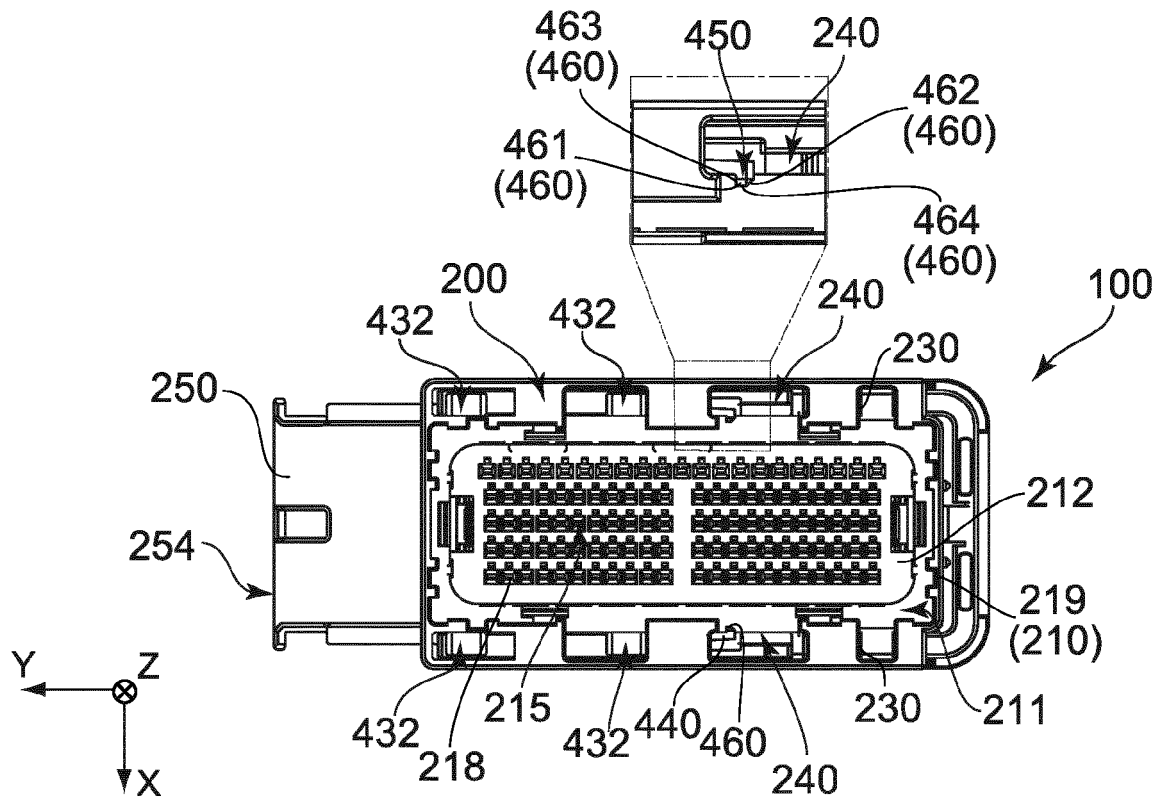


FIG. 7

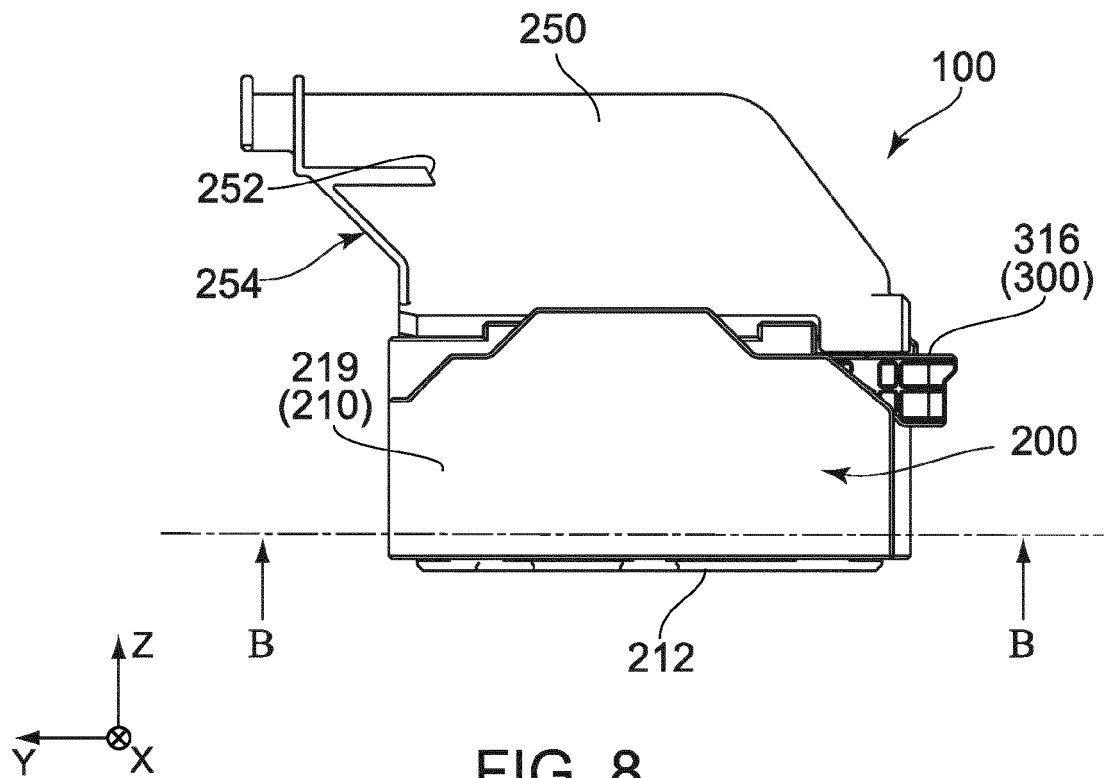


FIG. 8

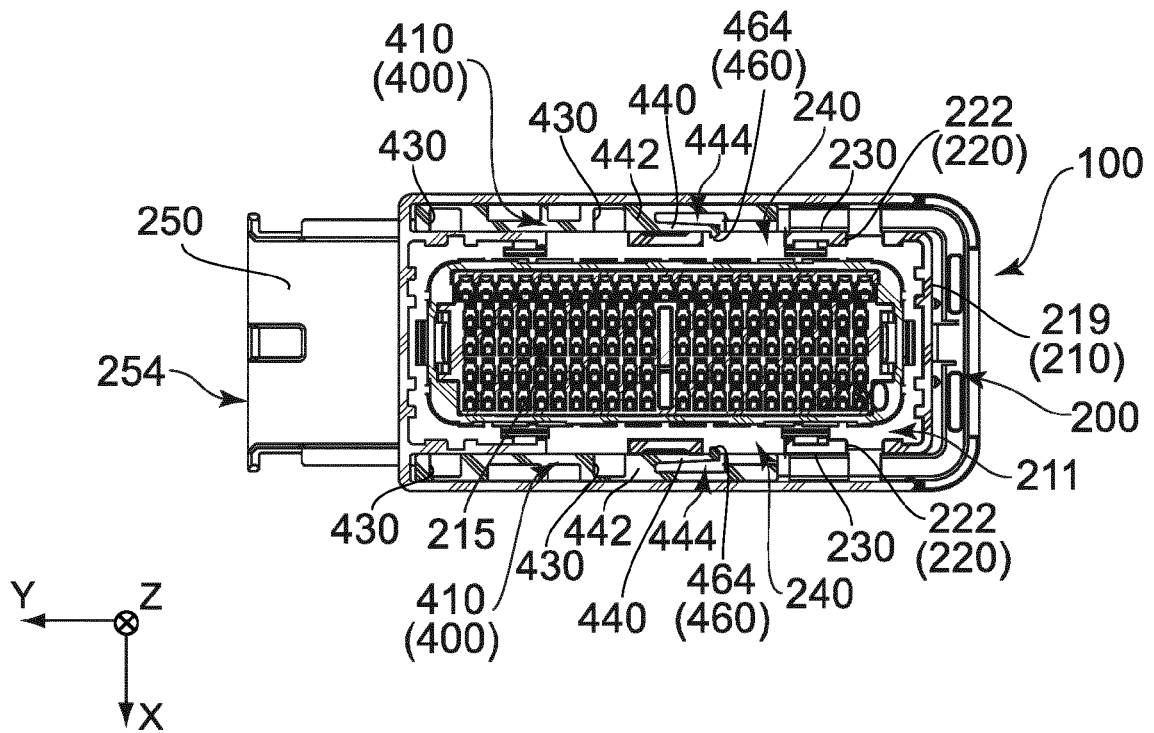


FIG. 9

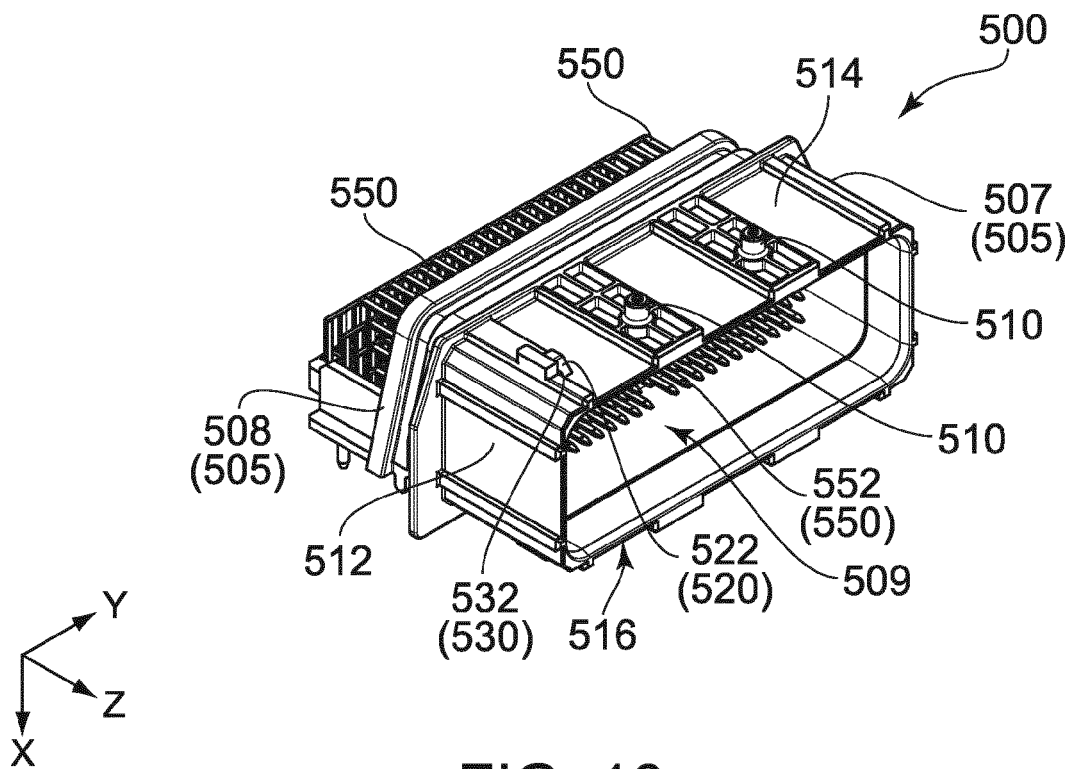


FIG. 10

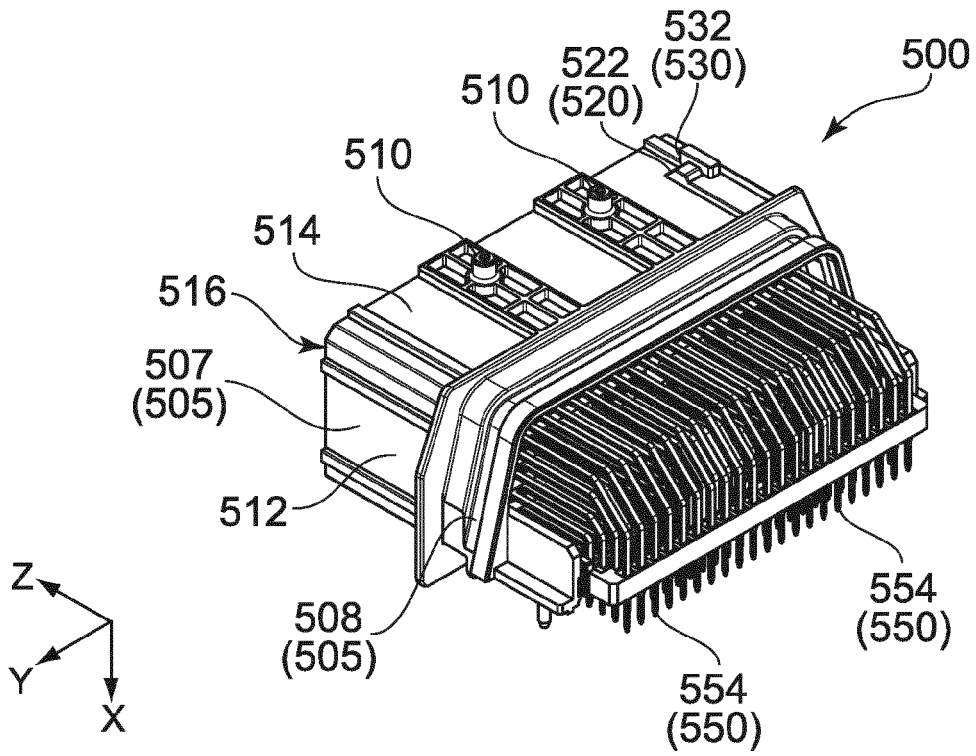


FIG. 11

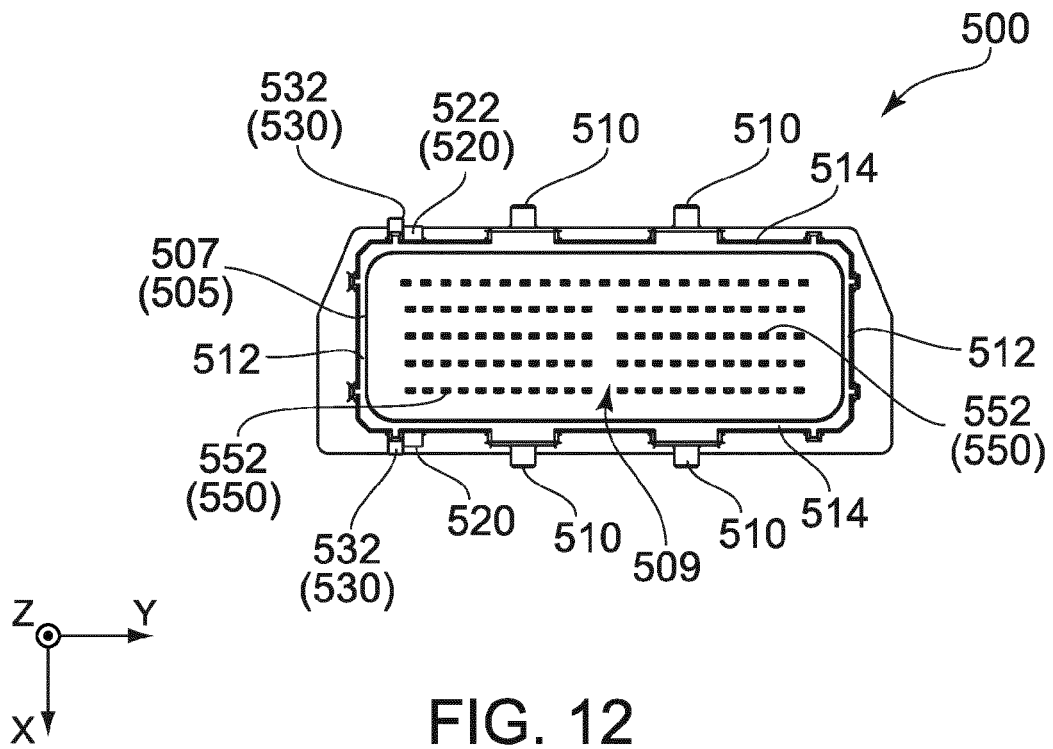
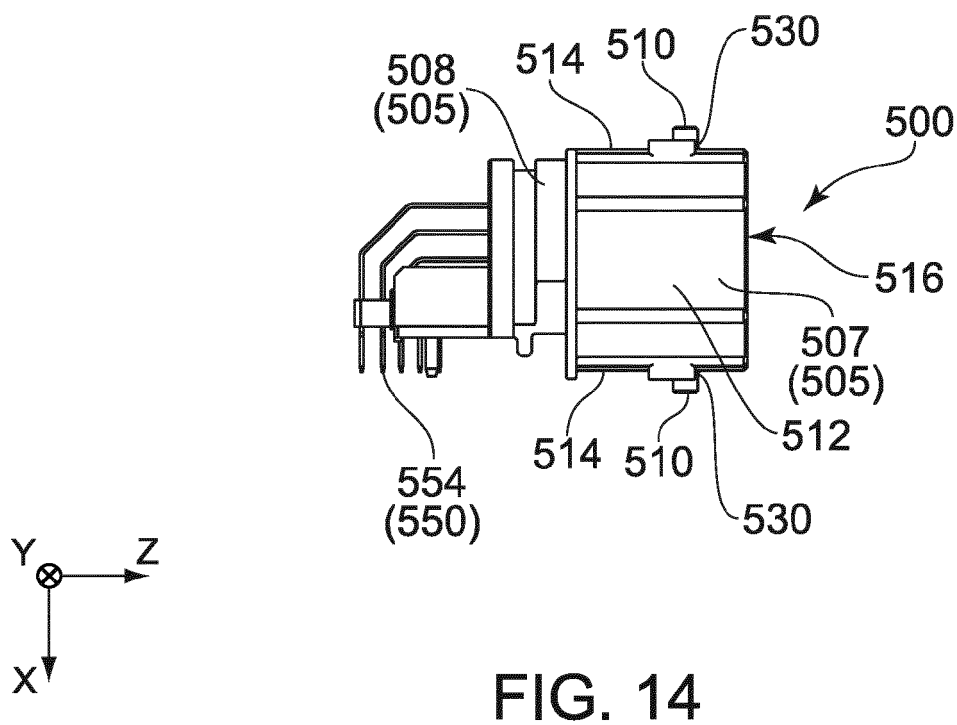
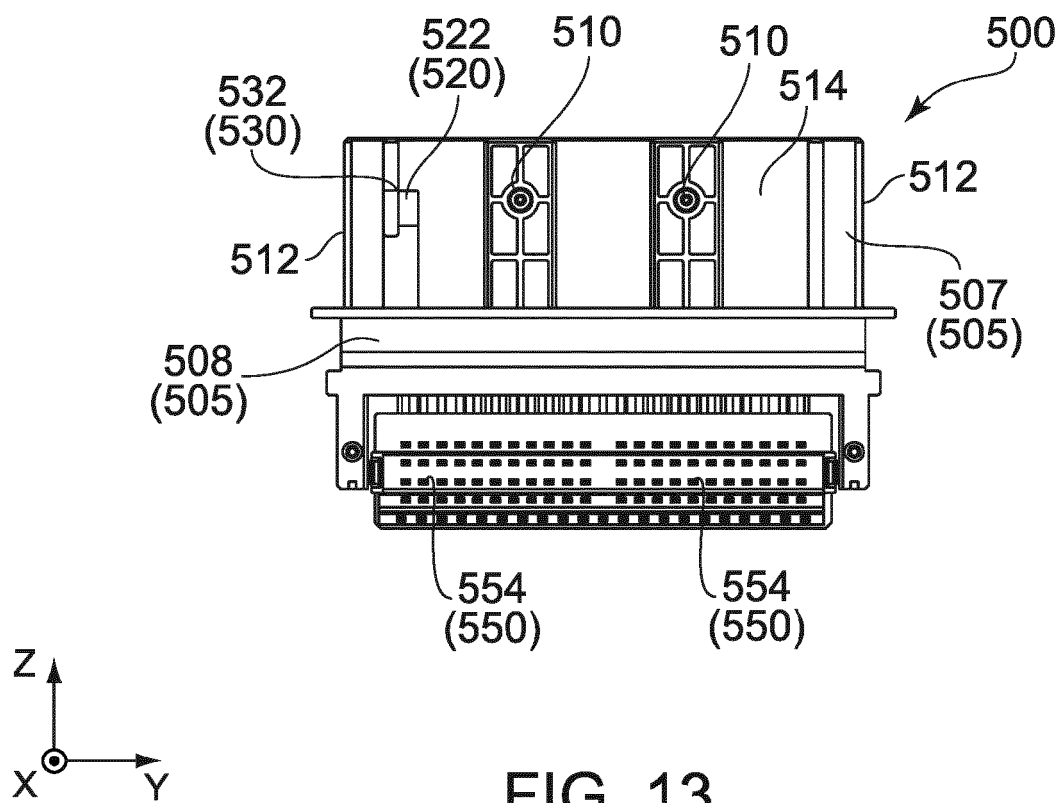


FIG. 12



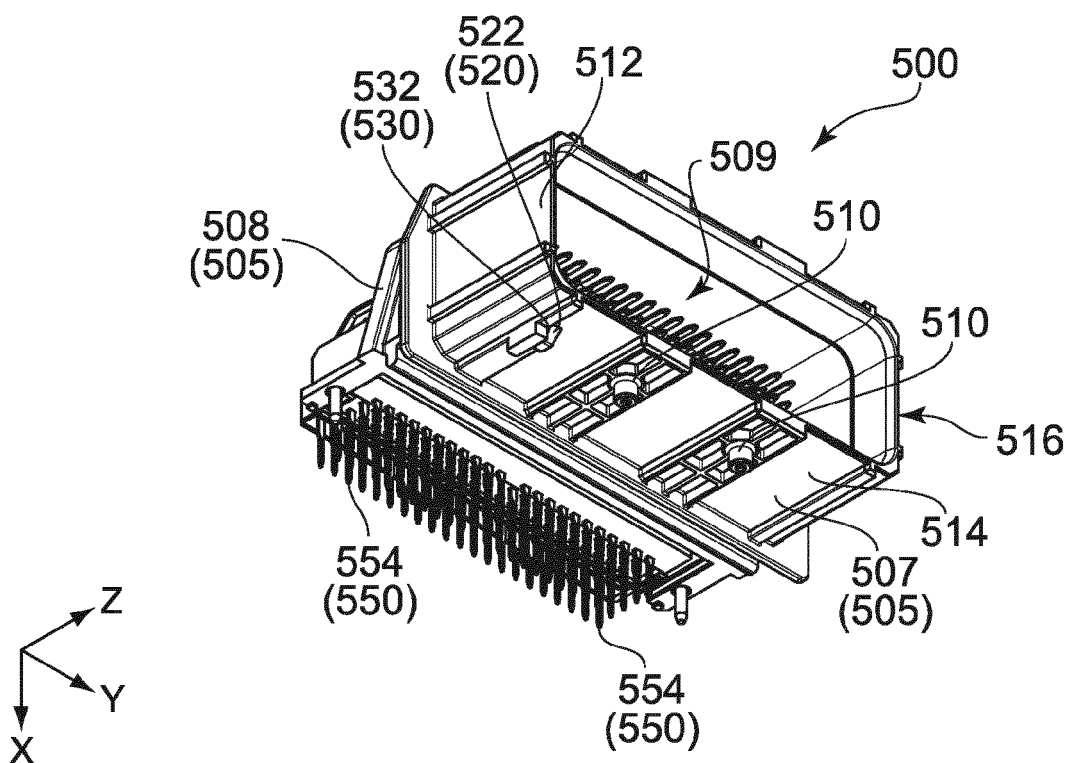


FIG. 15

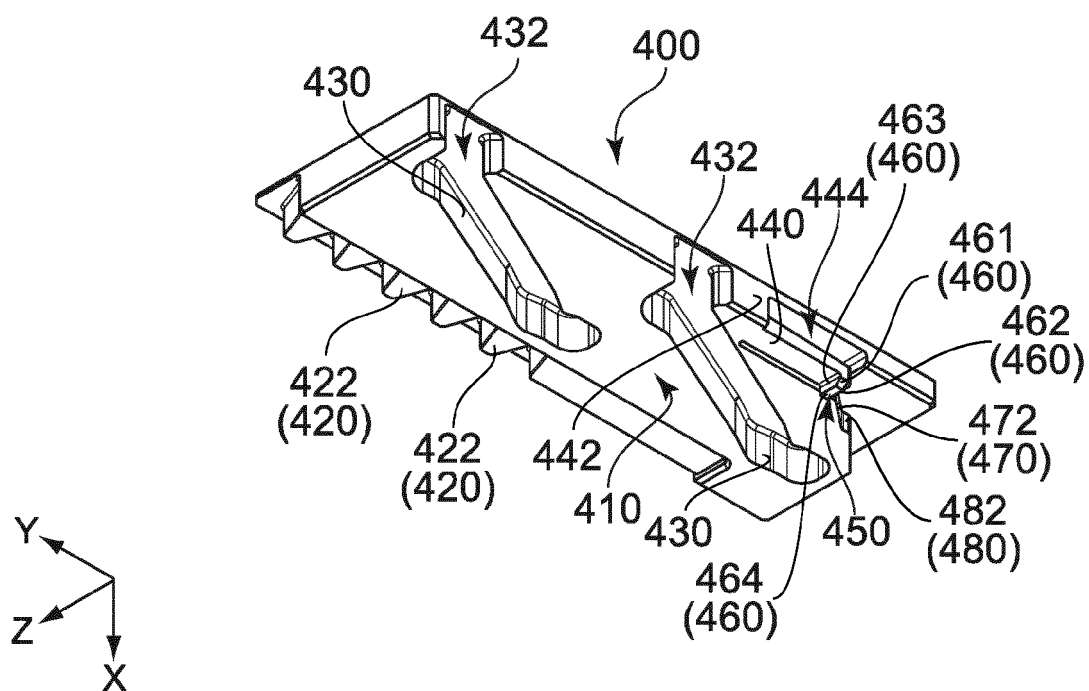


FIG. 16

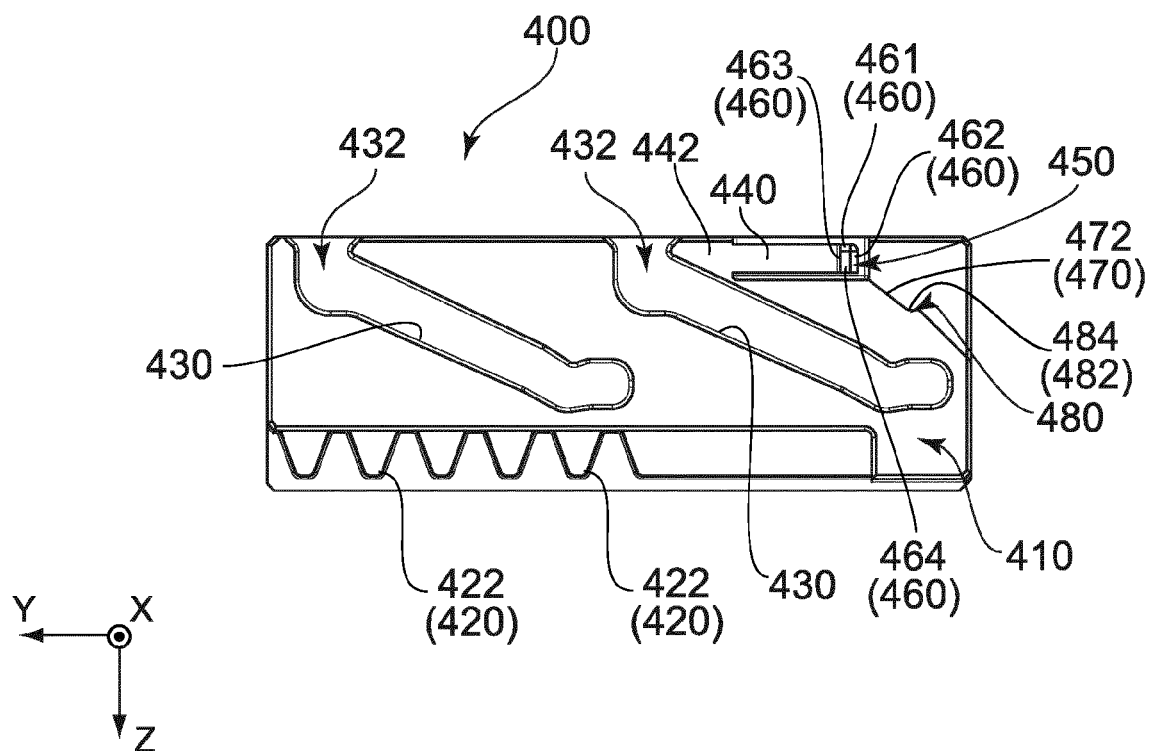


FIG. 17

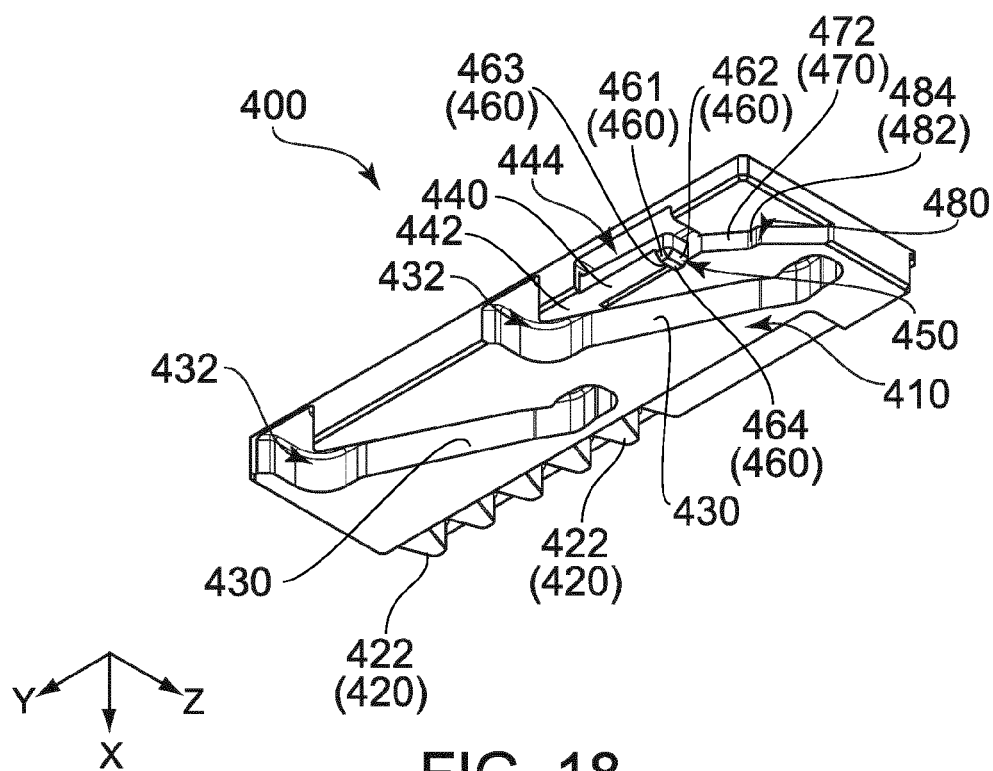


FIG. 18

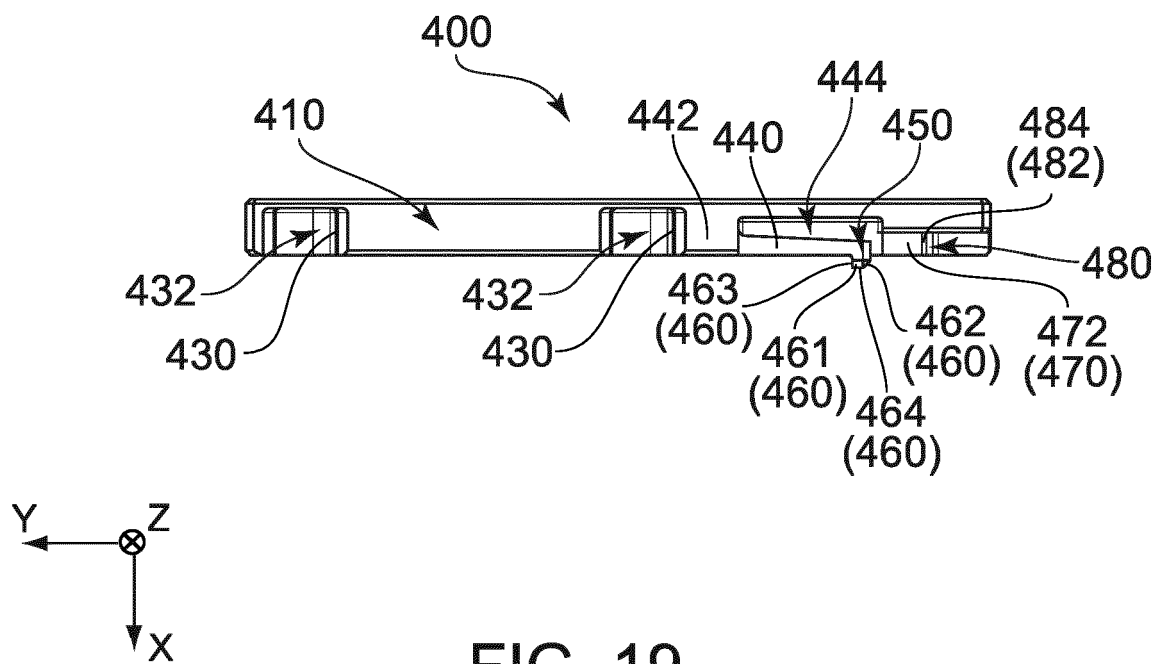


FIG. 19

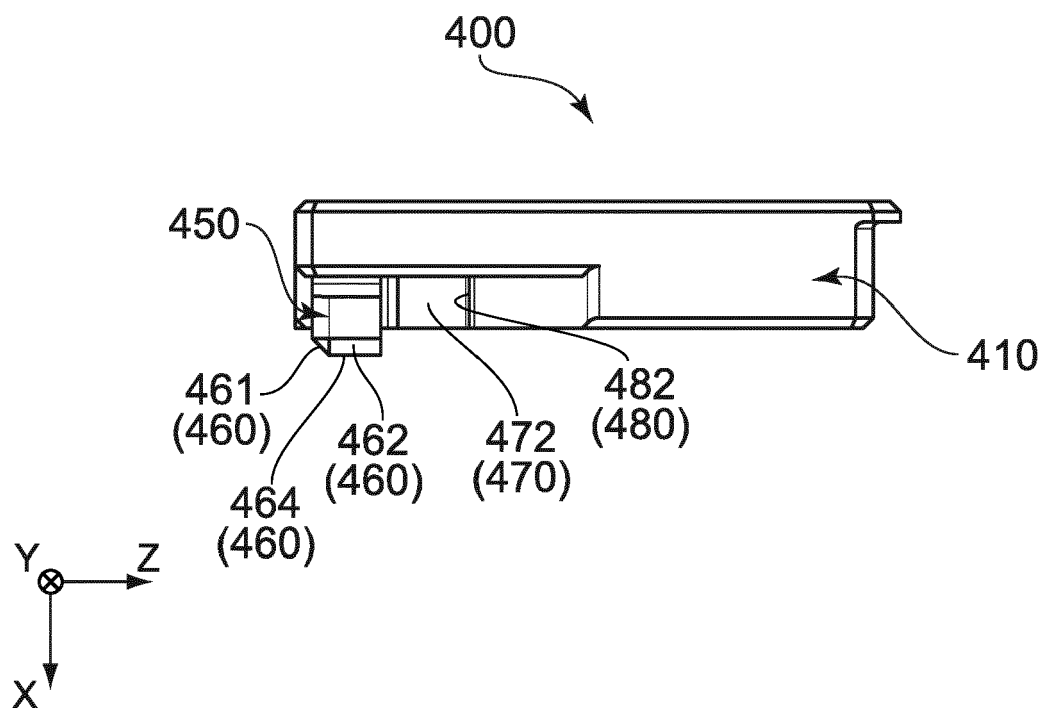


FIG. 20

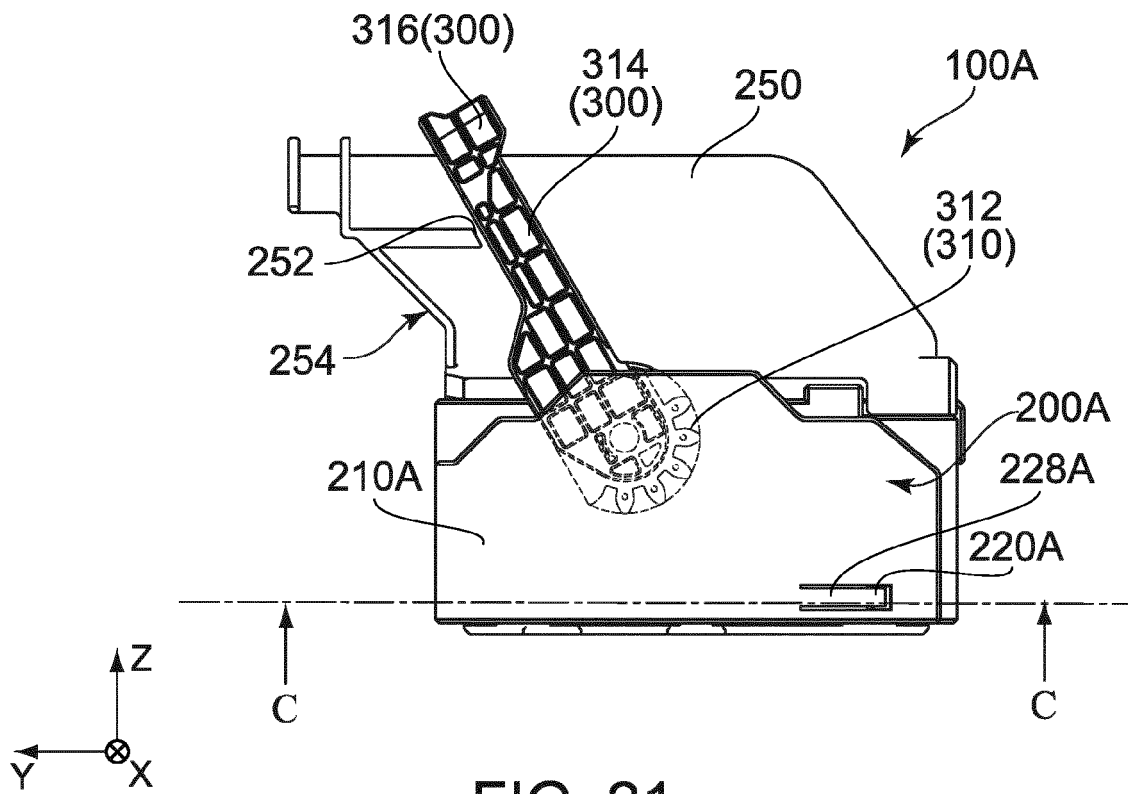


FIG. 21

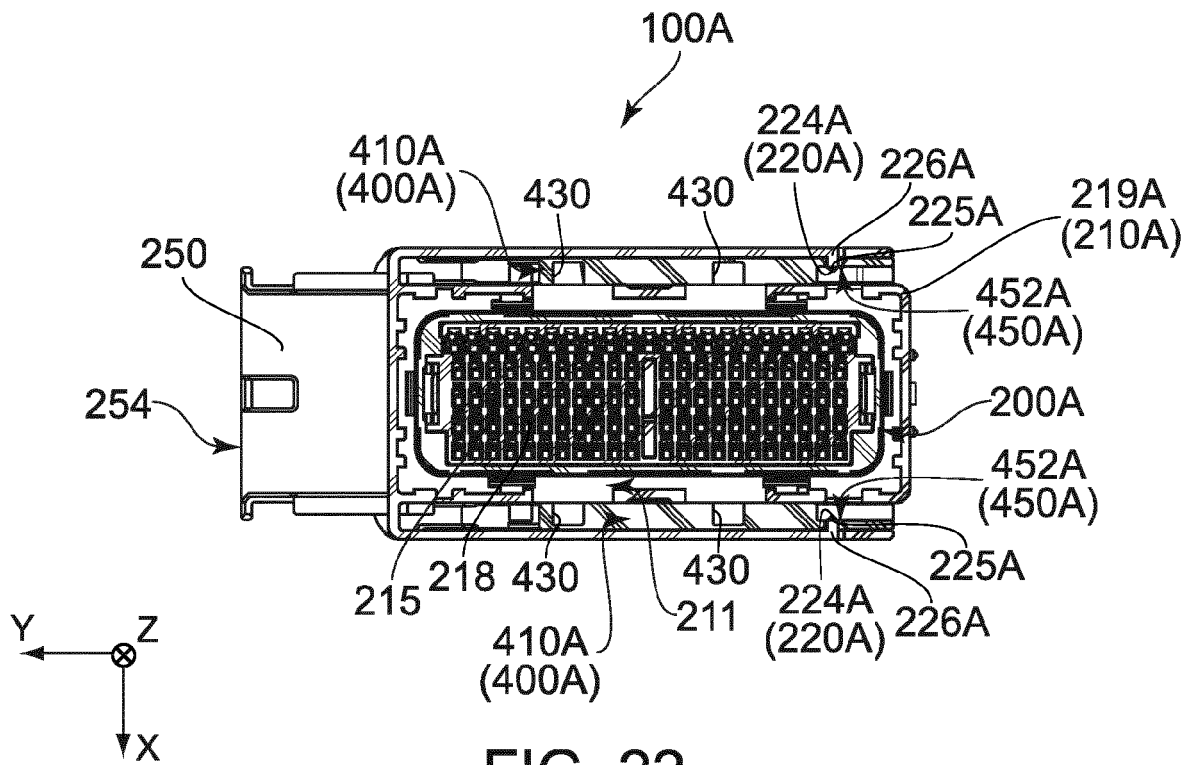
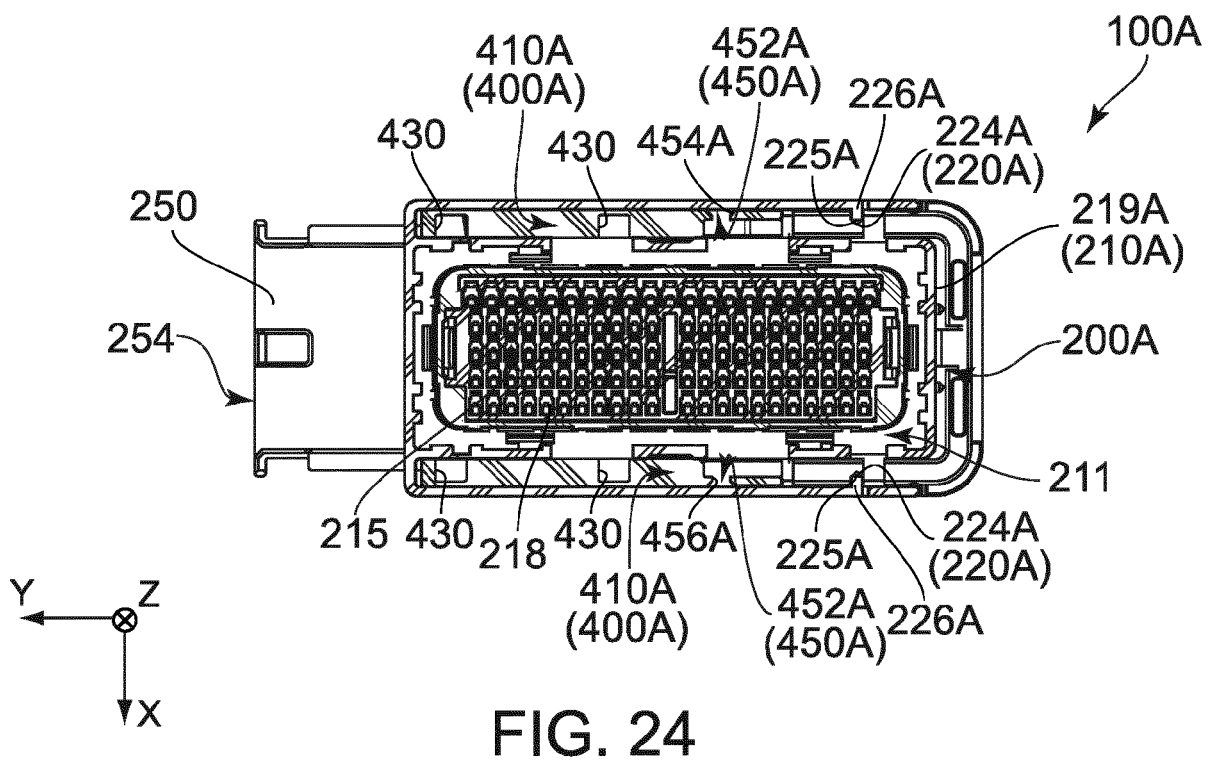
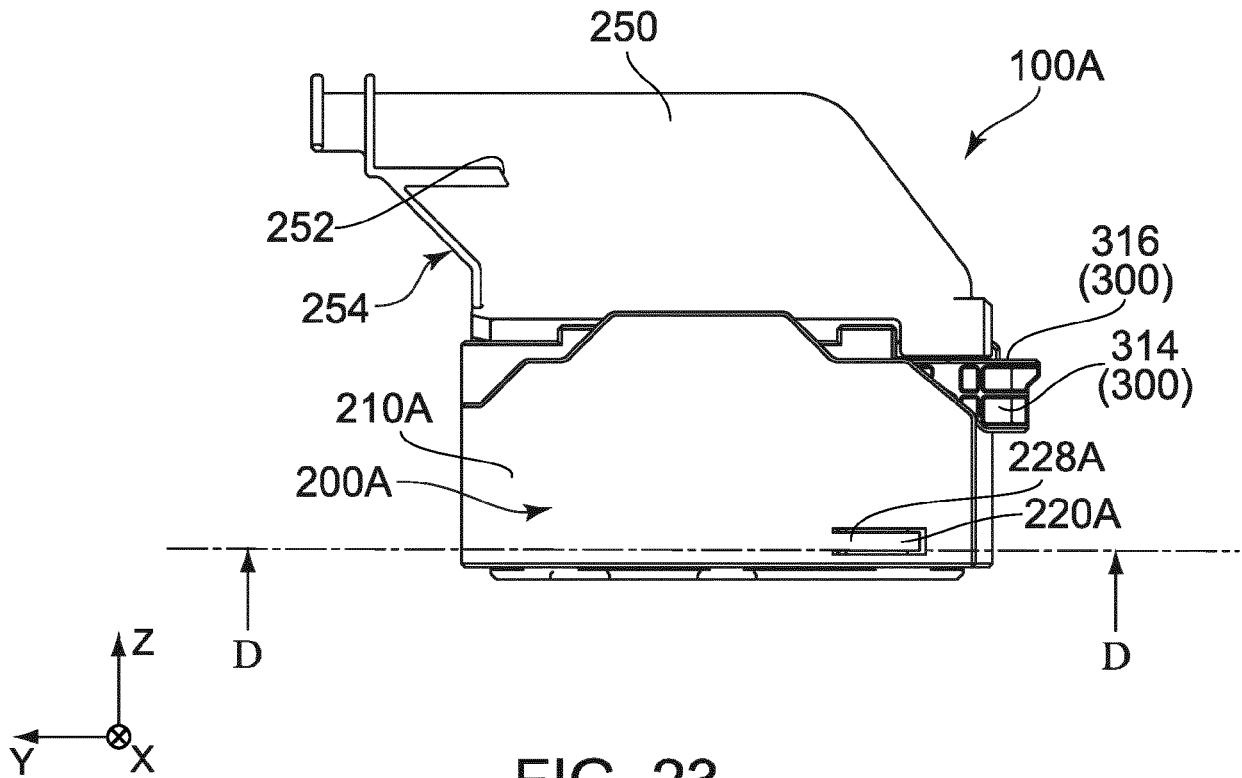
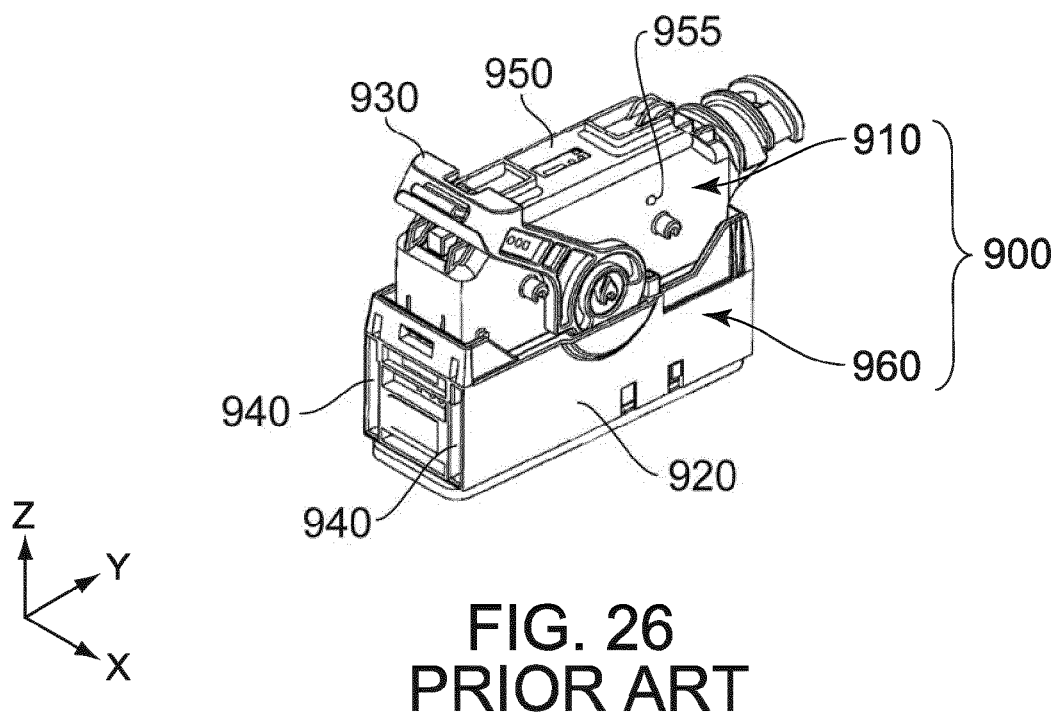
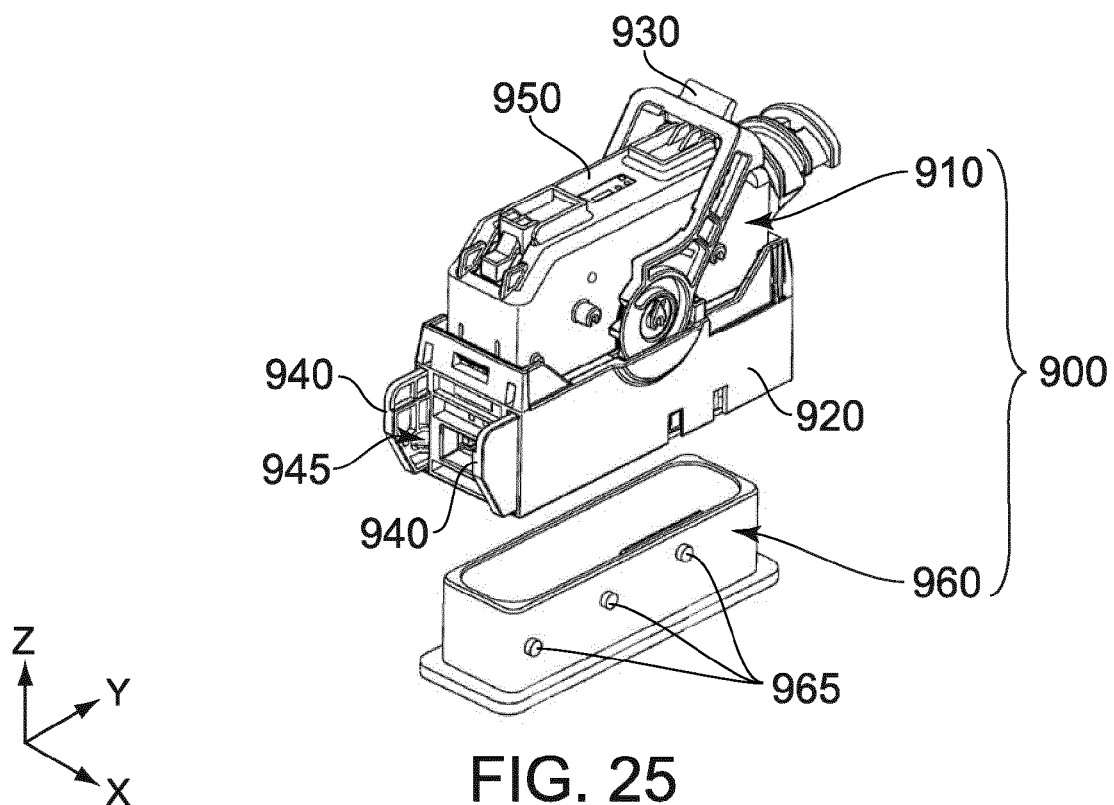


FIG. 22







EUROPEAN SEARCH REPORT

Application Number
EP 17 15 6872

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/106911 A1 (SHARPLES ROBERT J [US] ET AL) 19 May 2005 (2005-05-19)	1-4,11,15,16	INV. H01R13/629
Y	* paragraph [0017] - paragraph [0036]; figures 1-5 *	5-10,12-14	ADD. H01R13/645
Y	US 6 254 407 B1 (BURNS MARK V [US]) 3 July 2001 (2001-07-03) * column 2, line 35 - column 4, line 44; figures 1-7 *	5-10,12-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 August 2017	Examiner Oliveira Braga K., A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 15 6872

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The members are as contained in the European Patent Office EDP file on
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30-08-2017

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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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