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

(11) EP 0 863 234 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
28.04.2004 Bulletin 2004/18

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

(21) Application number: **97122447.2**

(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:
09.09.1998 Bulletin 1998/37

(73) Proprietor: **Murata Kikai Kabushiki Kaisha**
Minami-ku, Kyoto-shi, Kyoto 601 (JP)

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

(74) Representative: **Liedl, Christine, Dipl.-Chem. et al**
Hansmann & Vogeser
Patentanwälte
Postfach 70 08 60
81308 München (DE)

(56) References cited:
EP-A- 0 611 841
DE-U- 29 606 150
JP-B- 44 006 685
US-A- 4 222 221

- **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)**
- **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)**

EP 0 863 234 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a four-for-one twister according to the preamble of claim 1

[0002] A four-for-one twister of this type is known from JP-44-6685. This four-for-one twister 1, as shown in the accompanying Figure 4, 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 long an inner yarn path A and an outer yarn path B vertically around the supply package P. Drive providing the pulleys 7 and 9 are driven by drive belts 10 and 11, which are attached between motors (not shown), and 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 take-up 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] Thus, it takes a long time for the yarn to pass through the yarn path comprised of the yarn guide hole 3a of the upper disk 3, the yarn path 8a of the spindle 8, and the yarn guide hole 4a of the lower disk 4.

[0005] Hence, the problem of the conventional four-for-one twister is that it takes a long time to pass the yarn and clear a new supply package, bringing down the operational efficiency of the twister.

[0006] This problem is solved by the features defined in the characterizing portion of claim 1.

[0007] In the present invention, when the yarn guide holes eject air from the ejecting nozzle, outside air is sucked in from the upstream side by means of upstream suction force created by the nozzle openings. The air sucked in and the air ejected by the nozzle join, and by flowing towards the downstream end inside the hole, create a flow of air that passes the yarn in a forward moving direction through the length of the hole. When the yarn that is let out is made to enter the hole from the upper end of the yarn entry hole, it is automatically passed through the hole and pulled out from the outer downstream end by means of the air suction flowing along the yarn passage through the hole.

Brief Description of the Accompanying Drawing

[0008]

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 conventional four-for-one twister.

[0009] A four-for-one 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 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 package 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 package 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 package 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 and 38 on a standing center spindle 24a. The upper disk 23 is affixed to the inner guiding member 39 comprised of a tube with a bottom with something like a screw 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 with something like a screw 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 something like a nut member 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 23d, 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 (in reference to 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] The lower hole 47b of the lower disk 24 opens into an ejecting nozzle 48 at the border area between the radial portion and the curved portion, and the ejecting nozzle 48 jets air to pass the string in the direction of the outer surface 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 ejecting 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 package supporting member 22 in a stationary position. Between pulleys 27, 29 and the drive mechanism (not shown), 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 twister 21 is explained.

[0020] First, with the belt drives stopped, the operator inserts a new supply package P into the package 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 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 four-for-one 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 course of the inner yarn guide 39 and outer yarn guide 40 and the twister 21 can regulate the frictional 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 bottoms, and the fixed hood 33 acts as a stable cover, the four-for-one 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 four-for-one twister 21 to be compact.

[0029] Moreover, since thread tension can be regulated with only the inner guiding member 39, the twister 23 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 attached to the inner guiding member 39 can be removed from the four-for-one 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 highpressure hose to the coupler.

Claims

1. Four-for-one twister comprising a supply package supporting member (22), an upper disc (23) provided with a yarn guide hole (47a) and a lower disc (24) provided with a yarn guide hole (47b), said discs (23, 24) rotating concentrically, wherein an inner yarn path (Ra) and an outer yarn path (Rb) vertically around the supply package (P) are formed and connected through the guide holes (47a, 47b) in the upper and lower discs (23, 24),
characterized in that

for threading the yarn of the supply package (P) the yarn guide hole (47b) in the lower disc (24) is connected to a pressurized air ejecting nozzle (48) creating a suction attracting the yarn introduced into the yarn guide hole (47a) in the upper disc (23).

2. Four-for-one twister according to claim 1, **characterized in that** the inner yarn path (Ra) is formed by a yarn guide pipe (53) connected with the guide hole (47a) in the upper disc (23), the suction created by the pressurized air ejecting nozzle (48) attracts also the yarn introduced into the yarn guide pipe (53), and the yarn guide pipe (53) rotates around the outside of the supply package (P) via the rotation of the upper disc (23).

Patentansprüche

1. Vierfachzwimmaschine, bestehend aus einem Lieferspulen-Tragelement (22), einer oberen Scheibe (23), die mit einer Fadenführungsöffnung (47a) versehen ist, und einer unteren Scheibe (24), die mit einer Fadenführungsöffnung (47b) versehen ist, wobei die Scheiben (23, 24) konzentrisch drehen, und eine innere Fadenbahn (Ra) und eine äußere Fadenbahn (Rb) vertikal um die Lieferspule (P) gebildet und über die Fadenöffnungen (47a, 47b) in der oberen und unteren Scheibe (23, 24) verbunden sind, **dadurch gekennzeichnet, dass** zum Einfädeln des Fadens der Lieferspule (P) die Fadenführungsöffnung (47b) in der unteren Scheibe (24) mit einer Druckluftdüse (48 verbunden ist, die eine Saugkraft erzeugt, die den in die Fadenführungsöffnung (47a) eingeführten Faden in der oberen Scheibe (23) ansaugt.

2. Vierfachzwimmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die innere Bahn (Ra) durch ein Fadenführungsrohr (53) gebildet ist, das mit der Führungsöffnung (47a) in der oberen Scheibe (23) verbunden ist, die Saugkraft, die von der Druckluftdüse (48) erzeugt wird, auch den Faden, der in das Fadenführungsrohr (53) eingeleitet wird, ansaugt, und sich das Fadenführungsrohr (53) um die Außenseite der Lieferspule (P) durch die Drehung der oberen Scheibe (23) dreht.

Revendications

1. Broche quadruple torsion comprenant un organe de support de paquet d'alimentation (22), un disque supérieur (23) muni d'un trou de guidage de fil (47a) et d'un disque inférieur (24) muni d'un trou de guidage de fil (47b), lesdits disques (23, 24) tournant de manière concentrique un passage interne de fil (Ra) et un passage externe de fil (Rb) étant formé verticalement autour du paquet d'alimentation (P) et étant connecté par les trous de guidage (47b, 47b) dans les disques supérieurs et inférieurs (23, 24), **caractérisé en ce que** pour enfiler le fil du paquet d'alimentation (P), le trou de guidage de fil (47b) dans le disque inférieur (24) est connecté à une buse d'éjection d'air pressurisé (48) créant une aspiration attirant le fil introduit dans le trou de guidage de fil (47a) dans le disque supérieur (23).

2. Broche quadruple torsion selon la revendication 1, **caractérisé en ce que** le passage interne de fil (Ra) est formé par un tuyau de guidage de fil (53) connecté au trou de guidage (47a) dans le disque supérieur (23), **en ce que** l'aspiration créée par la buse d'éjection d'air pressurisé (48) attire également le fil introduit dans le tuyau de guidage de fil (53) et le tuyau de guidage de fil (53) tourne autour de l'extérieur du paquet d'alimentation (P) par la rotation du disque supérieur (23).

FIG. 1

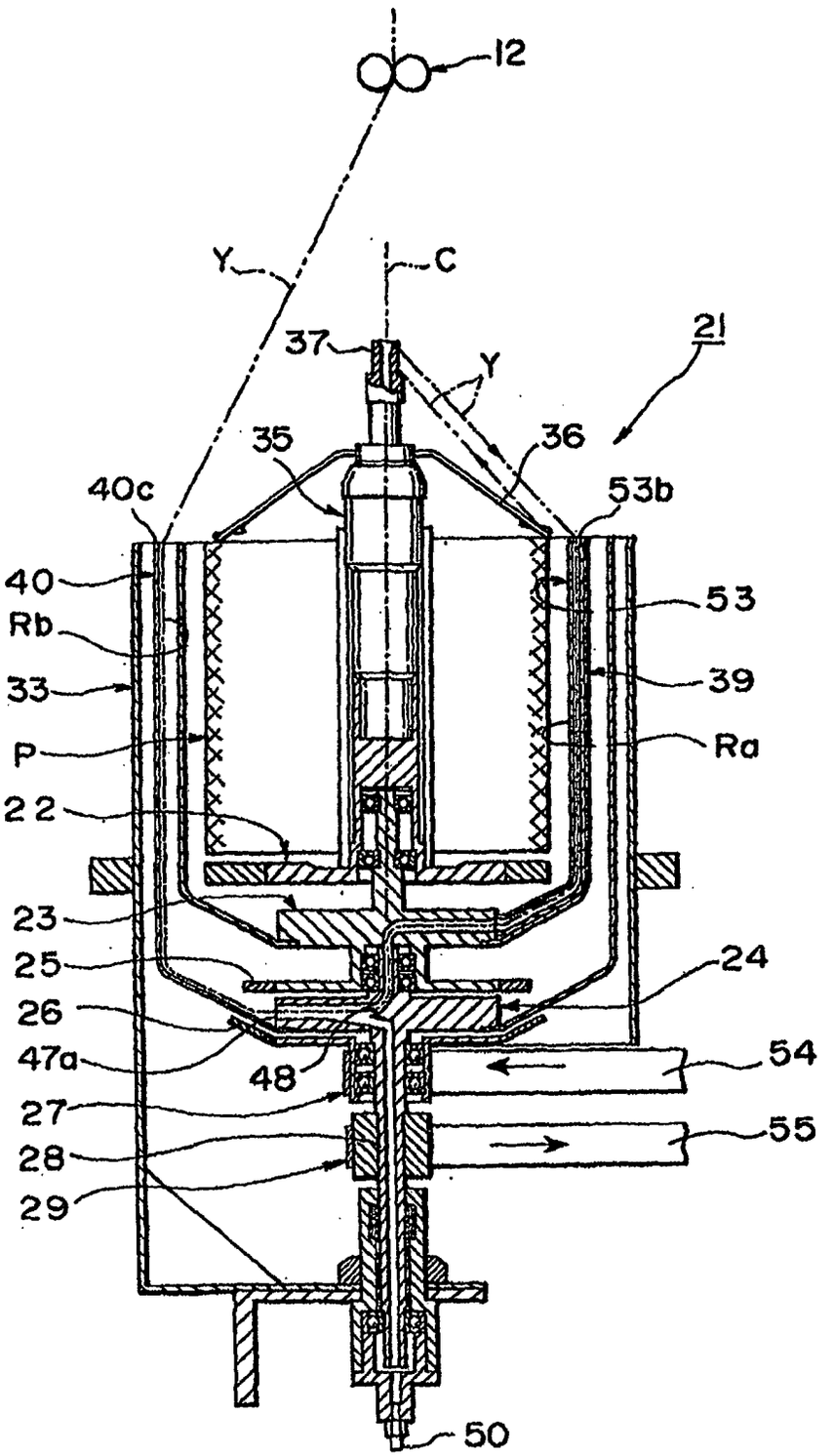
12
Y
C
37
Y
21
35
36
40c
53b
40
Rb
53
33
39
P
Ra
22
23
25
24
26
47a
48
54
27
55
28
29
50

FIG. 2

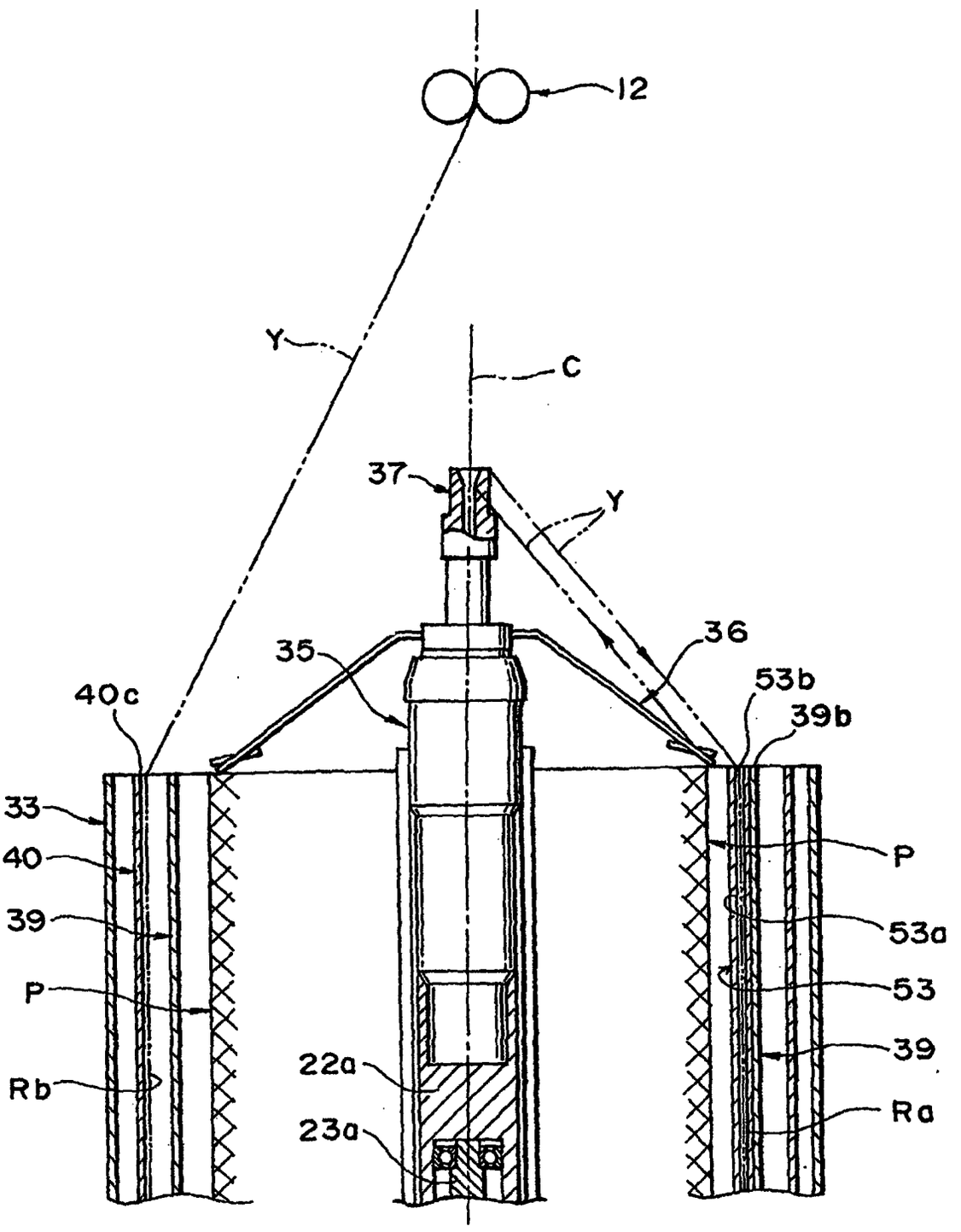

FIG. 3

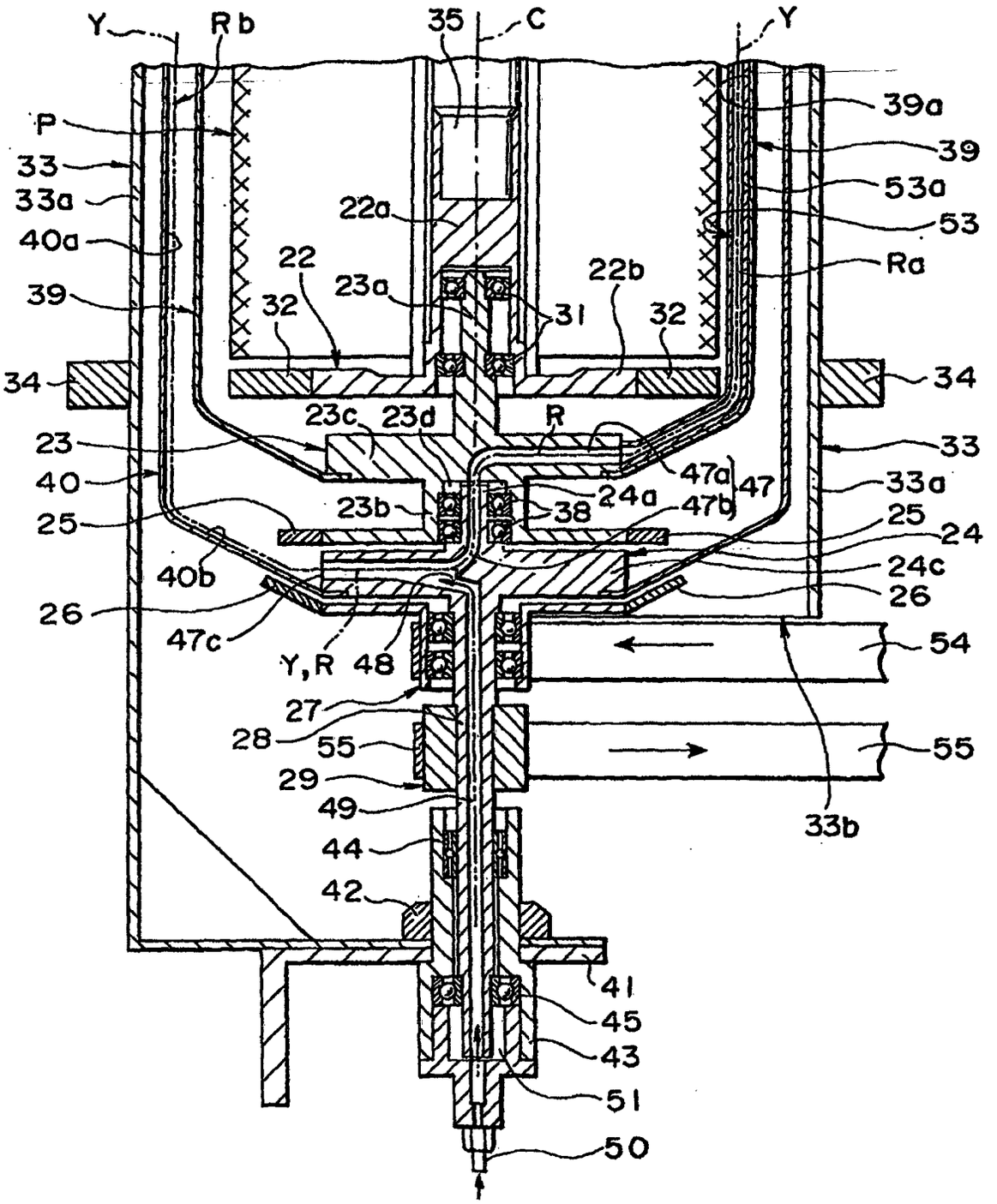
Y
Rb
35
C
Y
39a
P
39
33
53a
33a
53
22a
40a
Ra
22
22b
39
23a
31
32
32
34
34
23c
23d
R
33
23
47a
40
47
33a
24a
47b
23b
38
25
25
24
40b
24c
26
26
47c
Y,R
48
54
27
28
55
55
29
49
33b
44
42
41
45
43
51
50

FIG. 4