(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 171 731**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 85109828.5

(22) Date of filing: 05.08.85

(51) Int. Cl.⁴: D 01 H 1/135

(30) Priority: 11.08.84 JP 168047/84

(43) Date of publication of application:
19.02.86 Bulletin 86/8

(84) Designated Contracting States:
CH DE GB IT LI

(71) Applicant: Howa Kogyo Kabushiki Kaisha
32-3, Meieki 2-chome Nakamura-ku
Nagoya-shi Aichi-ken(JP)

(72) Inventor: Kishi, Katsutoshi
563, Heijima Ginan-cho
Hashima-gun Gifu(JP)

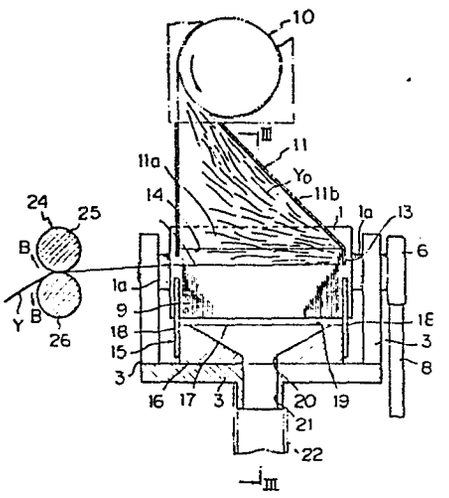
(72) Inventor: Terao, Osamu
7-73, Sakuradai 2-chome
Yokkaichi-shi Mie(JP)

(74) Representative: Wey, Hans-Heinrich, Dipl.-Ing. et al,
Patentanwälte Müller-Börner & Wey Widenmayerstrasse 49
D-8000 München 22(DE)

(54) Device for producing yarn.

(57) A device for producing a yarn from a staple fiber, comprising a pair of twisting rollers rotatable in the same direction and arranged in a manner confronting each other with a small gap between peripheral surfaces thereof, a spinning zone being formed on the upper surfaces of the twisting rollers in the vicinity of confronting portions of the rollers for condensing staple fibers to form a fiber bundle, at least one of the twisting rollers being provided with a plurality of grooves on at least one part of a peripheral surface thereof; a first duct for supplying a separated staple fiber, provided with an outlet opening disposed closely above the spinning zone; a second duct for sucking air, provided with an outlet opening disposed to confront the outlet opening of the first duct while intervened by the spinning zone so that the air is sucked from the spinning zone through a channel formed by the grooves; and means for withdrawing the fiber bundle from the spinning zone in a direction substantially along an axis of the twisting rollers to form a yarn.

Fig. 2



EP 0 171 731 A2

0171731

DEVICE FOR PRODUCING YARN

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a device for producing a yarn from a fiber. Specifically, it relates to such a device having a pair of rollers on which the opened fibers are condensed and twisted to form the yarn based on a so-called "friction spinning" system.

2. Description of the Related Art

One such device is disclosed in Japanese Examined Patent Publication No. 52-33697 (kokoku), comprising a pair of perforated rollers disposed closely to each other to form a spinning zone on the upper surfaces of the rollers in the vicinity of the confronting surfaces thereof, each roller rotating in the same direction as the other. A suction mouth is provided inside of each roller to cover the spinning zone, whereby air transporting a fiber onto the roller surface can pass through a perforation of the roller, permitting the fiber to be deposited and condensed on the spinning zone to form a fiber bundle. The fiber bundle is then continuously withdrawn from the spinning zone while being rotated about its own axis due to the same directional rotation of the two rollers, thereby being twisted to form a yarn. Since the above device has the suction means inside of the perforated rollers, the structure of the rollers is complicated and, in order to obtain accurate relative rotations between the two rollers, the manufacturing accuracy of every part thereof must be at a high level, which causes high manufacturing costs. Moreover, due to air intermittently sucked into the perforation of the rotating roller, an irritating shrill high frequency noise occurs during operation. In addition, due to the perforated structure of the roller, the fiber tends to enter therein accompanied by sucked air and is nipped between the rotating

inner surface of the roller and the fixed suction mouth, which results in breakage of the fiber and an increase of fluff in the resultant yarn. If the fiber forms a bridge having both ends thereof entrapped in the different perforations disposed, respectively, on the different rollers, each end of the fiber is drawn in a direction opposite to the other during the rotation of the rollers, causing a disturbance in the fiber orientation in the fiber bundle, which, in turn, deteriorates the yarn quality.

As an improvement of the above device, a means was proposed by Japanese Examined Patent Publication No. 56-52134 (kokoku), comprising a combination of a perforated roller and a smooth roller. The two rollers are arranged in the same manner as the above case. In this arrangement, however, formation of the bridge fiber can be avoided because the fiber is positively held only on the surface of the perforated roller, but the remaining drawbacks inherent to the prior art still remain unsolved.

To simplify the structure, a further device is disclosed in Japanese Examined Patent Publication (kokoku) No. 55-23929, in which air transporting a fiber is sucked through a gap between two rollers into a wide-mouthed opening provided in the opposite side of the gap, while the fiber is deposited on the surface of the rollers which may be smooth or perforated. When a thin yarn is spun in this device, since the gap between the rollers must be narrow corresponding to the thickness of the yarn, all the air supplied to the surface of the rollers cannot pass through the gap and a vortex is generated in the spinning zone on the roller surface, which prevents the fiber from being smoothly deposited in the spinning zone. This phenomena is further stressed when the deposited fiber gradually blocks the gap, whereby the entanglement of the each fiber in the fiber bundle becomes poor. Especially, according to an

experiment by the present inventors, in the case of the smooth roller, it was impossible to form a fiber bundle in the spinning zone or to withdrawn the former continuously therefrom even if it has been formed.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a device of the above mentioned type free from the drawbacks inherent to the prior art.

It is another object of the present invention to improve the prior art device so that the fiber can be separated from air transporting the same and be smoothly deposited on the spinning zone of the rollers as a fiber bundle to enhance the subsequent condensing and withdrawing operations of the fiber bundle.

It is further object of the present invention to provide such an improvement of the prior art device as to minimize noise during the operation and to prevent the breakage of the fiber in spite of a simplified, low cost structure.

Thus, the above object are achievable by a device, according to the present invention, for producing a yarn from a fiber, comprising a pair of rollers rotatable in the same direction and arranged in a manner confronting each other with a small gap between peripheral surfaces thereof, a spinning zone formed on the upper surfaces of the twisting rollers in the vicinity of confronting portions of the rollers for condensing a fiber to form a fiber bundle, at least one of the rollers being provided with a plurality of grooves on at least one part of the peripheral surface thereof; a first duct for supplying an opened fiber, provided with an outlet opening disposed closely above the spinning zone; a second duct for sucking air, provided with an inlet opening disposed to confront the outlet opening of the first duct and intervened by the spinning zone so that the air is sucked from the spinning zone through a channel formed by the groove; and means for withdrawing the fiber

bundle from the spinning zone in the direction substantially along an axis of the twisting rollers to form a yarn.

The grooves preferably may be provided only on one of the twisting rollers, which roller rotates in a direction such that the surface thereof passes through the spinning zone just before entering the gap between the pair of twisting rollers.

The grooves preferably may be in parallel to each other and perpendicular to a longitudinal axis of the twisting rollers.

Alternatively, the grooves preferably may be formed of at least one spiral.

The grooves preferably may be provided on part of the surface of at least one of the twisting rollers, which part is disposed at a distance farther than that of the remaining part of the surface of the spinning zone from the withdrawing means.

BRIEF DESCRIPTION OF THE DRAWINGS

The other objects and advantages of the present invention will be apparent from the description of the preferred embodiments of the present invention with reference to the accompanying drawings: wherein

Fig. 1 illustrates a diagrammatic plan view of a main part of an embodiment according to the present invention;

Fig. 2 illustrates a section taken along II-II line of Fig. 1;

Fig. 3 illustrates a section taken along III-III line of Fig. 2;

Fig. 4 illustrates an enlarged view of a part of Fig. 1;

Figs. 5 and 6 are enlarged views of part of the twisting rollers, respectively, illustrating the formation of a fiber bundle; and

Figs. 7 through 9 illustrate, respectively, different forms of grooves on the twisting rollers.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In this specification, a "fiber" stands for a natural or synthetic fiber having a limited length, including cotton fiber, polyester fiber or other.

A device according to an embodiment of the present invention shown in Figs. 1 through 3, comprises a pair of twisting rollers 1 and 2, a first duct 11, and second duct 15. The twisting rollers 1 and 2 are disposed substantially in a horizontal direction and in parallel to each other in a confronting manner with a small gap G therebetween. A spinning zone 12 having a valley shape is formed on the upper surface of the two rollers 1 and 2 along the gap G, in which a fiber bundle Y_1 is prepared from a fiber Y_0 as stated later. Shafts 1a and 2a of both rollers are rotatably supported by ball bearings 4 and 5 secured to a machine frame 3. The first duct 11 is disposed above the spinning zone 12 for supplying an opened fiber Y_0 thereto. The second duct 15 is disposed just beneath the gap G for withdrawing air transporting the fiber through the spinning zone 12.

The above gap G between the rollers 1 and 2 must be small enough, such as in a range of from 0.01 mm to 0.05 mm, to prevent the fiber from passing therethrough along with air. Further, the position of the twisting roller 1 or 2 is preferably adjustable toward the other roller to vary the width of the gap G in accordance with spinning conditions, such as a yarn thickness or a twist constant to be imparted to the resultant yarn.

The two rollers 1 and 2 are driven at substantially the same rate and direction as indicated by an arrow A in Fig. 3, relative to each other, by a motor (not shown) via pulleys 6 and 7 secured to ends of the shafts 1a and 2a, respectively, and a belt 8 commonly engaged around the pulleys 6 and 7.

One of the twisting rollers 1 and 2, for example, roller 1 shown at the upper side of Fig. 1 in this

embodiment, has a plurality of peripheral grooves 9 arranged in parallel to each other and perpendicular to an axis of the roller 1 on substantially the entire outer surface thereof. Though the grooves 9 are equidistantly arranged, as shown in Fig. 4, they may be provided at different intervals from each other and also the width and profile of the groove 9 may be varied. As stated later, the size of the groove profile and the number thereof should be decided in such a manner that air transporting the fiber Y_0 through the first duct 11 onto the spinning zone 12 in a valley form can pass through a channel 9a formed in the spinning zone 12 by an inner wall of the groove 9 and the surface portion of the other roller 2 confronting the groove 9, allowing only the staple fiber Y_0 to leave in the spinning zone 12. Preferable dimensions of the grooves are, for example, a pitch of 2 mm, a width of 1 mm, and a depth of 0.5 mm. Though the groove 9 is completely encircles the roller 1 in this embodiment, it may be intermitted, for example, by embedding part of the continuous groove or by randomly arranging a plurality of channel lengths on the surface of the roller, provided the intermitted portions are not aligned with those of the adjacent grooves.

The rotational direction of the rollers 1 and 2 is decided in such a manner that the surface of the roller 1 provided with the grooves 9 enters the gap G from the top and is directed to a suction mouth 19 of the second duct 15, described in more detail later, and conversely, the surface of the other roller 2 enters the gap G from below, away from the suction mouth 19.

The roller 1 is preferably made of a metal and the roller 2 is preferably wrapped with a synthetic rubber sheath, although the materials thereof are not necessarily restricted thereto.

The first duct 11 has a triangular profile and is connected by a narrow base portion to known means for

opening the fiber, such as a combing roller 10, and confronts the spinning zone 12 with a wide mouth portion 14, as illustrated in Figs. 2 and 3, whereby an individually separated fiber can be fed to the valley of the spinning zone 12. Lower ends of side walls 11a of the mouth portion 14 are positioned closely to the upper surfaces of the rollers 1 and 2, and a lower end of a back wall 11b is provided with a plate member 13 in a shape of triangle complementary to a profile of the spinning zone 12 for preventing extrication of the fiber from the spinning zone 12.

The second duct 15 comprises a suction body 16 secured to the machine frame 3 and a plurality of shield plates 17 and 18 fixed to the suction body 16. The upper ends of the shield plates 17, 18 are positioned closely to the lower surfaces of the rollers 1 and 2 for air tight seal of the underside of the spinning zone 12. The suction body 16 has a mouth portion 19 widening toward the end and communicating to a suction source (not shown) via an orifice 20, an aperture 21 bored through the machine frame 3, and a pipe 22.

One end of the spinning zone 12 opposite to the plate member 13 (the left side in Fig. 2) opens for withdrawing a fiber bundle Y_1 formed on the spinning zone 12 as a yarn Y from the latter by a withdrawing means 24 comprising a pair of delivery rollers 25 and 26 in the direction parallel to the axis of the twisting rollers 1 and 2. The delivery rollers 25, 26 are rotated in the direction indicated by an arrow B in Fig. 2 by a motor (not shown).

The operation of the above device is as follows:

Prior to feeding the fiber, the twisting rollers 1 and 2 are rotated in the same direction as stated before, while air is sucked from the mouth portion 19 of the second duct 15. Thereafter, the separated fiber Y_0 is transported from the combing roller 10 into the first duct 11 together with air. The

air is sucked through the channel 9a formed by the parallel grooves 9 of the roller 1 into the second duct 15 and, accompanying this, the fiber Y_0 is transferred on the spinning zone 12, namely the upper surface of the rollers 1 and 2 in the vicinity of the gap 6. The posture of the fiber Y_0 flying through the first duct 11 can be properly controlled by the profile of the duct 11 and a flow rate of the air so that the fiber finally lies substantially in parallel to the axis of the rollers 1 and 2 as illustrated in Fig. 2. The fiber Y_0 is gradually brought into the bottom of the spinning zone 12 as the fiber rotates while keeping the parallel state to the rollers and is left there while separated from the air. According to the continuous feed of the fiber Y_0 from the first duct 11, the fiber Y_0 is gradually deposited on the spinning zone 12 and forms a fiber bundle Y_1 which is further brought into the bottom of the spinning zone 12 by the air passing thereby through the channel 9a. The fiber bundle Y_1 is pressed onto the surfaces of the rollers 1 and 2 and, therefore, is rotated about its own axis in one direction as shown in Figs. 5 and 6 by the friction from both rollers 1 and 2, whereby the formation of the fiber bundle Y_1 is smoothly continued. Upon initially withdrawing the fiber bundle, a preliminarily prepared seed yarn (not shown) is reversely introduced into the spinning zone 12 through the opening provided at one side of the spinning zone 12 and entangled with the fiber bundle Y_1. Then, the seed yarn is withdrawn therefrom through the opening by means of the delivery rollers 25 and 26 while rotating about its own axis due to rotation of the twisting rollers 1 and 2. Thus, the newly formed fiber bundle Y_1 follows thereto to form the yarn Y.

According to the above device, since the fiber bundle Y_1 is brought deeper into the spinning zone 12 due to air passing through the channel 9a formed of the

parallel grooves 9 so that the fiber bundle Y_1 is assuredly held in the spinning zone 12, unavailing twists caused by flotation of the fiber bundle Y_1 from the spinning zone 12 can be avoided, whereby an effective twisting is attained. Elimination of the perforation on the twisting rollers usually provided in the case of the prior art solves the problem of fiber entrapped in the perforation and decreases the breakage thereof, thereby improving the yarn quality. Further, since the shrill noise caused by the air intermittently sucked in the perforation is eliminated, the total noise during the operation can be minimized.

In Fig. 7, a second embodiment of the present invention is illustrated, wherein the grooves 9e formed of a plurality of spirals are provided only on the right side part of the peripheral surface of the twisting roller 1e. The spiral groove 9e is preferably inclined in such a manner that the air flow directed opposite to the yarn withdrawal direction generates in the valley between the rollers due to rotation of the latter, because the parallelism of the fibers supplied in the spinning zone is improved. In this embodiment, the surface portions of the two rollers without the grooves 9e are substantially in contact with each other, whereby the air flow can be shut in this portion and formation of the fiber bundle is carried out only in the other portion where the grooves 9e are provided. The spiral grooves may be replaced by the parallel ones as in the first embodiment shown in Figs. 1 through 6.

Figure 8 illustrates a third embodiment of the present invention, in which both twisting rollers 1f and 2f are provided with parallel grooves $9f_1$ and $9f_2$, respectively, on the entire peripheral surfaces thereof.

Figure 9 illustrates a fourth embodiment of the present invention, in which spiral grooves $9g_1$ and $9g_2$ which intersect each other are provided on the entire peripheral surface of one twisting roller 1g.

According to another modification of the present invention, the twisting rollers may be tapered so that a peripheral speed of the withdrawal side of the rollers is larger than that of the other side. As a further modification, the feeding direction of the staple fiber may be altered as desired.

CLAIMS

1. A device for producing a yarn from fibers, comprising a pair of twisting rollers rotatable in the same direction and arranged in a manner confronting each other with a small gap between peripheral surfaces thereof, a spinning zone being formed on the upper surfaces of said twisting rollers in the vicinity of confronting portions of said twisting rollers for condensing fibers to form a fiber bundle, at least one of said rollers being provided with a plurality of grooves on at least one part of the peripheral surface thereof; a first duct for supplying an opened fiber, provided with an outlet opening disposed closely above said spinning zone; a second duct for sucking air, provided with an inlet opening disposed to confront said outlet opening of said first duct while intervened by said spinning zone so that the air is sucked from said twisting zone through a channel formed by said grooves; and means for withdrawing the fiber bundle from said spinning zone in the direction substantially along an axis of said twisting rollers to form a yarn.

2. A device defined by claim 1, wherein said grooves are provided only on one of said twisting rollers, which roller rotates in a direction such that the surface thereof passes through said spinning zone just before entering into said gap between said pair of twisting rollers.

3. A device defined by claim 1, wherein said grooves are in parallel to each other and perpendicular to a longitudinal axis of said twisting rollers.

4. A device defined by claim 1, wherein said grooves are formed of at least one spiral.

5. A device defined by claim 1, wherein said grooves are provided on part of the surface of at least one of said twisting roller, which part is disposed at a distance farther than that of the remaining part of the surface of said twisting roller from said withdrawing means.

0171731

Fig. 1

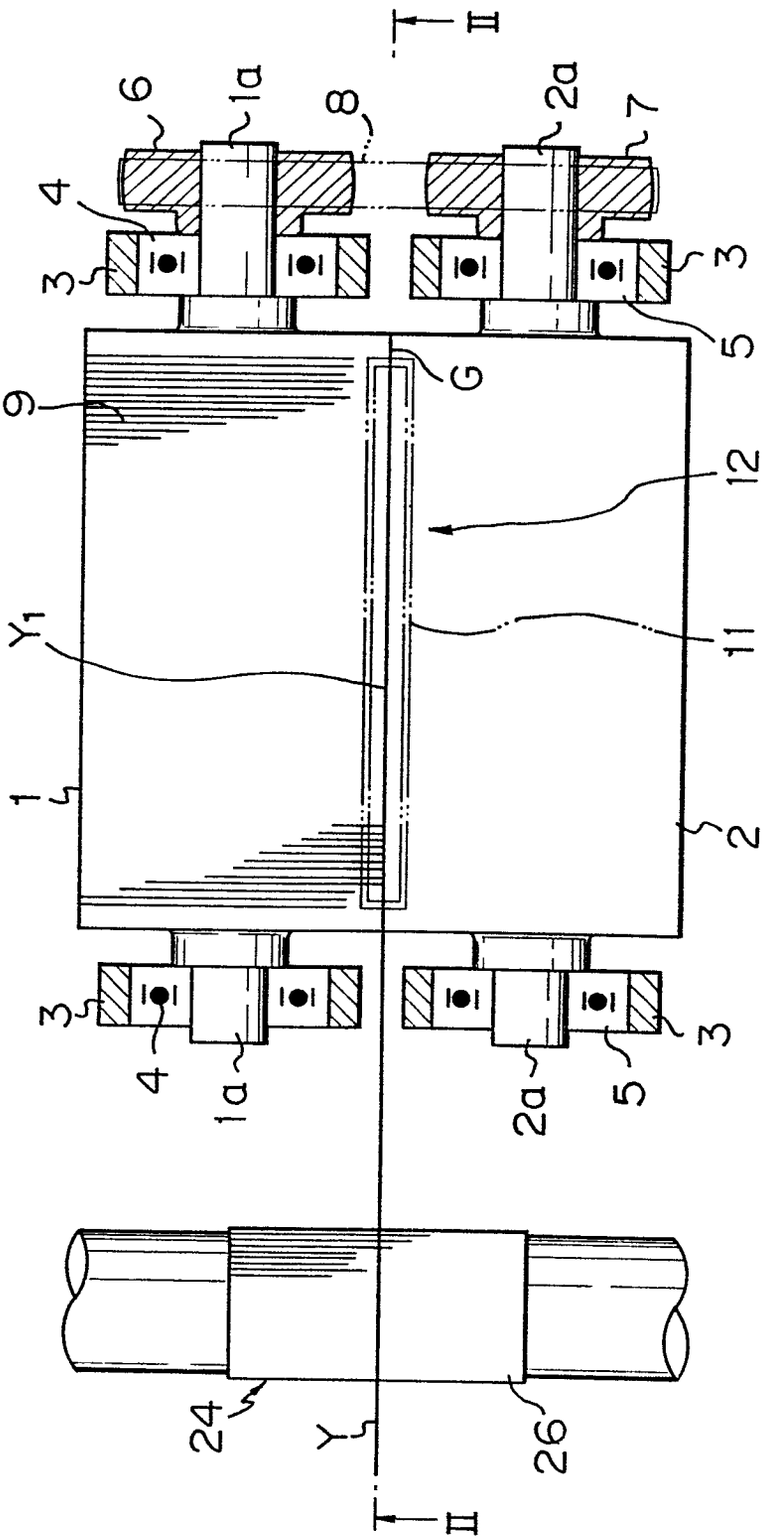


Fig. 2

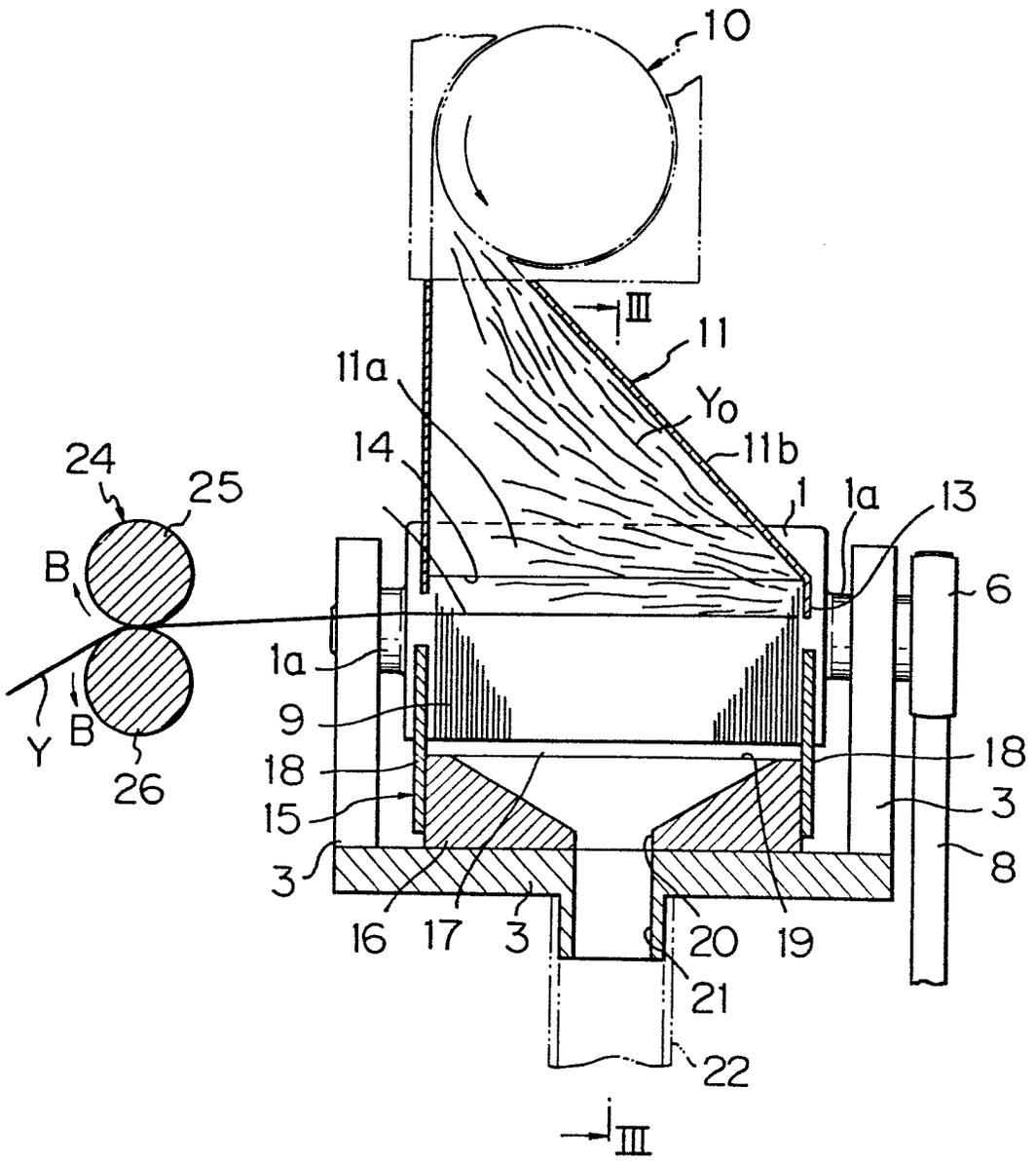

10
III
11
11a
Yo
11b
14
1
1a
13
24
25
B
6
1a
9
18
18
15
3
3
8
16
17
3
20
19
21
22
Y
B
26
III

Fig. 3

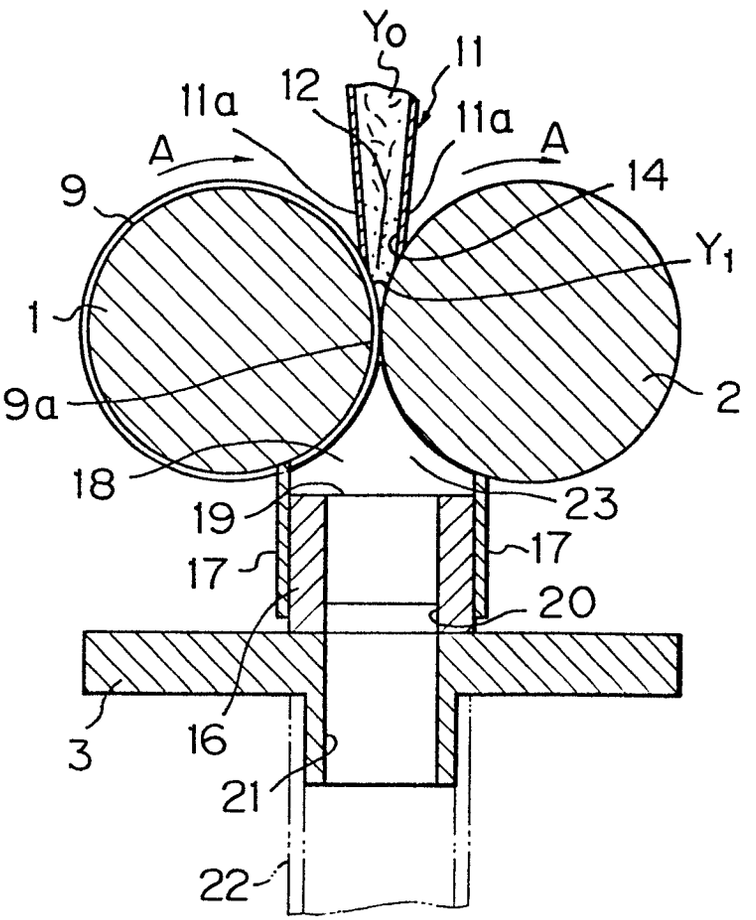


Fig. 4

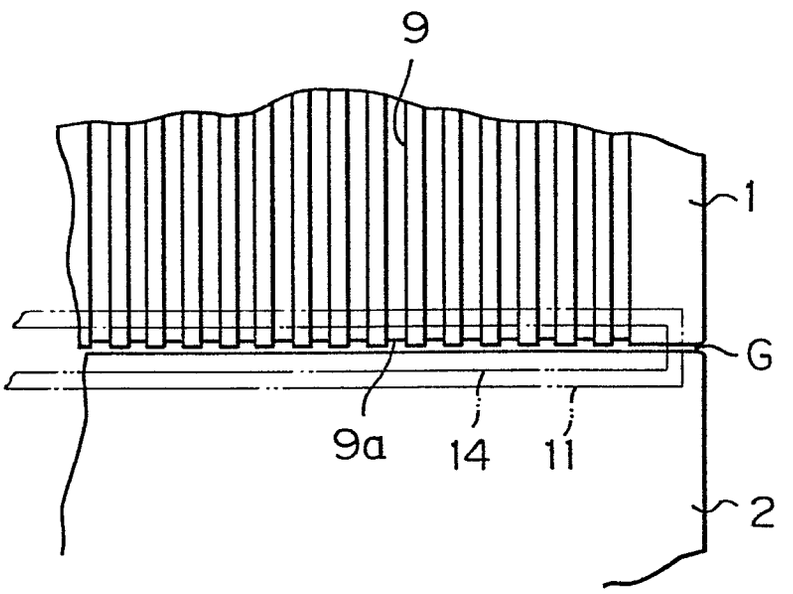


Fig. 5

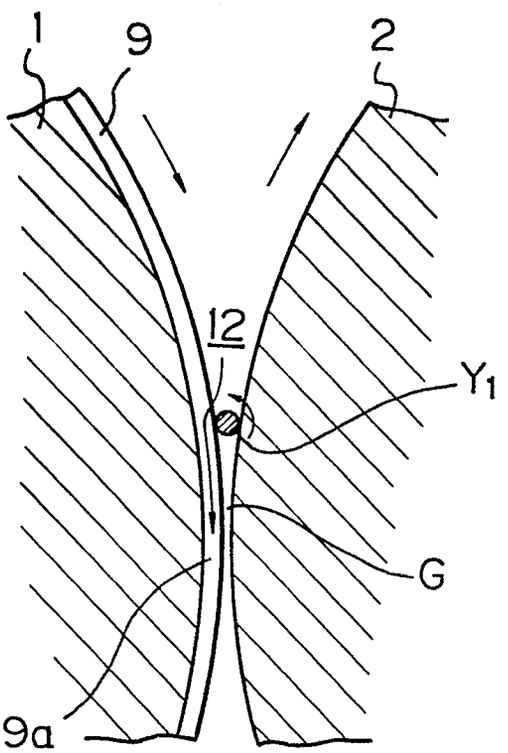


Fig. 6

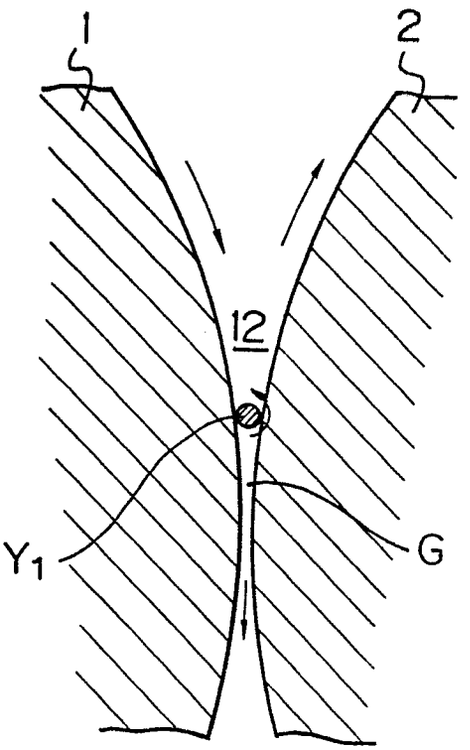


Fig. 7

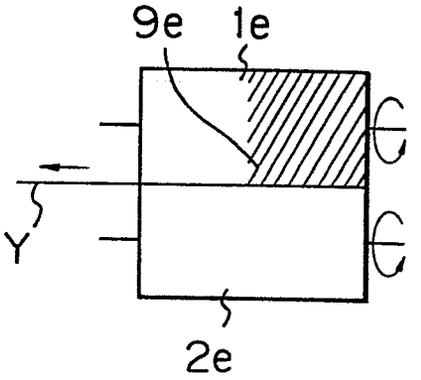


Fig. 8

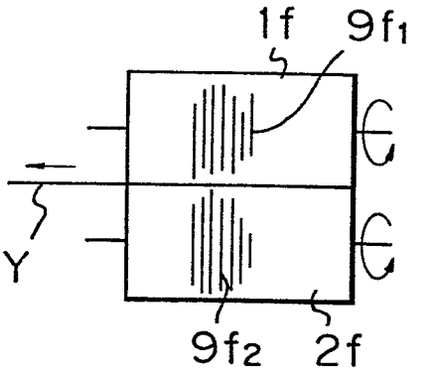


Fig. 9