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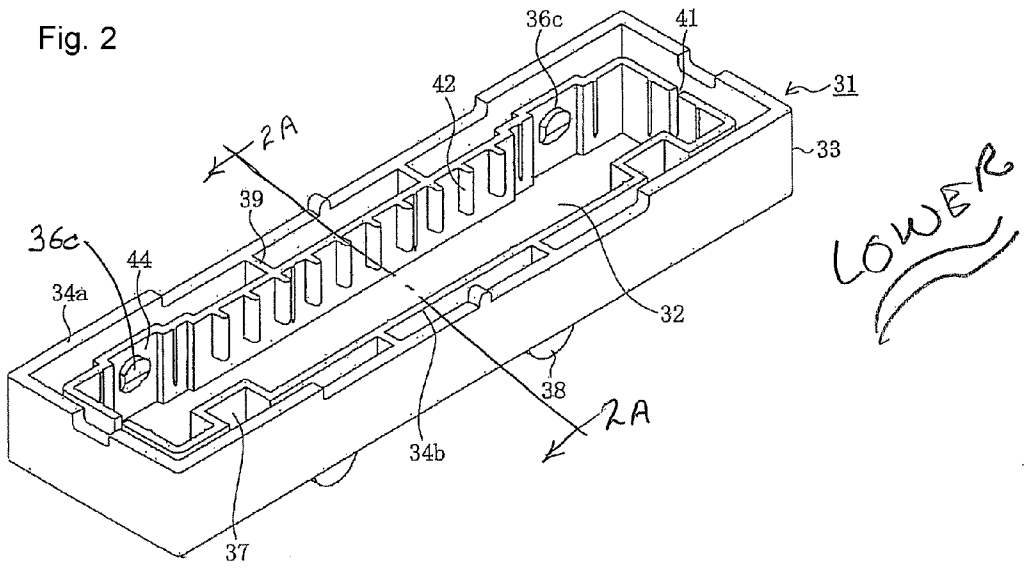
(54) Title: CONNECTOR COVER

Fig. 2




(57) Abstract: A connector cover is provided for imparting tamper-resistant properties to machines such as pachinko or pachinko-slot machines or other devices that can be enhanced with tamper-resistant features. The connector cover is multi-walled and exhibits elasticity due to a balance of structural features and the polymeric material of the cover, particularly its multiple walls. The innermost wall of the cover is shaped and sized and made of a material so as to comply with the outward shape of the wall of the connector to prevent access by a probe.

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# CONNECTOR COVER

## BACKGROUND OF THE INVENTION

The present invention relates to a connector cover. In order to connect a cable to a circuit board such as a printed circuit board, a substrate connector has been conventionally used. Such a substrate connector is mounted on a circuit board and is fitted to a cable connector at an end of the cable.

In recent years, fraudulent actions have increased where a probe such as a wire or a long thin metal needle or the like is used as a tampering tool by forcing the probe into contact with the terminal of a substrate connector connected to the circuit board of a game machine such as a pachinko machine or a pachinko-slot machine. This tampering action creates a fraudulent signal to a signal circuit of the game machine, thus fraudulently operating the machine. To this end, the probe is often inserted between the lower end edge of the side face of the substrate connector mounted on the circuit board and the surface of the circuit board to cause the probe to come into contact with a terminal projecting from the bottom surface of the substrate connector.

In order to prevent such tampering, it has been proposed to mount a plate-like tamperproof-lid in the form of a sheet, or plate around the lower end edge of the side

face of the substrate connector attached to the circuit board. By covering the periphery of the lower end edge of the substrate connector side face with such a lid and having predetermined dimensions, for example, a thickness of at least about 0.2mm, it is possible to prevent a probe from being inserted between the lower end edge of the substrate connector side face and the circuit board surface.

This tamper-proof lid is attached to a circuit board so as to cover the surface of the circuit board around the substrate connector after the substrate connector is attached to the circuit board. With this prior art approach, the tamper-proof lid has an aperture that surrounds the periphery of the substrate connector and is attached to the circuit board with the substrate connector extending through the aperture.

Nevertheless, there remains an unavoidable gap between the inner edge of the aperture and the periphery of the substrate connector, thus leaving the possibility of a probe being inserted into the gap. Therefore, such a technique has been proposed to mount a shielding member onto a circuit board that surrounds the periphery of the substrate connector as well as closing the gap (for example, refer to Japanese Laid-Open Patent Application Publication No. 2006-81714).

FIG. 6 is a cross-sectional view of a typical example of a prior art substrate connector. In FIG. 6, numeral 801 represents a circuit board comprising a conductive trace.

A substrate connector 802 is mounted on the circuit board, and a cable connector connected to a cable (not shown) is fitted into the substrate connector 802. A tamper-proof lid 803 in the form of a plate covers the surface of the circuit board 801 and is attached to an upper part of the circuit board 801. The tamper-proof lid 803 has an aperture and is attached to the circuit board 801 with the substrate connector 802 extending through the aperture.

A shielding member 805 that surrounds the periphery of the substrate connector 802 is also attached to the circuit board 801. The tamper-proof lid 803 has a cylindrical portion 804 extending down from an edge of the aperture and extending downward. This portion 804 engages a groove 806 formed in the shielding member 805.

This prior art structure closes the gap between the aperture in the lid 803 and the periphery of the substrate connector 802 with the shielding member 805, thereby preventing any foul play by which a probe is inserted through the gap and brought into contact with a terminal projecting from the bottom surface of the substrate connector 802.

## SUMMARY OF THE INVENTION

The present invention includes recognition that prior art approaches such as using the conventional shielding member 805 do not successfully address the

tampering problem. Since the cylindrical portion 804 of the tamper-proof lid 803 needs to be engaged in the groove 806 in order to avoid the formation of any gap between the periphery of the substrate connector and the tamperproof-lid 803, the structure of the shielding member 805 is made rather complicated and creates manufacturing difficulties. Additionally, the tamper-proof lid 803 must have the cylindrical portion 804 connected thereto so as to extend down to the aperture edge. This further complicates the structure and creates further manufacturing difficulties.

With more particular reference to this prior art anti-tampering approach, the shielding member 805 must keep its inner peripheral surface in tight contact with the outer peripheral surface of the substrate connector 802. In general, the outer peripheral surface of the substrate connector 802 is not flat but typically has some unevenness due to manufacturing tolerances. If prior art such as this were to attempt to account for such unevenness, it would be necessary to form the inner peripheral surface of the shielding member 805 into a shape complementary to the uneven shape of the outer peripheral surface of the substrate connector 802, thereby creating additional manufacturing difficulties and costs. Unless the inner peripheral surface of the shielding member 805 closely contacts the outer peripheral surface of the substrate connector 802, the insertion of a probe cannot be properly reliably prevented with the approach shown in FIG. 6.

An object of the present invention is, therefore, to solve the above-mentioned problems that the invention has identified as being encountered by the conventional connector cover. The present invention successfully addresses these problems through provision of a connector cover that surrounds at least a portion of the periphery of the connector at its end that faces the substrate onto which the connector is mounted. This connector cover has a side wall exhibiting a multi-wall construction that enables diverse parts to be elastically deformable and simplifies the structure thereof, while allowing the side wall to closely contact the outer periphery of the connector and a bottom surface of a plate-like lid while simplifying and reducing the cost of manufacturing, as compared to prior art structures. The present invention also can exhibit the improvement of enabling repeated attachment and detachment of the connector cover.

In order to achieve the above-mentioned aspects and objects, the present invention provides a connector cover having a main body that surrounds a connector mounted to a substrate at its periphery located on the side at which the connector cover faces the substrate, wherein the main body is provided with a top wall and a side wall having a multiple-wall structure, wherein the side wall is open on the side of the main body that faces the substrate, with the main body part being integrally connected to the top wall at the other side thereof, and wherein an innermost

side wall of the multi-walled side wall tightly contacts the outer peripheral surface of the substrate connector.

In accordance with another embodiment, aspect or object of the present invention, a connector cover is provided that has a main body part arranged to surround a connector mounted on a substrate along the periphery of the connector cover that faces the substrate. The connector cover has at least a portion thereof covered with a plate-like lid, wherein the lid has an aperture formed that surrounds the periphery of the substrate connector, the main body has a top wall and a side wall formed of multiple walls, the top wall contacts the periphery of the aperture along a surface of the lid that faces the substrate; and an innermost side wall component of the side wall tightly contacts the outer periphery of the connector located between the lid and the substrate.

In accordance with a further embodiment, aspect or object of the present invention, a connector cover is provided with a multi-walled side wall that has a double-wall structure made of an outer side wall component and an inner side wall component, wherein an upper end of each of the outer and inner side walls is connected to the top wall.

In accordance with a further embodiment, aspect or object of the present invention, a connector cover is provided with a multi-walled side wall having a portion lying between its outer side wall and its inner side wall in order to define a cavity within the body of the

connector cover.

In accordance with a further embodiment, aspect or object of the present invention, the connector cover inner side wall component includes at least one slit that extends vertically to an opening thereof at a lower end of this inner side wall component to increase the flexibility fo the connector cover.

In accordance with a further embodiment, aspect or object of the present invention, the connector cover main body part is provided with a coupling rib which couples together the outer and inner side wall components of the connector cover.

In accordance with a further embodiment, aspect or object of the present invention, the connector cover is also provided with a main body having a projection capable of closing an opening in the connector.

In accordance with a further embodiment, aspect or object of the present invention, the connector cover is provided with a main body having at least one locking claw, or projection, that is capable of locking a positional relationship between the connector and the connector cover.

In accordance with a further embodiment, aspect or object of the present invention, the connector cover is provided with a top wall thereof that has a flat surface facing the plate-like lid.

The connector cover according to the illustrated embodiments of the present invention surrounds at least the

entire periphery of the substrate connector, and the connector cover has a side wall with a multiple-wall structure. This provides a connector cover having elastically deformable parts and a simple structure allowing the connector cover to closely contact the outer periphery of the connector, which need not be flat but can exhibit unevenness, and this unevenness is accommodated by the deformable character of the cover. This also allows the connector cover to closely contact the bottom surface of the lid. With this approach, the connector cover is easy to manufacture and at low cost, while successfully accommodating repeated attachment and detachment.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an upper perspective view of a connector cover according to an embodiment of the present invention;

FIG. 2 is a lower perspective view of the connector cover of FIG. 1;

FIG. 2A is a cross-sectional view along the line 2A-2A of FIG. 2;

FIG. 3A is an exploded perspective view of a substrate connector, a flat-cable counterpart connector and a connector cover of FIG. 1, viewed from the side of the flat cable;

FIG. 3B is an exploded perspective view of a substrate connector, a counterpart connector and a

connector cover of FIG. 1, viewed from the side opposite of FIG. 3A;

FIG. 4 is a perspective view of a substrate connector to which a counterpart connector is fitted in a state where the substrate connector is mounted on a substrate, according to an embodiment of the present invention;

FIG. 5 is a cross-sectional view taken along the line 5-5 of FIG. 4, illustrating the connector cover of FIG. 1 attached to the substrate connector mounted on the substrate; and

FIG. 6 is a cross-sectional view illustrating a typical example of a substrate connector according to the prior art.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

As required, detailed embodiments of the present invention are disclosed herein while referring to the accompanying drawings; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriate manner, including

employing various features disclosed herein in combinations that might not be explicitly disclosed herein.

In the Figures, numeral 31 represents a connector cover according to the present embodiment. The connector cover 31 is attached so as to cover a substrate connector 1, which is provided as a connector mounted on a later-described substrate 91, at a periphery of a location at an end of the substrate connector 1, which end is located on the side of the substrate 91. The substrate connector 1 is a so-called straight type of receptacle connector. The substrate connector 1 extends vertically with respect to the substrate 91 and has an inner opening that opens upwardly. A counterpart connector 101 (FIG.5) engages the substrate connector 1 perpendicular to the substrate 91. The connector cover 31 is mounted so that its lower end shown in FIG. 1, contacts the surface of the substrate 91. FIG. 2 shows the connector cover inverted from its mounting orientation.

While the substrate and counterpart connectors 1, 101 may be used in any application, the embodiments shown herein are preferably used in gaming machines such as pachinko machines and pachinko-slot machines, and the substrate 91 is typically a printed circuit board for a game machine. In gaming machines, for example, fraudulent action is committed where tampering occurs by inserting a probe (171, 172 & 173 in FIG. 5) between the lower end edge of the side surface of the substrate connector 1 and the

surface of the substrate 91 so as to bring the probe(s) into contact with a later-described terminal 61 protruding from the bottom surface of the substrate connector 1, thus generating a fraudulent signal to the circuitry of the gaming machine. To assist in preventing such tampering, a later-described plate-like lid 92 is attached so as to cover at least a portion of the substrate 91.

Various types of electrical or electronic devices typically are mounted on the substrate 91 so that a predetermined spacing exists between the lid 92 and the surface of the substrate 91. The lid 92 has an aperture 93 that surrounds the periphery of the substrate connector 1 and is mounted on the substrate 91 with the substrate connector 1 extending through the aperture 93.

There is an unavoidable gap left between the inner edge of the aperture 93 and the periphery of the substrate connector 1, thus producing the possibility of tampering by inserting a probe into the gap. Thus, the connector cover 31 is attached so as to surround the substrate connector 1 at the periphery in the vicinity of one end of the substrate connector 1 that is located at a position opposing the substrate 91 in order to prevent such tampering by inserting a probe into the gap.

In this embodiment, representations of directions such as up, down, left, right, front, rear, and the like, used for explaining the structure and movement of each part of the connector cover 31, the substrate connector 1, the

counterpart connector 101, and the like, are not absolute, but relative. These representations are appropriate when the connector cover 31, the substrate connector 1, the counterpart connector 101, and the like, are in the position shown in the figures. However, if the positions or orientations of the connector cover 31, the substrate connector 1, the counterpart connector 101, and the like, change, it is understood that these representations are modified according to any such change in the position or orientation.

In this embodiment, the connector cover 31 is a member integrally formed of an insulating material such as a synthetic resin and has a connector-accommodating aperture 32 of a substantially rectangular shape and a main body part 33 as a continuous wall member surrounding the periphery of the connector-accommodating aperture 32. The illustrated main body part 33 has a generally rectangular shape comprised of mutually opposing two sets of linear wall members coupled to each other. The main body part 33 defines the outer periphery of the connector-accommodating aperture 32. The connector-accommodating aperture 32 is formed to penetrate the main body part 33 in its width direction, that is in the vertical direction.

The connector cover 31 exhibits flexibility due to the structural features discussed herein and/or due to the material out of which the cover is made. Typically, the structural features are of greater importance in achieving

the needed tamper-inhibiting characteristics. Concerning material, same typically is a synthetic resin that is elastic and compressible and that exhibits flexibility but also adequate stiffness so that tamper-inhibiting features of the structure are not lost. Examples of synthetic resin materials useful in this regard include polymeric resins, for example acrylonitrile-butadiene-styrene (ABS) resins, acrylonitrile-styrene (AS) resins, nylons or other polyamides, copolymers having a relatively high degree of hardness, and the like.

The main body part 33 has a multiple-wall structure having two side walls 34 surrounding the periphery of the connector-accommodating aperture 32. In other words, the main body part 33 has side walls 34 of multiple-wall structure. The number of wall components constituting the side walls 34 is at least two and may be, for example, three or four, although in the following description the number of wall components of each side wall 34 is two, and the main body part 33 has a double-wall structure for ease of explanation. In this case, the main body part 33 has an outer side wall component 34a as the outermost side wall component and an inner side wall component 34b as the innermost side wall component, as best shown in FIG. 2. The outer and inner side wall components 34a, 34b are respectively of a substantially rectangular shape comprised of mutually opposing two sets of linear plate members coupled to each other.

The main body part 33 has a top wall 35 connecting the upper ends of the outer and inner side wall components 34a, 34b, as shown in FIG. 1. The top surface of the top wall 35 is almost flat and abuts onto the surface of the plate-like lid 92 facing the substrate 91, that is the bottom surface of the plate-like lid 92. The side edges on both sides of the top wall 35 are integrally connected so as to be almost orthogonal to the upper end edge of the outer side wall component 34a and the inner side wall component 34b. Thus, the outer side wall component 34a and the inner side wall component 34b each have only their upper ends connected to the top wall 35 and have free lower ends to allow flexible and elastic deformation.

In this illustrated embodiment, as shown in FIG. 2, a coupling rib 39 for coupling the outer side wall component 34a and the inner side wall component 34b is formed in a position corresponding to the midway of each of the mutually opposing long sides of the main body part 33. The coupling rib 39 extends vertically, and both side edges are connected to the outer side wall component 34a and the inner side wall component 34b. The outer and inner side wall components 34a, 34b are respectively constrained by the coupling rib 39 so that their flexibility is lowered and are less likely to be deformed. This is because the outer and inner side wall component 34a, 34b are in the shape of a long narrow panel in a portion corresponding to the mutually opposing long sides of the main body part 33

so that the rigidity is lowered. However, this can result in excessive flexibility, in which case it can be advantageous to suppress this enhanced flexibility. By suitably arranging the coupling rib 39, it is possible to lessen the flexibility of the outer and inner side wall components 34a, 34b. It is possible to adjust the flexibility of the outer and inner side wall components 34a, 34b as required by selecting a desired number of the coupling ribs 39, by properly positioning the regions in which they are arranged, by choosing the thickness, and the like, as required to achieve the desired level of flexibility while not thwarting any of the tamper-resistant objectives of the present invention.

In this embodiment, as shown in FIGS. 1 and 2, a slit 41 is cut into a portion of the inner side wall component 34b nd is located at a position corresponding to midway of each of the mutually opposing short sides of the main body part 33. The slit 41 extends vertically and has one end open at the lower end of the inner side wall component 34b. The inner side wall component 34b is thus split by the slit 41 so that its flexibility is enhanced and deformation of the inner side wall component 34b is more likely.

This is because each end portion of the inner side wall component 34b is in the shape of a short rectangle with right and left side edges constrained by the mutually opposing short sides of the main body part 33, so that

without the slit 41 this end portion of the inner side wall component 34b can be too rigid and flexibility is below what is needed for enhanced operation. Addition of the slit provides increased flexibility as desired. Therefore, when the slit 41 is provided, it is possible to make adjustment to increase the flexibility of the end portions of the inner side wall component 34b and thus of the inner side wall component in total. It is to be understood that the flexibility of the inner side wall component 34b can be adjusted, as required, by varying the number of the slits 41, including varying their locations, their respective lengths and widths, and the like as required. Optionally, it is also possible to adjust the flexibility of the outer side wall component 34a by forming a slit 41 on the outer side wall component 34a, thereby increasing the flexibility of the outer wall component 34a and of the multi-walled side wall of the connector cover.

An engaging projection part 37 is formed on the inner side wall component 34b of the side wall. This engaging projection parts engaged with a recessed part 19 formed on the later-described housing 11 of the substrate connector 1. In addition, a closing projection or lug 38 is provided for engaging with the opening 12 formed on the housing 11 and for closing the opening or slot 12, with an engaging recessed part 44 engaging a projecting part 18 formed on the housing 11, and with a protruding portion 42 engaging a recessed groove 17 formed in the housing 11.

Each illustrated lug 38 has a stud 45 mounted near the end of the lug and project outwardly to be received within slot 12 which can be provided to provide an upper limit for compressing the connector cover 31.

Projections on the inside of the connector cover 31 are received within slots of the substrate connector 1 to provide an interference fit when the cover and connector are joined together. This is illustrated by projections in the form of what we term as "locking claw projections". A first locking claw 36a and a third locking claw 36c are formed in the inner side wall component 34b, and each engages or projects into an outwardly opening lock hole 16 formed in the housing 11 and these serve to lock the connector cover 31 in place on the substrate connector 1. A second locking claw or horizontal lug 36b, formed in the inner side wall component 34a, typically at its center as illustrated, engages the edge of an opening 13 provided in the housing 11. This horizontal lug 36b can provide a lower limit for compression of the connector cover 31. In the illustrated example, the first locking claw 36a is provided in the engaging projection part 37, and the third locking claw 36c is provided in the engaging recessed part 44. The first locking claw 36a, second locking claw 36b and third locking claw 36c may be formed in any region and the number of these projections may be selected and set as required. When the first locking claw 36a, second locking claw 36b and third locking claw 36c are described herein in

a consolidated fashion, the claws are described as a locking claw 36.

Next, the substrate connector 1 and the counterpart connector 101 according to this embodiment will be described. FIG. 3A and FIG. 3B are exploded perspective views of a substrate connector 1, a counterpart connector 101 and a connector cover 31 described herein. In the illustrated example, the substrate connector 1 is so-called a header connector that is an article conforming to the U.S. Military Specification. A counterpart connector 101 is so-called a flat ribbon connector that is also an article conforming to the U.S. Military Specification.

The illustrated counterpart connector 101 is comprised of a counterpart housing 111 integrally formed of an insulating material such as a synthetic resin, and a counterpart retainer 121 is made of an insulating material and is coupled to the counterpart housing, typically being integrally formed with the counterpart housing 111. A flat cable 191, also referred to as a ribbon cable, has its end formed of multiple conductors connected in parallel and is connected to the counterpart connector 101.

The substrate connector 1 has a housing 11 integrally formed of an insulating material such as a synthetic resin, and conductive terminals 61 that penetrate the bottom plate of the housing 11. The terminals 61 have a tail part 62 extending downward beyond the bottom plate and an upper part that contacts a counterpart terminal 161

of the counterpart connector 101, with the tail part 62 being connected to a substrate 91. The terminal 61 is fitted into a terminal fitting hole on the bottom plate of the housing 11.

A holding arm member 21 for holding the counterpart connector 101 is rotatably mounted on each of both sides of the housing 11. A holding claw 24 is formed at the free end of the holding arm member 21. When the counterpart connector 101 is fitted into the substrate connector 1, the holding claw 24 is engaged with a holding projection 124 formed at each of both sides of the top surface of the counterpart housing 111. This reliably holds a fit of the counterpart connector 101 into the substrate connector 1 to prevent unwanted disengagement.

A projecting part 18 engaged with the engaging recessed part 44 of the connector cover 31 is formed on the side wall of the housing 11. A recessed groove 17, which extends vertically and engages the protruding portion 42 on the connector cover 31, is formed in the area of the lower end of the side wall of the housing 11. A lock hole 16, which engages the third locking claw 36c on the connector cover 31, is formed in the projecting part 18.

Next, the connector cover 31 will be described, with particular reference to FIG. 4 and FIG. 5. While the illustrated substrate 91 is a circuit board used in gaming machines such as pachinko machines and pachinko-slot machines in this embodiment, the substrate may be a circuit

board used in a computer, a vending machine, an electrical appliance, or the like, and may be a circuit board used in any kind of electrical or electronic equipment. A conductive trace (not shown) and through-holes 94 are formed on the substrate 91. As generally appreciated, the through-holes 94 penetrate the substrate 91 in its width direction and are used for electrical connection to the conductive trace.

The substrate connector 1 is mounted on the substrate 91 so the bottom surface of its housing 11 opposes the top surface of the substrate 91. (FIG. 5.) With this arrangement, the tip of the terminal tail parts 62 extend downwardly into a corresponding through-hole 94. This secures the substrate connector 1 on the substrate 91 in a predetermined orientation. As shown in FIG. 5, the respective tips of the terminal tail parts 62 penetrate the respective through-holes 94 and protrude from the rear surface, and each tail part 62 is fixed to the through-hole 94 and substrate 91 by way of soldering, or the like.

The connector cover 31 is attached so as to surround the connector 1 at the periphery of the lower end of the connector 1. In this case, the engaging projecting parts 37, the closing projections 38, the engaging recessed parts 44 and the protruding portions 42 of the connector cover 31 engage the recessed parts 19, the openings 12, the projecting parts 18 and recessed grooves 17 formed on the housing 11 of the connector 1, respectively. Thus, the

recessed parts 19, the openings 12, the projecting parts 18 and the recessed grooves 17 of the housing 11 of the substrate connector 1 are sealed by the engaging projecting parts 37, the closing projections 38, the engaging recessed parts 44 and the protruding portions 42 of the connector cover 31. The inner side wall component 34b of the connector cover 31 has appropriate flexibility and elastically deforms to conform to the outer shape of the connector housing 11 and thus tightly contacts the outer periphery of the housing 11. The locking claw 36 of the cover 31 engages the housing lock hole 16 to lock the cover 31 in place with respect to the connector 1. With this arrangement, no gap appears between the periphery of the lower end of the connector 1 and the cover 31, thereby adequately preventing tampering by insertion of a probe from the outside of the machine. The lower end of each of the outer and inner side wall components 34a, 34b of the connector cover 31 closely contact the surface of the substrate 91.

The plate-like lid 92 is attached so as to cover the upper surface of the substrate 91 and so that the substrate connector 1 passes through the aperture 93. The lid 92 is a thin plate made of an insulating resin such as acrylic or a sheet made of an insulating resin such as polyimide and may be of any type as long as it is a thin plate-shaped or sheet-shaped plate member made of an insulating material. The dimension of the lid 92 in vertical or horizontal

directions may be any dimension as long as the lid 92 is sized and shaped to surround the periphery of the substrate connector 1. The outer peripheral part of the aperture 93 and the bottom surface of the lid 92 contacts with the top wall 35 of the connector cover 31. When the top wall 35 is pressed down toward the substrate 91 by the lid 92, the outer and inner side wall component 34a, 34b are elastically deformed to produce an upward spring force, which energizes and urges the top wall 35 toward the lid 92. This brings the top surface of the top wall 35 into close contact with the bottom surface of the lid 92. No gap appears between the lid 92 and the cover 31 in the periphery of the aperture 93, and thus tampering obtained by insertion of a cheating probe is reliably prevented.

The counterpart connector 101 mates with the substrate connector 1. Counterpart terminals 161 are connected at one end to each conductor of the flat cable 191 and at the other end to the connector terminals 61. This brings each conductor of the flat cable 191 into electrical contact with corresponding traces on the substrate 91. The holding arm member 21 is in position to hold the counterpart connector 101, and the holding claw 24 engages the holding projection 124 formed on both sides of the top surface of the counterpart housing 111. This reliably maintains proper fitting of the counterpart connector 101 into the substrate connector 1, and thus appropriately prevents both substrate connector 1 and

counterpart connector 101 from being unintentionally disengaged.

In this embodiment, the main body part 33 of the cover 31 is provided with a top wall 35 and a side wall 34 of a multiple-wall structure. The top wall 35 tightly abuts against the outer peripheral part of the aperture 93 in the surface of the lid 92 facing the substrate 91. The inner side wall component 34b as the innermost side wall of the multi-walled side wall 34 abuts against the outer peripheral surface of the substrate connector 1 between the lid 92 and the substrate 91. In this case, the multiple-wall structure of the side wall 34 provides appropriate flexibility so that the inner side wall component 34b can be elastically deformed so as to conform to the outer shape of the substrate connector 1. Thus, no gap appears between the inner side wall component 34b of the cover 31 and the outer peripheral surface of the substrate connector 1, and thus possible tampering by insertion of a probe can be appropriately prevented. The side wall 34 is elastically deformed to produce an upward spring force, which energizes the top wall 35 toward the lid 92. No gap appears between the lid 92 and the cover 31 in the periphery of the aperture 93 and thus possible tampering by insertion of a probe can be appropriately prevented. Furthermore, the side wall 34 is elastically deformed so that attachment/detachment of the cover 31 is facilitated, thus allowing the cover 31 to be repeatedly attached or detached.

With further reference to the double-wall structure of an illustrated embodiment of the side wall 34, the top ends of the outer and inner side wall components 34a, 34b are connected to the top wall 35. This allows the outer and the inner side wall components 34a, 34b to elastically deformed in a flexible manner.

The portion between the outer side wall component 34a and the inner side wall component 34b is hollow. This reduces the thickness of each member constituting the connector cover 31. It is thus possible to mold the cover 31 with easy and high accuracy and uniformly form the thickness of each member and therefore occurrences of warpage and generation of shrinking marks can be avoided.

Furthermore, the inner side wall component 34b is illustrated with a slit 41 extending vertically and having one end open at the lower end of the inner side wall component 34b. This makes it possible to make adjustment so as to increase the flexibility of the inner side wall component 34b, as generally discussed herein.

The main body part 33 is provided with a coupling rib 39 for coupling the outer side wall component 34a and the inner side wall component 34b. This makes it possible to adjust the flexibility of the outer side wall component 34a and/or of the inner side wall component 34b as required or desired.

Furthermore, the main body part 33 is provided with a closing projection 38 for closing the opening 12 in the

substrate connector 1. Therefore, no gap appears between the substrate connector 1 and the connector cover 31 and thus, tampering by insertion of a probe can be appropriately prevented.

FIG. 5 includes illustrations of locations at which tampering activity could be attempted. Probes (171-173), partially broken away, are shown at locations above the top of the plate-like lid 92. The right side of FIG. 5 shows a wide wall of the cover 31 with a stepped configuration that prevents easy insertion of a probe 171 into the space between the lid 92 and the substrate connector 1. Similarly, the left side shows the cover 31 to prevent easy insertion of probe 172 into the space between the lid 92 and the substrate connector 1. The left side of FIG. 5 also shows the cover 31 raised and "reverse stepped" to extend upward through the opening in the lid 92 through which the raised step projects to prevent access of a probe 173 into the machine.

While in this embodiment, the connector 1 and counterpart connector 101 are respectively a header connector and a flat ribbon connector conforming to the U.S. Military Specification, the connector 1 and counterpart connector 101 are not limited thereto but may be of any type.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present

examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein. Numerous modifications may be made without departing from the disclosure, including those combinations of features that are individually disclosed or claimed herein.

**CLAIMS**

1. A connector cover comprising a main body part arranged to surround a connector having a substrate-facing side that is arranged to mount on a substrate, the main body part being arranged to surround the connector outer periphery surface, wherein:

the main body part is provided with a top wall and a side wall of a multiple-walled structure having an innermost side wall component;

said multiple-walled side wall is open at one side thereof located on a side of said main body part that faces the substrate and is integrally connected to the top wall at the other side thereof; and

said innermost side wall component of the side wall is in contact with the connector outer periphery surface along at least the substrate-facing side thereof.

2. A connector cover comprising a main body part arranged to surround a connector having a substrate-facing side that is mounted on a substrate having at least a portion covered with a plate-like lid, the main body part being arranged to surround the connector outer periphery surface, wherein:

the plate-like lid has an aperture formed to surround a periphery of the connector;

the main body part is provided with a top wall and a side wall of a multiple-walled structure having an innermost side wall component;

the top wall is in contact with an outer peripheral part of the aperture in a surface of the plate-like lid that faces the substrate; and

said innermost side wall component of the side wall is in tight contact with the connecter outer peripheral surface that is located between the plate-like lid and the substrate.

3. The connector cover according to claim 1 or 2, wherein: the multiple-walled side wall has a double-wall structure made of an outer side wall component and said innermost side wall component; and the upper end of each of said outer and innermost side wall components is connected to the top wall.

4. The connector cover according to claim 3, wherein a portion lying between the outer side wall component and the innermost side wall component is formed to define a cavity.

5. The connector cover according to any of claims 1-4, wherein said innermost side wall component has a slit extending vertically and ending at one end thereof opening at a lower end of the innermost side wall component.

6. The connector cover according to any of claims 1-5, wherein the main body part is provided with a coupling rib that couples the outer side wall component and the innermost side wall component together.

7. The connector cover according to any of claims 1-6, wherein the main body part is provided with a projection capable of closing a slot in the connector.

8. The connector cover according to claim 7, wherein said closing projection is a lug that provides an upper limit for compression of the connector cover.

9. The connector cover according to claim 8, wherein said lug includes a projecting stud received within the slot in the connector.

10. The connector cover according to any of claims 1-9, wherein the main body part is provided with a locking claw capable of locking a positional relationship between the connector and the connector cover.

11. The connector cover according to claim 10, wherein more than one said locking claw is provided, and one of said locking claws provides a lower limit for compression of the connector cover.

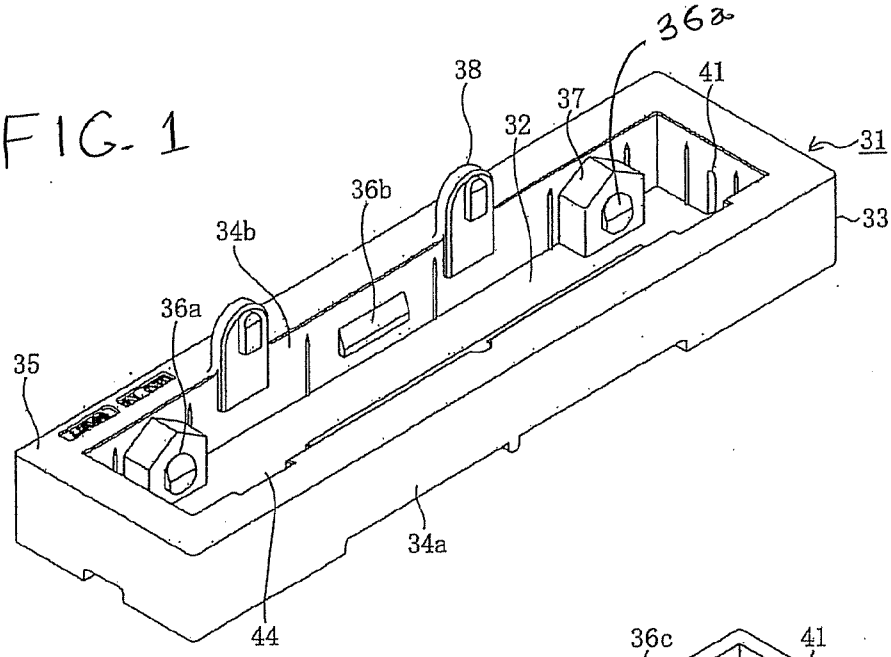
12. The connector cover according to any of claims 2-11, wherein the top wall has a flat surface facing said the plate-like lid.

13. The connector cover according to any of claims 1-12, wherein said innermost side wall component is elastically deformable to tightly contact the connector outer peripheral surface.

14. The connector cover according to claim 13, wherein said innermost side wall component is made of an elastically deformable synthetic resin that exhibits flexibility to tightly contact the connector outer peripheral surface and exhibits stiffness adequate to maintain tamper resistance, said synthetic resin selected from the group consisting of ABS resins, AS resins, nylons, polyamides, copolymers having a relatively high degree of hardness, and combinations thereof.

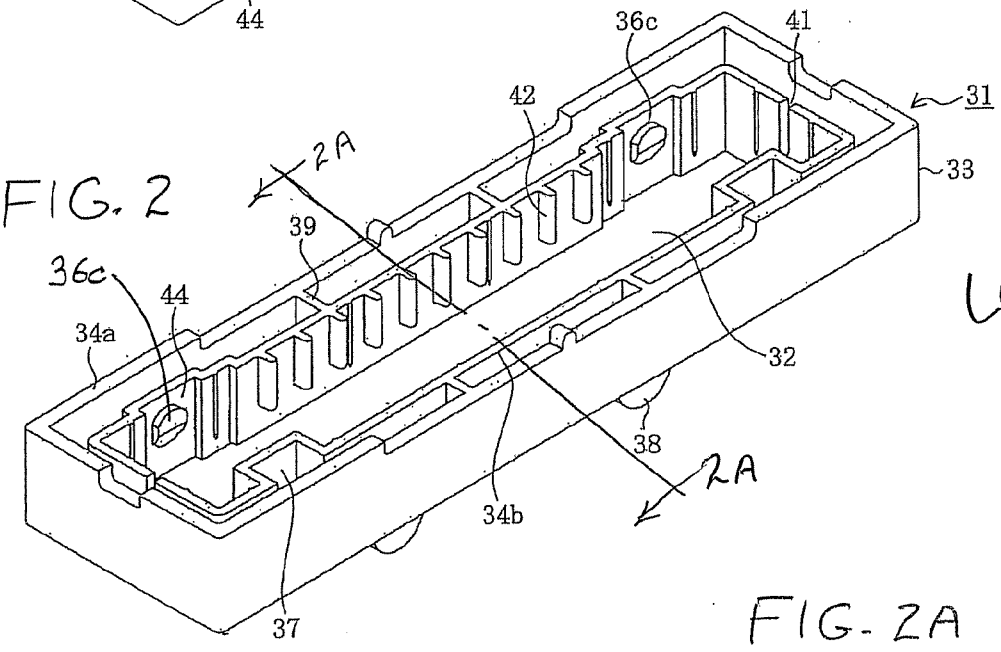
15. The connector cover according to claim 1 or 2, wherein said side wall component has an outer side wall component and slit extending vertically and ending at one end of said outer side wall component opening at a lower end thereof.

FIG. 1



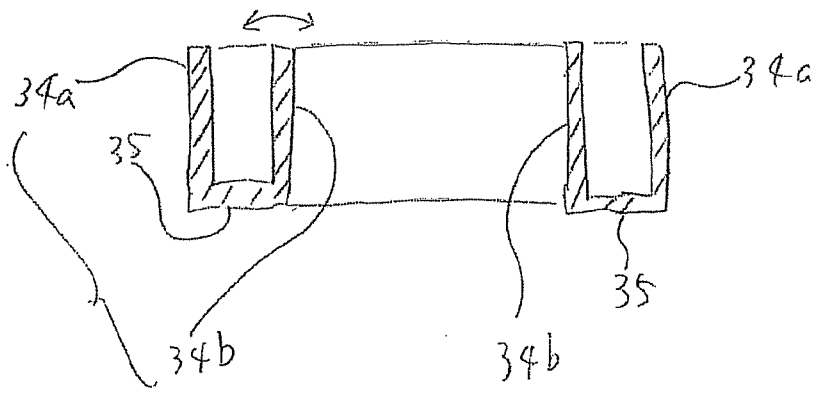

UPPER

FIG. 2




LOWER

FIG. 2A




X-SECTION

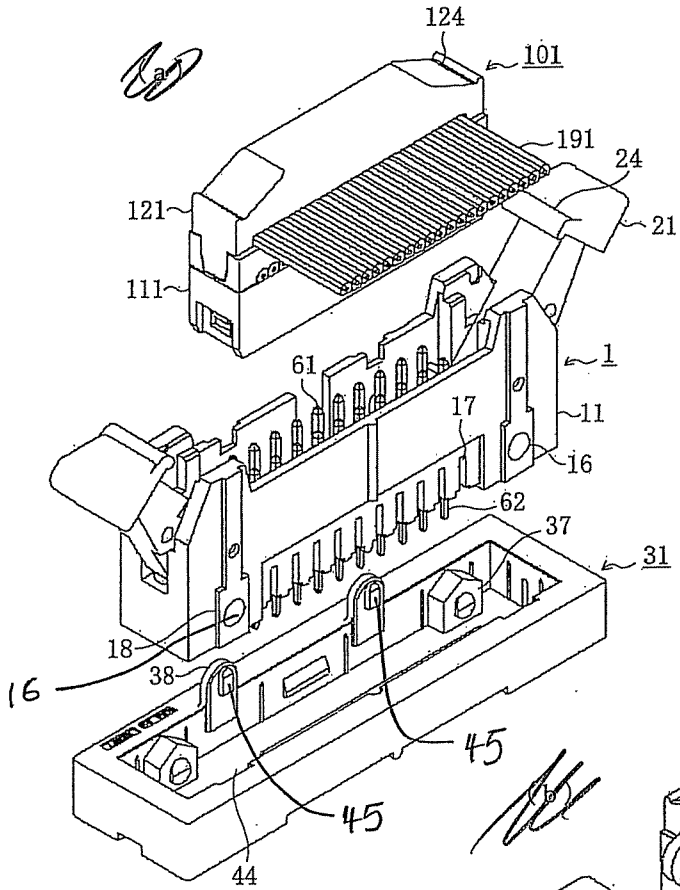

124
101
191
24
121
21
111
1
61
17
11
16
62
37
31
18
38
16
45
45
44

FIG. 3A

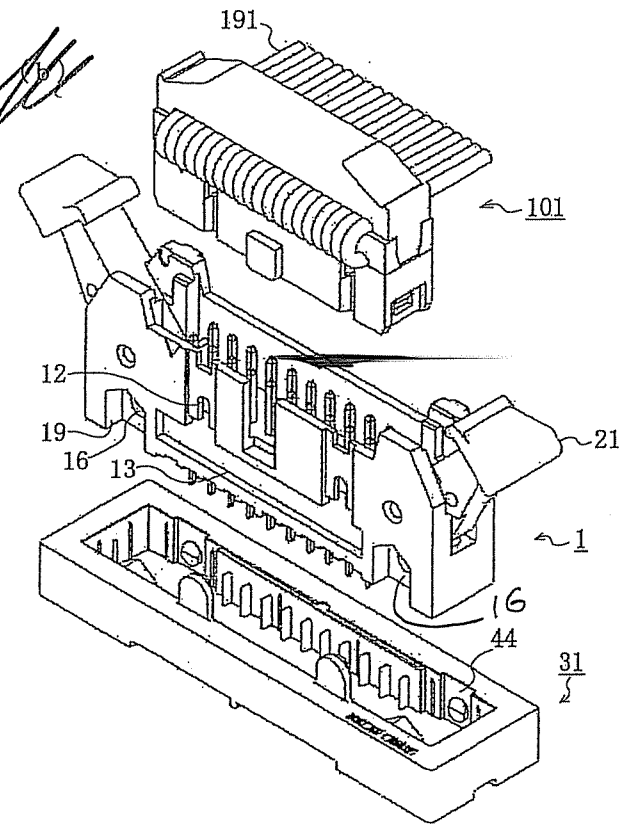

191
101
12
19
16
13
21
1
16
44
31

FIG. 3B

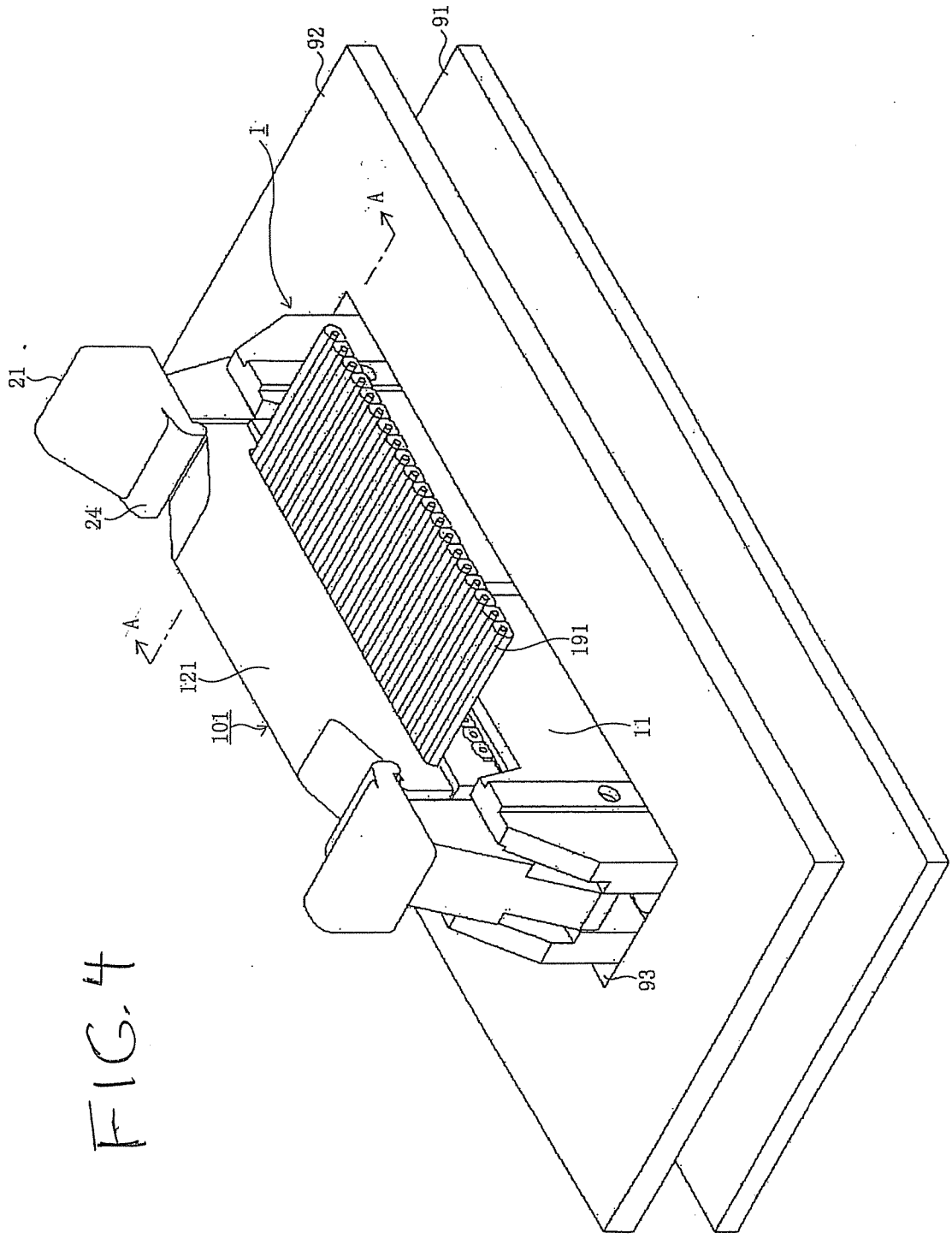
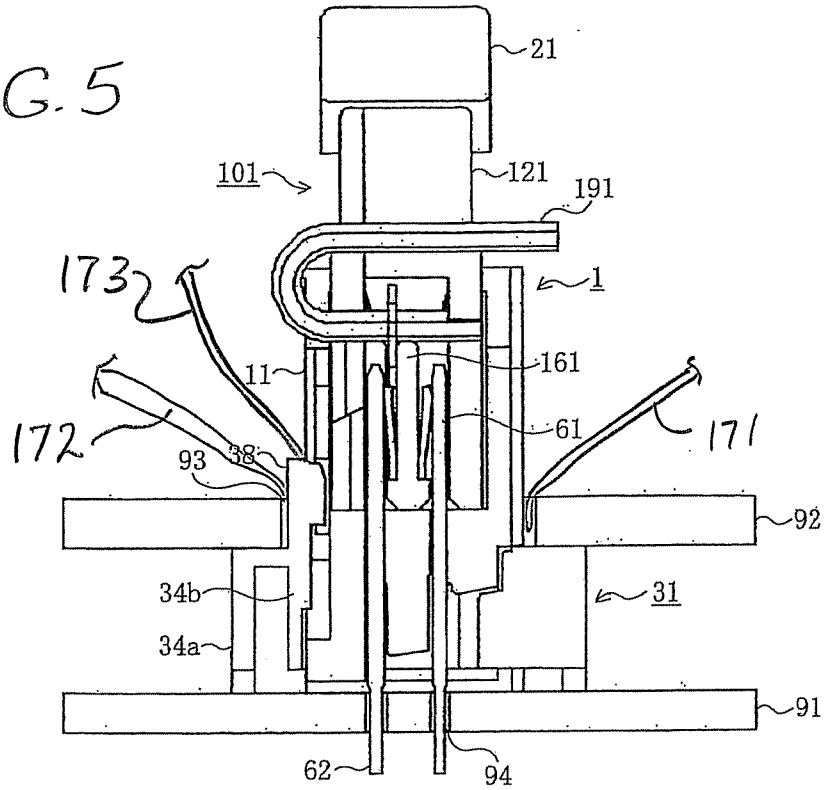



FIG. 4

FIG. 5



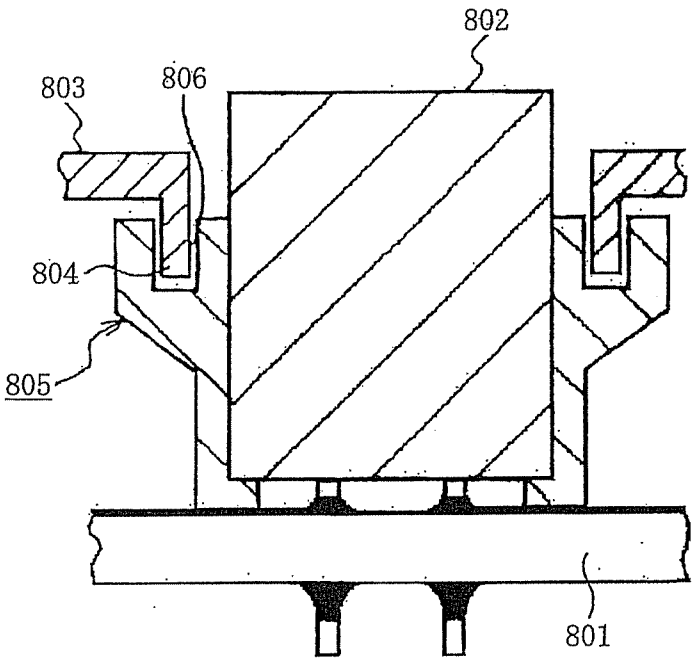




FIG. 6
(Prior art)

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/054284

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/52 H01R12/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 2006 081714 A (KITA DENSHI CORP)<br>30 March 2006 (2006-03-30)<br>cited in the application<br>abstract; figures 1-4b | 1,2 |
| A | WO 98/05095 A (WHITAKER CORP [US]; CONSOLI JOHN J [US]; SIPE LYNN R [US])<br>5 February 1998 (1998-02-05)<br>page 3, paragraph 2; figure 2 | 2 |
| A | US 2005/152084 A1 (BLASKO RAYMOND J [US] ET AL) 14 July 2005 (2005-07-14)<br>paragraphs [0012] - [0014]; figures 1,2 | 2 |
| A | US 2004/023537 A1 (SASAME NAOTAKA [JP] ET AL) 5 February 2004 (2004-02-05)<br>paragraphs [0046], [0047]; figure 14 | 1 |

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 12 June 2008 | 24/06/2008 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Jiménez, Jesús |

Form PCT/ISA/210 (second sheet) (April 2005)

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/054284

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 6 077 121 A (WU KUN-TSAN [TW])<br>20 June 2000 (2000-06-20)<br>column 2, line 21 - line 35; figure 2 | 2 |
| A | US 7 101 196 B1 (MCCLELLAND TIMOTHY [US])<br>5 September 2006 (2006-09-05)<br>abstract; figures 1-5 | 2 |

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Information on patent family members

International application No
PCT/US2008/054284

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
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| US 2005152084 A1 | 14-07-2005 | NONE | |
| US 2004023537 A1 | 05-02-2004 | NONE | |
| US 6077121 A | 20-06-2000 | NONE | |
| US 7101196 B1 | 05-09-2006 | NONE | |