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(71) Applicant: **SEIKO EPSON CORPORATION**

Shinjuku-ku, Tokyo 163-0811 (JP)

(72) Inventors:

• **Shiho, Akihiko**

Suwa-shi Nagano 392-8502 (JP)

• **Kumagai, Toshio**

Suwa-shi Nagano 392-8502 (JP)

• **Kobayashi, Atsushi**

Suwa-shi Nagano 392-8502 (JP)

• **Takemura, Masanori**

Suwa-shi Nagano 392-8502 (JP)

• **Matsumoto, Hitoshi**

Suwa-shi Nagano 392-8502 (JP)

(74) Representative: **HOFFMANN - EITLE**

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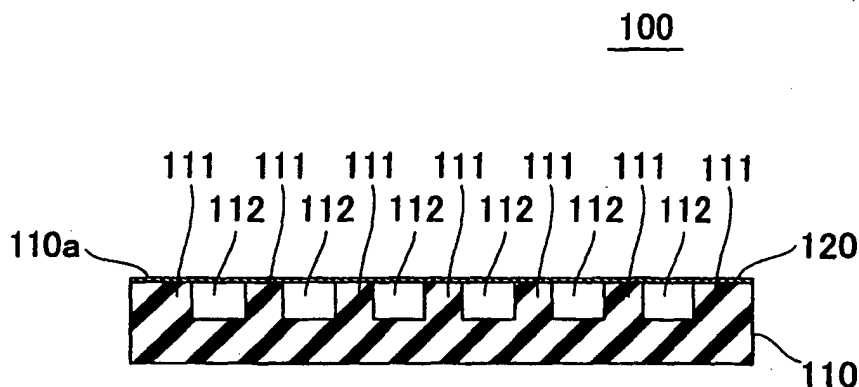
81925 München (DE)

(54) **Liquid supplying member, method of manufacturing the same, and liquid ejection apparatus incorporating the same**

(57) In a liquid supplying member for supplying liquid from a liquid container to a liquid ejection head provided in a liquid ejection apparatus, a flexible base member has a first face in which a plurality of first grooves

are arranged side by side in a first direction. A first flexible plate member is joined to the first face of the base member so as to seal the first grooves to form liquid supplying channels.

FIG. 3



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Description**BACKGROUND OF THE INVENTION**

[0001] The invention relates to a liquid supplying member for supplying liquid contained in a liquid cartridge to a liquid ejection apparatus for effecting recording or printing operation. The invention also relates to a method of manufacturing such a liquid supplying member.

[0002] For instance, the liquid ejection apparatus, such as an ink jet recording apparatus, subjects an object to recording or printing by ejecting liquid to the object while a liquid ejection head is reciprocally actuated. Liquid to be ejected to the object (e.g., ink) is supplied from a liquid container (e.g., a liquid cartridge) to a liquid ejection head (e.g., a recording head).

[0003] In addition to the liquid ejection apparatus of the type having both a liquid ejection head and a liquid container mounted on a carriage that travels reciprocally, a liquid ejection apparatus of another type having only a liquid ejection head mounted on a carriage is also available as disclosed in Japanese Patent Publication No. 2001-212974A, for example.

[0004] When the carriage is equipped with only the liquid ejection head, the liquid ejection apparatus must be provided with a liquid supplying member for supplying liquid from the liquid container to the liquid ejection head. A polyethylene tube has hitherto been used as such a liquid supplying member.

[0005] However, when the polyethylene tube is used, a plurality of polyethylene tubes must be used for supplying a plurality of types of liquid to the liquid ejection head. For this reason, difficulty is encountered in making the liquid ejection apparatus compact. Further, efforts are required to attach the polyethylene tubes to the liquid ejection apparatus.

SUMMARY OF THE INVENTION

[0006] It is therefore an object of the invention to provide a liquid supplying member in which the liquid ejection apparatus body can be made compact and the attaching operation of the liquid supplying member can be facilitated.

[0007] It is also an object of the invention to provide a method of manufacturing such a liquid supplying member, and a liquid ejection apparatus incorporating such a liquid supplying member.

[0008] In order to achieve the above objects, according to the invention, there is provided a liquid supplying member, for supplying liquid from a liquid container to a liquid ejection head provided in a liquid ejection apparatus, the liquid supplying member comprising:

a flexible base member, having a first face in which a plurality of first grooves are arranged side by side in a first direction; and

a first flexible plate member, joined to the first face of the base member so as to seal the first grooves to form liquid supplying channels.

[0009] Preferably, each of the first grooves is formed with a through hole extending to a second face of the base member which is opposite to the first face.

[0010] With such a configuration, since a single liquid supplying member enables supply of a plurality of types of liquids, the liquid supplying member can be routed in a compact manner within the liquid ejection apparatus. Accordingly, the liquid ejection apparatus can be made compact.

[0011] Preferably, the base member is comprised of a thermoplastic elastomer. In this case, injection molding can be adopted to form the base member. Consequently, the liquid supplying member can be manufactured inexpensively, and alternatives of shape of the liquid supplying member can be easily increased.

[0012] Here, it is preferable that: the thermoplastic elastomer is comprised of polypropylene; and the first plate member comprises a first layer which is joined to the first face of the base member and comprised of at least one of polypropylene and polyethylene. In this case, the base member and the first plate member can be welded together.

[0013] It is further preferable that the first plate member comprises a second layer comprised of metal. In this case, even when another layer of the first plate member has enabled permeation of liquid, the metal layer prevents evaporation of the liquid. Further, even when another layer of the elongated plate member has enabled permeation of exterior air, the metal layer prevents intrusion of outside air into liquid.

[0014] It is further preferable that the first plate member comprises a third layer comprised of polyamide and a fourth layer comprised of polyethylene terephthalate, between which the second layer is sandwiched. In this case, not only the metal layer is protected, but also the strength of the first plate member is enhanced.

[0015] The liquid supplying member may further comprise a second flexible plate member which is joined to a part of the second face and comprised of a metal layer. In this case, even when liquid has permeated through the base member, the metal layer prevents evaporation of liquid.

[0016] It is also preferable that: the liquid supplying member comprises a first portion to be flexed and a second portion not to be flexed; and the first portion has a first thickness and the second portion has a second thickness thicker than the first thickness. In this case, the liquid supplying member can be readily flexed, while the quantity of liquid permeating through the base member in the thickness direction becomes smaller.

[0017] Preferably, a portion of the base member corresponding to at least the first portion has a cross section curved in a direction that the liquid supplying member is to be flexed. In this case, the liquid supplying

member can be routed in the liquid ejection apparatus more compactly.

[0018] Preferably, the second face of the base member is formed with a plurality of second grooves arranged side by side in the first direction and sealed by a second flexible plate member.

[0019] Here, it is preferable that each one of the first grooves is communicated with associated one of the second grooves.

[0020] It is also preferable that each of the second grooves is formed with a through hole extending to the first face.

[0021] In the above configurations, alternatives in a direction in which the liquid supplying member is connected to the outside can be increased.

[0022] The liquid supplying member may further comprise a connector having a higher rigidity than the base member and communicating the first grooves and the liquid ejection head. In this case, attachment of the liquid supplying member is performed easily.

[0023] A cross-sectional area of each of the first grooves may be partly changed. For example, the channel can be given a small cross-sectional area in only a portion of the liquid supplying member which is to be passed through a narrow area, thereby rendering the cross-sectional area of the liquid supplying member small.

[0024] Preferably, the base member is curved such that both longitudinal ends are opposed to each other in the vicinity of a longitudinal center portion thereof, in an original state. In this case, injection molding can be preferably adopted to form the base member.

[0025] According to the invention, there is also provided a method of manufacturing a liquid supplying member for supplying liquid from a liquid container to a liquid ejection head provided in a liquid ejection apparatus, the method comprising steps of:

providing a mold for forming a base member having a first face in which a plurality of first grooves are arranged side by side in a first direction;
injecting molten thermoplastic elastomer into the mold to form the base member having a flexibility;
and
joining a flexible plate member to the first face of the base member so as to seal the first grooves to form liquid supplying channels.

[0026] With such a configuration, the liquid supplying member can be manufactured inexpensively.

[0027] It is preferable that: the mold is configured such that the base member is curved such that both longitudinal ends are opposed to each other in the vicinity of a longitudinal center portion thereof; and the thermoplastic elastomer is injected from portions of the mold corresponding to the both longitudinal ends and the longitudinal center portion.

[0028] In this case, even when the liquid supplying

member is long, the base member can be formed through injection molding.

[0029] According to the invention, there is also provided a liquid ejection apparatus in which the above liquid supplying member is extended from the liquid container to the liquid ejection head.

[0030] Preferably, the liquid supplying member is flexed such that either one of the base member or the first plate member having a higher elasticity than the other faces inwards.

[0031] Here, the bending direction is preferably a direction in which any one having higher elasticity from among the base member and the elongated plate member becomes contracted. Such a configuration enables an improvement in durability of the liquid supplying member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The above objects and advantages of the present invention will become more apparent by describing in detail preferred exemplary embodiments thereof with reference to the accompanying drawings, wherein:

Fig. 1 is a perspective view of an ink jet recording apparatus;

Fig. 2 is a perspective view of the ink jet recording apparatus in a disassembled state;

Fig. 3 is a section view of a liquid supplying member according to a first embodiment of the invention;

Fig. 4 is an enlarged section view of an elongated plate member of the liquid supplying member;

Fig. 5 is a perspective view of the liquid supplying member;

Fig. 6 is an enlarged perspective view showing one side of a base member of the liquid supplying member;

Fig. 7 is an enlarged perspective view showing the other side of a base member of the liquid supplying member;

Fig. 8 is a perspective view of one side of a connector showing a state that the liquid supplying member is connected;

Fig. 9 is a perspective view of the connector showing a state that the liquid supplying member is disconnected;

Fig. 10 is a perspective view of the other side of the connector;

Fig. 11 is a section view of a liquid supplying member according to a second embodiment of the invention;

Fig. 12 is a section view of a liquid supplying member according to a third embodiment of the invention;

Fig. 13 is a section view of a liquid supplying member according to a fourth embodiment of the invention;

Figs. 14 and 15 are section views of a liquid supplying member according to a fifth embodiment of the invention;

Fig. 16 is a side view showing the liquid supplying member of the fifth embodiment in a flexed state;

Fig. 17 is a perspective view of a liquid supplying member according to a sixth embodiment of the invention;

Fig. 18 is a section view taken along a line A-A of Fig. 17;

Fig. 19 is a transverse section view of a liquid supplying member according to a seventh embodiment of the invention;

Fig. 20 is a perspective view of a liquid supplying member according to an eighth embodiment of the invention;

Fig. 21 is a side view of a liquid supplying member according to a ninth embodiment of the invention; and

Fig. 22 is a side view of a liquid supplying member according to a tenth embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0033] Preferred embodiments of the invention will be described below in detail with reference to the accompanying drawings.

[0034] As shown in Figs. 1 and 2, an ink jet recording apparatus 10 is provided with: a carriage 42 which reciprocally travels so as to straddle a recorded object; a recording head 44 which is mounted on the carriage 42 and subjects the object to recording, writing, or printing by ejecting a plurality of colors of ink to the object; a plurality of cartridges 45 which contains different colors of ink therein; and a liquid supplying member 100.

[0035] The carriage 42 is reciprocally moved along a guide shaft 48 by an unillustrated motor. The cartridges 45 are fixed not to the carriage 42 but to the main body of the ink jet recording apparatus 10. The liquid supplying member 100 is made of plastic material (e.g., thermoplastic elastomer) and formed with a required number of channels (a plurality of channels in the embodiment) to supply a plurality of colors of ink held in the respective cartridges 45 to the recording head 44 that travels back and forth. The recording head 44 ejects ink to the object 11 located below a travel path of the recording head 44, to thus perform recording, writing, or printing operation. The plurality of colors of ink held in the cartridges 45 are supplied to one end 100a (see Fig. 5) of the liquid supplying member 100 by way of unillustrated stationary channels.

[0036] With such a configuration, it is possible to supply a plurality of colors of ink held in the plurality of cartridges 45 to the recording head 44 by attaching only one liquid supplying member 100 to the ink jet recording apparatus 10. Consequently, the ink jet recording apparatus 10 can be made compact. Further, the efforts required to mount the liquid supplying member 100 be-

come smaller.

[0037] Here, in a case where an elastomer primarily made of SEPS (polystyrene-polyethylene-polypropylene-polystyrene) polymer is used as an elastic material to be used for forming the liquid supplying member 100 is used, the liquid supplying member 100 becomes softer than the polyethylene tube. In this case, the liquid supplying member 100 can be folded largely, to thereby render the ink jet recording apparatus 10 particularly compact. Moreover, when the carriage 42 is driven, the load exerted on a motor which drives the carriage 42 becomes smaller.

[0038] The ink jet recording apparatus 10 is an example of the liquid ejection apparatus. Further, the recording head 44 of the ink jet recording apparatus is an example of a liquid ejection head of the liquid ejection apparatus, and the cartridges 45 are examples of a liquid container.

[0039] However, the invention is not limited to these examples. Another example of the liquid ejection apparatus corresponds to a color filter manufacturing apparatus to be used for manufacturing a color filter of a liquid-crystal display. In this case, a coloring material ejection head of the apparatus is an example of the liquid ejection head. Another example of the liquid ejection apparatus is an electrode formation apparatus for forming electrodes, such as those of an organic EL display or those of a FED (Field Emission Display). In this case, an electrode material (a conductive paste) ejection head of the apparatus is an example of the liquid ejection head. Still another example of the liquid ejection apparatus is a biochip manufacturing apparatus for manufacturing a biochip. In this case, a bio-organic substance ejection head of the apparatus and a sample ejection head serving as a precision pipette correspond to examples of the liquid ejection head. The liquid ejection apparatus of the invention includes other industrial liquid ejection apparatuses of industrial application.

[0040] The object 11 is a substance to be subjected to recording, writing, or printing as a result of ejection of liquid. For instance, the object includes recording paper, a circuit board on which a circuit pattern such as electrodes of a display are printed, a CD-ROM on which a label is printed, and a preparation on which a DNA circuit is to be printed.

[0041] As shown in Fig. 3, the liquid supplying member 100 according to a first invention comprises a base member 110 made of plastic material, and an elongated plate member 120 joined to one face 110a of the base member 110 by, e.g., adhesion or welding. While being joined to the base member 110, the elongated plate member 120 has flexibility.

[0042] The base member 110 is formed with a plurality of elongated ridges 111 defining a plurality of individual grooves 112 each having rectangular cross section and arranged in a width direction of the base member 110. Open side of the grooves 112 are covered with the elongated plate member 120 to form a plurality of individual

ink supplying channels.

[0043] Such a structure enables manufacture of the liquid supplying member 100 by injecting plastic material (e.g., a thermoplastic elastomer) into a mold, to thereby mold the base member 110. In this case, the base member 110 can be formed into a complicated geometry, and manufacturing costs can be reduced. In addition to the SEPS polymer, the plastic material constituting the liquid supplying member 100 preferably includes paraffin oil serving as a softening agent. Further, the plastic material may contain polypropylene along with or separately from the paraffin oil.

[0044] Among the ridges 111, ones provided at both widthwise ends of the base member 110 are wider than the remaining ridges 111. By such a configuration, the quantity of ink solvent (e.g., water) permeating through the base member 110 and the quantity of outside air which permeates through the base member 110 and dissolves in ink can be reduced.

[0045] As shown in Fig. 4, the elongated plate member 120 has a multilayer structure in which a welding layer 121, a reinforcement layer 122, a metal layer 123, and a protective layer 124 are laminated, in the order given from the base member 110.

[0046] The welding layer 121 is for joining the elongated plate member 120 to the base member 110 by welding. In a case where the base member 110 includes the polypropylene as well as the SEPS, the welding layer 121 is formed from polyethylene or polypropylene.

[0047] The reinforcement layer 122 is for reinforcing the elongated plate member 120. The reinforcement layer 122 also serves to improve the heat resistance of the elongated plate member 120. Specifically, the reinforcement layer 122 is formed from polyamide.

[0048] The metal layer 123 is formed of an aluminum foil, for example. Providing the metal layer 123, the elongated plate member 120 serves to prevent evaporation of a solvent (water, for example) contained in ink. The metal layer 123 also serves to prevent exterior air from penetrating through the elongated plate member 120 and dissolving in the ink.

[0049] The protective layer 124 serves to protect the metal layer 123 physically and thermally, and is formed from, e.g., polyethylene terephthalate. The protective layer 124 also serves to reinforce the elongated plate member 120.

[0050] The liquid supplying member 100 can be flexed in a direction orthogonal to the face 110a of the base member 110 as shown in Fig. 8. Since the base member 110 has elasticity higher than that of the elongated plate member 120, it is preferable to bent the liquid supplying member 100 such that the base member 110 faces inwards. In this case, the elongated plate member 120 becomes less prone to being exfoliated from the base member 110. Further, the elongated plate member 120 becomes less susceptible to slitting.

[0051] In a non-flexed state, as shown in Fig. 5, both ends 100a and 100b opposed to each other in the vicinity of the longitudinal center portion of the liquid supplying member 100. The liquid supplying member 100 is curved at an angle of 180° and at positions about a quarter of an entire longitudinal length from the both ends 100a and 100b.

ity of the longitudinal center portion of the liquid supplying member 100. The liquid supplying member 100 is curved at an angle of 180° and at positions about a quarter of an entire longitudinal length from the both ends 100a and 100b.

[0052] With such a configuration, when the base member 110 is subjected to the injection molding, the plastic material having flown through a single channel can be caused to simultaneously inject into areas in the mold corresponding to the both ends 100a, 100b, and the center section of the base member 110. Accordingly, even when the liquid supplying member 100 is long, the base member 110 can be formed through injection molding.

[0053] As shown in Fig. 6, each of the grooves 112 formed in the face 110a extends up to a position before one end 100a of the base member 110 and is connected to a through hole 114 penetrating through to the other side face 110b opposite the face 110a.

[0054] As shown in Fig. 7, the through holes 114 are arranged so as to become staggered with respect to the longitudinal direction of the base member 110 so that the diameters of the through holes 114 can be made larger than those achieved in a case where the through holes 114 are arranged in parallel.

[0055] In the other end 110b of the liquid supplying member 100 is configured so as to be identical with the end 100a.

[0056] As shown in Fig. 8, the ink supplying member 100 is fastened to a connector 200 by a retainer 300. The connector 200 is a member for readily connecting the liquid supplying member 100 to the carriage 42 or the recording head 44. The connector 200 and the retainer 300 are formed from plastic material which is higher in rigidity than the liquid supplying member 100 at the room temperature.

[0057] As shown in Figs. 9 and 10, the connector 200 is provided with: a plurality of cartridge-side connecting ports 210 respectively fitted with the through holes 114; a plurality of head-side connecting ports 220 respectively fitted with the carriage 42; and channels 230 respectively communicating the cartridge-side connecting ports 210 and the head-side connecting ports 220. The retainer 300 clamps the liquid supply member 100 in such a direction that the connecting ports 210 are forced to be inserted into the through holes 114.

[0058] The connecting ports 210 are tubular members provided so as to stand upright on the main body of the connector 200 and are arranged along one longitudinal end of the connector 200 in a staggered manner. The arrangement of the connecting ports 210 corresponds to the layout of the through holes 114.

[0059] The connecting ports 220 are tubular members standing upright on the main body of the connector 200. A predetermined number of the connecting ports 220 are provided at separated positions and are arranged in parallel with a short side of the connector 200, thereby constituting groups. In the embodiment, each group

comprises a pair of connecting ports 220. Packings 222 are provided so as to surround the respective groups so that the chance of leakage of ink from the connection between the connecting ports 220 and the recording head 44 can be prevented. Here, the packings 222 may be omitted.

[0060] In the embodiment, the connecting ports 210 and 220 are provided on the same side of the main body of the connector 200. However, they may be provided on different sides of the main body.

[0061] Another preferred embodiments of the invention will be described below. Members substantially identical with those described in the first embodiment are designated by the same reference numerals, and detailed explanation for those will be omitted.

[0062] Fig. 11 shows a liquid supplying member according to a second embodiment of the invention. In this embodiment, each of grooves 112 is configured so as to have a semicircular cross section, so that more smooth ink flows can be realized.

[0063] Fig. 12 shows a liquid supplying member according to a third embodiment of the invention. In this embodiment, ridges 111 and grooves 112 are provided in both of faces 110a and 110b of a base member 110. An elongated plate member 120 is joined to both the faces 110a and 110b. Accordingly, the number of grooves 112 per a unit area in the liquid supplying member 100 can be increased.

[0064] Fig. 13 shows a liquid supplying member according to a fourth embodiment of the invention. In this embodiment, each of grooves 112 has a triangular cross section. Ridges 111 and the grooves 112 are provided in both faces 110a and 110b of a base member 110. An elongated plate member 120 is caused to adhere to both the face 110a and 110b. The grooves 112 formed in the face 110a and the grooves 112 formed in the face 110b are arranged in a staggered manner with respect to the thickness direction of the base member 110. By such an arrangement, the number of the grooves 112 per a unit width in the liquid supplying member 100 can be increased, while the thickness of the liquid supplying member 100 can be reduced.

[0065] Fig. 14 shows a liquid supplying member according to a fifth embodiment of the invention. In this embodiment, at least a portion of a base member 110 to be flexed is curved such that a face in which grooves 112 are formed faces outward. It may be curved such that the face in which the grooves 112 are formed faces inward as shown in Fig. 15. With such a configuration, at portions B where the ink supplying member 100 is flexed shown in Fig. 16, the portions B can be flexed more compactly.

[0066] Figs. 17 and 18 show a liquid supplying member according to a sixth embodiment of the invention. In this embodiment, ridges 111 and grooves 112 are provided in a face 110a of the liquid supplying member 100 within a range from one end 100a to an arbitrary intermediate point, while the ridges 111 and the grooves 112

are provided in an opposite face 110b within a range from the intermediate point to the other end 100b. Specifically, the ends of the grooves 112 provided in the face 110a and the ends of the grooves 112 provided in the face 110b are partly overlapped and communicated by connection channels 116.

[0067] With such a structure, the through holes 114 provided at the end 100a can be oriented in a direction different from that in which the through holes 114 formed at the other end 100b are oriented.

[0068] Fig. 19 shows a liquid supplying member according to a seventh embodiment of the invention. In this embodiment, a cross-sectional area of each groove 112 changes at a certain intermediate point in the longitudinal direction of a base member 110. In order to change the cross-sectional area of the groove, the width of the groove 112 is changed at the intermediate point. However, the depth of the groove 112 may be changed at the intermediate point. A portion of the groove 112, which must be caused to pass through a narrow area in an ink jet recording apparatus 10, is given a small cross-sectional area, thereby making the cross section of the liquid supplying member 100 small. The other area of the groove 112 is given a wider cross-sectional area. In this case, a pressure loss in ink due to flow of ink through the groove 112 can be reduced.

[0069] Injection molding enables inexpensive manufacture of the base member 110 of such a structure.

[0070] Fig. 20 shows a liquid supplying member according to an eighth embodiment of the invention. In this embodiment, a plurality of projections 118 for fixing purpose are provided on side faces of a base member 110. The projections 118 are for fixing the liquid supplying member 100 within an ink jet recording apparatus 10. Adopting the injection molding to form the base member 110, the positions and shape of the fixing projections 118 can be set arbitrarily in consideration of the shape and position of an area where the base member 110 is to be fixed.

[0071] Fig. 21 shows a liquid supplying member according to a ninth embodiment of the invention. In this embodiment, a portion of a base member 110 which is not to be flexed is thicker than a portion of the base member 110 which is to be flexed. With such a configuration, the solvent of ink becomes less prone to passing through the base member 110 and evaporating. Further, the liquid supplying member 100 remains easily foldable. In the modification, a face 110a in which grooves 112 are formed is made flush, and irregularities are formed in an opposite face 110b, thereby changing the thickness of the base member 110.

[0072] Fig. 22 shows a liquid supplying member according to a tenth embodiment of the invention. In this embodiment, each of a face 110a and a face 110b are provided with an elongated plate member 120 at a portion of a base member 110 which is not to be flexed, while only the face 110a is provided with the elongated plate member 120 at a portion of the base member 110

which is to be flexed.

[0073] With such a configuration, even if the solvent of ink has permeated through the base member 110, the solvent will be blocked by the elongated plate member 120, thereby rendering the ink less prone to evaporating. Since the elongated plate member 120 is joined to only the face 110a in the portion where the liquid supplying member 100 to be flexed, the flexibility of the liquid supplying member 100 is not impaired.

[0074] Although the present invention has been shown and described with reference to specific preferred embodiments, various changes and modifications will be apparent to those skilled in the art from the teachings herein. Such changes and modifications as are obvious are deemed to come within the spirit, scope and contemplation of the invention as defined in the appended claims.

Claims

1. A liquid supplying member, for supplying liquid from a liquid container to a liquid ejection head provided in a liquid ejection apparatus, the liquid supplying member comprising:

a flexible base member, having a first face in which a plurality of first grooves are arranged side by side in a first direction; and
a first flexible plate member, joined to the first face of the base member so as to seal the first grooves to form liquid supplying channels.

2. The liquid supplying member as set forth in claim 1, wherein each of the first grooves is formed with a through hole extending to a second face of the base member which is opposite to the first face.

3. The liquid supplying member as set forth in claim 1 or 2, wherein the base member is comprised of a thermoplastic elastomer.

4. The liquid supplying member as set forth in claim 3, wherein:

the thermoplastic elastomer is comprised of polypropylene; and
the first plate member comprises a first layer which is joined to the first face of the base member and comprised of at least one of polypropylene and polyethylene.

5. The liquid supplying member as set forth in any of claims 1 to 4, wherein the first plate member comprises a second layer comprised of metal.

6. The liquid supplying member as set forth in claim 5, wherein the first plate member comprises a third

layer comprised of polyamide and a fourth layer comprised of polyethylene terephthalate, between which the second layer is sandwiched.

7. The liquid supplying member as set forth in any of claims 2 to 6, further comprising a second flexible plate member which is joined to a part of the second face and comprised of a metal layer.

8. The liquid supplying member as set forth in any of claims 1 to 7, wherein:

the liquid supplying member comprises a first portion to be flexed and a second portion not to be flexed; and
the first portion has a first thickness and the second portion has a second thickness thicker than the first thickness.

9. The liquid supplying member as set forth in any of claims 1 to 8, wherein:

the liquid supplying member comprises a first portion to be flexed and a second portion not to be flexed; and
a portion of the base member corresponding to at least the first portion has a cross section curved in a direction that the liquid supplying member is to be flexed.

10. The liquid supplying member as set forth in any of claims 2 to 9, wherein:

the second face of the base member is formed with a plurality of second grooves arranged side by side in the first direction and sealed by a second flexible plate member.

11. The liquid supplying member as set forth in claim 10, wherein each one of the first grooves is communicated with associated one of the second grooves.

12. The liquid supplying member as set forth in claim 10 or 11, wherein each of the second grooves is formed with a through hole extending to the first face.

13. The liquid supplying member as set forth in any of claims 1 to 12, further comprising a connector having a higher rigidity than the base member and communicating the first grooves and the liquid ejection head.

14. The liquid supplying member as set forth in any of claims 1 to 13, wherein a cross-sectional area of each of the first grooves is partly changed.

15. The liquid supplying member as set forth in any of

claims 1 to 14, wherein the base member is curved such that both longitudinal ends are opposed to each other in the vicinity of a longitudinal center portion thereof, in an original state.

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16. A method of manufacturing a liquid supplying member for supplying liquid from a liquid container to a liquid ejection head provided in a liquid ejection apparatus, the method comprising steps of:

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providing a mold for forming a base member having a first face in which a plurality of first grooves are arranged side by side in a first direction;

injecting molten thermoplastic elastomer into the mold to form the base member having a flexibility; and

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joining a flexible plate member to the first face of the base member so as to seal the first grooves to form liquid supplying channels.

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17. The manufacturing method as set forth in claim 16, wherein:

the mold is configured such that the base member is curved such that both longitudinal ends are opposed to each other in the vicinity of a longitudinal center portion thereof; and

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the thermoplastic elastomer is injected from portions of the mold corresponding to the both longitudinal ends and the longitudinal center portion.

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18. A liquid ejection apparatus in which the liquid supplying member as set forth in any of claims 1 to 15 is extended from the liquid container to the liquid ejection head.

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19. The liquid ejection apparatus as set forth in claim 18, wherein the liquid supplying member is flexed such that either one of the base member or the first plate member having a higher elasticity than the other faces inwards.

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FIG. 1

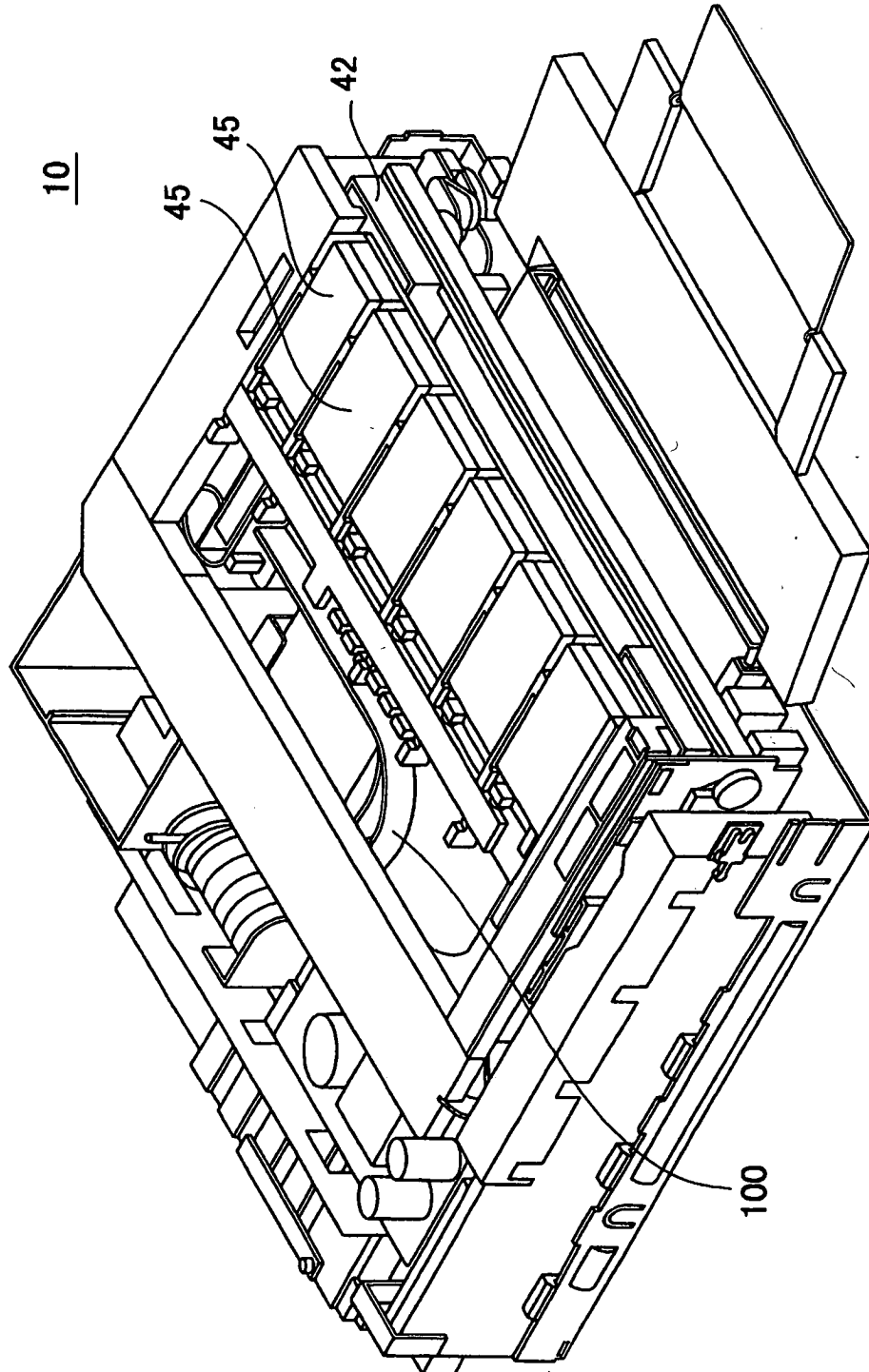


FIG. 2

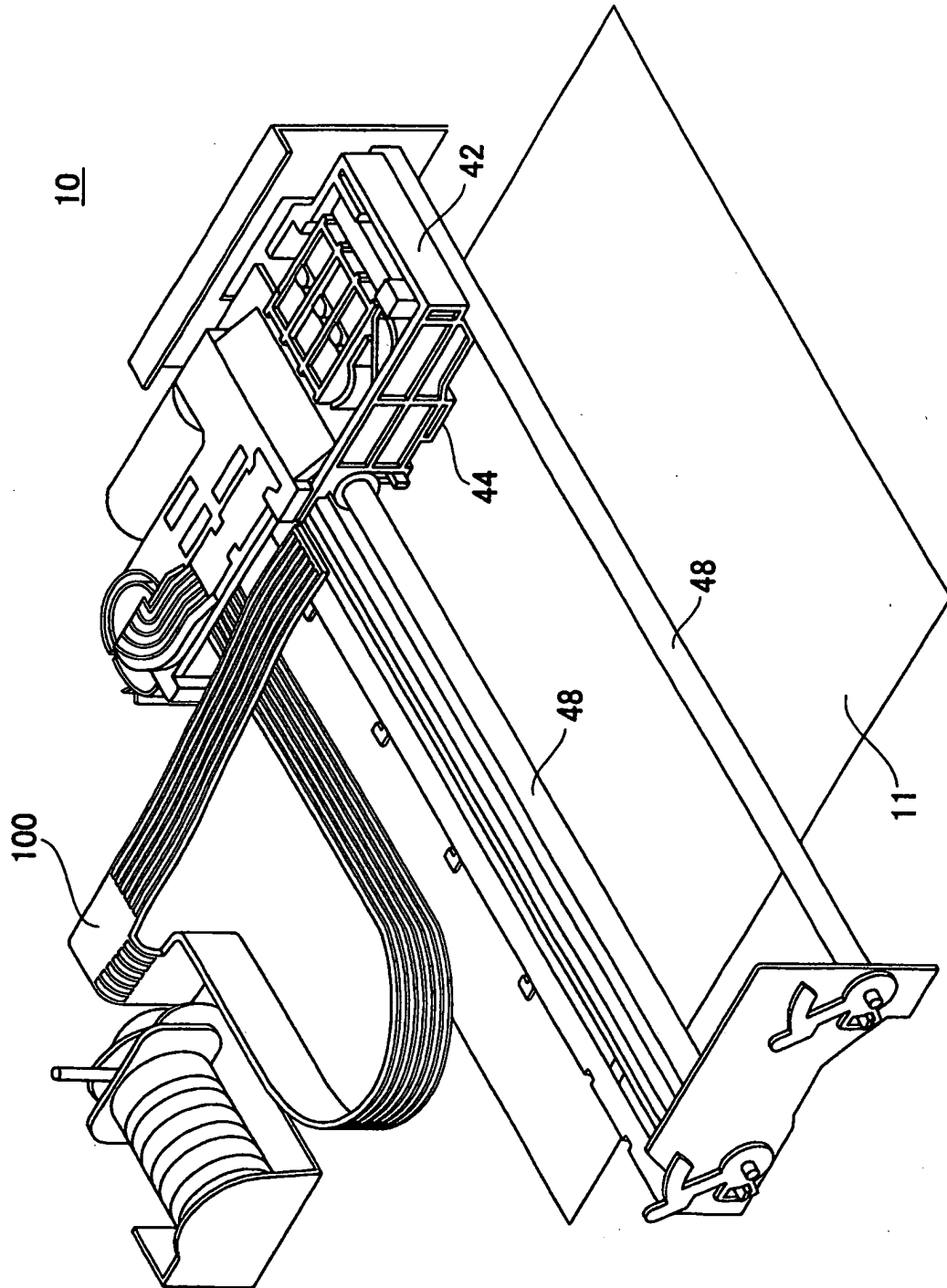


FIG. 3

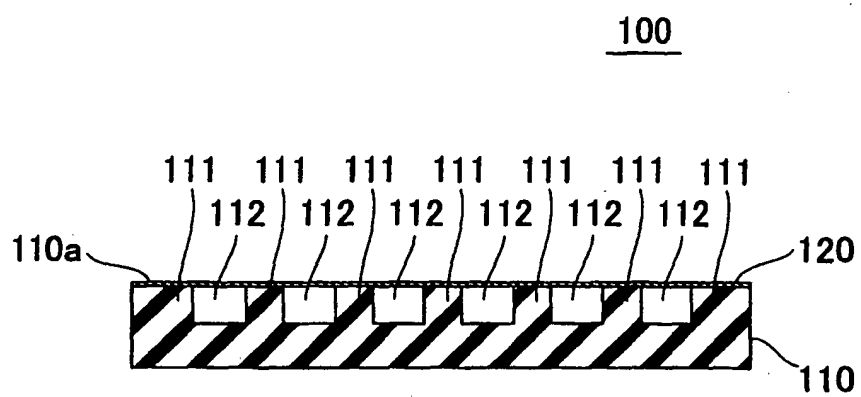


FIG. 4

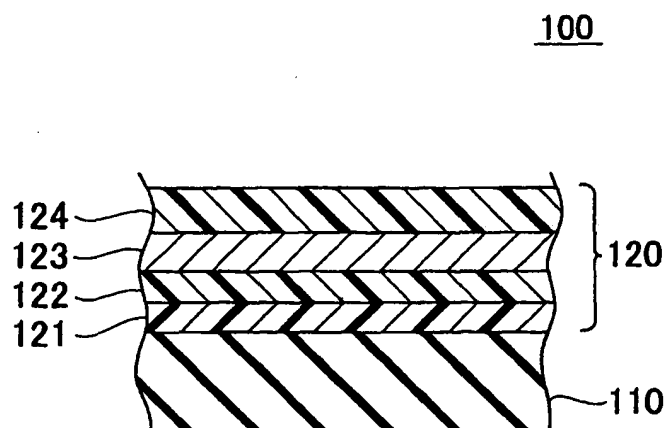


FIG. 5

100

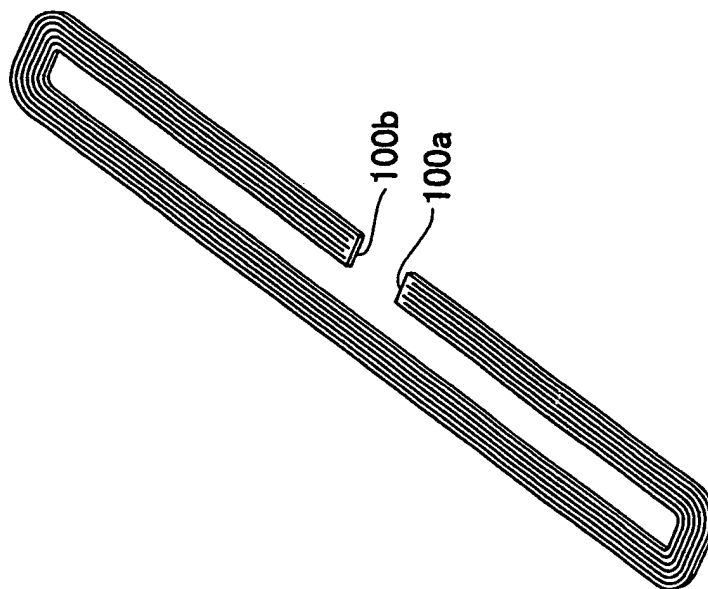


FIG. 6

110

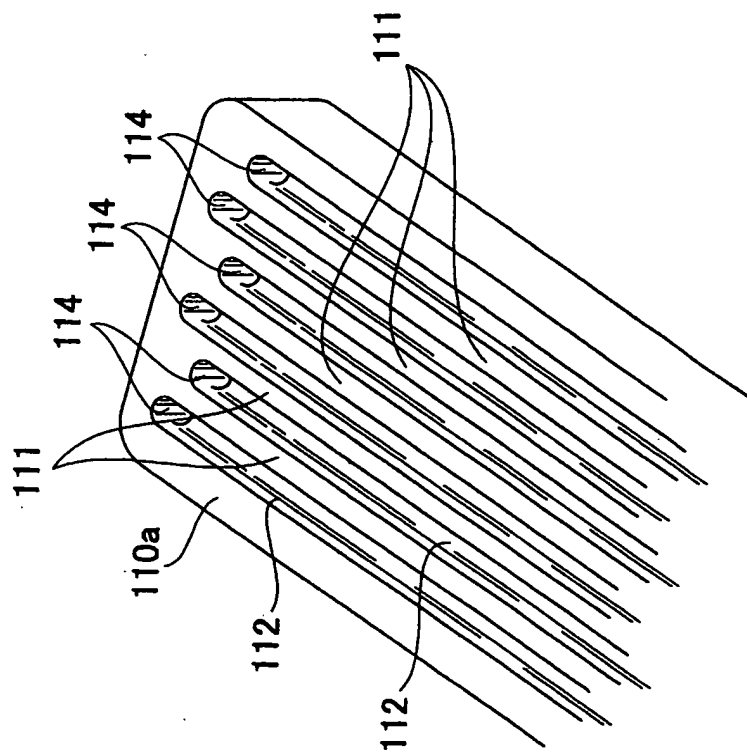


FIG. 7

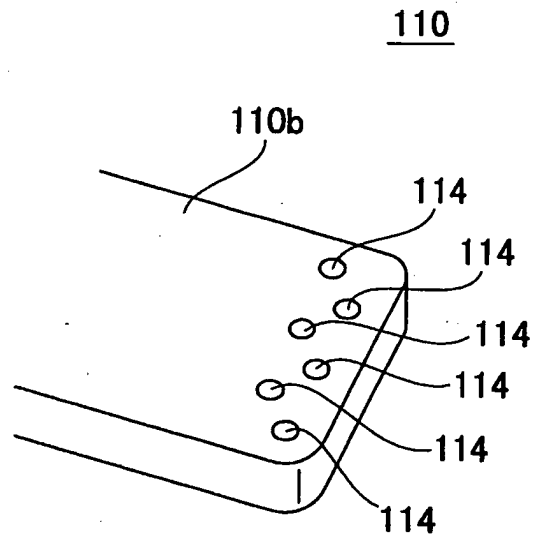


FIG. 8

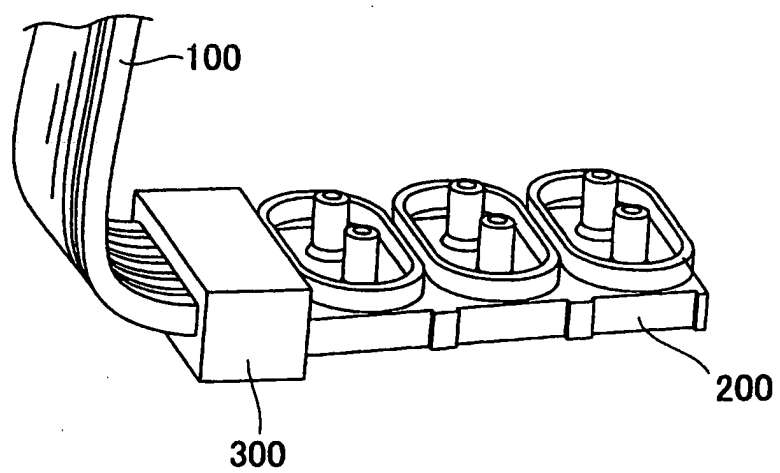


FIG. 9

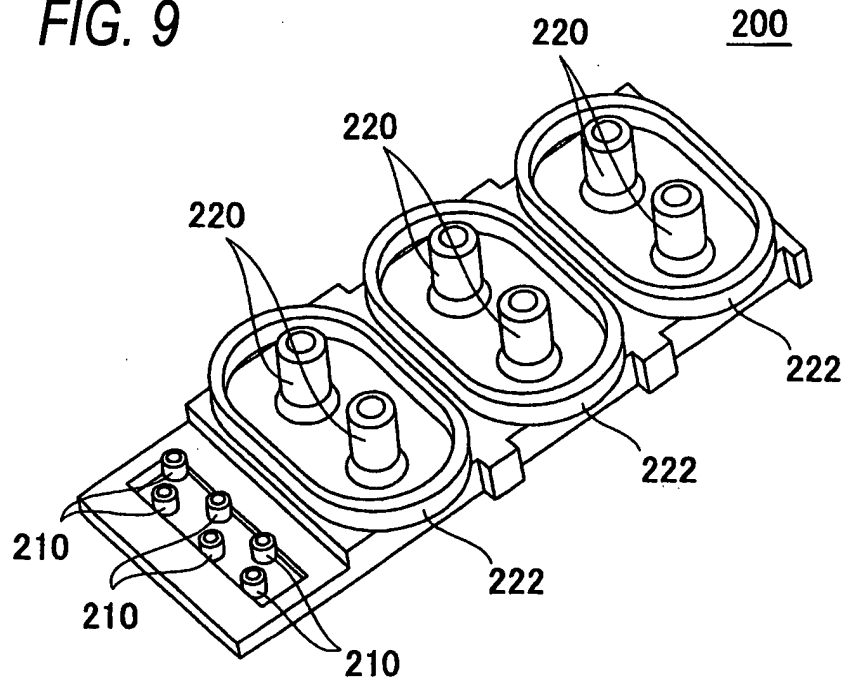


FIG. 10

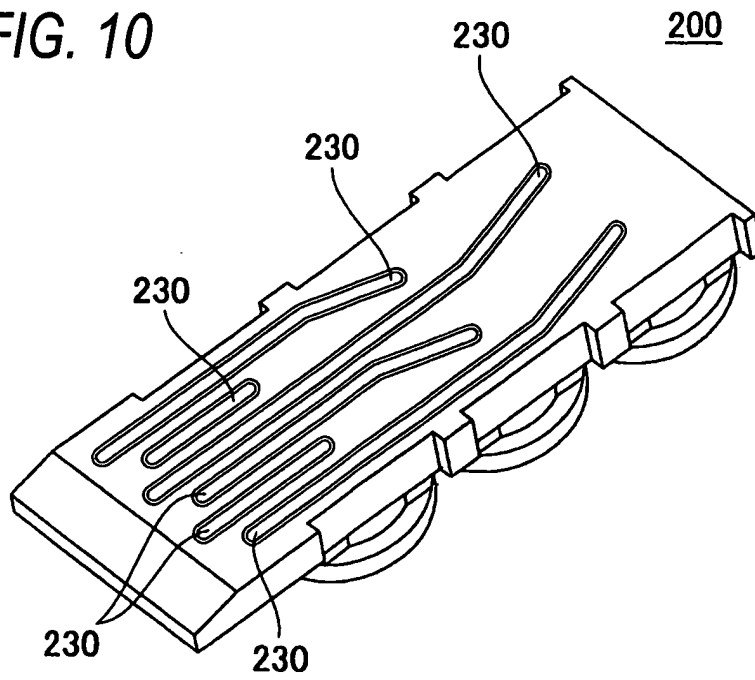


FIG. 11

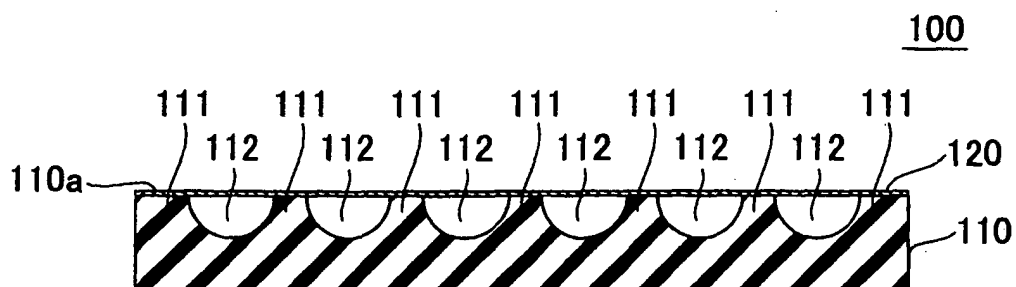


FIG. 12

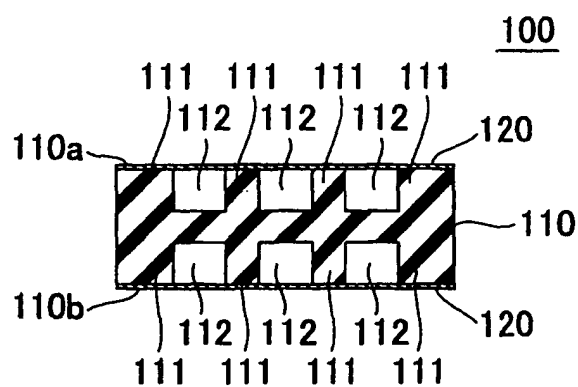


FIG. 13

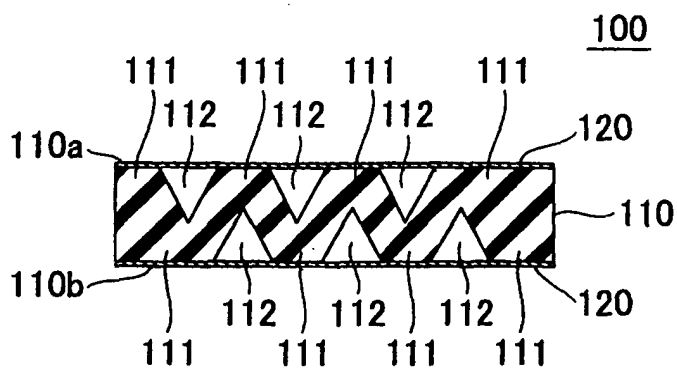


FIG. 14

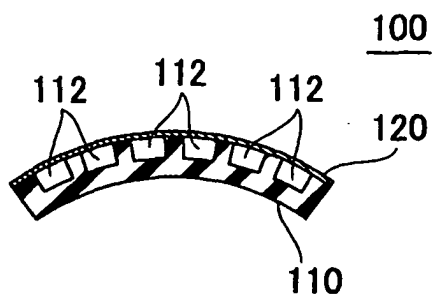


FIG. 15

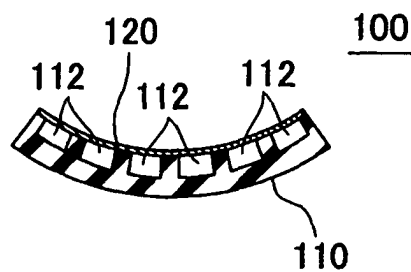


FIG. 16

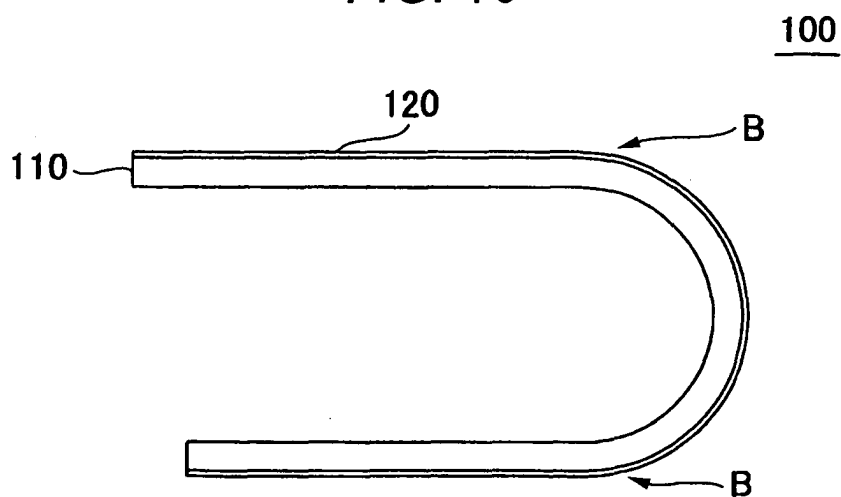


FIG. 17

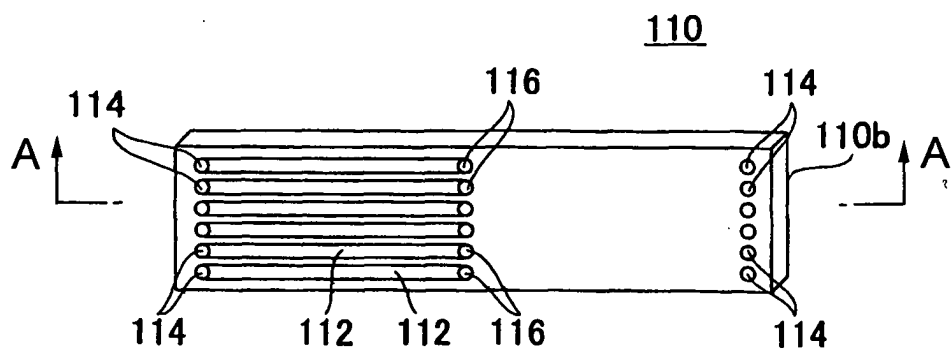


FIG. 18

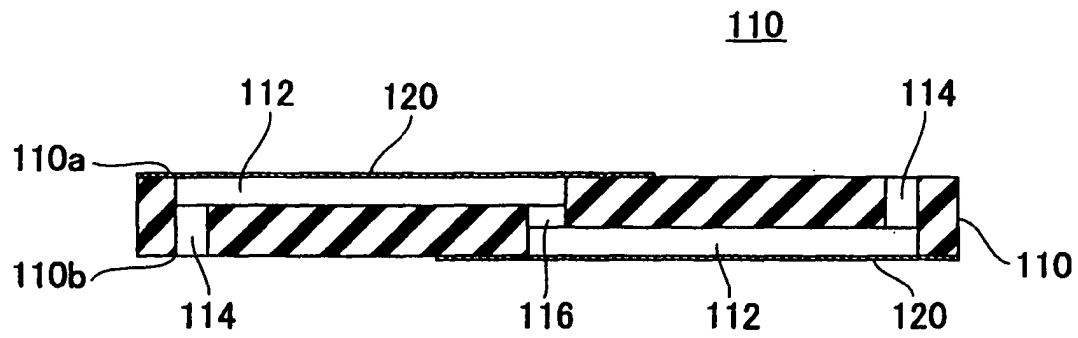


FIG. 19

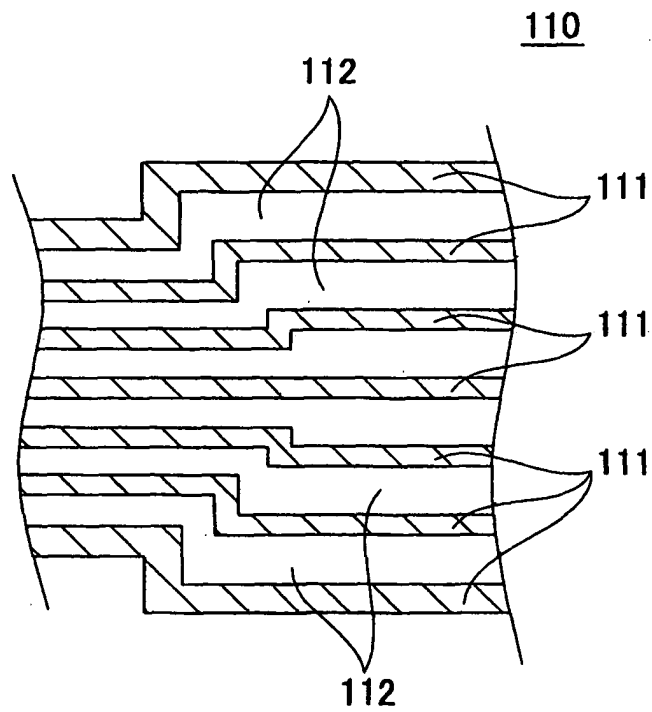


FIG. 20

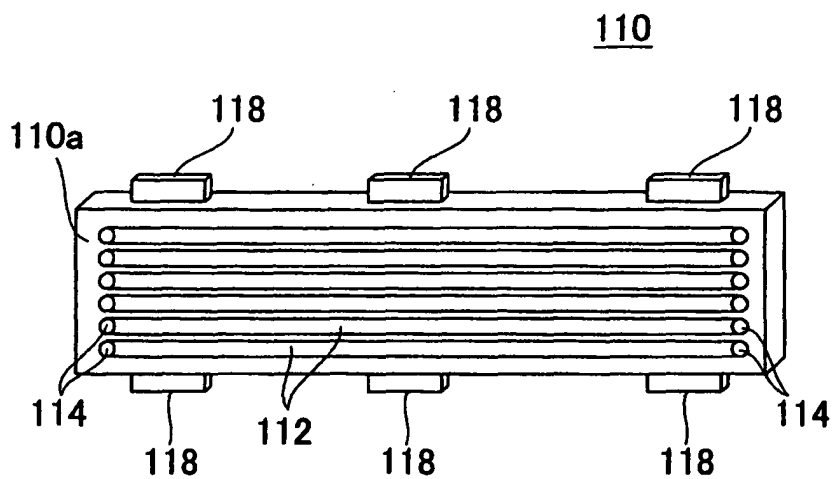


FIG. 21

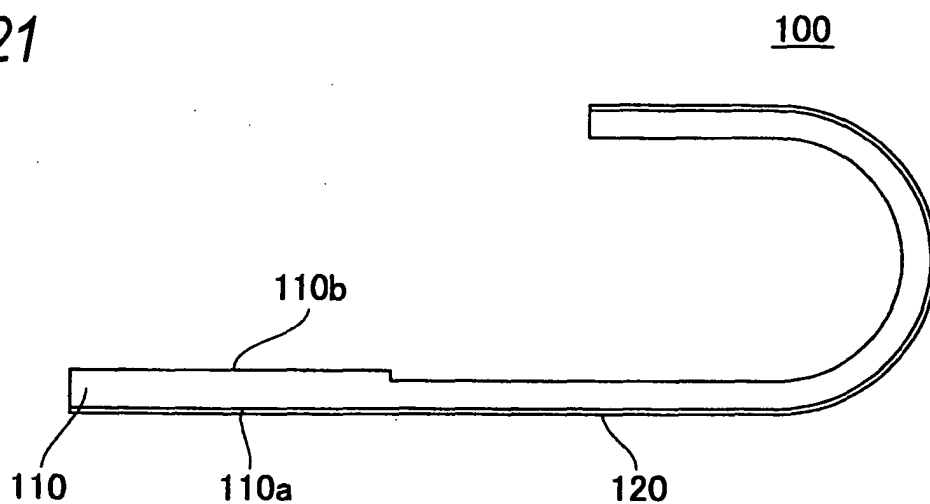
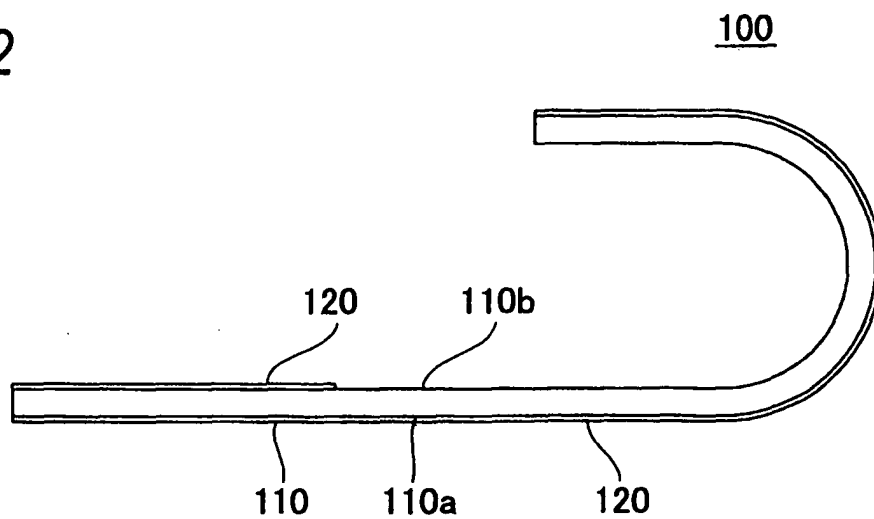


FIG. 22





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 01 8761

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Place of search MUNICH		Date of completion of the search 17 May 2004	Examiner Axters, M
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EPO FORM 1503 03.82 (P04C01)

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