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(54) Electroplating method and electroplating apparatus

(57) The present invention provides a plating method and a plating apparatus capable of plating small parts effectively without any deformation. A object product to be plated is put in each accommodating concave portion in a carrier tape including a number of the accommodating concave portions spaced at a specific interval and this carrier tape is passed through a plating apparatus so as to form metallic plating layer on the surface of the object product to be plated.

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Description

[0001] The present invention relates to a plating method and a plating apparatus.

[0002] Conventionally, when electric components such as a connector terminal or small parts of automobile body are plated, those components are taken into a cage and dipped into plating solution or hung by a hook or a similar device and plated.

[0003] Japanese Patent Application Laid-Open No. 2002-220690 has disclosed such a conventional technology.

[0004] When small parts are plated, those parts collide with each other during plating treatment, so that deformation often occurs, which is a problem to be solved.

[0005] Further, in case of a small part, after plating a sheet material, that part is punched out into a predetermined shape with a press machine. In case of such formation by punching with the press machine after plating treatment, most plated section is thrown away, which is a great waste. Additionally, its shearing section is free of plating treatment and thus, that part is insufficiently plated, which is another problem to be solved.

[0006] The present invention has been achieved in views of the above-described problems and an object of the present invention is to provide a plating method and a plating apparatus capable of plating electric parts or small parts of automobile effectively without any deformation.

[0007] According to the invention there is provided a plating method comprising locating objects to be plated in accommodating concave portions in a carrier tape having a number of spaced accommodating concave portions and passing the carrier tape and thus the objects to be plated through a plating apparatus by feeding the carrier tape so as to form metallic plating layer on the surface of the objects to be plated.

[0008] Preferably the method includes the step of washing the objects which are accommodated in the carrier tape in washing units upstream and/or downstream of the plating unit.

[0009] The invention also provides a plating apparatus comprising a feeding mechanism for feeding carrier tape containing a number of accommodating concave portions each capable of receiving an object to be plated, and a plating unit so constructed that the carrier tape can pass through plating solution therein and provided with a cathode member for supplying the object to be plated with electricity.

[0010] The invention also provides a carrier tape for use in such method or apparatus comprising a tape having a plurality of accommodating concave portions, each concave portion having above it a slip-out prevention piece extending into the portion and there being a through opening extending through all accommodating portions in the longitudinal direction of the tape.

FIG. 1 is a schematic arrangement diagram provided by the plating method which plates continuously by feeding a carrier tape;

FIG. 2 is a perspective structure diagram of the carrier tape when viewed from its front side;

FIG. 3 is a perspective structure diagram of major portions in the carrier tape as viewed from its rear side;

FIG. 4 is a perspective structure diagram showing a condition in which the carrier tape is fed while it is supported by a cathode member provided in a cell;

FIG. 5 is a schematic enlarged structure diagram showing the condition of FIG. 4; and

FIG. 6 is a partially broken perspective structure diagram showing the interior of the cell so constructed that the cathode member is provided above the same cell so as to feed the carrier tape in a upside down condition.

[0011] Hereinafter, the preferred embodiment of the present invention will be described with reference to the accompanying drawings.

[0012] FIG. 1 shows schematic arrangement diagram of a plating apparatus, in which a washing unit filled with alkaline solution such as sodium hydrate solution, a plating unit filled with plating solution, a washing unit filled with water or the like, and a drying unit are disposed in succession from an upstream to a downstream. Sprockets are disposed to construct a feeding mechanism for the carrier tape so that the carrier tape can be passed through insides of the respective units. When these feeing sprockets are rotated, the carrier tape is fed successively from the upstream to the downstream. After plating and drying, the carrier tape is wound around a reel.

[0013] In this carrier tape, a number of accommodating concave portions are formed and then, an object product to be plated such as a small electric part or automobile part is placed into each accommodating concave portion on the upstream of the washing unit.

[0014] After the object products to be plated are placed in respective accommodating concave portions and the carrier tape is fed out by rotations of the sprockets. In this process, when the carrier tape is passed through the washing unit, the object product to be plated accommodated in the accommodating concave portion is degreased and washed with sodium hydrate solution or the like. Next, the same product is advanced into the plating unit, in which metallic plating layer is formed on the surface of the object product to be plated. After that, it is passed through the washing unit so as to wash off the plating solution and then, when it is passed through the drying unit, the object product to be plated is dried excellently. Consequently, the plating on the object product to be plated can be carried out continuously and finally, the carrier tape can be wound around the reel with the plated products accommodated in the respective accommodating concave portions. Then, the carrier tape wound around the reel is transported to plant as it is and loaded on a charging unit disposed on electronic

products or automobile part production line. By feeding the carrier tape successively from the reel, the plated products are taken out successively and installed on an electric product or the like.

[0015] Therefore, according to the present invention, the object products to be plated can be plated in a condition that they are accommodated in the carrier tape and thus, no deformation or damage occurs in those object products to be plated W during the plating treatment and such small parts can be plated very effectively.

[0016] Additionally, after that, the plated products can be fed to the charging unit continuously in a condition that they are accommodated in the carrier tape.

[0017] FIG. 2 shows a perspective view of major portions indicating an example of the carrier tape and FIG. 3 shows a perspective view of the rear side of the carrier tape.

[0018] The carrier tape is constructed of resin excellent in heat resistance and chemical resistance having two layers or multiple layers formed by coextrusion. Each accommodating concave portion is formed into a concave shape corresponding to the shape of the object product to be plated. A pair of slip-out preventing pieces are provided on a top face of the accommodating concave portion such that the center portions of those pieces, are tilted downward and oppose each other in order to prevent the object product to be plated from dropping out when the same object products to be plated are put into the accommodating concave portions.

[0019] The bottom portion and side portions of the accommodating concave portion are cut out at positions of the slip-out preventing pieces so that a through opening is formed. The through opening in the respective accommodating concave portion is formed continuously in the longitudinal direction of the carrier tape.

[0020] Narrow slits are formed through at least in the bottom and side faces of each accommodating concave portion so that washing solution or plating solution escapes easily.

[0021] Further, the washing solution or plating solution can flow into the accommodating concave portion excellently through the opening and the slits, so that the washing solution or plating solution can flow into or out the accommodating concave portion easily.

[0022] When the object product to be plated is put into each accommodating concave portion, if the object product to be plated is pressed into the accommodating concave portion, the slip-out pieces are pressed downward elastically and restored to its upper face of the object product to be plated. As a result, the top face of the object product to be plated is pressed excellently so that the object product to be plated is prevented from dropping from the accommodating concave portion.

[0023] Feeding holes are formed through on both sides in the width direction of the carrier tape at a specific interval in the length direction. Said feeding sprocket engages these feeding holes and when the feeding sprocket is rotated, the carrier tape is fed successively from the upstream to the downstream.

[0024] FIG. 4 shows a schematic structure diagram of the plating unit and the plating unit contains a cell filled with plating solution and a cathode member is provided within this cell.

[0025] This cathode member is provided from the upstream to the downstream in the cell along the flow direction of the carrier tape and connected to a cathode of an outside power supply.

[0026] In addition, a copper plate, connected to an anode of a power supply, is disposed on a side of the cell.

[0027] In case where the copper plate is disposed, the object product to be plated is plated with copper and the cell is filled with plating solution composed of copper sulfate solution.

[0028] When the carrier tape is fed successively in the plating solution, the cathode member is fit to the opening in the carrier tape and then, the carrier tape is fed from the upstream to the downstream along the cathode member in a condition that the carrier tape rides on the cathode member.

[0029] FIG. 5 is a schematic structure diagram showing the condition in the plating solution in enlargement. The top face of the object product to be plated accommodated in each accommodating concave portion in the carrier tape is pressed to the slip-out preventing pieces. Consequently, the cathode member invades into the opening so that this cathode member comes into a contact with the bottom face of the object product to be plated accommodated in each accommodating concave portion. At this time, minus current is supplied to the object product to be plated through the cathode member, so that the object product to be plated is charged with negative electricity.

[0030] Therefore, the copper plate on the anode side is dissolved and copper plating layer is formed on the surface of each object product to be plated successively.

[0031] For example, if the carrier tape is fed slowly in the cell such that it is dipped in the plating solution for about 10 minutes, copper plating is achieved on each object product to be plated excellently within the cell.

[0032] In case where nickel plating is carried out in the plating unit, the plating solution is nickel sulfate solution and instead of the copper plate, a nickel plate is employed. Additionally, silver plating, gold plating, galvanization, chrome plating and the like can be carried out in similar ways.

[0033] FIG. 6 shows a modification, in which the carrier tape is fed in an upside down condition (state shown in FIG. 3) through the plating solution in the cell. FIG. 7 shows a schematic diagram indicating enlarged major parts.

[0034] In this case, the bottom face of each object product to be plated is supported by a pair of the slip-out preventing pieces so that the object product to be plated is prevented from dropping out. Further, because the opening is disposed on the side of the top face of the object product to be plated W, if the cathode member

from which a number of brushes capable of invading into the opening is provided above the cell, minus current is supplied to each object product to be plated through each brush from this cathode member. Consequently, each object product to be plated turns to a cathode so that the surface is plated excellently.

[0035] With such a configuration, the cathode member can be disposed outside the plating solution.

[0036] In this example, in a process in which the carrier tape is fed successively from the upstream to the downstream in the plating solution within the cell, plating layer is formed on the surface of each object product to be plated accommodated in each accommodating concave portion.

[0037] According to the plating method of the present invention, because the object product to be plated is put into each accommodating concave portion in the carrier tape including a number of the accommodating concave portions spaced at a specific interval and the carrier tape is fed through the plating unit so as to form metallic plating layer on the surface of the object product to be plated, the object product to be plated can be plated effectively in a condition that it is accommodated in the carrier tape without damaging or deforming small electric parts or automobile parts. Consequently, the plating treatment can be carried out continuously and effectively while the carrier tape is fed. Additionally, the carrier tape can be used by a charging unit in plant or the like just as it is and the effectively plated products can be transferred to a next production stage without any delay.

[0038] Further because the washing units are disposed in the upstream and downstream of the plating unit and each object product to be plated is washed when it passes through each washing unit, washing in a process before plating and washing in a process after plating can be carried out continuously in a condition that the object product to be plated is kept in the carrier tape.

[0039] Further because the plating unit of the present invention includes a feeding mechanism for the carrier tape containing a number of the accommodating concave portions each capable of keeping the object product to be plated and the cell so constructed that the carrier tape can pass through the plating solution and that cell is provided with the cathode member which supplies the object product to be plated with electricity, when the carrier tape is passed through the plating solution in the cell in a condition that the object product to be plated is kept in each accommodating concave portion, the object product to be plated is charged with negative electricity through the cathode member. Consequently, metallic plating layer can be formed excellently on the surface of the object product to be plated in the cell.

[0040] Because the plating solution can flow in and out of each accommodating concave portion in the carrier tape and additionally, the opening which allows the cathode member to invade is formed, the cathode member comes into a contact with the object product to be plated accommodated in the accommodating concave portion, so that the object product to be plated is charged with negative electricity excellently. Further, because the plating solution can flow in and out through the opening excellently, the object product to be plated in each accommodating concave portion can undergo excellent plating treatment.

Claims

1. A plating method comprising locating objects to be plated in accommodating concave portions (51) in a carrier tape (5) having a number of spaced accommodating concave portions and passing the carrier tape and thus the objects to be plated through a plating apparatus (2) by feeding the carrier tape so as to form metallic plating layer on the surface of the objects to be plated.

2. The plating method according to claim 1 including the step of,washing the objects which are accommodated in the carrier tape in washing units (1,3) upstream and/or downstream of the plating unit (2).

3. A plating apparatus comprising a feeding mechanism (6) for feeding carrier tape (5) containing a number of accommodating concave portions (51) each capable of receiving an object to be plated, and a plating unit (2) so constructed that the carrier tape can pass through plating solution therein and provided with a cathode member (9) for supplying the object to be plated with electricity.

4. The plating apparatus according to claim 3 wherein each accommodating concave portion in said carrier tape includes an opening (53) which allows plating solution to flow in and out and said cathode member to be introduced.

5. The plating apparatus of claim 3 or 4 including at least one washing unit (1,3) through which the carrier tape can pass and located upstream and/or downstream of the plating unit.

6. The plating apparatus of claim 3, 4 or 5 including the said carrier tape and a means (7) to wind it up after it has passed through the plating unit and/or the downstream washing unit.

7. A carrier tape for use in the method of claim 1 or with the plating apparatus of claim 3 comprising a tape having a plurality of accommodating concave portions (51), each concave portion (51) having above it a slip-out prevention piece (52) extending into the portion (51) and there being a through opening (53) extending through all accommodating portions in the longitudinal direction of the tape.

8. The carrier tapes of claim 7 made of two or more layers of extruded resin.

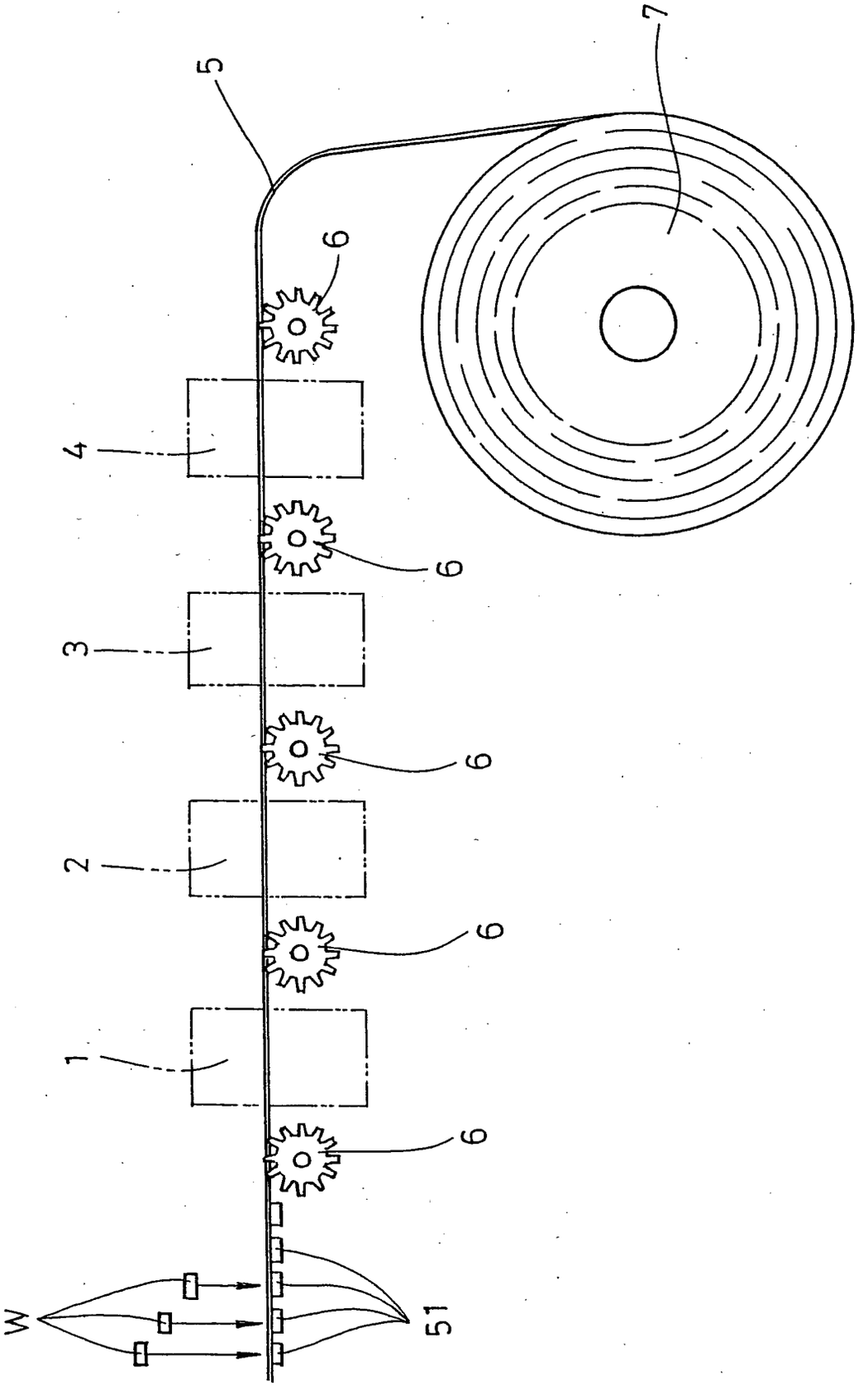

FIG. 1

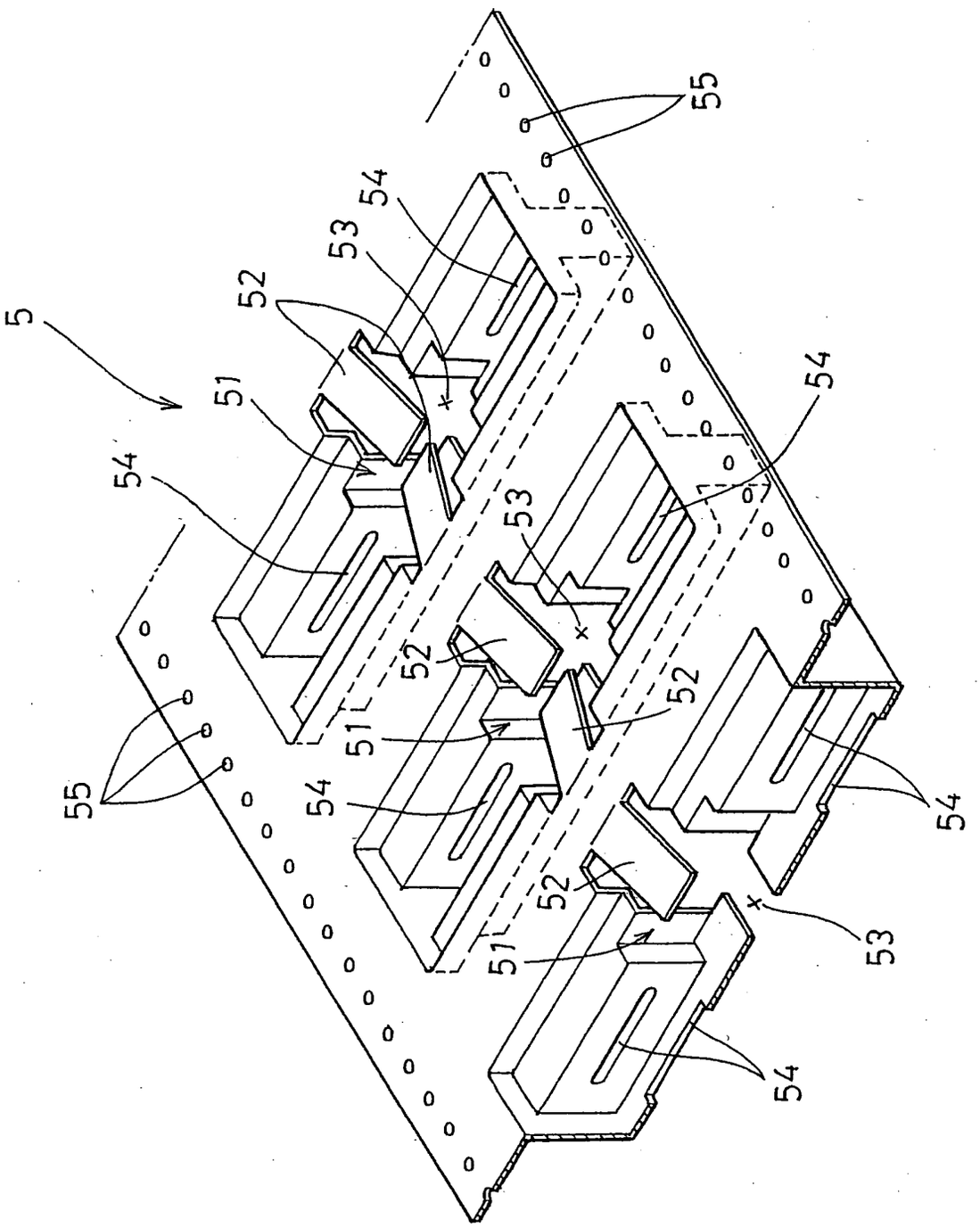

FIG. 2

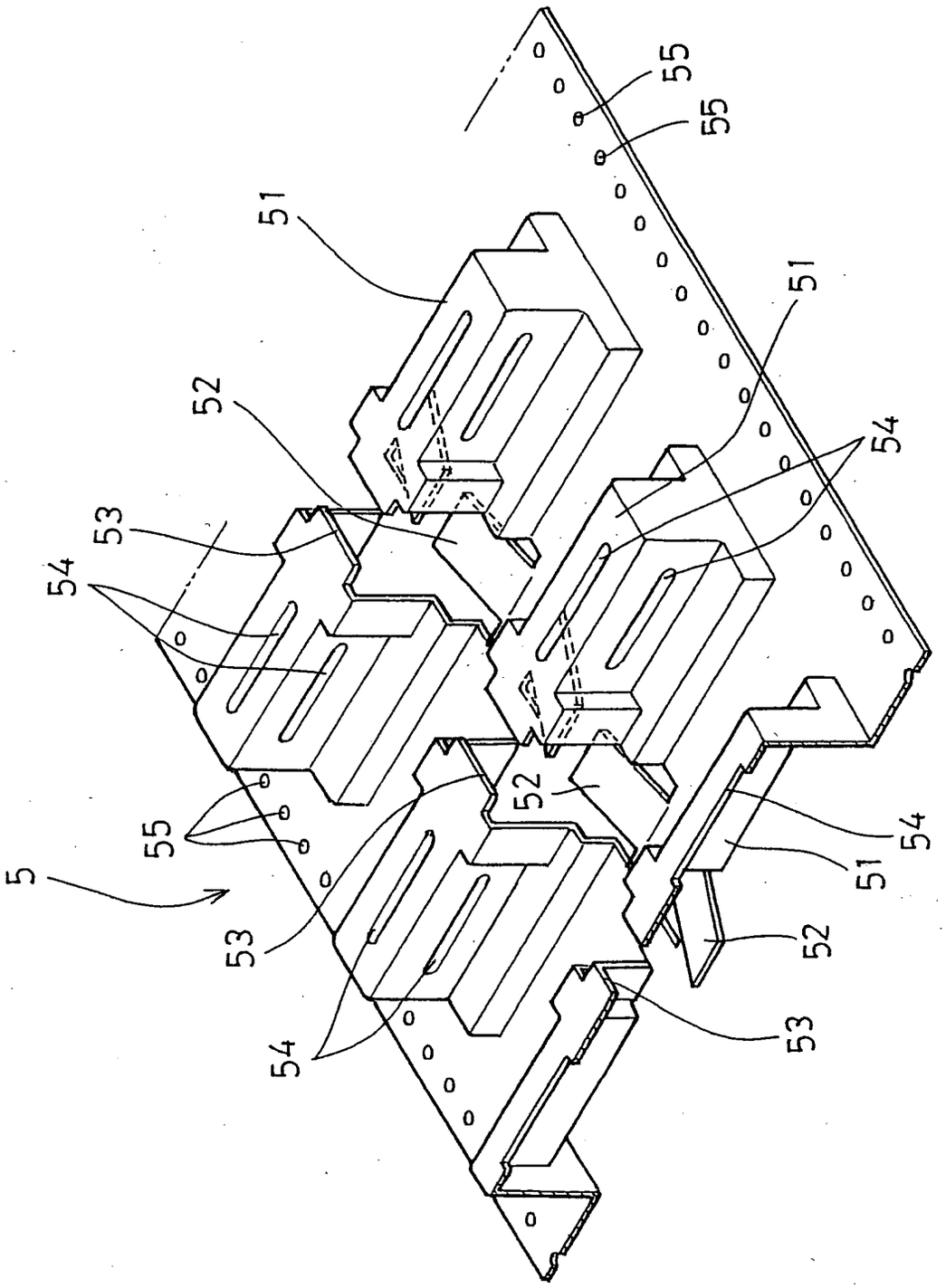

FIG. 3

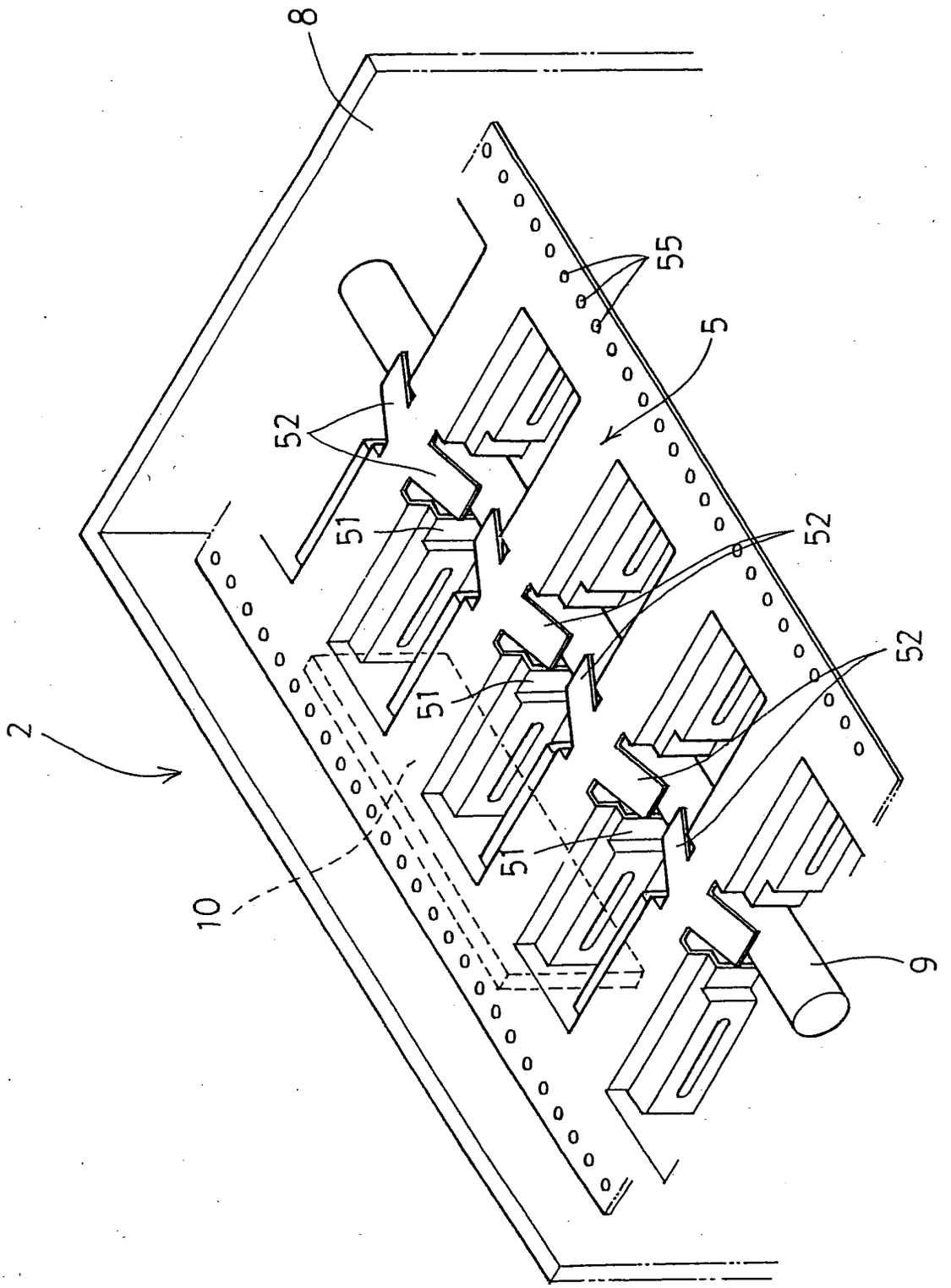

FIG. 4

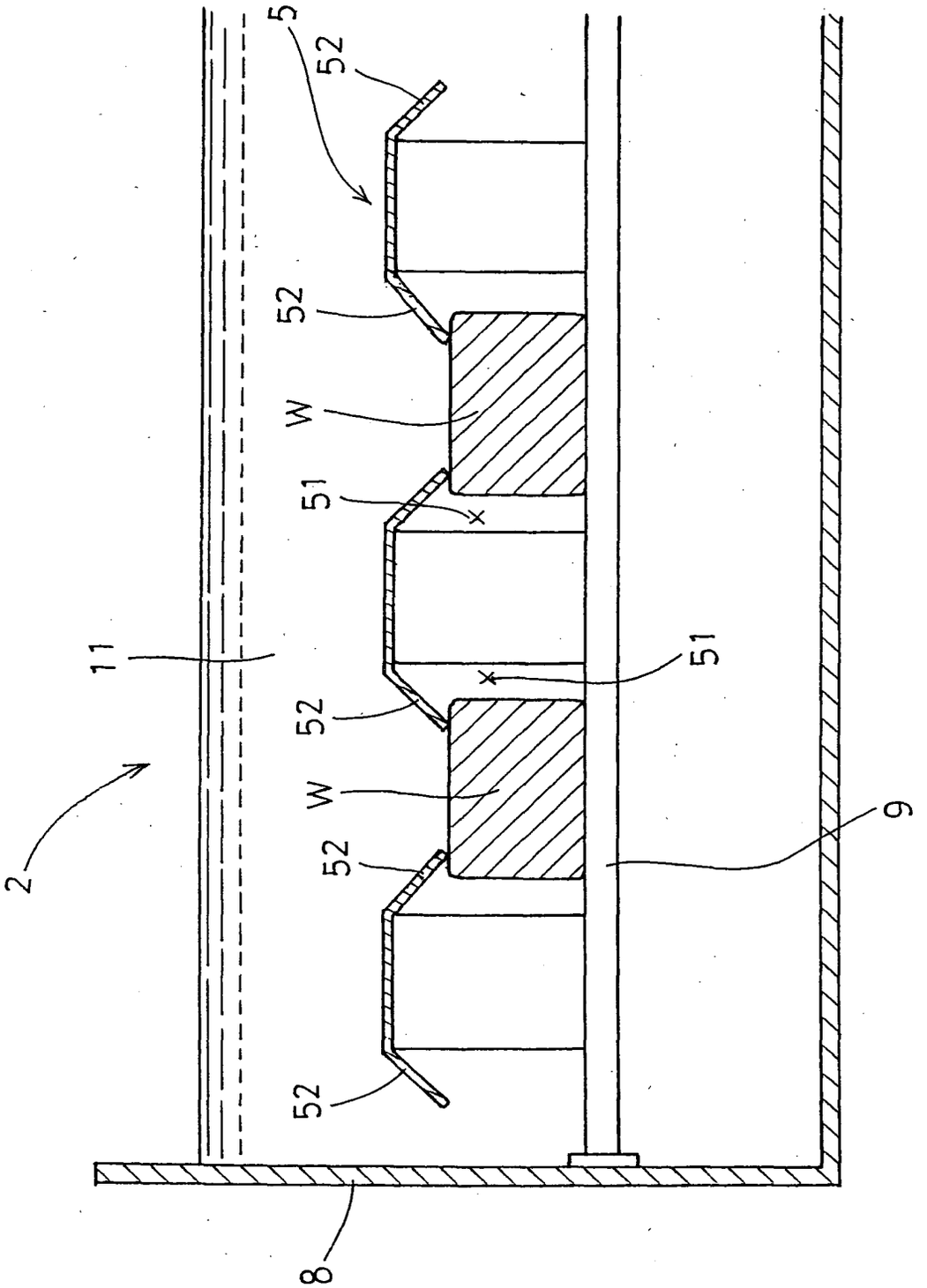

FIG. 5

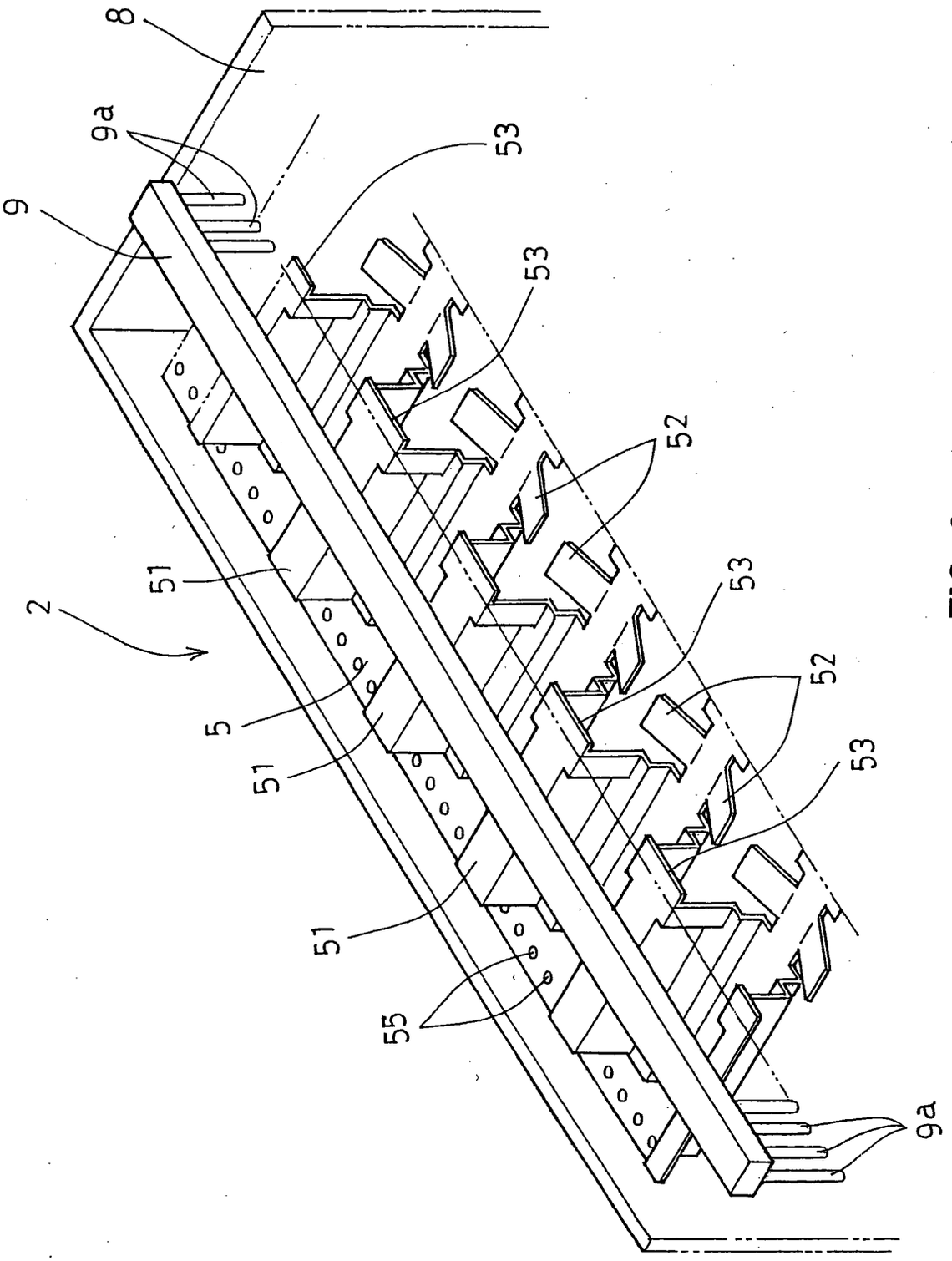

FIG. 6

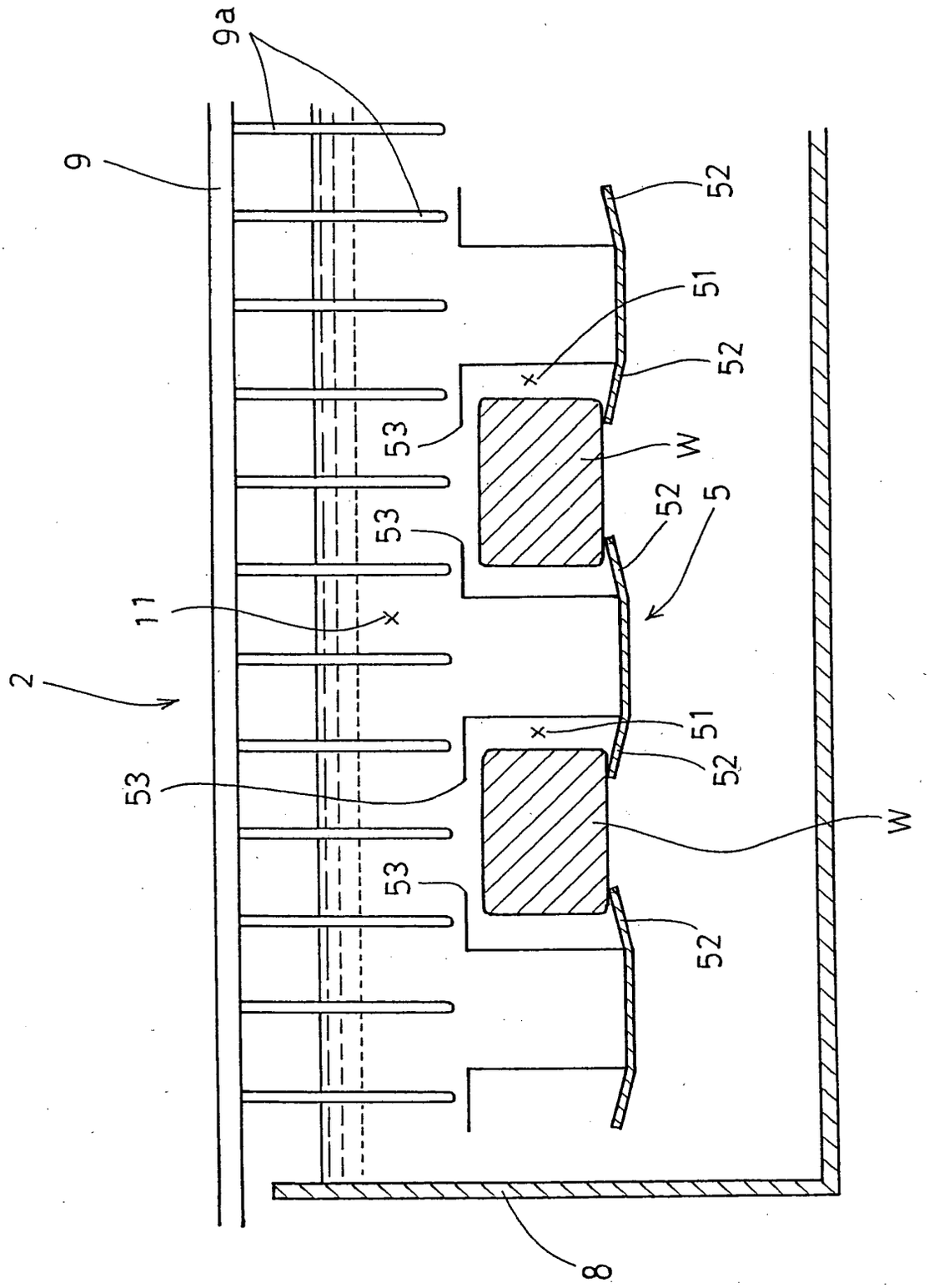

FIG. 7