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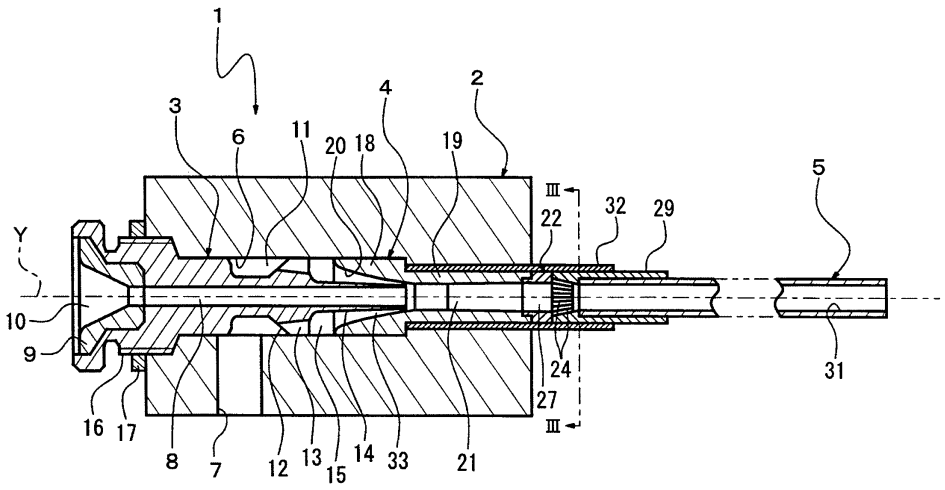
(54) Main nozzle of an air jet loom

(57) A main nozzle (1) for an air jet loom includes a yarn inlet pipe (3) into which a weft yarn (Y) is introduced, a passage forming pipe (4) cooperating with a downstream end of the yarn inlet pipe (3) to form therebetween an air passage (33), a yarn accelerator pipe (5) disposed downstream of the passage forming pipe (4), and a nozzle body (2) to which the yarn inlet pipe (3), the passage forming pipe (4) and the yarn accelerator pipe (5) are mounted. A brush (22) as a weft yarn catcher is disposed between the yarn inlet pipe (3) and the yarn accelerator pipe (5).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a main nozzle of an air jet loom with a structure which functions to catch a weft yarn which has been cut.

[0002] During weft insertion in an air jet loom, a weft yarn inserted into a shed by a main nozzle is subjected to a strong tension by injection air. When such weft yarn is cut at the selvedge of woven fabric after completion of the weft insertion, spring back of the weft yarn occurs, which may cause the weft yarn to be moved out of the main nozzle. In particular, a weft yarn of high stretchablity, which is also called stretch yarn, is shrunk significantly simultaneously with the cutting of weft yarn. There has been known a method of actively or passively holding a weft yarn to prevent a weft yarn from being moved out of the main nozzle. In the active holding, the end of the weft yarn which has been cut after the completion of weft insertion is held in the main nozzle, for example, by a slight amount of low pressure air supplied to the main nozzle, or an actively operable mechanical clamp.

[0003] Such active holding method, however, leads to an increased air consumption due to the supply of additional air and also to a complicated mechanical structure. To solve such problems, for example, Japanese Unexamined Patent Application Publication No. 2007-177341 proposes a method of holding a weft yarn passively, and specifically discloses a weft insertion nozzle including a nozzle body having a through hole, a needle having a hole through which a weft yarn is passed, a flow rectifier fitted in the hole of the nozzle body, and a pipe projecting downstream from the nozzle body. The weft insertion nozzle further includes a detachable yarn guide mounted to the upstream end of the hole of the needle or weft yarn inlet.

[0004] The detachable yarn guide is formed of an annular holder mounted to the upstream end of the needle and plural filaments bonded to the periphery of the holder by adhesive tape. With the holder mounted in place to the upstream end of the needle, the filaments are bent inward by the inner surface of the hole within the needle so that the tips of the filaments are positioned on or adjacent to the central axis of the hole of the needle. After the completion of weft insertion and the cutting of weft yarn, the weft yarn is moved back upstream in the hole of the needle of the weft insertion nozzle due to its spring back. In this case, the tips of the filaments enter between the fibers of the weft yarn so that the weft yarn is caught.

[0005] The publication No. 2007-177341 also discloses another arrangement of the filaments for catching weft yarn. Specifically, there is provided a holder ring at the downstream end of the pipe or weft yarn outlet, and a number of filaments are bonded to the outer periphery of the holder ring by adhesive tape. The holder ring is mounted to the downstream end of the pipe in such a manner that the tips of the filaments are directed downstream. The filaments are bent by another ring fitted onto the holder ring so that the tips of the filaments are positioned on or adjacent to the central axis of the pipe. After the completion of weft insertion, the weft yarn having been cut and then moved back toward the upstream side of the weft insertion nozzle due to spring back is caught by the filaments provided at the end of the pipe and kept remaining in the weft yarn passage of the weft insertion nozzle.

[0006] In the above publication No. 2007-177341 in which the filaments are provided at the inlet of the needle, the inner diameter of the hole of the needle is generally small and, therefore, the filaments are positioned adjacent to the central axis of the hole of the needle. In this case, when compressed air is supplied to the weft insertion nozzle at a start of weft insertion, the filaments prevents the air flow caused by vacuum and the movement of the weft yarn in the hole of the needle, which may prevent proper movement of weft yarn. In addition, as described above, the weft yarn which has been cut after the completion of weft insertion may be moved back into the hole of the needle due to spring back, and, particularly, a stretch yarn having high stretchablity is shrunk significantly simultaneously with the cutting of the weft yarn and moved back into the hole of the needle. At the subsequent weft insertion, the weft yarn having been caught by the filaments and present in the hole of the needle is moved only by the air flow caused by vacuum, which means that proper weft insertion cannot be performed successfully.

[0007] In the case that the filaments are provided at the outlet of the pipe, it is difficult to catch a weft yarn because the cutter for cutting a weft yarn after the completion of weft insertion is located adjacent to the outlet of the pipe, generally at a distance of a few millimeters from the outlet of the pipe. Specifically, the weft yarn just after cutting is straight in a tensioned state as it was before the cutting, and moved back with a shrinkage of weft yarn. Such straight weft yarn just after cutting passes through the filaments that is located adjacent to the cutting position of the weft yarn, which makes it difficult to catch the weft yarn by the filaments.

[0008] In order to catch a weft yarn at the outlet of the pipe, the filaments need to be positioned closer to the central axis of the pipe so that weft yarn passage is substantially closed by the filaments. However, the filaments thus positioned closer to the axis of the pipe hampers air injection and hence the movement of weft yarn, which may cause improper weft insertion.

[0009] The present invention is directed to providing a main nozzle of an air jet loom which allows reliable catching of cut end of a weft yarn while giving less influence on air flow.

SUMMARY OF THE INVENTION

[0010] In accordance with an aspect of the present invention, a main nozzle of an air jet loom includes a yarn

inlet pipe into which a weft yarn is introduced, a passage forming pipe cooperating with a downstream end of the yarn inlet pipe to form therebetween an air passage, a yarn accelerator pipe disposed downstream of the passage forming pipe, and a nozzle body to which the yarn inlet pipe, the passage forming pipe and the yarn accelerator pipe are mounted. A brush as a weft yarn catcher is disposed between the yarn inlet pipe and the yarn accelerator pipe.

[0011] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a longitudinal sectional view of a main nozzle of an air jet loom according to an embodiment of the present invention;

Fig. 2 is an enlarged fragmentary view of the main nozzle of Fig. 1, showing a brush and its related components of the main nozzle;

Fig. 3 is a cross-sectional view taken along the line III-III of Fig. 1;

Fig. 4 is an fragmentary sectional view of the main nozzle of Fig. 1, explaining how a weft yarn is caught;

Fig. 5 is a perspective view of the brush of Fig. 2;

Fig. 6 is a longitudinal sectional view of the brush of Fig. 5; and

Fig. 7 is a cross-sectional view taken along the line VII-VII of Fig. 6.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0013] The following will describe one embodiment of a main nozzle of an air jet loom according to the present invention with reference to Figs. 1 to 7. It is noted that the terms "upstream" and "downstream" appearing in the following description are used to denote directions or relative positions with respect to the direction in which a weft yarn is moved for weft insertion. Referring to Figs. 1 to 3, the main nozzle which is designated generally by 1 mainly includes a nozzle body 2, and a yarn inlet pipe 3, a passage forming pipe 4 and a yarn accelerator pipe 5 which are fixed to the nozzle body 2.

[0014] The nozzle body 2 has therethrough an axial hole 6 in which the yarn inlet pipe 3 is inserted. The nozzle body 2 also has therein a compressed air passage 7 for connection to an air tank (not shown) through a pipe (not shown either). The yarn inlet pipe 3 has a longitudinally extending central yarn passage 8 and is equipped with a yarn inlet 10 having a guide 9 that is connected at the upstream end of the passage 8. The guide 9 is made of a rigid material such as a ceramic and has a funnelled opening.

[0015] The part of the yarn inlet pipe 3 facing the passage 7 is made smaller in diameter so that a first annular chamber 11 is formed between the inner peripheral surface of the hole 6 of the nozzle body 2 and the outer peripheral surface of the yarn inlet pipe 3. The yarn inlet pipe 3 has plural radial fins 12 downstream of the first annular chamber 11. With the yarn inlet pipe 3 inserted in place in the nozzle body 2, the fins 12 are contact at their tips with the inner peripheral surface of the hole 6 so that plural passages 13 in communication with the first annular chamber 11 are formed between any two adjacent fins 12. The yarn inlet pipe 3 has a tapered downstream end 14. The downstream end 14 of the yarn inlet pipe 3 need not necessarily be tapered but may be extended straight and parallel to the direction in which a weft yarn is moved for weft insertion.

[0016] A second annular chamber 15 is formed downstream of the passages 13. The first annular chamber 11, the passages 13, the second annular chamber 15 cooperate to form a compressed air passage between the inner peripheral surface of the hole 6 of the nozzle body 2 and the outer peripheral surface of the yarn inlet pipe 3. The upstream part of the yarn inlet pipe 3 has on its outer periphery an external thread 16 that is engaged with an internal thread formed on the inner peripheral surface of the hole 6 of the nozzle body 2 so that the end 14 of the yarn inlet pipe 3 is positioned appropriately by screwing the yarn inlet pipe 3 into the hole 6 of the nozzle body 2. Tightening a lock nut 17 engaged with the external thread 16, the yarn inlet pipe 3 is fixed to the nozzle body 2.

[0017] The passage forming pipe 4 is disposed in the hole 6 of the nozzle body 2 at a position downstream of the yarn inlet pipe 3. The passage forming pipe 4 has on its upstream side a large-diameter portion 18 and on its downstream side a small-diameter portion 19 having a smaller diameter than the large-diameter portion 18. The passage forming pipe 4 has in the large-diameter portion 18 thereof a tapered inner peripheral surface 20 and in the small-diameter portion 19 thereof a passage 21 extending downstream of the inner peripheral surface 20. The inner peripheral surface 20 of the passage forming pipe 4 cooperates with the outer peripheral surface of the tapered end 14 of the yarn inlet pipe 3 to form therebetween a passage 33 through which compressed air flows. The yarn accelerator pipe 5 is disposed downstream of the passage forming pipe 4 and a brush 22 as a weft yarn catcher is interposed between the passage forming pipe 4 and the yarn accelerator pipe 5.

[0018] Referring to Figs. 5 to 7, the brush 22 is formed of a cylindrical holder 23 and a number of filaments 24. The holder 23 has on its upstream side a small-diameter portion 25 and on its downstream side a large-diameter

portion 26 having a larger diameter than the small-diameter portion 25, and is formed therethrough at the center thereof with a hole 27 through which air flows. The filaments 24 are implanted in the downstream end of the large-diameter portion 26 of the holder 23 and bonded thereto by means such as adhesive. The filaments 24 are arranged along the circumference of the hole 27 in such a manner that the tips of the filaments 24 are directed downstream and the circumferentially arranged filaments 24 as a whole are tapered downstream.

[0019] Each of the filaments 24 is made of material such as resin, metal or animal hair.

[0020] As shown in detain in Figs. 2 and 3, the positioning of the brush 22 downstream of the passage forming pipe 4 is accomplished by engagement of the small-diameter portion 25 of the holder 23 with a recess 28 formed in the downstream end of the small-diameter portion 19 of the passage forming pipe 4. The yarn accelerator pipe 5 is held by a first holder 29 which is disposed downstream of the brush 22. The upstream part of the yarn accelerator pipe 5 is fitted in the first holder 29 and secured thereto by means such as adhesive so that the yarn accelerator pipe 5 and the first holder 29 are integrated.

[0021] The first holder 29 has at its upstream end a downstream tapered passage 30 that is connected at its downstream end smoothly to a passage 31 formed within the yarn accelerator pipe 5. The filaments 24 of the brush 22 are disposed along the tapered inner peripheral surface of the passage 30 of the first holder 29. The diameter of the space surrounded by the downstream ends of the respective filaments 24 is set substantially the same as the diameters of the hole 27 and the passage 31 within the yarn accelerator pipe 5 (see Fig. 3). The hole 27 and the passage 31 have substantially the same diameter. The large-diameter portion 26 of the brush 22 is held between the downstream end of the small-diameter portion 19 of the passage forming pipe 4 and the upstream end of the first holder 29.

[0022] The small-diameter portion 19 of the passage forming pipe 4, the large-diameter portion 26 of the holder 23 of the brush 22 and the upstream part of the first holder 29 are fitted in a second holder 32 and bonded together by adhesive thereby to form one unit. As shown in Fig 1, inserting the second holder 32 into the hole 6 of the nozzle body 2, the passage forming pipe 4, the brush 22 and the yarn accelerator pipe 5 which are integrated into one unit can be mounted to the nozzle body 2 at one time, which facilitates assembly of the main nozzle 1. Inserting the second holder 32 into the hole 6 of the nozzle body 2 so that the large-diameter portion 18 of the passage forming pipe 4 is engaged with a stepped part of the hole 6, the second holder 32 can be positioned properly.

[0023] The following will describe the operation of the main nozzle 1 during weft insertion and also how a weft yarn is caught. At a time of weft insertion while the air jet loom is operating, compressed air is supplied through the passage 7 to the first annular chamber 11 of the main nozzle 1 in response to the operation of an air valve (not shown). After being rectified by the passages 13, the compressed air flows through the second annular chamber 15 and then injected into the passage 21 from the restricted passage 33. A weft yarn Y introduced into the yarn passage 8 of the yarn inlet pipe 3 and present between the passages 21, 31 is drawn by air injected through the passage 33.

[0024] The filaments 24 of the brush 22 are disposed in the passage 30 having a larger diameter than the yarn passage 8 of the yarn inlet pipe 3 and the space surrounded by the downstream ends of the filaments 24 of the brush 22 has a diameter that is substantially the same as the diameter of the passage 31 of the yarn accelerator pipe 5. Air injected from the passage 33 is less affected by the filaments 24 of the brush 22 as compared to the case of the above-cited background art, flowing smoothly through the passage 21, the hole 27 and the passage 31, so that the weft yarn Y is moved properly. Passing through the passage 31, the weft yarn Y is injected out from the downstream opening of the yarn accelerator pipe 5 and then inserted into a warp shed (not shown).

[0025] When the weft insertion is completed and the weft yarn Y is cut by a cutter (not shown), the weft yarn Y on the side thereof that is closer to the main nozzle 1 is pulled upstream due to tension acting thereon and moved back into the passage 31 of the yarn accelerator pipe 5. In this case, particularly, a stretch yarn having high stretchablity is shrunk significantly. As shown in Fig. 4, the weft yarn Y is shrunk in the form of a meander while being brought into repeated contact with the inner wall of the passage 31 of the yarn accelerator pipe 5. The weft yarn Y having passed through the yarn accelerator pipe 5 is shrunk in the form of a meander also at a position where the brush 22 is disposed, and such weft yarn Y is caught by the filaments 24 of the brush 22. Thus, such shrinkage movement of the weft yarn Y is stopped by the filaments 24, so that the leading end of the weft yarn Y is kept remaining in the passage 31 of the yarn accelerator pipe 5.

[0026] At a start of the subsequent weft insertion, air injected from the passage 33 serves to draw the weft yarn Y which has been caught by the filaments 24 of the brush 22 and present in the passage 31, so that weft insertion is performed properly. In this case, the downstream ends of the filaments 24 are circularly arranged to form a round space radially inward thereof, the diameter of which is substantially the same as the diameter of the passage 31 of the yarn accelerator pipe 5, so that the air flows smoothly without being affected by the filaments 24. Additionally, because no obstacle exists in the passage 31 and the flow of air is rectified, stabilized weft insertion is achieved.

[0027] It is to be understood that the present invention is not limited to the above-described embodiment, but it may be modified in various ways as exemplified below without departing from the scope of the invention.

(1) The brush 22 need not necessarily be provided between the passage forming pipe 4 and the first holder 29, but may be provided at any suitable position between the yarn inlet pipe 3 and the yarn accelerator pipe 5.

(2) The filaments 24 of the brush 22 may be arranged not only in the form of a circle, but also in the form of an ellipse or a polygon. The filaments 24 also need not necessarily be arranged over the entire circumference of the hole 27 of the brush 22, but may be arranged only partly along the circumference of the hole 27, which also serves to catch the weft yarn Y moving in the form of a meander.

(3) The brush 22 need not necessarily be held between the passage forming pipe 4 and the first holder 29, but may be mounted directly to the nozzle body 2 or the second holder 32.

(4) The first holder 29 to hold the yarn accelerator pipe 5 need not necessarily be used. Alternatively, the passage forming pipe 4, the brush 22 and the yarn accelerator pipe 5 may be mounted directly to the second holder 32 as long as the brush 22 is provided between the yarn inlet pipe 3 and the yarn accelerator pipe 5.

(5) The passage forming pipe 4, the brush 22 and the yarn accelerator pipe 5 need not necessarily be integrated into one unit by use of the second holder 32, but such components may be mounted separately and directly to the nozzle body 2.

[0028] A main nozzle of an air jet loom includes a yarn inlet pipe into which a weft yarn is introduced, a passage forming pipe cooperating with a downstream end of the yarn inlet pipe to form therebetween an air passage, a yarn accelerator pipe disposed downstream of the passage forming pipe, and a nozzle body to which the yarn inlet pipe, the passage forming pipe and the yarn accelerator pipe are mounted. A brush as a weft yarn catcher is disposed between the yarn inlet pipe and the yarn accelerator pipe.

Claims

1. A main nozzle (1) of an air jet loom, comprising:

a yarn inlet pipe (3) into which a weft yarn (Y) is introduced;
a passage forming pipe (4) cooperating with a downstream end (14) of the yarn inlet pipe (3) to form therebetween an air passage (33);
a yarn accelerator pipe (5) disposed downstream of the passage forming pipe (4); and
a nozzle body (2) to which the yarn inlet pipe (3), the passage forming pipe (4) and the yarn accelerator pipe (5) are mounted,
characterized in that a brush (22) as a weft yarn catcher is disposed between the yarn inlet pipe (3) and the yarn accelerator pipe (5).

2. The main nozzle (1) of claim 1, wherein the brush (22) is held between the passage forming pipe (4) and a first holder (29) that holds the yarn accelerator pipe (5).

3. The main nozzle (1) of claim 2, wherein the passage forming pipe (4), the brush (22) and the first holder (29) are held by a second holder (32) that is mounted to the nozzle body (2).

4. The main nozzle (1) of any one of claims 1 to 3, wherein the brush (22) is formed of a cylindrical holder (23) and a number of filaments (24) implanted in the holder (23), the holder (23) has a hole (27) through which air flows, and the filaments (24) are arranged along the circumference of the hole (27).

FIG. 1

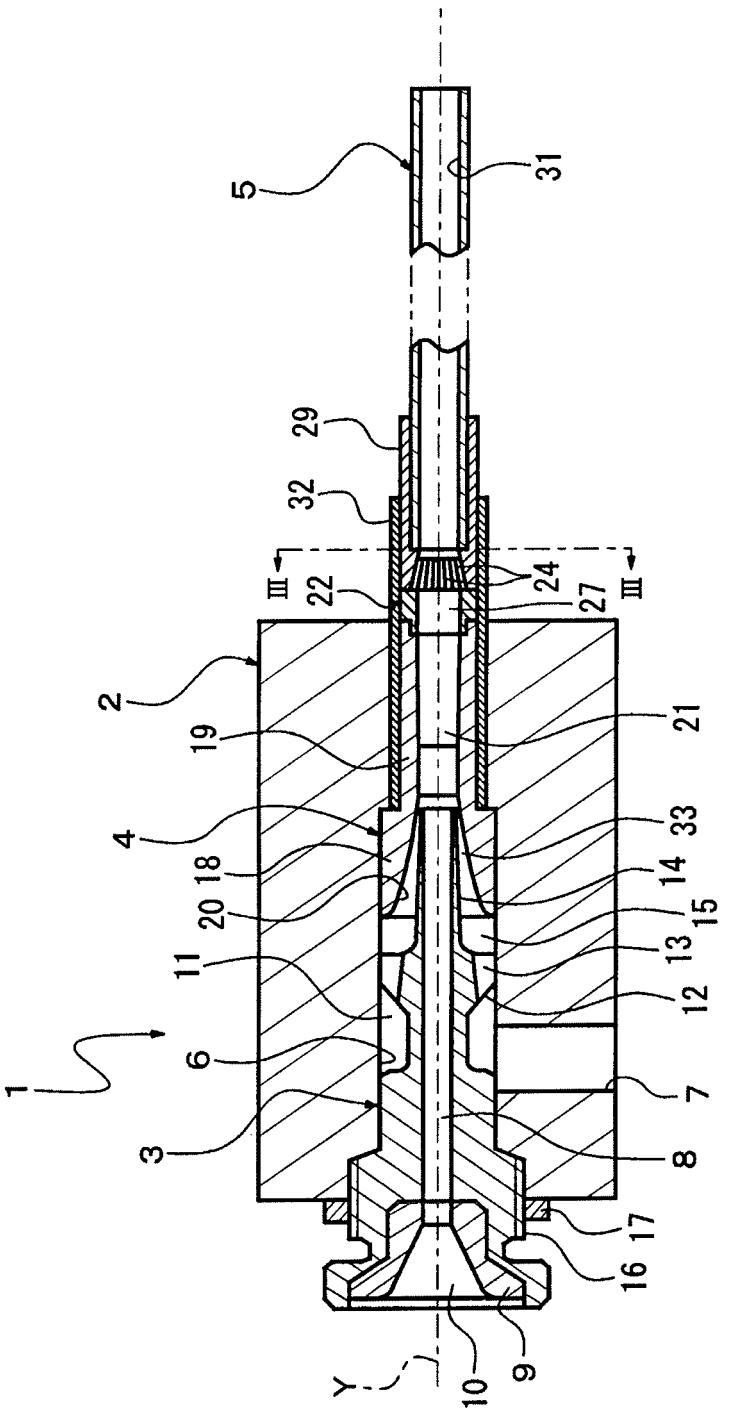
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FIG. 2

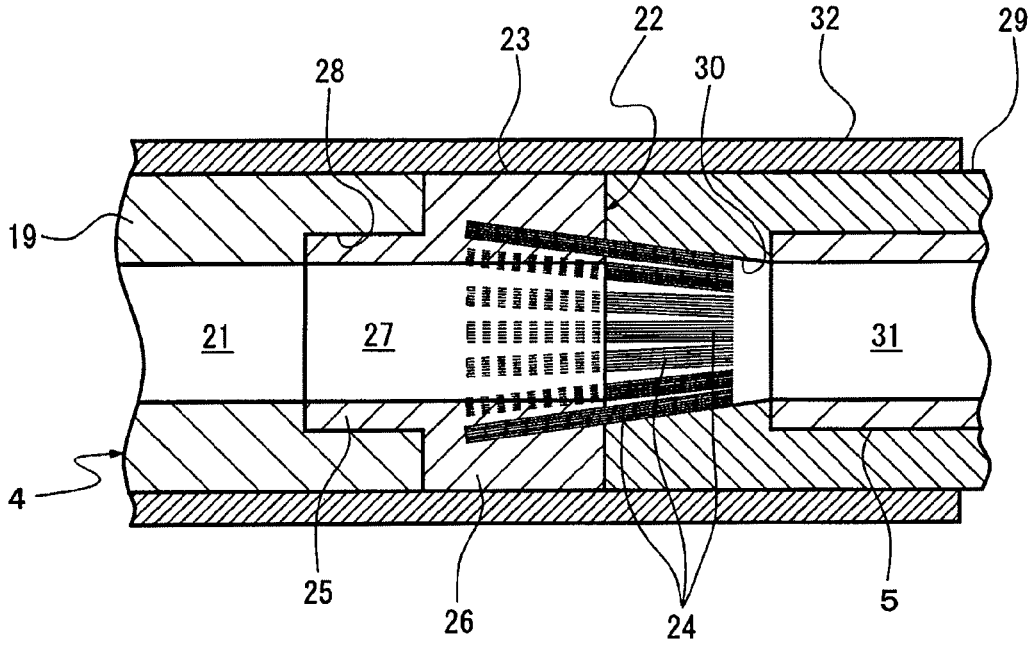


FIG. 3

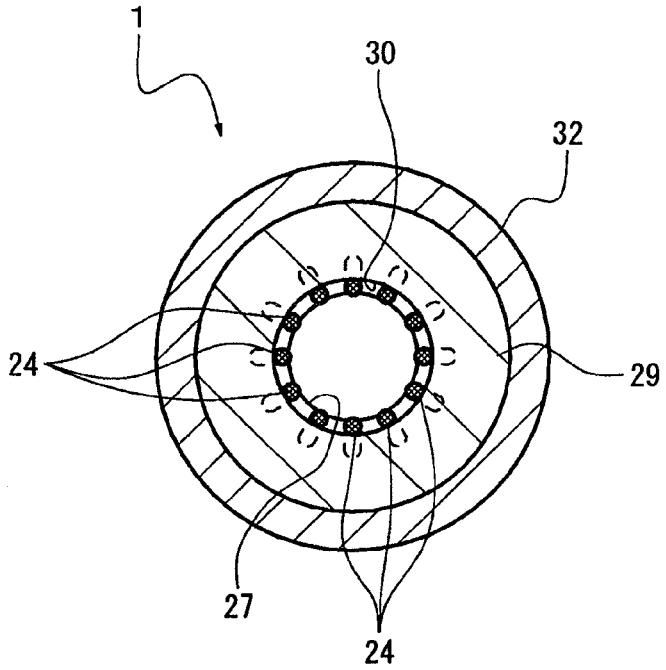


FIG. 4

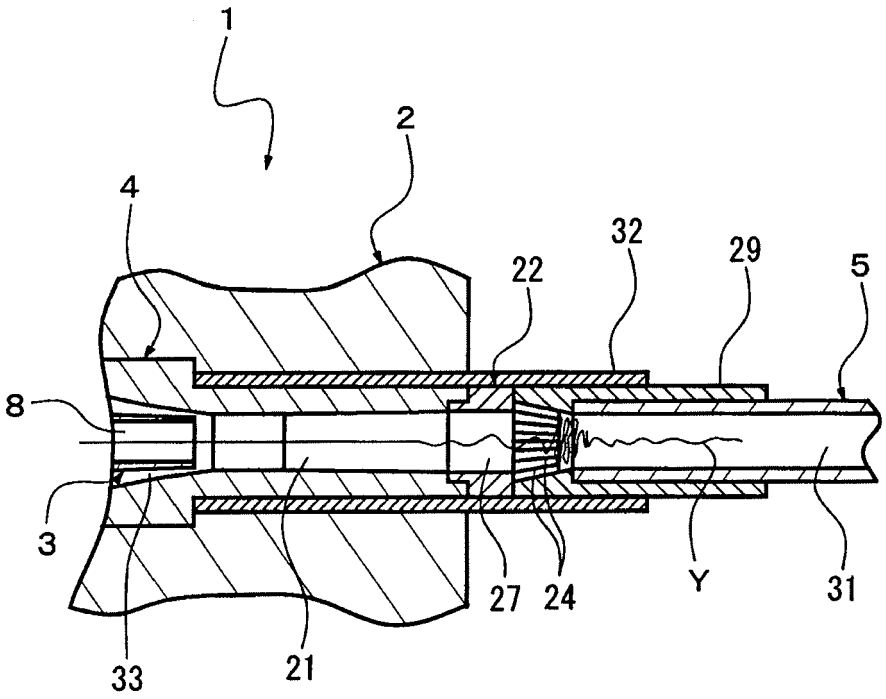


FIG. 5

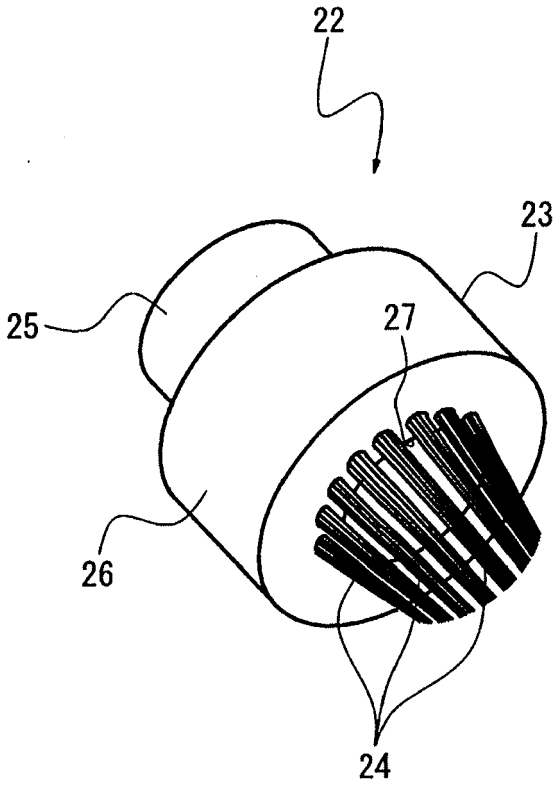


FIG. 6

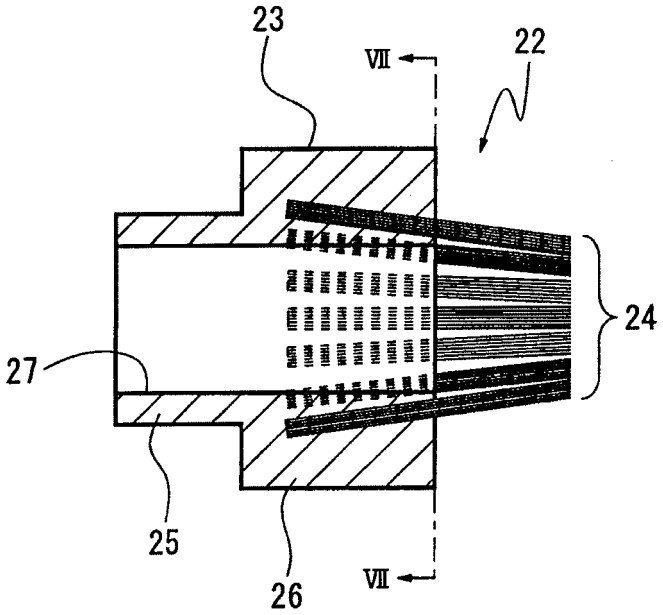
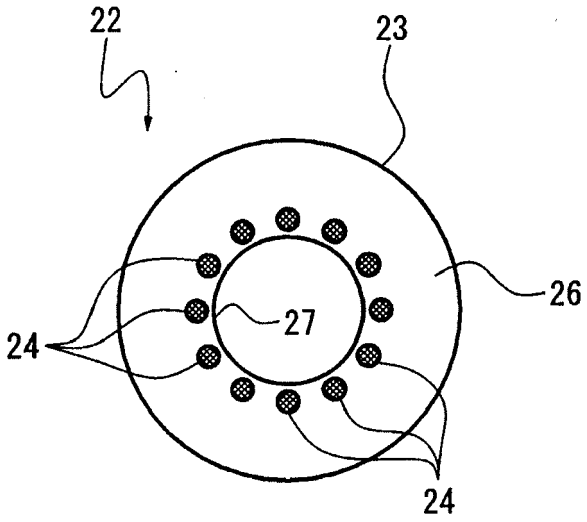


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 14 15 0725

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC) D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 June 2014	Hausding, Jan

CATEGORY OF CITED DOCUMENTS

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05-06-2014

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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