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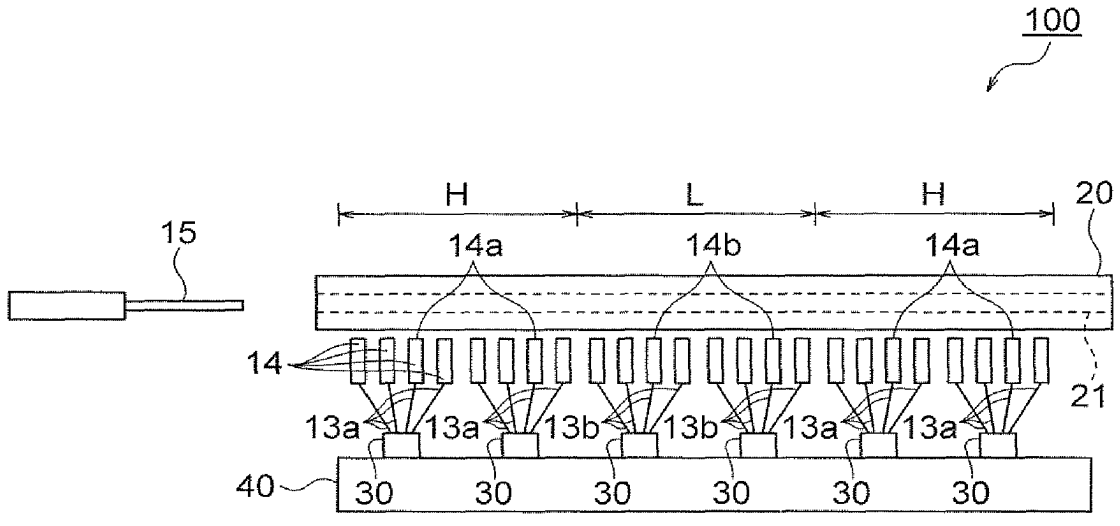
(54) **AIR-JET LOOM**

(57) An air-jet loom (100) includes a main nozzle (15) that injects a weft yarn into a weft insertion passage (21), a plurality of sub-nozzles (14) that is arranged along the weft insertion passage (21) and from which air is jetted, and an air tank (40) that is connected to the plurality of the sub-nozzles (14) and reserving air therein. The plurality of the sub-nozzles (14) includes a first sub-nozzle (14a) from which air is jetted into a high air-pressure zone (H) of the weft insertion passage (21), and a second sub-nozzle (14b) from which air is jetted into a low air-pressure zone (L) of the weft insertion passage (21). A flow resistance in a first air passage (16a) between the first sub-nozzle (14a) and the air tank (40) is lower than a flow resistance in a second air passage (16b) between the second sub-nozzle (14b) and the air tank (40).

FIG. 1



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Description

BACKGROUND ART

[0001] An air-jet loom includes a main nozzle that injects a weft yarn, and a plurality of sub-nozzles that is arranged along a weft insertion passage. Jetting air from the sub-nozzles enhances a force to transport the weft yarn through the weft insertion passage.

[0002] On an inlet side of the weft insertion passage, the volumes of air jetted from the sub-nozzles need to be set high to enhance the force to transport the weft yarn. Likewise, on an outlet side of the weft insertion passage, the volumes of air jetted from the sub-nozzles need to be set high to enhance a tensile force applied to the weft yarn. On the other hand, in the vicinity of the center portion of the weft insertion passage, the volumes of air jetted from the sub-nozzles may be set lower than those on the inlet side and the outlet side. An air-jet loom disclosed in EP2163670 includes an air tank connected to the sub-nozzles that are provided in the vicinity of the center portion of the weft insertion passage and other air tanks connected to the sub-nozzles that are provided on the inlet side and the outlet side of the weft insertion passage, as shown in Fig. 1 of EP2163670, to improve the energy efficiency. More specifically, an air pressure in the air tank connected to the sub-nozzles that are provided in the vicinity of the center portion of the weft insertion passage is lower than the air pressures in the air tanks connected to the sub-nozzles that are provided on the inlet side and the outlet side of the weft insertion passage in the air-jet loom shown in Fig. 1 of EP2163670.

[0003] However, as shown in Fig. 1 of the air-jet loom disclosed in EP2163670, in the weft insertion passage, the high air-pressure zone in which the volumes of air jetted from the sub-nozzles are high and the low air-pressure zone in which the volumes of air jetted from the sub-nozzles are low are at fixed positions determined by the positions of the air tanks to which those sub-nozzles are connected. These positions of the high air-pressure zone and the low air-pressure zone cannot be changed suitably for the width of the warp sheet in the reed to weave.

[0004] Pitches between the sub-nozzles in the high air-pressure zone may be varied from those in the low air-pressure zone. However, even in this method, it is difficult to change the positions of the high air-pressure zone and the low air-pressure zone in the weft insertion passage. What is more, the irregular arrangement of the sub-nozzles complicates the arrangement of the hoses connected to the sub-nozzles.

[0005] The present disclosure has been made in view of the above circumstances and is directed to providing an air-jet loom that is capable of adjusting the positions of a high air-pressure zone and a low air-pressure zone in the weft insertion passage, by easily changing the volumes of air jetted from a plurality of sub-nozzles, individually.

SUMMARY

[0006] In accordance with an aspect of the present disclosure, there is provided an air-jet loom. The air-jet loom includes a main nozzle that injects a weft yarn into a weft insertion passage, a plurality of sub-nozzles that is arranged along the weft insertion passage and from which air is jetted, and an air tank that is connected to the plurality of the sub-nozzles and reserves air therein. The plurality of the sub-nozzles includes a first sub-nozzle from which air is jetted into a high air-pressure zone of the weft insertion passage, and a second sub-nozzle from which air is jetted into a low air-pressure zone of the weft insertion passage. A flow resistance in a first air passage between the first sub-nozzle and the air tank is lower than a flow resistance in a second air passage between the second sub-nozzle and the air tank.

[0007] Other aspects and advantages of the disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principle of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The disclosure, together with objects and advantages thereof, may best be understood by reference to the following description of the embodiments together with the accompanying drawings in which:

FIG. 1 is a schematic view of an air-jet loom according to an embodiment of the present disclosure;

FIG. 2 is a cross-sectional view showing a structure of a connection point of a first hose or a second hose to an air tank in the air-jet loom of FIG. 1;

FIG. 3 is a cross-sectional view showing an installation structure of an end portion of the first hose or the second hose on the air-tank side thereof in the air-jet loom of FIG. 1;

FIGs. 4A and 4B are cross-sectional views schematically showing a difference in the shape of a sleeve attached to between the first hose and the second hose in the air-jet loom of FIG. 1, in which FIG. 4A shows the shape of a first sleeve provided for the first hose and FIG. 4B shows the shape of a second sleeve provided for the second hose;

FIGs. 5A and 5B are cross-sectional views schematically showing a difference in the shape between the first hose and the second hose in the air-jet loom according to another embodiment of the present disclosure, in which FIG. 5A shows the shape of the first hose and FIG. 5B shows the shape of the second hose;

FIGs. 6A and 6B are cross-sectional views schemat-

ically showing a difference in the shape between the first hose and the second hose in the air-jet loom according to yet another embodiment of the present disclosure, in which FIG. 6A shows the shape of the first hose and FIG. 6B shows the shape of the second hose; and

FIGs. 7A and 7B are cross-sectional views schematically showing differences between shapes of the first hose and the second hose in the air-jet loom according to yet another embodiment of the present disclosure, in which FIG. 7A shows the shape of the first hose and FIG. 7B shows the shape of the second hose.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0009] An air-jet loom according to an embodiment of the present disclosure will be described with reference to the accompanying drawings.

[0010] As shown in FIG. 1, an air-jet loom 100 includes a reed 20, a main nozzle 15 injecting a weft yarn into a weft insertion passage 21 that is formed along the reed 20, and twenty-four sub-nozzles 14 that are arranged along the weft insertion passage 21. The weft insertion passage 21 has high air-pressure zones H on an inlet side and an outlet side of the weft insertion passage 21. The weft insertion passage 21 also has a low air-pressure zone L between the high air-pressure zone H on the inlet side and the high air-pressure zone H on the outlet side. The sub-nozzle 14 that is arranged at a position associated with the high air-pressure zone H into which air is jetted therefrom is a first sub-nozzle 14a, and the sub-nozzle 14 that is arranged at a position associated with the low air-pressure zone L into which air is jetted therefrom is a second sub-nozzle 14b. The volume of air jetted from the first sub-nozzle 14a is higher than the volume of air jetted from the second sub-nozzle 14b. The number of the first sub-nozzles 14a associated with the high air-pressure zone H on the inlet side of the weft insertion passage 21 is eight, and the number of the first sub-nozzles 14a associated with the high air-pressure zone H on the outlet side of the weft insertion passage 21 is also eight.

[0011] By providing the high air-pressure zone H on the inlet side of the weft insertion passage 21, a force to transport the weft yarn is enhanced. Likewise, by providing the high air-pressure zone H on the outlet side of the weft insertion passage 21, a tensile force applied to the weft yarn is enhanced.

[0012] One end of each of first hoses 13a is connected to each of the first sub-nozzles 14a. The other end of each of the first hoses 13a is connected to an air tank 40 that reserves air therein. One end of each of second hoses 13b is connected to each of the second sub-nozzles 14b. The other end of each of the second hoses 13b is also connected to the air tank 40. A valve 30 is provided for every four first hoses 13a, and is disposed between the first hoses 13a and the air tank 40. Likewise, a valve 30 is provided for every four second hoses 13b and is disposed between the second hoses 13b and the air tank 40. Overall, six valves 30 are provided for sixteen first sub-nozzles 14a and eight second sub-nozzles 14b.

[0013] More specifically, as shown in FIG. 2, the first hoses 13a or the second hoses 13b are connected to the air tank 40 via a fixing members 50. A connector 11 is used to attach one end portion of each of the first hoses 13a or the second hoses 13b to the fixing member 50. A connecting passage 51 that connects the first hoses 13a or the second hoses 13b to the air tank 40 is formed in the fixing member 50. The valve 30 is attached to the fixing member 50. The valve 30 switches between the open state and the closed state of the connecting passage 51 through which air flows, and adjusts the air flow rate therethrough.

[0014] As shown in FIG. 3, to prevent the hose from being squashed, a substantially cylindrical shaped sleeve 12 is fitted into the end portion, on the air tank 40 side, of each of the first hoses 13a and the second hoses 13b each of which is inserted into the connecting passage 51 in the fixing member 50. As shown in FIG. 4A, the sleeve 12 fitted into the end portion of the first hose 13a on the air tank 40 side is referred to as a first sleeve 12a. As shown in FIG. 4B, the sleeve 12 fitted into the end portion of the second hose 13b on the air tank 40 side is referred to as a second sleeve 12b. An internal diameter D1 of the first sleeve 12a is larger than an internal diameter D2 of the second sleeve 12b. Thus, a flow resistance in a first air passage 16a formed inside the first hose 13a disposed between the first sub-nozzle 14a and the air tank 40 is lower than a flow resistance in a second air passage 16b formed inside the second hose 13b disposed between the second sub-nozzle 14b and the air tank 40. The flow resistance here refers to a force that interferes with an air flow in the first air passage 16a or the second air passage 16b depending on the shape thereof.

[0015] As described above, in the air-jet loom 100 according to the present embodiment, the flow resistance in the first air passage 16a between the first sub-nozzle 14a and the air tank 40 is lower than the flow resistance in the second air passage 16b between the second sub-nozzle 14b and the air tank 40. This allows the volume of air jetted from the first sub-nozzle 14a into the high air-pressure zone H of the weft insertion passage 21 to be higher than the volume of air jetted from the second sub-nozzle 14b into the low air-pressure zone L in the weft insertion passage 21. In other words, only by appropriately changing the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40, the sub-nozzle 14 connected to the air passage with a lower flow resistance has a higher volume of air jetted therefrom, which is the first sub-nozzle 14a, and the sub-nozzle 14 connected to the air passage with a higher flow resistance has a lower volume of air jetted therefrom, which is the second sub-nozzle 14b. In the weft insertion passage 21,

the high air-pressure zone H is thereby set to a position where the first sub-nozzle 14a is arranged, and the low air-pressure zone L is thereby set to a position where the second sub-nozzle 14b is arranged. Therefore, by appropriately changing the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40, and thereby by easily changing the volume of air jetted from the sub-nozzle 14, the positions of the high air-pressure zone H and the low air-pressure zone L are adjustable suitably for a changed width of the warp sheet in the reed to weave. The volumes of air jetted from the sub-nozzles 14 are individually adjustable, independently of the air tank 40 or the valves 30 to which the sub-nozzles 14 are connected.

[0016] In the air-jet loom 100, the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40 may be changed by selecting and appropriately exchanging between the first sleeve 12a having the larger internal diameter D1 and the second sleeve 12b having the smaller internal diameter D2. This thereby allows determining how much volume of air jetted from the sub-nozzle 14 to reduce according to the dimension of the sleeve 12, and easily changing the positions of the high air-pressure zones H and the low air-pressure zones L in the weft insertion passage 21. When the volume of air jetted from the sub-nozzle 14 is adjusted by the dimension of the sleeve 12, the stiffness of the hose disposed between the sub-nozzle 14 and the air tank 40 is not affected by the difference in the flow resistance in the air passage.

[0017] To change the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40, the internal diameter of the first hose 13a and the internal diameter of the second hose 13b may be different from each other, as shown in FIG. 5. In this case, the internal diameter of the first hose 13a shown in FIG. 5A is larger than the internal diameter of the second hose 13b shown in FIG. 5B, and the flow resistance in the second air passage 16b is higher than the flow resistance in the first air passage 16a.

[0018] To change the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40, the length of the second hose 13b may be set greater than the length of the first hose 13a, and the flow resistance in the second air passage 16b may be set higher than the flow resistance in the first air passage 16a. Even when the length is varied between the second hose 13b and the first hose 13a, the diameter and the material of these two hoses may be the same, which allows the component procurement easier.

[0019] To change the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40, the inner surface of the second hose 13b may be processed to be rough, as shown in FIG. 6. Specifically, providing an abrasive to the inner surface of the second hose 13b gives a higher degree of roughness to the inner surface of the second hose 13b shown in FIG. 6B than the roughness of the inner surface of the first hose 13a shown in FIG. 6A. The flow resistance in the second air passage 16b thus becomes higher than the flow resistance in the first air passage 16a.

[0020] To change the flow resistance in the air passage between the sub-nozzle 14 and the air tank 40, the cross-sectional shape of the first hose 13a and the cross-sectional shape of the second hose 13b may be different from each other, as shown in FIG. 7. Specifically, the cross-sectional shape of the inner surface of the first hose 13a shown in FIG. 7A is circular, whereas the cross-sectional shape of the inner surface of the second hose 13b shown in FIG. 7B is irregular. That is, the inner surface area of the second hose 13b is wider than the inner surface area of the first hose 13a. The flow resistance in the second air passage 16b thus becomes higher than the flow resistance in the first air passage 16a.

[0021] The cross-sectional shape of the inner surface may be varied between the first hose 13a and the second hose 13b by using different extrusion dies to form the hoses.

[0022] To make the first hose 13a and the second hose 13b easily identifiable, the color of the hoses may be made different between the first hose 13a and the second hose 13b.

[0023] An air-jet loom (100) includes a main nozzle (15) that injects a weft yarn into a weft insertion passage (21), a plurality of sub-nozzles (14) that is arranged along the weft insertion passage (21) and from which air is jetted, and an air tank (40) that is connected to the plurality of the sub-nozzles (14) and reserving air therein. The plurality of the sub-nozzles (14) includes a first sub-nozzle (14a) from which air is jetted into a high air-pressure zone (H) of the weft insertion passage (21), and a second sub-nozzle (14b) from which air is jetted into a low air-pressure zone (L) of the weft insertion passage (21). A flow resistance in a first air passage (16a) between the first sub-nozzle (14a) and the air tank (40) is lower than a flow resistance in a second air passage (16b) between the second sub-nozzle (14b) and the air tank (40).

Claims

1. An air-jet loom (100) comprising:

a main nozzle (15) that injects a weft yarn into a weft insertion passage (21);
a plurality of sub-nozzles (14) that is arranged along the weft insertion passage (21) and from which air is jetted; and
an air tank (40) that is connected to the plurality of the sub-nozzles (14) and reserves air therein,
characterized in that
the plurality of the sub-nozzles (14) includes:

a first sub-nozzle (14a) from which air is jetted into a high air-pressure zone (H) of the weft insertion passage (21); and

a second sub-nozzle (14b) from which air is jetted into a low air-pressure zone (L) of the weft insertion passage (21), and

a flow resistance in a first air passage (16a) between the first sub-nozzle (14a) and the air tank (40) is lower than a flow resistance in a second air passage (16b) between the second sub-nozzle (14b) and the air tank (40).

2. The air-jet loom (100) according to claim 1, **characterized in that**

a first hose (13a) is provided between the first sub-nozzle (14a) and the air tank (40),
a first sleeve (12a) is fitted into an end portion of the first hose (13a) on the air tank (40) side,
a second hose (13b) is provided between the second sub-nozzle (14b) and the air tank (40),
a second sleeve (12b) is fitted into an end portion of the second hose (13b) on the air tank (40) side, and
an internal diameter (D2) of the second sleeve (12b) is smaller than an internal diameter (D1) of the first sleeve (12a).

3. The air-jet loom (100) according to claim 1, **characterized in that**

a first hose (13a) is provided between the first sub-nozzle (14a) and the air tank (40),
a second hose (13b) is provided between the second sub-nozzle (14b) and the air tank (40), and
a length of the second hose (13b) is greater than a length of the first hose (13a).

4. The air-jet loom (100) according to claim 1, **characterized in that**

a first hose (13a) is provided between the first sub-nozzle (14a) and the air tank (40),
a second hose (13b) is provided between the second sub-nozzle (14b) and the air tank (40), and
roughness of an inner surface of the second hose (13b) is higher than roughness of an inner surface of the first hose (13a).

5. The air-jet loom (100) according to claim 1, **characterized in that**

a first hose (13a) is provided between the first sub-nozzle (14a) and the air tank (40),
a second hose (13b) is provided between the second sub-nozzle (14b) and the air tank (40), and
an inner surface area of the second hose (13b) is wider than an inner surface area of the first hose (13a).

FIG. 1

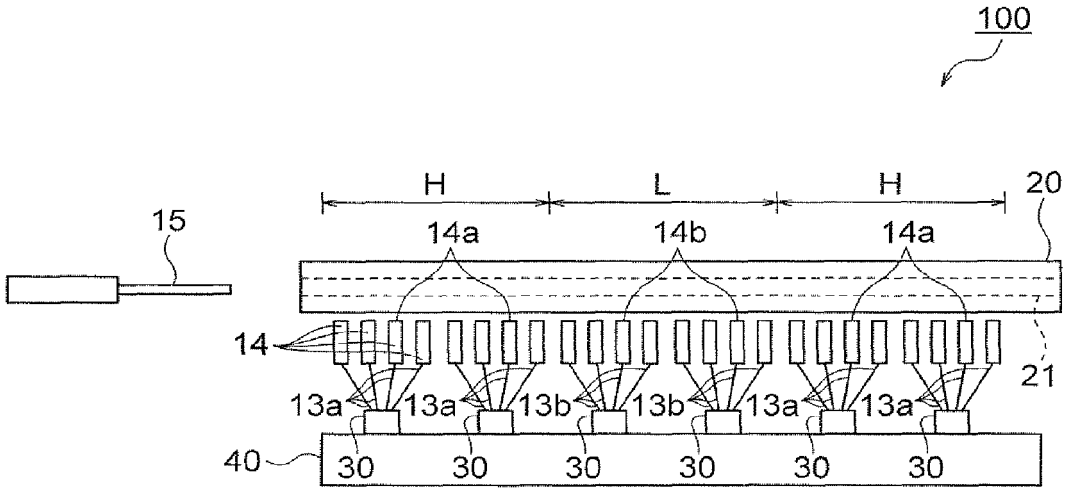

100
H
L
H
20
15
14a
14b
14a
14
21
13a
13a
13b
13b
13a
13a
40
30
30
30
30
30
30

FIG. 2

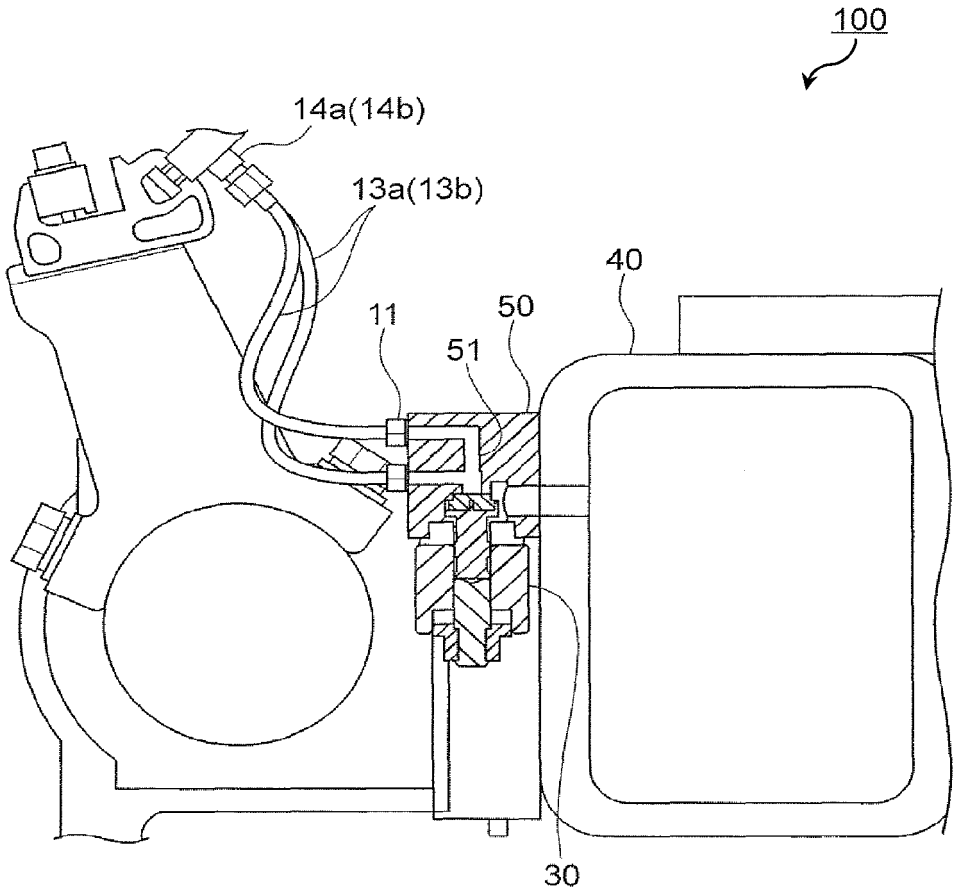

100
14a(14b)
13a(13b)
40
11
50
51
30

FIG. 3

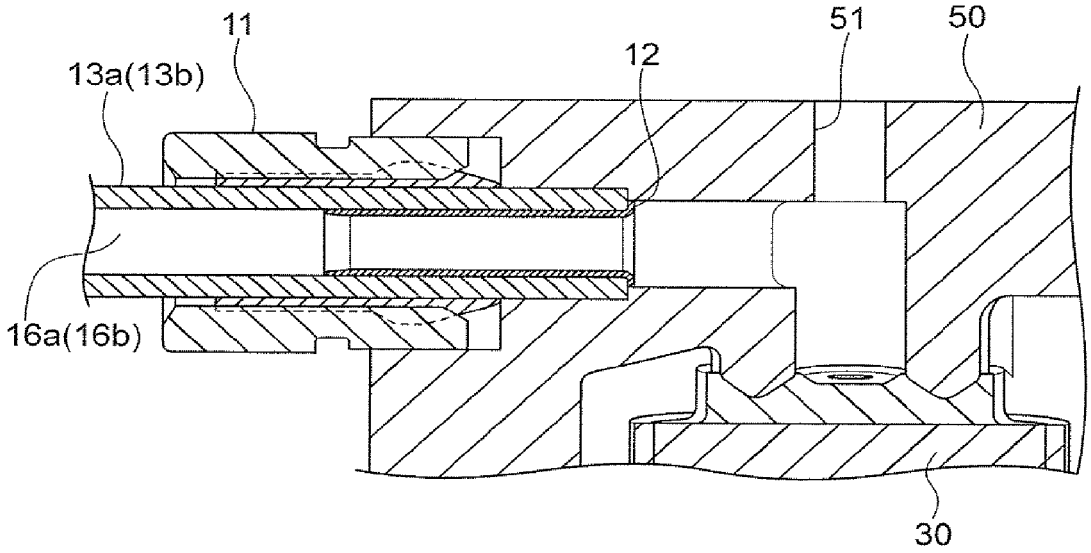


FIG. 4A

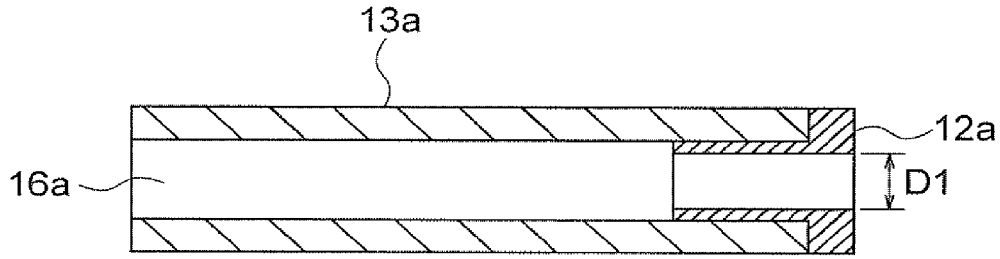


FIG. 4B

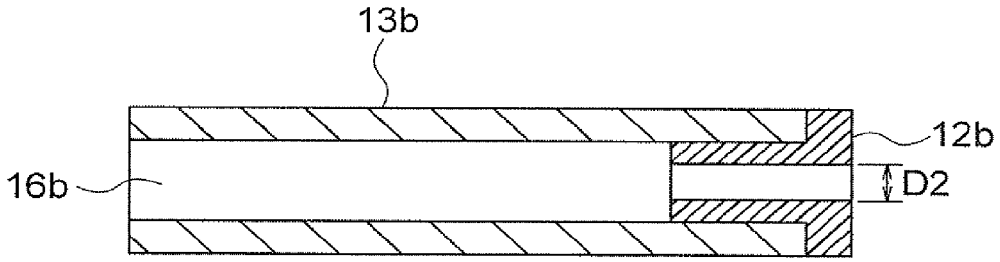


FIG. 5A

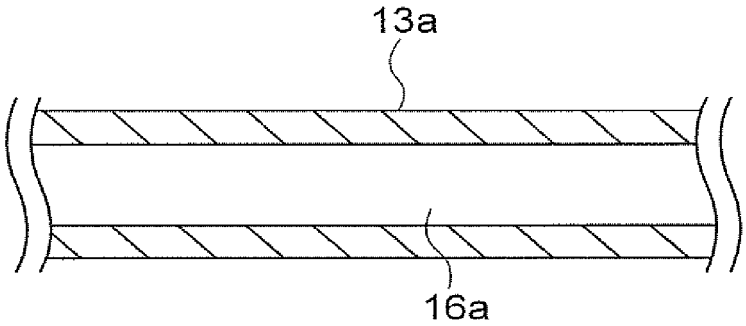


FIG. 5B

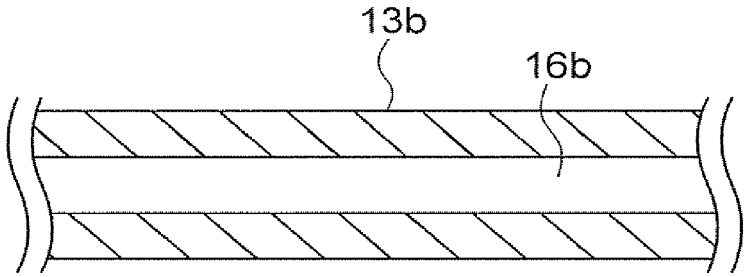


FIG. 6A

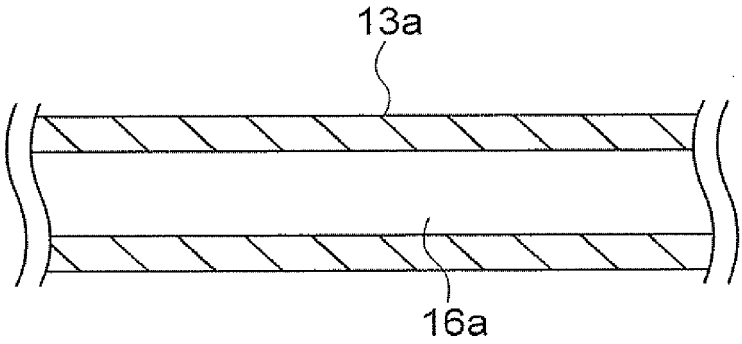


FIG. 6B

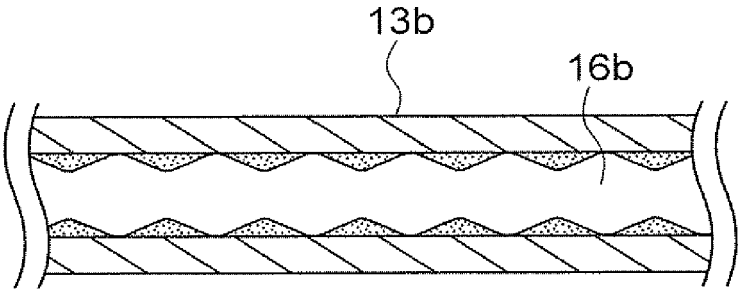


FIG. 7A

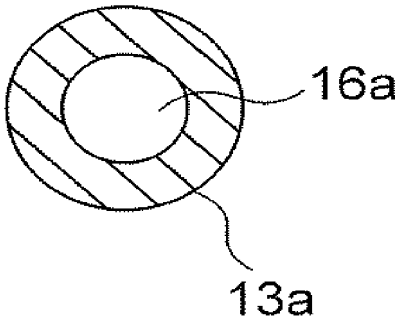
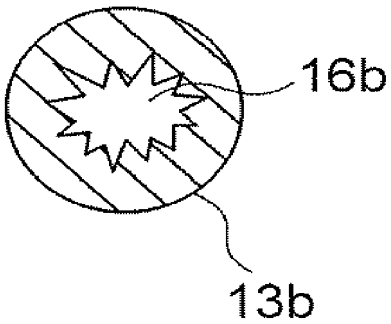


FIG. 7B



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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 5285

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	JP 2016 172937 A (TOYOTA IND CORP) 29 September 2016 (2016-09-29) * claim 1 * * figures 1-5 * * paragraphs [0001] - [0003], [0006] - [0008], [0019], [0020], [0025], [0028], [0029], [0041] *	1	TECHNICAL FIELDS SEARCHED (IPC) D03D
A	US 4 458 731 A (TAKAHASHI TAKAO [JP] ET AL) 10 July 1984 (1984-07-10) * abstract * * claims 1-11 * * figures 1-5 * * column 1, line 1 - column 2, line 47 * * column 3, line 28 - line 59 * * column 4, line 14 - line 27 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 February 2020	Heinzelmann, Eric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 20 5285

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2163670 A **[0002] [0003]**