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

(11) EP 1 452 632 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.02.2009 Bulletin 2009/06

(51) Int Cl.:
D01H 7/88 *(2006.01)*

(21) Application number: **04008829.6**

(22) Date of filing: **18.12.1997**

(54) **Four-for one twister**

Vierfach-Zwirnmaschine

Broche quadruple torsion

(84) Designated Contracting States:
DE IT

(30) Priority: **24.02.1997 JP 3896297**
25.02.1997 JP 4071997

(43) Date of publication of application:
01.09.2004 Bulletin 2004/36

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
97122447.2 / 0 863 234

(73) Proprietor: **MURATA KIKAI KABUSHIKI KAISHA**
Minami-ku
Kyoto-shi
Kyoto 601 (JP)

(72) Inventor: **Nagao, Isao**
Omihachiman-shi
Shiga (JP)

(74) Representative: **Vogeser, Werner et al**
Patent- und Rechtsanwälte
Hansmann, Vogeser, Dr. Boecker,
Alber, Dr. Strych, Liedl
Albert-Rosshaupter-Strasse 65
81369 München (DE)

(56) References cited:
EP-A- 0 611 841 **US-A- 4 222 221**

- **PATENT ABSTRACTS OF JAPAN vol. 1996, no. 02, 29 February 1996 (1996-02-29) & JP 07 268732 A (TEIJIN SEIKI CO LTD), 17 October 1995 (1995-10-17)**
- **PATENT ABSTRACTS OF JAPAN vol. 1996, no. 02, 29 February 1996 (1996-02-29) & JP 07 268731 A (TEIJIN SEIKI CO LTD), 17 October 1995 (1995-10-17)**

EP 1 452 632 B1

Description

[0001] The present invention relates to a four-for-one twister according to the preamble of claim 1, as for example disclosed in JP 7268732 A.

[0002] A comparable four-for-one twister is known from JP 44-6685. This twister 1, as shown in Figure 5, is comprised of a package supporting member 2 which supports a supply package P on vertically extending center line C in a stationary position, an upper disk 3 and a lower disk 4 which revolve around the center line C, a pulley 7 which drives the upper disk 3 and is provided with permanent magnets 6 that attract permanent magnets 5 provided on the upper disk 3, and a pulley 9 which drives the lower disk 4, and is attached through a spindle 8 to the lower disk 4. The twister 1 is constructed so as to form an inner yarn path A and an outer yarn path B vertically around the supply package P. The pulleys 7 and 9 are driven by 10 and 11 rotated in mutually opposed directions.

[0003] The twister 1 guides a yarn Y, which is first pulled in an upward direction from the supply package P, in a downward direction along the inner yarn path A, and through a yarn guide hole 3a of the upper disk 3. It then guides the yarn through a yarn path 8a of the spindle 8, and further passes it through a yarn guide hole 4a of the lower disk 4 which revolves in an opposed direction from the upper disk 3. It then guides the yarn Y drawn out of the guide hole 4a to rollers 12 through the outer yarn path B. With each rotation of the upper disk 3 and lower disk 4 rotating in mutually opposed directions, four additional twists are imparted to the yarn Y.

[0004] Since the four-for-one twister 1 creates a curved, bow-shaped balloon along the outer yarn path B and inner yarn path A from the yarn Y revolving at high speeds around the center line C, the balloon tension is higher than in a two-for-one twister which only creates one balloon. This creates another problem, which is that with the four-for-one twister 1, increasing the speed of the rotation of the upper disk 3 and lower disk 4, by severely increasing the tension of the balloon, creates hairiness in the yarn and can lead to yarn breakage. Also, due to changes in the yarn tension, the inner balloon may expand into the outer balloon, and the two balloons may become entangled causing the yarn to break. Furthermore, the outer balloon, due to changes in the tension of the yarn, may come into contact with a permanent magnet 13 which keeps the package supporting member 2 stationary, and this may cause the yarn to break.

[0005] The problem of the present invention is solved by the features defined in the characterizing portion of claim 1. The four-for-one twister provided with a package supporting member to support the supply package on the center line in a stationary position, an inner yarn path formed in a vertical direction outside of the supply package, and an outer yarn path formed in a vertical direction outside of the inner yarn path, has, therefore, the inner yarn path formed in the inner guiding member which revolves around the center line. Even if the rotational speed of the inner guiding member is increased in order to impart additional twist to the yarn, the yarn led along the inner yarn path formed in the inner guiding member does not form a balloon. Because of this, the yarn tension can be regulated, and the yarn passing along the inner yarn path does not become entangled with the yarn passing along the outer yarn path, and yarn breakage can be reduced. Since the yarn rotates around the center line along with the inner guiding member, no slip occurs between the yarn and the inner guiding member, and frictional heating can be regulated.

[0006] Preferably an outer guiding member rotates in an opposed direction to the inner guiding member around the center line wherein in the outer yarn guiding member the outer yarn path is formed and the outer yarn guiding member and the inner yarn guiding member each are formed as a tube with a bottom and yarn guide linked in the outer yarn guiding member and inner yarn guiding member at the bottom of each of the tubes are connected and extend to the center line. Even if the rotational speed of the inner guiding member is increased in order to impart additional twist to the yarn, the yarn led along the inner yarn path formed in the inner yarn guiding member and the yarn led along the outer yarn path formed in the outer yarn guiding member do not form a balloon. Because of this the yarn tension can be regulated and the yarn passing along the inner and outer yarn paths do not become entangled, and yarn breakage is reduced. The yarn rotates around the center line with the inner and outer guiding members, so there is no slip created in the rotational path between the inner and outer guiding members, and frictional heating can be regulated. The rotating inner and outer guiding members are formed with tube bottoms, so air flows conically along the surface of the inner and outer tubes, and wind resistance and noise can be reduced.

Brief Description of the Accompanying Drawing

[0007]

Figure 1 shows a vertical cross-section of a four-for-one twister according to a first embodiment of the present invention.

Figure 2 is an enlarged front view of a cross-section of the upper half of a first embodiment of the present invention as shown in Figure 1.

Figure 3 is an enlarged front view of a cross-section of the lower half of a first embodiment of the present invention as shown in Figure 1.

Figure 4 shows a vertical cross-section of a four-for-one twister according to a second embodiment of the present invention.

Figure 5 shows a vertical cross-section of a conventional four-for-one twister.

Detailed Description of the Preferred Embodiments

[0008] Figure 1 to Figure 3 show an embodiment of a four-for-one twister 21 according to the present invention. Figure 1 is a front diagram showing an entire vertical section, Figure 2 is an enlarged front diagram of a cross-section of the upper half, and Figure 3 is an enlarged front diagram of a cross-section of the lower half.

[0009] A twister 21, as shown in Figure 1, is comprised of an inner yarn path Ra which extends vertically along an inner guiding member 39 which revolves around a center line C, and an outer yarn path Rb which extends vertically along an outer guiding member 40 which revolves around the center line C. The inner guiding member 39 and outer guiding member 40 together form a tube with a bottom that guides a yarn Y. Furthermore, the four-for-one twister 21 is provided with a package supporting member 22 which supports a supply package P along the center line C in a stationary condition, an upper disk 23 and a lower disk 24 which rotate around an axis of the center line C, a pulley 27 which drives the upper disk 23 which is provided with permanent magnets 26 that mutually attract permanent magnets 25 which is attached to the upper disk 23, and a pulley 29 which drives the lower disk 24 which is attached through a spindle 28 to the lower disk 24.

[0010] The supporting member 22, as shown in Figure 3, fits into a boss portion 22a through bearings 31 and 31 on a standing center spindle 23a of the rotating upper disk 23. The supporting member 22 is made stationary by the mutual attraction of fixed permanent magnets 32 which are affixed to a disk base 22b and fixed permanent magnets 34 which are affixed to the outside of a fixed hood 33. The supporting member 22 is set up so that a cylindrical guide supporting member 35 can be freely attached and removed at the boss portion 22a. The guide supporting member 35, as shown in Figure 2, is provided with freely rotating guides 36 and 37 which guide the yarn Y taken off from the package P.

[0011] The upper disk 23, as shown in Figure 3, fits into a boss portion 23b through bearings 38 received in a space 23d of a standing center spindle 24a. The upper disk 23 is affixed to the inner guiding member 39 comprised of a tube with a bottom fastened to a base portion 23c. The lower disk 24 is affixed to the outer guiding member 40 comprised of a tube with a bottom fastened to a base portion 24c. The inner guiding member 39 and outer guiding member 40 are made from non-magnetically conductive materials like aluminum, synthetic resin, stainless steel, or titanium, for example, so as not to interfere with the magnetic attraction between the permanent magnets 32 and 34, and 25 and 26. Since the inner guiding member 39 and outer guiding member 40 are formed of a non-magnetically conductive material, when they revolve, even though the magnetic power of the attraction of the permanent magnets 32 and 34 is present, the electric power consumption used in driving the rotation does not create an overcurrent or produce heat, so it does not have to be increased. The spindle 28 is allowed to freely rotate through bearings 44 and 45 on a bearing tool 43. The bearing tool 43 is fixed to fixed frame 41 by a nut 42.

[0012] The upper disk 23 and lower disk 24 are provided with yarn guide holes 47 that form a yarn path R. The yarn guide holes 47 are sequentially comprised of an upper hole 47a and a lower hole 47b, the upper hole 47a opening into the base portion 23c of the upper disk 23, and the lower hole 47b opening into the base portion 24c and the standing center spindle 24a of the lower disk 24. The upper hole 47a and lower hole 47b, are connected through an air-tight passage, and are positioned, as described below, so as not to leak, and thereby allow the air to flow through the holes 47a, 47b smoothly while passing the yarn Y along the yarn path R. The upper hole 47a consists of a radial portion extending towards the center line C from the outer-surface of the base portion 23c, and a curved portion which continues at a right angle from said radial portion. The lower hole 47b consists of a standing portion in the same plane as the center line C, a curved portion at a right angle connecting to this standing portion, and a radial portion extending from this curved portion towards the outer surface of the base portion 24c.

[0013] The upper hole 47a of the upper disk 23 is connected to a yarn guide hole 53a of a yarn guide pipe 53 attached to the inner surface of the inner guide member 39. The yarn guide pipe 53 forms inside the pipe the inner yarn path Ra extending vertically to the inside of the inner guide member 39. The yarn guide pipe 53 is formed either from a combination of or a single non-magnetically conductive material such as aluminum, synthetic resin, ceramics, stainless steel, or titanium, so as not to interfere with the magnetic attraction of permanent magnets 32 and 34, to make the inner surface chafe-resistant, and decrease the frictional resistance. The upper end 53b (Figure 2) of the yarn guide pipe 53 opens in almost the same place as an open end 39b of the inner guiding member 39, permitting the thread to pass easily.

[0014] An ejecting nozzle 48 into the lower hole 47b of the lower disk 24 opens at the border area between the radial portion and the curved portion, and the ejecting nozzle 48 jets air to pass the yarn in the direction out of the base 24. The ejecting nozzle 48 is connected to an air passage 49 opening vertically in the spindle 28, and receives a supply of pressurized air. In other words, the pressurized air supplied from an air supply pipe 50 which is attached to the bearing tool 43 is led in the air passage 49 by means of an air chamber 51 formed inside the bearing tool 43, and jetted from the ejecting nozzle 48.

[0015] The jetted air creates suction power in the yarn guide hole 47 from the electing nozzle 48 towards the upstream portion, and sucks in outside air from the upper end 53b of the yarn guide pipe 53 which connects to the yarn guide hole 47. In this way, the ejecting nozzle 48 can flow air used to pass the yarn Y in a forwardly moving direction along the yarn path R comprised of the yarn

guide pipe 53 and yarn guide hole 47. Moreover, the air supply pipe 50 is fitted with an open/close valve (not shown), and the supply of air pressure can be selectively stopped.

[0016] The outer guiding member 40 is formed like a bowl, with a rounded topless shape slanting up from the outer surface of a bottom portion 40b, and forms the outer yarn path Rb which extends vertically along an inner surface 40a and the inner surface of the bottom portion 40b, and from which yarn fed out an exit 47c of the yarn guide hole 47 is smoothly directed into a standing vertical position thereby preventing hairiness and yarn breakage.

[0017] The permanent magnets 25 and 26 placed above and below the bottom of the outer guiding member 40 impart rotational force to the upper disk 23 from the pulley driving the upper disk 23. The lower permanent magnets 26 are slanted upwards along the upper incline of the bottom portion 40b of the outer guiding member 40, and cause the upper permanent magnets 25 to draw near, imparting rotational force. Further, although not shown, the upper permanent magnets 25 on the upper disk 23, while maintaining the yarn path R, are slanted upwards along the rising incline of the bottom portion 40b of the outer guiding member 40 while drawing the lower permanent magnets 26 closer and imparting rotational force.

[0018] The fixed hood 33 is fixed to the fixed frame 41 and the like, and is provided with a tube portion 33a which engages revolving the outer guiding member 40 and a notch 33b past which drive belts 54 and 55 travel. The fixed hood 33 has the permanent magnet 34 permanently attached on the outside, and maintains the supporting member 22 in a stationary position. Between pulleys 27, 29 and the drive mechanism (not shown in the drawings), drive the belts 54, 55 are attached, and cause the pulleys 27, 29 to rotate in mutually opposed directions at the same rotation speed.

[0019] Next, operation of the four-for-one twister 21 is explained.

[0020] First, with the belt drives stopped, the operator inserts a new supply package P into the supporting member 22 along with the previously removed the guide supporting member 35, as shown in Figure 1.

[0021] Next, the operator passes the yarn Y from the supply package P through the guides 36 and 37, and inserts it into the end opening 53b of the yarn guide pipe 53. At this time, if pressurized air is supplied from the air supply pipe 50, the yarn Y is sucked into the yarn guide hole 53a of the yarn guide pipe 53 where air suction is created from the ejecting nozzle 48 as shown in Figure 3, guided along its passage with the air flow to the yarn guide hole 47, and comes out from the exit 47c facing the bottom portion 40b of the inclined inner guiding surface of the outer guiding member 40.

[0022] At this time, the air passing the yarn Y jetted from the exit (down-stream end) 47c of the yarn guide hole 47 flows up along the bottom portion 40b of the inclined inner guiding surface of the outer guiding member 40 and up the vertical inner surface 40a, and is further blown out vertically from an end opening 40c of the outer guiding member 40 (as shown Figure 1 and Figure 2). Thus, the yarn coming out from the exit 47c of the yarn guide hole 47 is ejected from the exit 47c and is passed with the air flow along surface 40a of the outer guiding member 40 vertically with the air flow, and passes vertically from the end opening 40c of the outer guiding member 40.

[0023] Next, the operator guides the yarn Y that has risen out of the end opening 40c into the take-up roller 12 (as shown in Figure 1), completing the yarn path. When the yarn passage is completed, drive is engaged by means of the drive belts 54 and 55, the upper disk 23 and inner guiding member 39 are made to rotate as the lower disk 24 and outer guiding member 40 are rotated in the opposite direction, and the twisting process is initiated. The supply of pressurized air from the air supply pipe 50 is, at a suitable time either after the yarn passage has been completed or immediately before the twisting process is begun, cut off by closing the open/close valve (not shown).

[0024] Depending on the type of the yarn Y, pressurized air with pressure adjusted from the air supply pipe 50 can be supplied during the twisting process, and air can be flowed to the yarn guide hole 53a of the yarn guide pipe 53 and yarn guide hole 47, thereby easing the friction created between the yarn Y and yarn guide holes 53a and 47, and cooling the yarn Y, thus enabling control over the heating of the yarn Y.

[0025] Since the yarn Y, guided by the inner guiding member 39 and outer guiding member 40, does not form a balloon even when the rotational velocity of the inner guiding member 39 and outer guiding member 40 is increased to impart additional twist to the yarn Y, the twister 21 can reduce yarn breakage, eliminate entanglement of the yarn Y, and regulate yarn tension.

[0026] Since the yarn Y revolves around the circumference of the center line C with the inner guiding member 39 and outer guiding member 40, there is no slip in the rotational curse of the inner yarn guide 39 and outer yarn guide 40 and the twister 21 can regulate the fictional heating caused by the yarn Y.

[0027] Furthermore, since rotating the inner guiding member 39 and outer guiding member 40 are formed as tubes with bottom, and the fixed hood 33 acts as a stable cover, the twister 21 can reduce wind resistance and wind noise.

[0028] Further still, since the permanent magnets 34 are attached to the outside of the fixed hood 33, it is possible to bring the fixed hood 33 and the outer guiding member 40 close together, enabling the twister 21 to be compact.

[0029] Moreover, since thread tension can be regulated with only the inner guiding member 39, the twister 21 allows the outer guiding member 40 and fixed hood 33 to be removed to accommodate different kinds of yarn.

[0030] Additionally, the yarn guide pipe 53 which is at-

tached to the inner guiding member 39 can be removed from the twister 21, and when the yarn is passed through, the tip of the yarn is then sucked towards the entrance of the yarn guide hole 47.

[0031] Further, the inner guiding member 39 and outer guiding member 40 can be formed without the tube with a bottom, with only the upper disk 23 and lower disk 24 comprising the standing pipes, and with the inner yarn path Ra and outer yarn path Rb allowing for the yarn to be passed by the air flow.

[0032] Further, it is possible to form the standing member as a hollowed out section standing from the upper disk 23 and lower disk 24, the inside of the concave groove facing the center line C to make the yarn path.

[0033] Further, although not shown it is possible for the yarn path Rb, extending in the yarn guide pipe to the end opening 40c along the inner surface of the inner guiding member 40 from the exit 47c of the yarn guide hole 47, to be comprised of a single pipe hole, and further, for the yarn path R formed between the inner guiding member 39 and outer guiding member 40 to be comprised of a single hole. In this case, the ejecting nozzle 48 can be placed either at the entrance of the yarn path R (the upper end 53a of yarn guide pipe 53) or at the exit of the yarn path R (the yarn guide pipe exit forming yarn path Rb). In this case, the air hole supplying pressurized air from the ejecting nozzle 48 is provided with a coupler at the air hole entrance, and while the rotation of the inner guiding member 39 and outer guiding member 40 are stopped, and the yarn Y is passed through, it is possible to attach a high-pressure hose to the coupler.

[0034] Figure 4 describes a second embodiment of the present invention.

[0035] A four-for-one twister 61 does twisting with a single drive belt 72, and is provided with a lower disk 64 which freely revolves on a fixed frame 74 through a bearing 81, a middle disk 75 which is attached on the lower disk 64 through a bearing 82, an upper disk 63 which freely revolves on the middle disk 75 through a bearing 83, and a package supporting member 62 which is attached on the upper disk 63 through a bearing 84. Further, the twister 61 is provided with a fixed hood 73 which is attached to the fixed frame 74, a outer guiding member 70 which is attached to the lower disk 64, a stationary cap 76 which is fixed to the middle disk 75, and an inner guiding member 69 which is attached to the upper disk 63.

[0036] The inner guiding member 69 and outer guiding member 70 are made of tubular shaped non-magnetically conductive materials, and on their inner surface are provided with yarn guide pipes 91 and 92 made from non-magnetically conductive materials, these pipes 91 and 92 forming an inner yarn path Ra and an outer yarn path Rb. The lower end of the yarn guide pipe 91 is connected to a yarn guide hole 65 of the upper disk 63, and the lower end of the yarn guide pipe 92 is connected to a yarn guide hole 68 of the upper disk 64.

[0037] The twister 61, after guiding the yarn drawn from stationary yarn supply package P in a downward direction to the yarn guide hole 65 on the upper disk 63 through a primary tensor 66, guides it upwards through the yarn guide pipe 91 of the inner guiding member 69 which revolves entirely with the upper disk 63. Then, after the yarn Y is guided in a downward direction to the yarn guide pipe 92 of the outer guiding member 70 through a secondary tensor 67, it is brought to a take-up device 71, having been guided through the yarn guide hole 68 of the lower disk 64 which rotates entirely with the outer guiding member 70. With each revolution of the upper disk 63 and lower disk 64 rotating in mutually opposed directions with drive from the belt 72, yarn Y is provided with four twists.

[0038] The supporting member 62 supports the package by means of the mutual attraction of a permanent magnet 77 attached to the supporting member 62 and a permanent magnet 78 attached to the stationary cap 76, along with the mutual attraction of a permanent magnet 80 attached to the fixed hood 73 and permanent a magnet 79 attached to the middle disk 75.

[0039] Between the lower disk 64 and upper disk 63, an intermediate conveyor device 86 is set up in order to reverse the rotational drive force from the lower disk 64 to the upper disk 63. The intermediate conveyor device 86 is provided with a pulley 89 and a friction driven wheel 88 at the end of a rotating spindle 87. A belt 90 is attached between the pulley 89 and the boss member 63a of the upper disk 63, and frictional force is applied to the friction-driven wheel 88 from the upper boss member 64a on the lower disk 64. The tips of ejecting nozzles 93 and 94 are opened in the yarn guide hole 65 of the upper disk 63 and yarn guide hole 68 of the lower disk 64, and air for passing the yarn Y in a forwardly moving direction is flowed through. An air passage 95 (shown in the drawling by the dotted line) which supplies pressurized air to the ejecting nozzles 93 and 94 is comprised sequentially of an air hole 95a opened in the fixed frame 74, a sealed chamber 95b formed between the fixed frame 74 and lower disk 64, an air hole 95c opened in the lower disk 64, a sealed chamber 95d formed between the lower disk 64 and middle disk 75, the air hole 95e opened in the middle disk 75, and a sealed chamber 95f formed between the middle disk 75 and upper disk 63, and is connected to the air supply pipe 50 in the air hole 95a.

Claims

1. A four-for-one twister provided with a package supporting member (22, 62) which supports a supply package (P) in a stationary position on a center line (C), an inner yarn path (Ra) formed in a vertical direction outside of the supply package, an outer yarn path (Rb) formed in a vertical direction outside of the inner yarn path, and an upper disk (23, 63) and a lower disk (24, 64) guiding the yarn to the inner yarn path (Ra) and the outer yarn path (Rb), respectively,

characterized in that
the inner yarn path (Ra) is formed on the inner surface of a tubular inner guiding member (39, 69) that revolves around the center line and is connected to the upper disk (23, 63).

2. A four-for-one twister according to claim 1
characterized in that
the outer yarn path (Rb) extends along an outer guiding member (40, 70) that revolves around the center line.

3. A four-for-one twister according to claim 2
characterized in that
the inner guiding member (39, 69) and the outer guiding member (40, 70) form together a tube with a bottom that guides a yarn (Y) on the outer yarn path (Rb).

4. A four-for-one twister according to one of the claims 1 to 3
characterized in that
a yarn guide pipe (53, 91) is attached to the inner surface of the inner guiding member (39, 69), that forms inside the inner yarn path (Ra).

5. A four-for-one twister according to one of the claims 1 to 4
characterized in that
the upper disk (23) is provided with an upper guide hole (47a) opening into the base portion (23c) of the upper disk (23), and the lower disk (24) is provided with a lower hole (47b), opening into the base portion (24c) of the lower disk.

6. A four-for-one twister according to claim 5
characterized in that
the upper hole (47a) and the lower hole (47b) are air-tight connected.

7. A four-for-one twister according to claim 5
characterized in that
the lower hole (47b) is provided with an exit (47c) opening to the inner surface (40a) of the outer guiding member (40).

Patentansprüche

1. Vierfachzwirnmaschine mit einem Lieferspulenträger (22, 62), der eine Lieferspule (P) in einer stationären Position auf einer Mittellinie (C) aufnimmt, einer inneren Fadenbahn (Ra), die in vertikaler Richtung außerhalb der Lieferspule gebildet ist, einer äußeren Fadenbahn (Rb), die in vertikaler Richtung außerhalb der inneren Fadenbahn gebildet ist, und einer oberen Scheibe (23, 63) und einer unteren Scheibe (24, 64), die den Faden zur inneren Fadenbahn (Ra) bzw. zur äußeren Fadenbahn (Rb) führen,
dadurch gekennzeichnet, dass
die innere Fadenbahn (Ra) an der Innenfläche eines rohrförmigen inneren Führungselements (39, 69) gebildet ist, das sich um die Mittellinie dreht und mit der oberen Scheibe (23, 63) verbunden ist.

2. Vierfachzwirnmaschine nach Anspruch 1,
dadurch gekennzeichnet, dass
die äußere Fadenbahn (Rb) längs eines äußeren Führungselements (40, 70) verläuft, das sich um die Mittellinie dreht.

3. Vierfachzwirnmaschine nach Anspruch 2,
dadurch gekennzeichnet, dass
das innere Führungselement (39, 69) und das äußere Führungselement (40, 70) zusammen ein Rohr mit einem Boden bilden, das einen Faden (Y) zur äußeren Fadenbahn (Rb) führt.

4. Vierfachzwirnmaschine nach einem der Ansprüche 1 bis 3,
dadurch gekennzeichnet, dass
ein Fadenführungsrohr (53, 91) an der Innenfläche des inneren Führungselements (39, 69) befestigt ist, das die Innenseite der inneren Fadenbahn (Ra) bildet.

5. Vierfachzwirnmaschine nach einem der Ansprüche 1 bis 4,
dadurch gekennzeichnet, dass
die obere Scheibe (23) mit einer oberen Führungsöffnung (47a) versehen ist, die in den Basisabschnitt (23c) der oberen Scheibe (23) mündet, und die untere Scheibe (24) mit einer unteren Führungsöffnung (47b) versehen ist, die in den Basisabschnitt (24c) der unteren Scheibe mündet.

6. Vierfachzwirnmaschine nach Anspruch 5,
dadurch gekennzeichnet, dass
die obere Öffnung (47a) und die untere Öffnung (47b) luftdicht verbunden sind.

7. Vierfachzwirnmaschine nach Anspruch 5,
dadurch gekennzeichnet, dass
die untere Öffnung (47b) mit einem Auslass (47c) versehen ist, der zur Innenfläche (40a) des äußeren Führungselements (40) mündet.

Revendications

1. Retordeur quadruple muni d'un élément de support de bobine (22, 62) qui supporte une bobine d'alimentation (P) dans une position stationnaire sur une ligne centrale (C), un chemin de fil intérieur (Ra) formé dans une direction verticale à l'extérieur de la bobine d'alimentation, un chemin de fil extérieur (Rb) formé dans une direction verticale à l'extérieur du chemin

de fil intérieur, et un disque supérieur (23, 63) et un disque inférieur (24, 64) guidant le fil au chemin de fil intérieur (Ra) et au chemin de fil extérieur (Rb), respectivement,
caractérisé en ce que
le chemin de fil intérieur (Ra) est formé sur la surface intérieure d'un élément de guidage tubulaire intérieur (39, 69) qui tourne autour de la ligne centrale et qui est relié au disque supérieur (23, 63).

2. Retordeur quadruple selon la revendication 1, **caractérisé en ce que** le chemin de fil extérieur (Rb) s'étend le long d'un élément de guidage extérieur (40, 70) qui tourne autour de la ligne centrale.

3. Retordeur quadruple selon la revendication 2, **caractérisé en ce que** l'élément de guidage intérieur (39, 69) et l'élément de guidage extérieur (40, 70) forment ensemble un tube avec un fond qui guide un fil (Y) sur le chemin de fil extérieur (Rb).

4. Retordeur quadruple selon l'une des revendications 1 à 3, **caractérisé en ce qu'**un tube de guidage de fil (53, 91) est fixé à la surface intérieure de l'élément de guidage intérieur (39, 69) qui forme à l'intérieur du chemin de fil intérieur (Ra).

5. Retordeur quadruple selon l'une des revendications 1 à 4, **caractérisé en ce que** le disque supérieur (23) présente un trou de guidage supérieur (47a) s'ouvrant dans la portion de base (23c) du disque supérieur (23), et le disque inférieur (24) présente un trou inférieur (47b), s'ouvrant dans la portion de base (24c) du disque inférieur.

6. Retordeur quadruple selon la revendication 5, **caractérisé en ce que** le trou supérieur (47a) et le trou inférieur (47b) sont reliés d'une manière étanche à l'air.

7. Retordeur quadruple selon la revendication 5, **caractérisé en ce que** le trou inférieur (47b) présente une sortie (47c) s'ouvrant vers la surface interne (40a) de l'élément de guidage extérieur (40).

FIG. 1

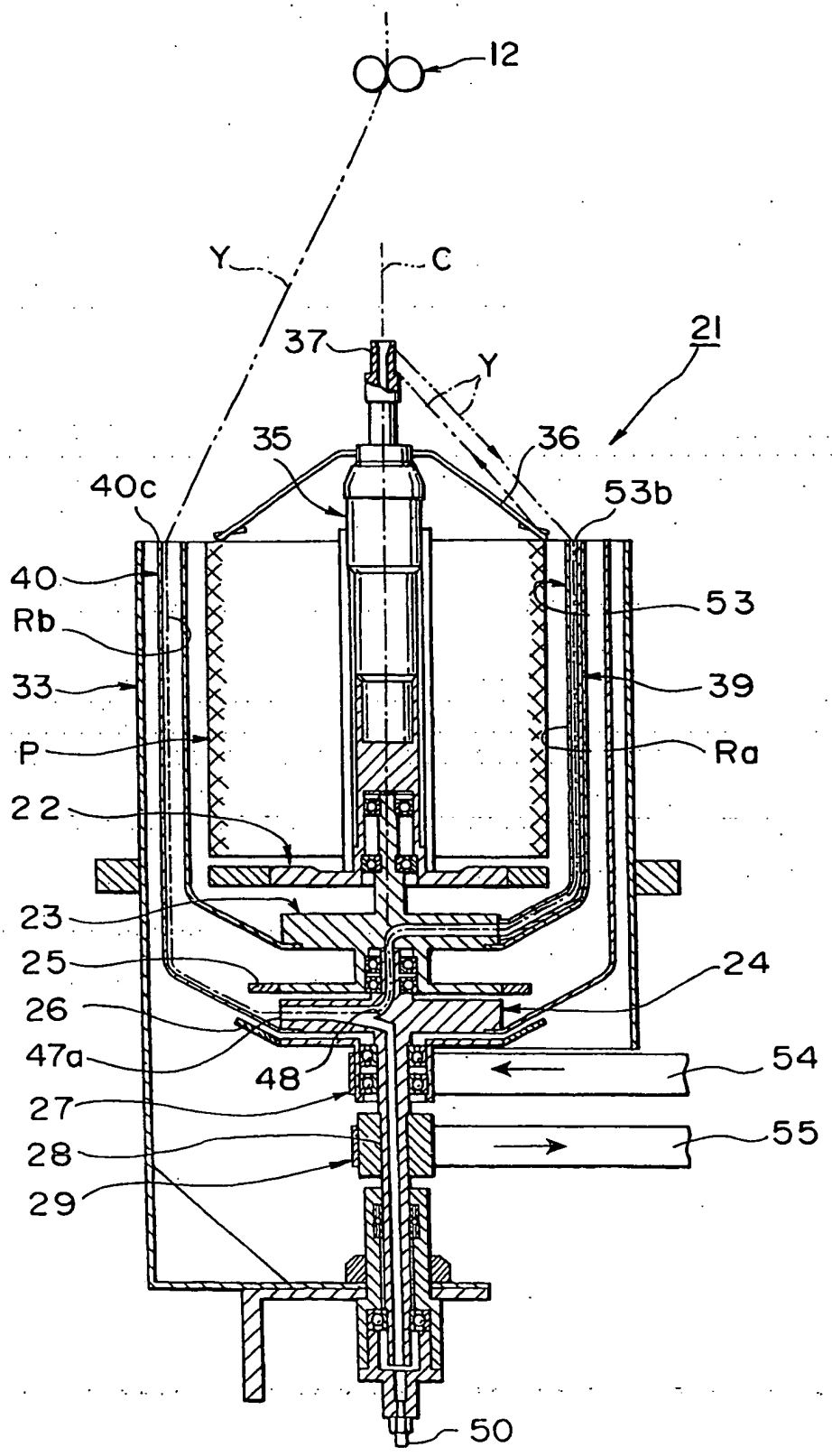

12
Y
C
37
Y
21
35
36
40c
53b
40
Rb
53
33
39
P
Ra
22
23
25
24
26
47a
48
54
27
55
28
29
50

FIG. 2

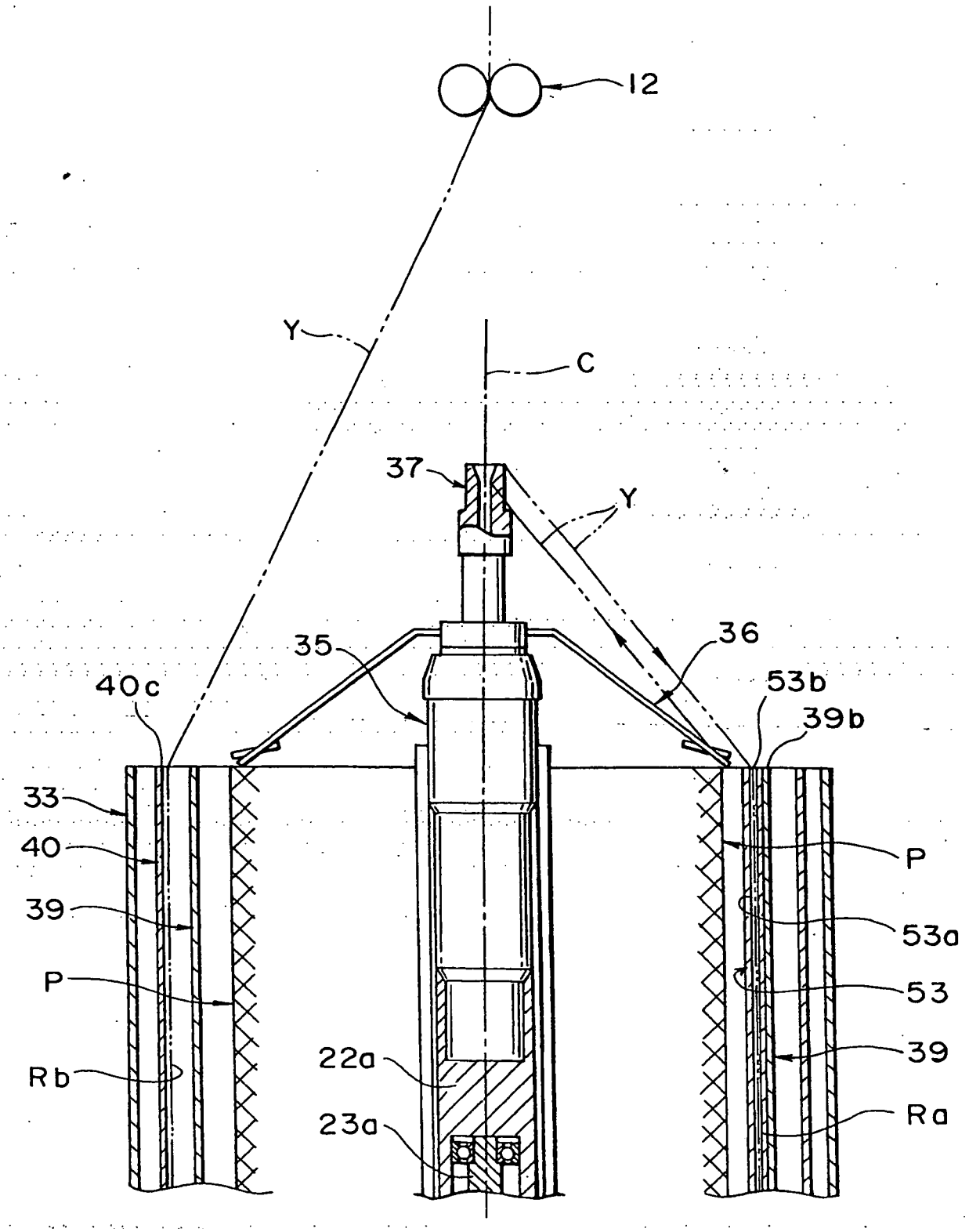


FIG. 3

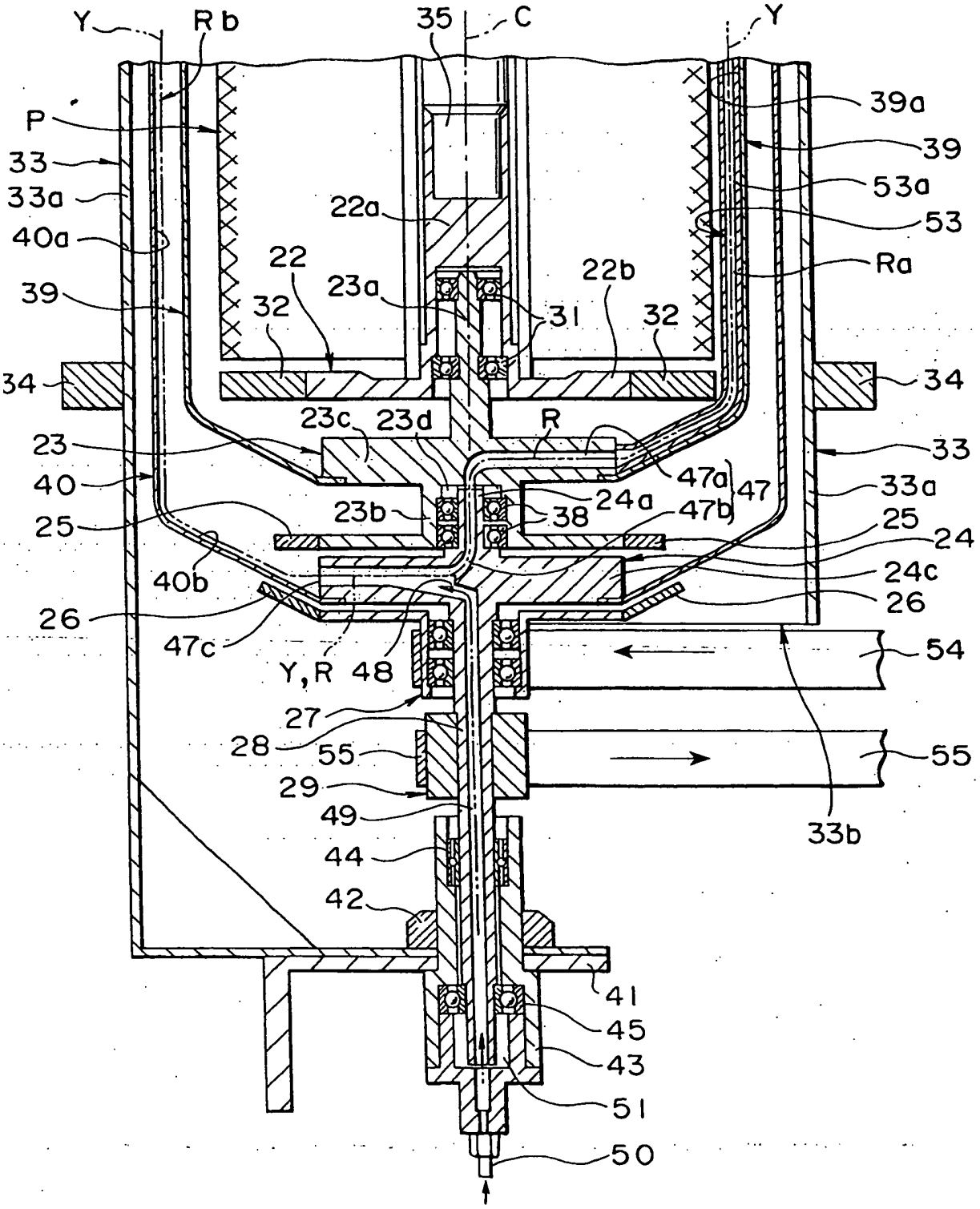

Y
Rb
35
C
Y
39a
P
39
33
53a
33a
22a
53
40a
22
Ra
22b
39
23a
32
31
32
34
34
23c
23d
R
23
33
47a
47
40
33a
24a
23b
38
47b
25
25
24
40b
24c
26
26
47c
54
Y,R
48
27
28
55
55
29
49
33b
44
42
41
45
43
51
50

FIG. 4

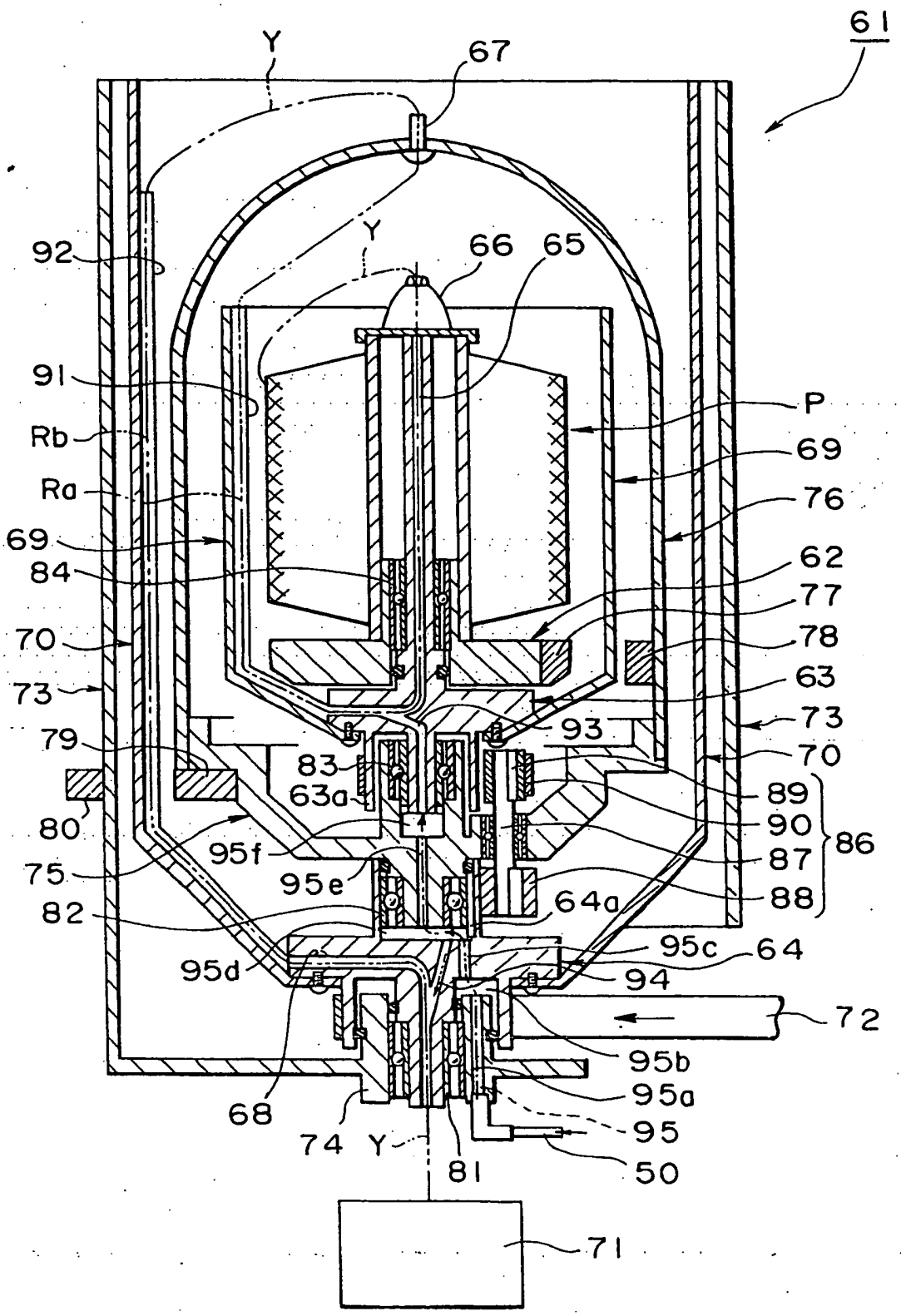
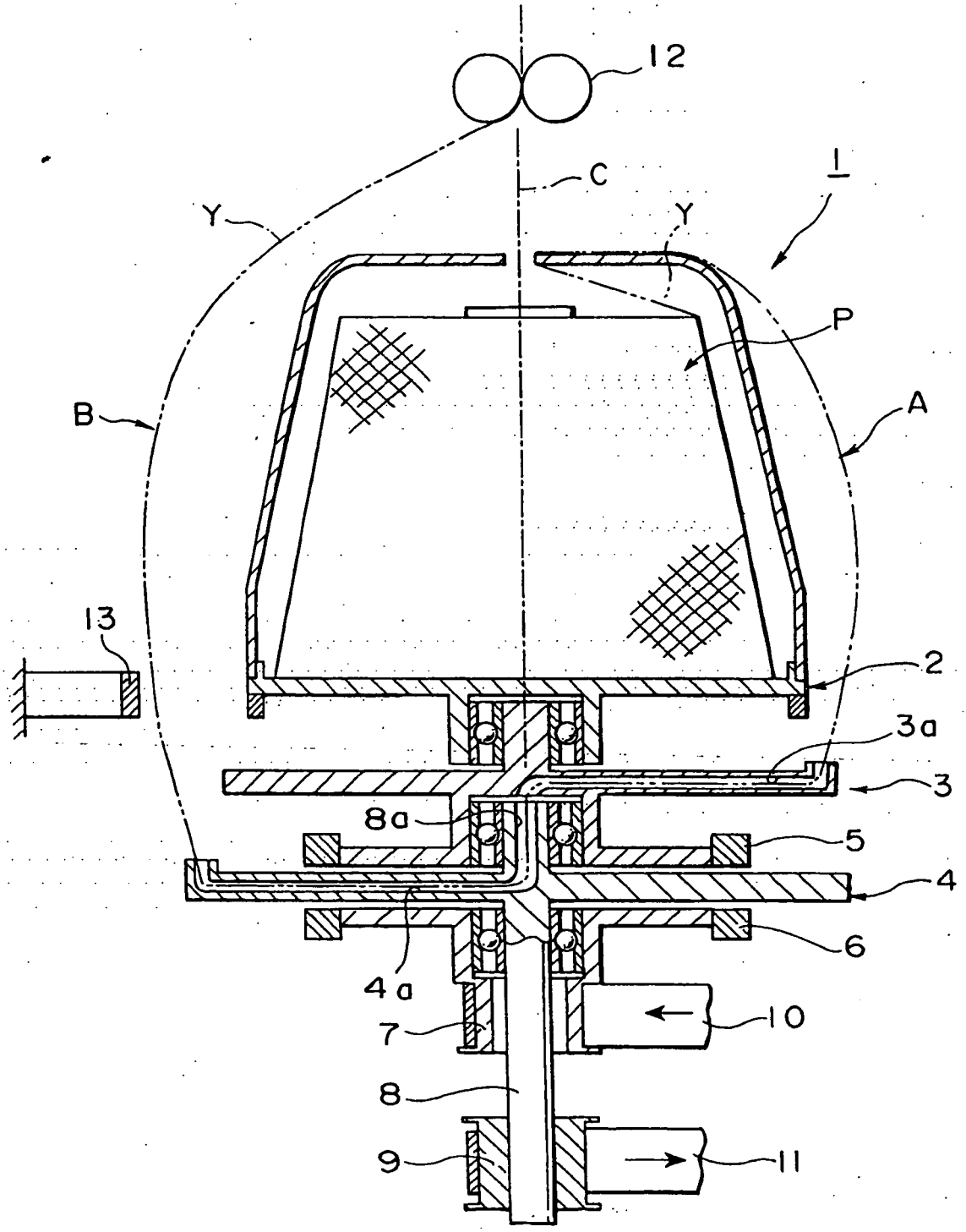

61
Y
67
Y
66
65
92
91
Rb
Ra
69
84
70
73
79
80
75
82
95d
68
74
Y
81
71
P
69
76
62
77
78
63
73
93
70
83
63a
89
90
87
88
86
95f
95e
64a
95c
64
94
72
95b
95a
95
50

FIG.5



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 7268732 A **[0001]**
- JP 446685 A **[0002]**