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(54) **An apparatus for expanding and rotating tubular fabrics in rope-like form.**

(57) An apparatus for expanding and rotating tubular fabrics, of the type comprising in a sequence a device (11) for untwisting a tubular fabric (23) in rope-like form and a device (20,59) for expanding the tubular fabric and exploiting an air flow that is sent inside the tubular fabric (23) downstream of the untwisting device (11). A device (14) for rotating the expanded tubular fabric (23) in the two opposite ways with respect to the direction in which the fabric advances is provided downstream of the untwisting device, so as to straighten the fabric and orient it correctly.

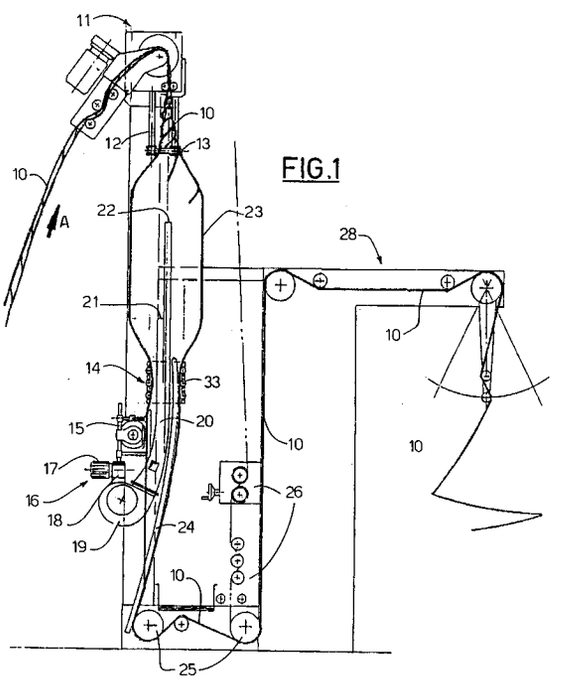


FIG.1

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The present invention refers to an apparatus for expanding and rotating tubular fabrics in rope-like form.

After dyeing, tubular fabrics come out in rope-like form, so it is necessary to expand them and carry out following operations such as lengthwise cutting or simple storage.

It is evident that apparatuses accomplishing the above expanding operations need to work automatically and continuously at high speed.

In a normal working process, the tubular fabric in rope-like form passes through an automatic untwisting assembly that unrolls the fabric and delivers it free of any twistings. This allows the fabric to be easily spread out and at the same time cuts down tensions in the fabric.

If the fabric just has to be expanded and not cut lengthwise, an expanding device is generally located downstream of the first automatic untwisting assembly. The expanding device is formed by a metal ring fitted with several small plates. The ring is inserted inside the tubular fabric and cooperates with a series of magnet plates disposed at the outside. In this way the ring is kept in a raised position and expands the fabric without causing high friction on it. The fabric is expanded and arrives to a further spreading assembly in a well stretched and regular form according the wefts of the fabric.

This kind of plants suffer from a few drawbacks, the first of which is the need to have a ring that can be widened for working a large range of fabrics of various dimensions. Moreover, the above expanding device is rather complex in shape and is considerably expensive.

Several attempts have been made in order to replace the metal ring with a expanding assembly formed by a plurality of nozzles through which air is inflated into the fabric from different and opposite positions so as to blow it up and expand it.

However, the spread tubular fabric has to be straightened and oriented so as to allow it to go on straight to following workstations.

Therefore, there is a need for means disposed downstream of the expanding nozzles, for rotating the expanded fabric in both opposite directions with respect to the direction of advancement, otherwise all of the untwisting and expanding operations already accomplished on the fabric in rope-like form would be wasted.

In other cases, the fabric needs to be cut lengthwise after it is untwisted and expanded.

Tubular fabric cutting is a step of primary importance in fabric manufacturing, especially when it is accomplished after dyeing operations. Plants for expanding and cutting a tubular fabric in rope-like form after dyeing are designed to work automatically and continuously at high speed.

Generally, the fabric in rope-like form is made to pass through an automatic untwisting assembly that eliminates twistings and renders the fabric easy to be expanded. Also, the untwisting assembly reduces mechanical traction on the fabric. The untwisted fabric is made to pass over a basket disposed downstream of the automatic untwisting assembly. The basket opens and expands the tubular fabric. Then, this is delivered to a disc-like cutter located immediately downstream of the basket. The cutter cooperates with the basket so as to follow expansion and contraction movements thereof according to the diameter of the tubular fabric.

Downstream of the basket and cutter assemblies is a triangular frame device for opening the cut fabric and stretch it out without causing weft distortions.

This plant of known kind suffers from a few inconveniences. First of all, an expandable and contractible basket cooperating with a mobile cutter has a considerable cost and requires frequent maintenance operations. Moreover, its position on the working line does not allow the triangular frame coming after the cutter to be fitted in an ideal position at the inside of the cut fabric to guarantee correct opening, as the basket prevents the frame from being inserted beyond a certain length.

A variable diameter basket requires a rather complex cutter support device, as the cutter has to move lengthwise along perpendicular axes to follow expansion and contraction of the basket.

Several attempts have been made in order to replace the basket with an air flow coming from below and directed upwardly into the fabric between the untwisting assembly and the cutter.

Also in this case, however, as for the above discussed apparatuses only for expanding the fabric in rope-like form, no means are provided for rotating the expanded fabric in the two opposite ways respect to the advancing direction and cooperating with the cutter so as to allow the latter to perform a correct lengthwise cut in the fabric.

It is an object of this invention to resolve the aforesaid problems in connection with apparatuses for expanding rope-like fabric and eventually cutting it lengthwise.

The above and further objects, that will be better understood hereinafter, are attained by a an apparatus according to claim 1.

Various exemplary embodiments of the apparatus of this invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a front view of a first embodiment of the apparatus of this invention;

Figure 2 is a plan view of the apparatus of Figure 1;

Figure 3 is a perspective view of the ap-

paratus of Figure 1;

Figure 4 is a front view of a second embodiment of the apparatus of this invention;

Figure 5 is a plan view of the apparatus of Figure 4;

Figure 6 is a perspective view of the apparatus of Figure 4;

Figure 7 is a front view of a third embodiment of the apparatus of this invention;

Figure 8 is a perspective view of the apparatus of Figure 7;

Figure 9 shows a further embodiment of the apparatus of this invention;

Figure 10 is a front view of a fifth embodiment of the apparatus of this invention;

Figure 11 is a plan view of the apparatus of Figure 10;

Figure 12 is a perspective view of the apparatus of Figure 10;

Figure 13 is a side view of the apparatus of this invention comprising three embodiments, all shown;

Figure 14 is a front view of the apparatus of Figure 13;

Figure 15 is a plan view of part of the apparatus of Figure 13.

The apparatuses shown in Figures 1 to 12 are of the kind for opening and cutting tubular fabrics, while the ones shown in Figures 13 to 15 are only for opening tubular fabrics.

Referring at first to the arrangement of the apparatus shown in Figures 1 to 3, it can be seen that a fabric in rope-like form 10 advances in the direction indicated by arrow A towards an untwisting device for eliminating the twist in the fabric. Such a device, of known kind, is disclosed for example in Italian Patent No. 1 083 519.

Downstream of the untwisting device is a structure 12, the free end of which carries an idly mounted ring 13 through which the fabric 10 coming from the untwisting device is made to pass.

Downstream of this unit the fabric is free until it comes to and passes through a further device 14, that will be better described further on. Then, the fabric arrives to a conventional cutter 15, of the type generally used in this kind of plant.

According to the invention, downstream of the cutter is a unit 16 comprising a motor 17 that sends air to a scroll 19 through a pump 18. A tube 20 extends from the free end of the scroll 19 and is provided at its ends with a plurality of nozzles 21, 22. The tube is slipped inside the fabric above the cutter 15, through the device 14 and inside the above indicated free portion of fabric that is comprised between the ring 13 and the device 14. The nozzles blow the air the is sent by the pump 18 inside said free portion of fabric, blowing it up so as to get it to take the arrangement shown in Figures 1, 2 and 3.

Downstream of the assembly formed by the cutter and the scroll 19 is a triangular device 24, of known kind per se. Owing to the particular solution that is proposed, the device 24 extends upwardly beyond the cutter 15 and inside the device 14, to the extent that is deemed more convenient without causing encumbrance or hindrance problems to the other devices.

The fabric that is opened by the cutter and laid open by the triangle 24 is then delivered to rollers 25 of a foulard unit. The rollers deliver it to other devices known "per se", such as expanding and centring devices 26, cloth folders, and so on.

In the arrangement shown in Figures 1 to 3, the device 14 consists of a belt 30 that winds over pulleys 31, one of which is rotated in reciprocating rotary motion by a motor 32. A set of equally spaced rollers 33 having their axes disposed substantially parallel to the plane of the belt are idly mounted on the belt. Upon rotating in both ways due to the action of the motor 32, the belt 30 causes the rollers 33 on the belt to friction horizontally the fabric 10 passing inside the belt. The rollers 33 make the fabric rotate in the two opposite ways with respect to its vertical direction of advancement. At the same time, as the rollers 33 are idle, they transmit irrelevant friction, or no friction at all, to the fabric moving vertically. Therefore, the fabric can maintain its vertical speed.

As shown in Figure 2, oscillating rollers 34 can be fitted in a side position, in such a way that if they are rotated in the direction of arrow B they bias one side of the belt towards the other side for variating (increasing or decreasing) the width of the tubular fabric arriving to the cutter 15.

The cutter 15 will obviously be mounted on a sledge 35 so as to allow it to slide sideways and cut automatically with the precision of the needle. The cutter 15 and the belt 30 are also connected so as to cooperate in directing the fabric correctly while it descends to be cut and expand out on the triangle 24. In this case, the triangle is advantageously slipped to a considerable extent inside the tubular fabric and above the belt 30 so as to ensure perfect expansion without causing weft distortion.

This apparatus, that provides blowing up of the tubular fabric at portion 23 by simply insufflating air inside through nozzles 21 and 22, allows to eliminate the use of a conventional basket. Another advantage is that the rotation of the tubular fabric upstream of the cutter is accomplished from the outside (by the rollers 33 of belt 30). Therefore, no mechanical tools or units have to be employed

inside the tubular fabric, as is instead currently done when a conventional basket is used.

In the embodiment shown in Figures 4 to 6, the device 14 is formed by two pairs of helically scored rolls. The pair of rolls 40 that are fitted on one side have opposite handed helics scored thereon with respect to the rolls 41 located on the other side.

Suitable motor means (not shown) provide reciprocating rotary motion to the two pairs of rolls 40, 41, so as to rotate in either way the fabric that advances vertically, in the same way as this rotation was accomplished in the embodiment of Figures 1 to 3 by the belt 30 and its rollers 33. The pairs of rolls 40, 41 do not provide considerable friction against the vertical advancement of the fabric. This is also demonstrated by the fact that these rolls are well known in prior art and are currently used in several applications, as for example the expanding units indicated by numeral 26 in the drawings.

It is evident that the belt 30-rollers 33 solution of the first embodiment as well as the one with pairs of helically scored rolls 40, 41 of Figures 4-6 are disclosed purely as an example. What is essential is that between the open portion 23 of the fabric and the cutter there are provided means for rotating the fabric so as to enable the cutter 15 to cut the fabric accurately, as is done conventionally with the fabric sliding on the periphery of a basket before it arrives to the cutter.

Figures 7 and 8 show a solution wherein the fabric 23 is rotated from the inside instead of the outside, as shown in the previous figures. The rotating device is an umbrella 50 that rotates about its own vertical axis and has arms 51 fitted with idle rollers 52 upon which the fabric slides. These rollers 52 have the same function of the rollers 33 of Figures 1-3 of the first embodiment, so their characteristics and operation no longer need to be described in detail.

The air that is delivered by tube 20 blows the fabric up in tubular form upstream of the umbrella 50. Anyway, the fabric settles upon the arms 51 and, consequently, upon rotating in either way, the umbrella 50 causes also the fabric to rotate but does not encounter vertical friction as it slides over rollers.

Figure 9 shows the aforesaid apparatus, wherein the device 14 is a hybrid of the above described first two embodiments. The third embodiment shows that by using air to blow the fabric up and a device 14 to rotate it before it arrives to the cutter, the apparatus can be disposed horizontal instead of vertical. This arrangement involves obvious maintenance facilitations and renders the various parts of the apparatus more accessible.

Figures 10 to 13 show a variant of the device 14 for rotating the fabric 23. This variant provides two chains or belts 42, 53 fitted with the rollers 33 already described with reference to Figures 1 to 3. One belt 53 is positioned at the inside of the fabric 23, while the other belt 42 is on the outside and is moved by a motor 54.

As shown in Figure 12, the two belts 42 and 53 face each other for a portion along which the rollers on one belt are displaced with respect to the ones on the other belt. The fabric passing between the two belts in that part is rotated in either way by moving the outer belt 42. The latter urges also the inner belt 53 to rotate and, consequently, the fabric that is interposed there between.

Still referring to Figures 10 to 12, the scroll 19 can send air to a flat body 55 instead of the tube, as in the previous examples. The body 55 is formed by two overlapping surfaces separated by an air passage gap. The edges of the flat body are provided with a plurality of nozzles 56 sending the air sideways and upwards in the fabric 23, obtaining the same effect of the aforesaid tube with nozzles.

Referring to Figures 13 to 15, numeral 1 indicates a frame for sustaining the apparatus of this invention in case it is only desired to open the tubular fabric.

Numeral 23 indicates a tubular fabric in rope-like form coming from a dyeing apparatus (not shown). The fabric 23 advancing in the direction of arrow A is delivered to an untwisting device 11, known per se, for eliminating twistings in the tubular fabric.

Downstream of the untwisting device is the already cited structure 12, carrying at one end thereof an idle ring 13 which the fabric coming from the untwisting device 11 passes through.

Downstream of the idle ring 13 the fabric is free of twistings, but is not expand out. At this point, the fabric passes through a expanding device 57 which, according to this invention, consists of a plurality of air nozzles disposed in various positions, also in opposite positions. In this not-limiting arrangement, the nozzles are obtained in two plates 58 that are fixed to the frame 60 and air fed through an air conduit 59 by a pump, not shown for simplicity.

Upon passing through these two plates and being air insufflated, the fabric expands and arrives in this form to a successive centring device 14 that can be accomplished in three different embodiments herein disclosed.

In the first embodiment the device 11 comprises the already described belt 30 wound on pulleys 31 and provided with equally spaced idle rollers 33 having their axes substantially parallel to the belt's motion plane. Upon rotating the belt by

means of a motor in the two directions of arrow B, the rollers 33 friction horizontally the fabric 23 passing in the belt. In this way the fabric is rotated in the two opposite ways with respect to the vertical direction in which the fabric advances. Thus, the wefts are maintained rectilinear. At the same time the rollers 33 being idle, realise very little friction or almost no friction at all on the fabric moving vertically. Therefore, the fabric can maintain its vertical speed. A second embodiment of the centring device shown in the drawings makes use of two rolls 40, 41 with helically scored surfaces, of the kind disclosed in Figures 4 to 6.

This embodiment also exploits suitable motor means (not shown) for providing reciprocating rotary motion to the two rolls 40, 41, so as to always rotate in either way the fabric as it advances vertically. As for the previous embodiment, the weft is kept rectilinear. The two rolls 40, 41 do not friction the fabric considerably: as a matter of fact, similar rolls are used in the sector for other applications, for example in cloth folders or spreading devices of known kind.

A third embodiment of the device 14 shown in Figures 13 to 15 makes use of two rigid bars 61,62. This arrangement is employed for fabrics not requiring the weft to be positioned vertical. In a favourite form, the two bars can have nozzles to allow air passage and be connected to the air feed of tube 59 (not shown). This provides further expanding of the fabric and keeps it always contacting the two bars, so that the fabric is well stretched out when it arrives to the expanding and tensioning assembly 63 located downstream of the centring device. The tensioning assembly 63 is common to all three of the embodiments of the apparatus of the drawings, and it is composed by two idle wheels 64 that cooperate with two pairs of V shaped walls 65 between which the fabric passes. Said walls are movable along an axle 66 connected to the frame for following the different shapes of the fabric.

Finally, the apparatus of this invention is fitted with a roll 67 for pulling the fabric and make it pass in a cloth folding assembly 68 to be stored.

Claims

1. An apparatus (10) for expanding and rotating tubular fabrics, of the type comprising in a sequence a device (11) for untwisting a tubular fabric (23) in rope-like form and a device (20,59) for expanding the tubular fabric and exploiting an air flow that is sent inside the tubular fabric (23) downstream of the untwisting device (11), characterized in that a device (14) for rotating the expanded tubular fabric (23) in the two opposite ways with respect to the direction in which the fabric advances is provided downstream of the untwisting device, so as to straighten the fabric and orient it correctly.

2. An apparatus according to claim 1, characterized in that the device (14) for rotating the fabric is a belt (30), the belt being motorised for rotating in two opposite ways and being disposed on a plane perpendicular to the direction in which the fabric (23) advances; the fabric passes at the inside of and adheres to two branches of the belt.

3. An apparatus according to claim 2, characterized in that rollers (33) having their axes parallel to the belt (30) are idly mounted on the inner surface of the belt (30).

4. An apparatus according to claim 1, characterized in that the device (14) for rotating the fabric consists of motorised rolls (40,41) between which the fabric (23) passes adhering thereto, said rolls having opposite handed helically scored surfaces.

5. An apparatus according to claim 4, characterized in that said rolls (40,41) are two, the rolls being superimposed on either side with respect to the fabric (23).

6. An apparatus according to claim 1, characterized in that the device (14) for rotating the fabric is an umbrella assembly (50), rotatably mounted about its vertical axis, upon which the fabric (23) slides adhering on part of the outer cylindrical surface (51) of said umbrella assembly.

7. An apparatus according to claim 6, characterized in that rollers (52) having their axes disposed substantially horizontal and parallel to the direction in which the fabric (23) advances are mounted on the outer surface (50) of the umbrella assembly (50).

8. An apparatus according to claim 1, characterized in that the device (14) for rotating the fabric consists of two facing belts (42,53), at least one of which is motorised; the belts (42,53) being disposed on a plane parallel to the direction in which the fabric advances; the fabric advancing on the outside of one of the two belts (53) and being contacted, while advancing, by both the facing portions of the belts (42,53).

9. An apparatus according to claim 8, characterized in that idle rollers (33) are mounted on the outer surfaces of the belts (42,53); the axes of said rollers being parallel to the belts.

10. An apparatus according to claim 1, characterized in that the centring device (14) for rotating the fabric (23) is constituted by two fixed bars (61,62) between which the fabric passes adhering thereto, said bars being provided with nozzles for delivering air to the fabric.

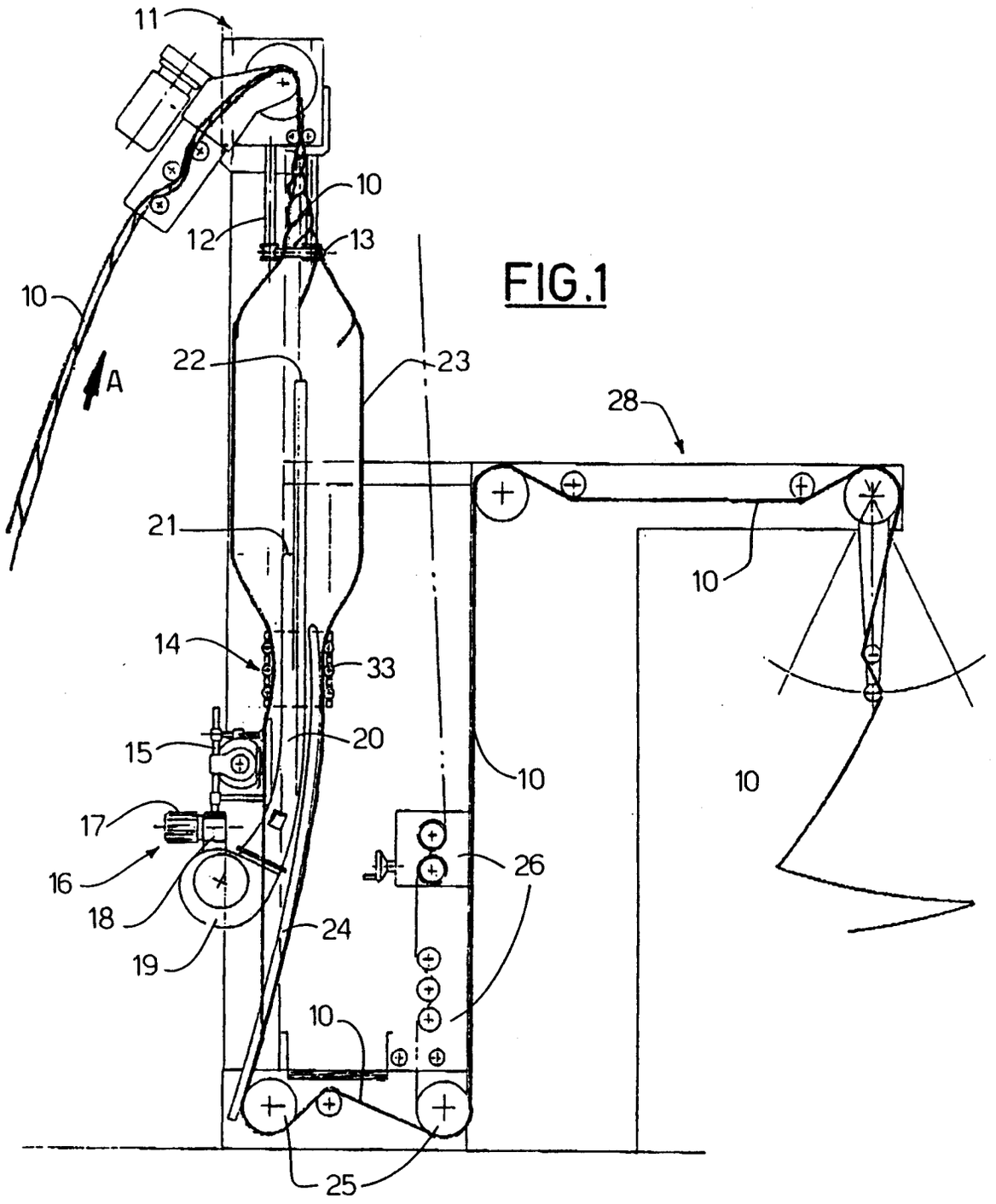


FIG.1

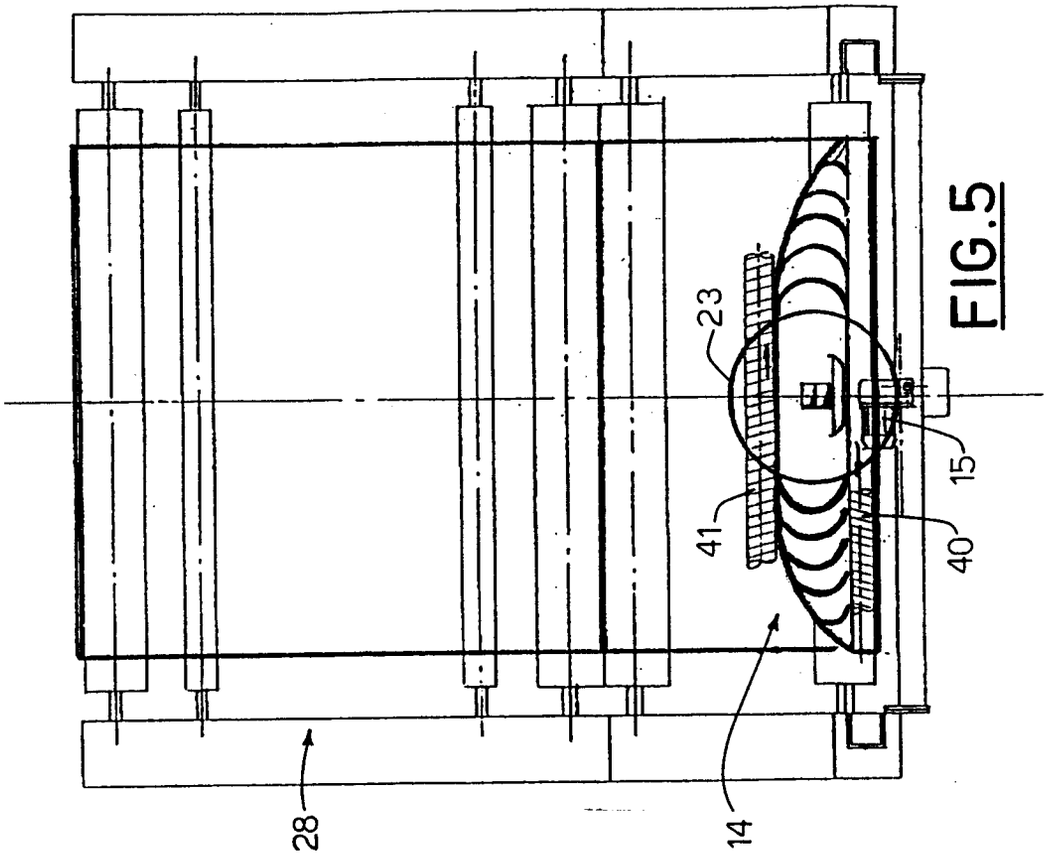


FIG.5

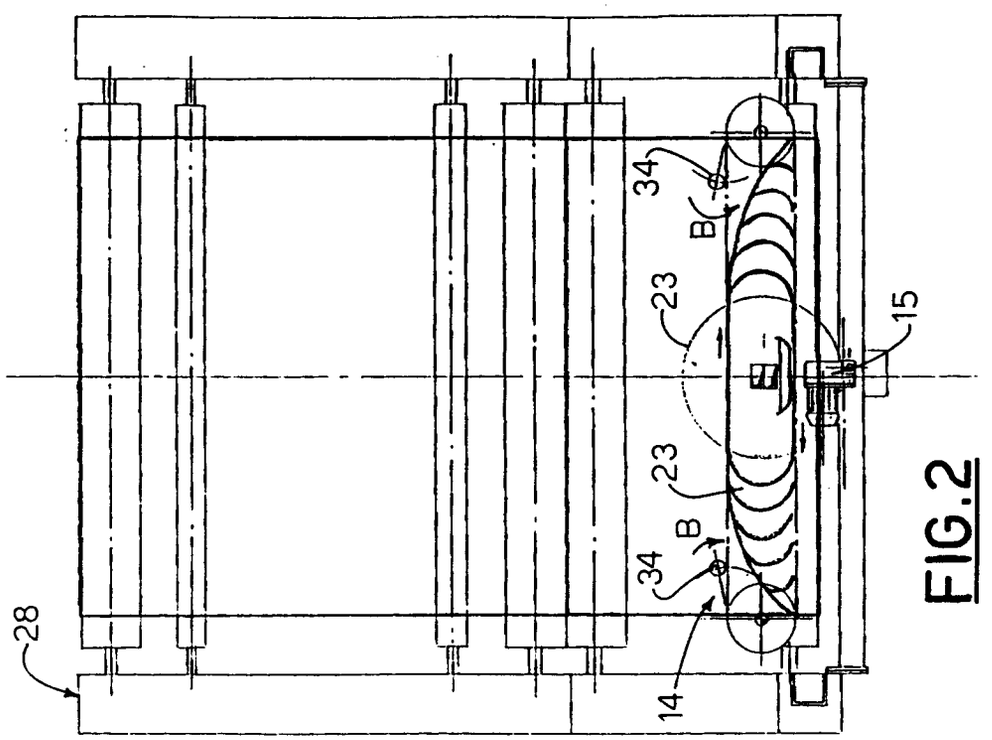


FIG.2

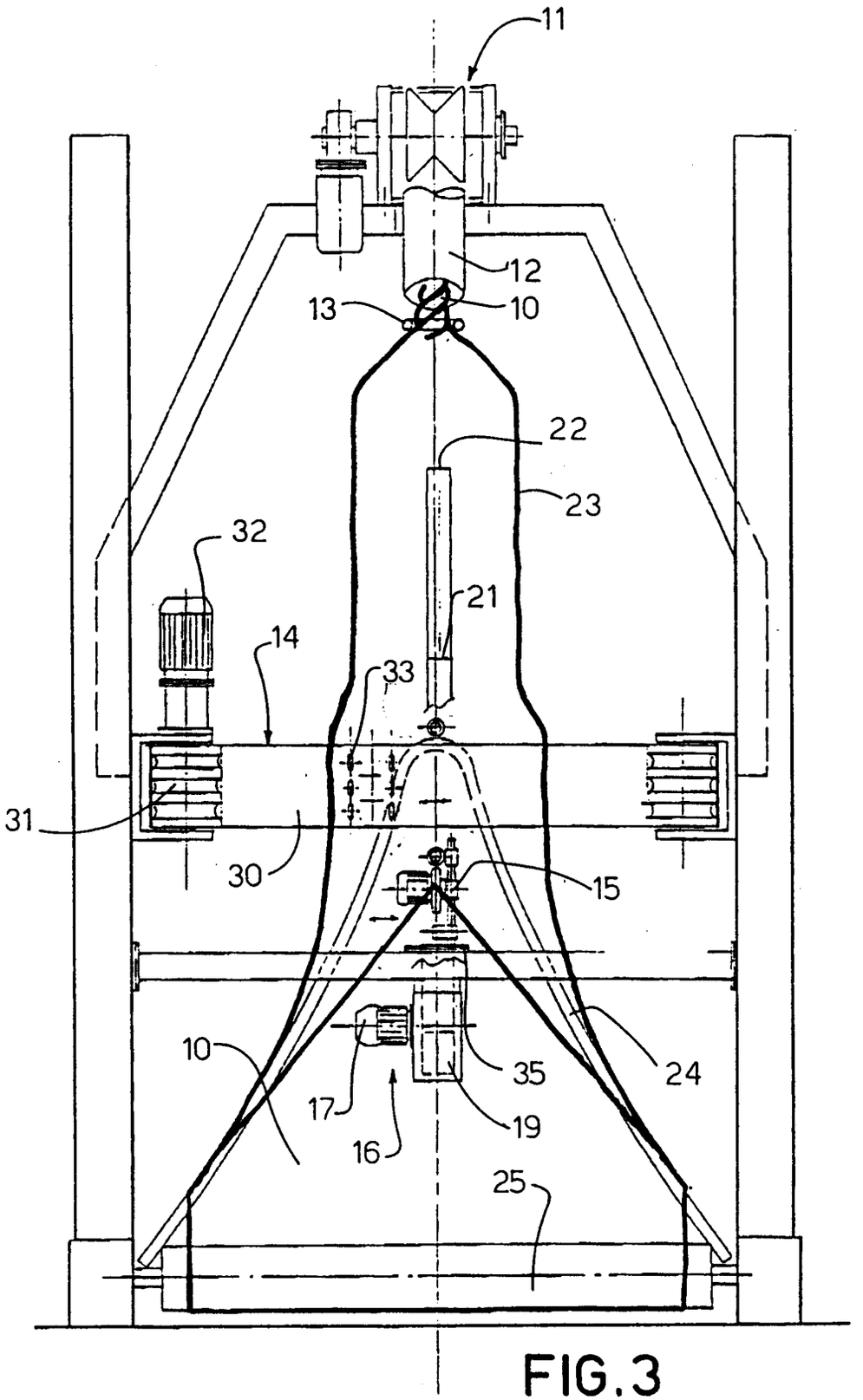


FIG.3

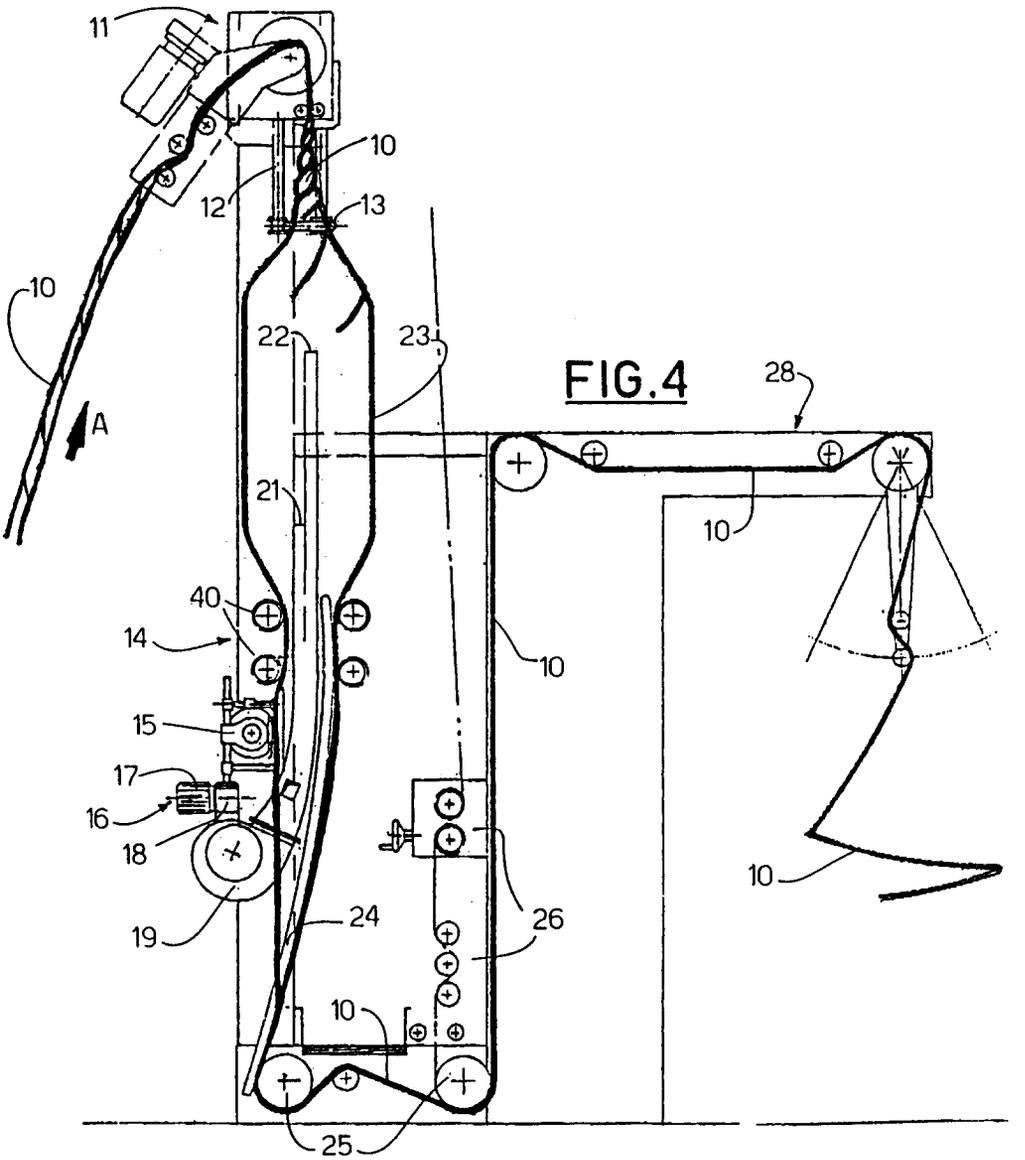


FIG.4

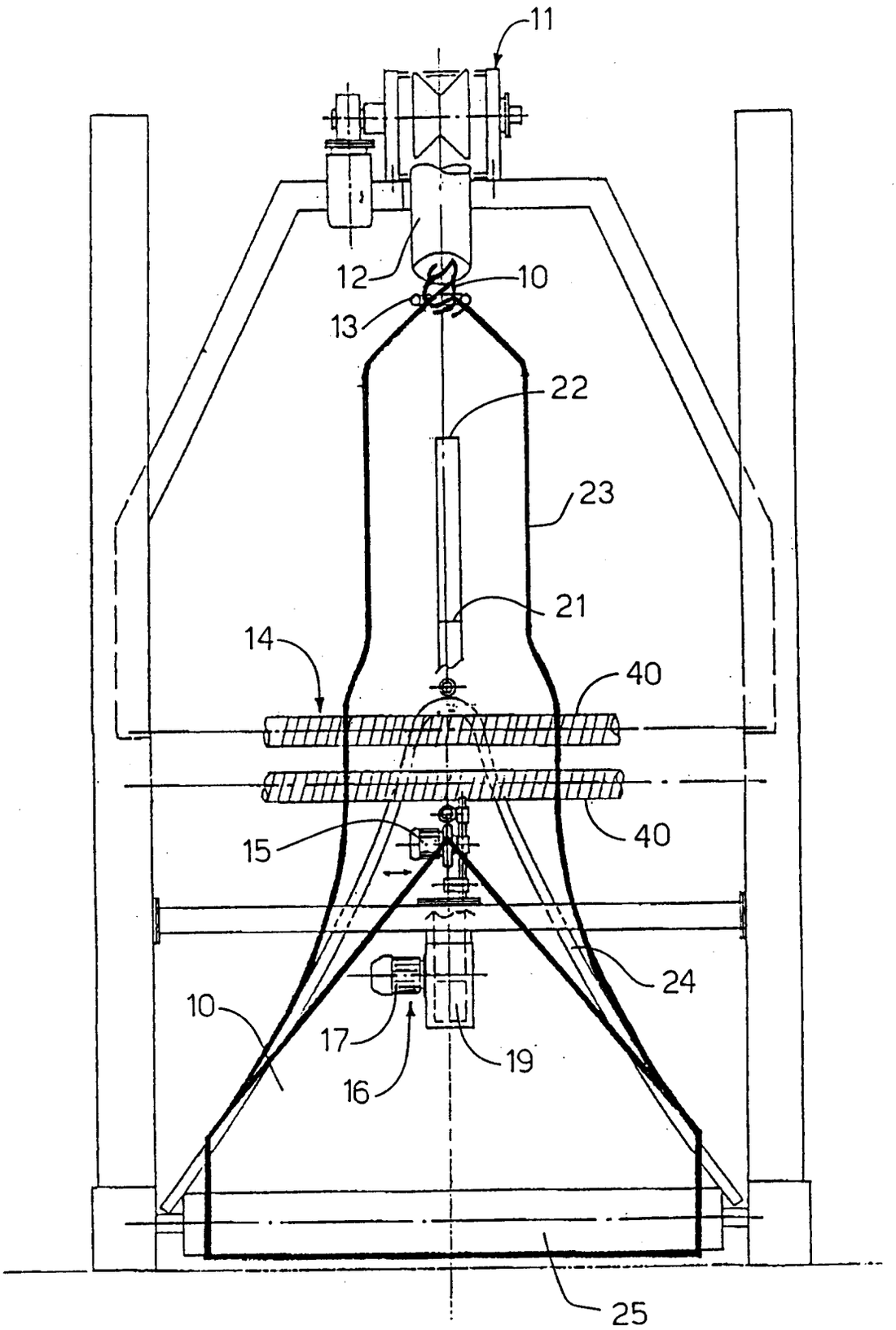


FIG.6

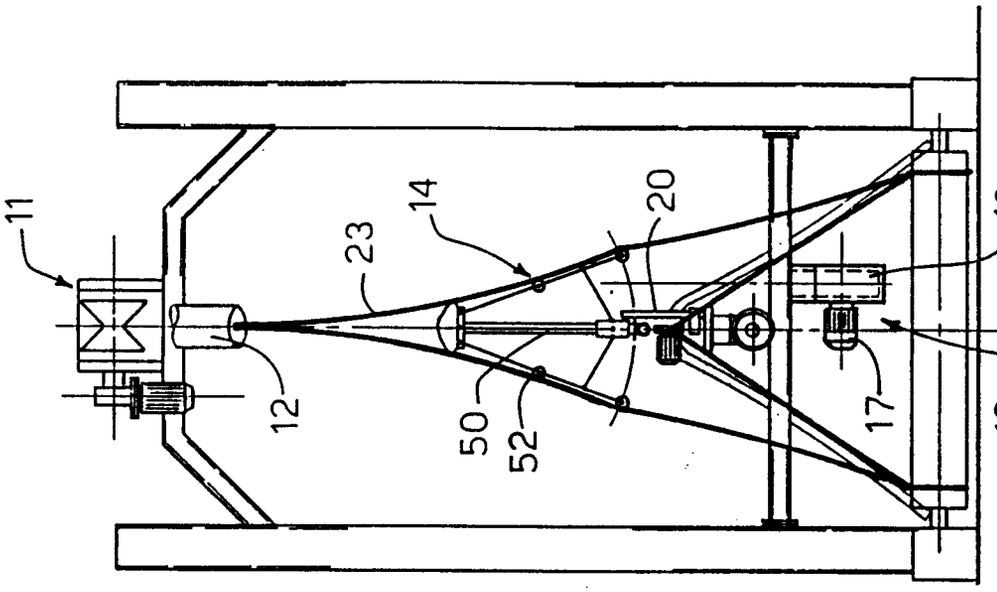


FIG.7

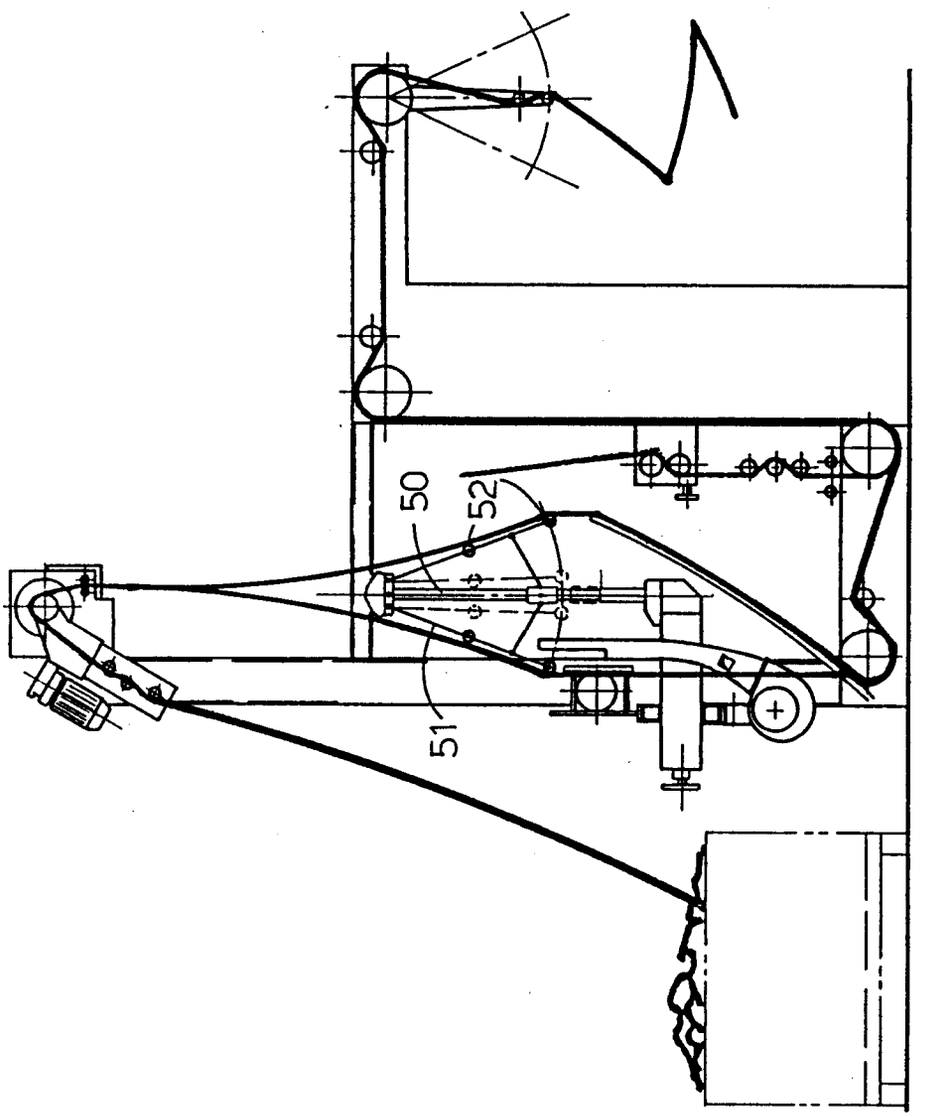


FIG.8

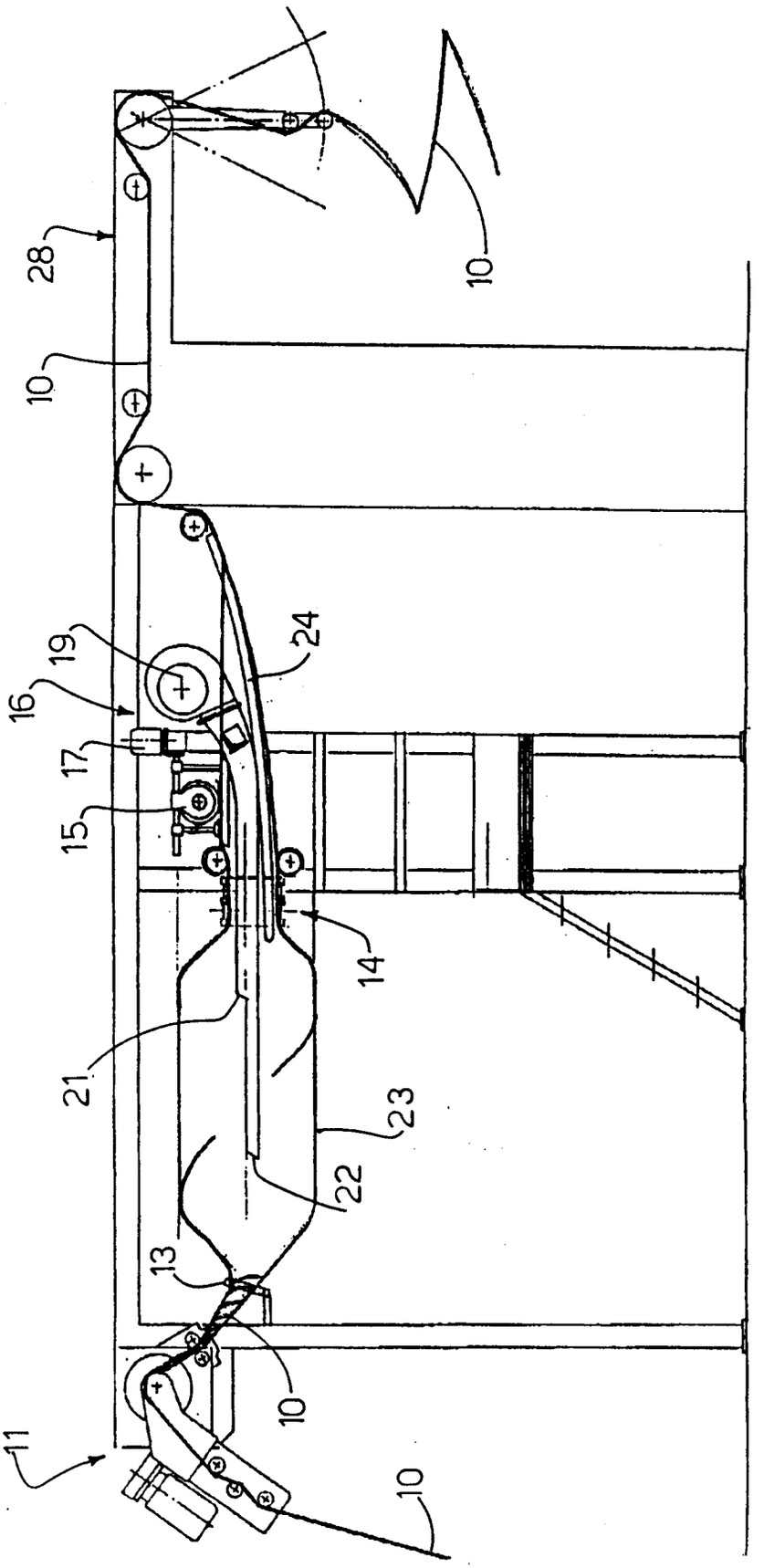


FIG.9

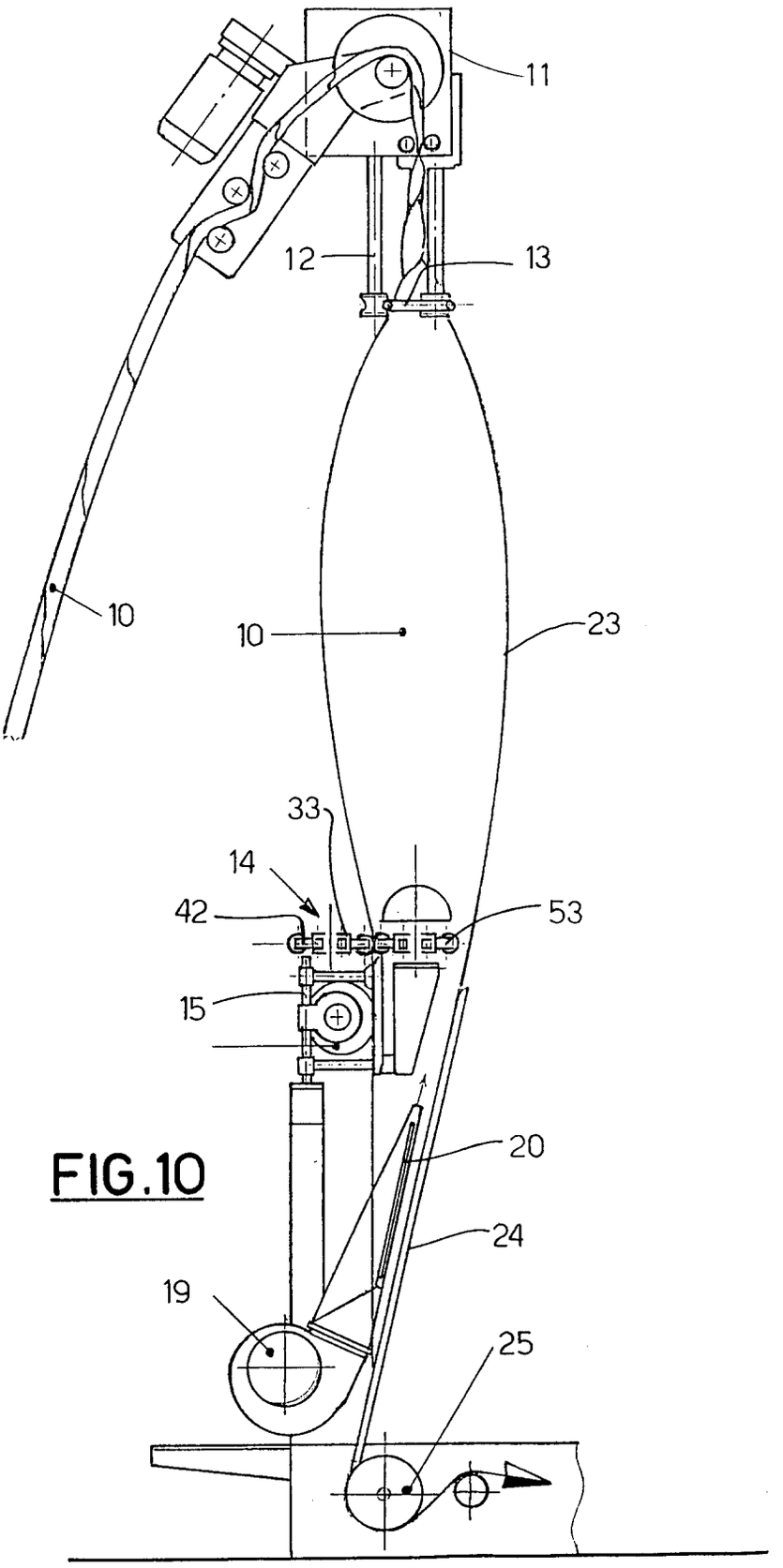


FIG.10

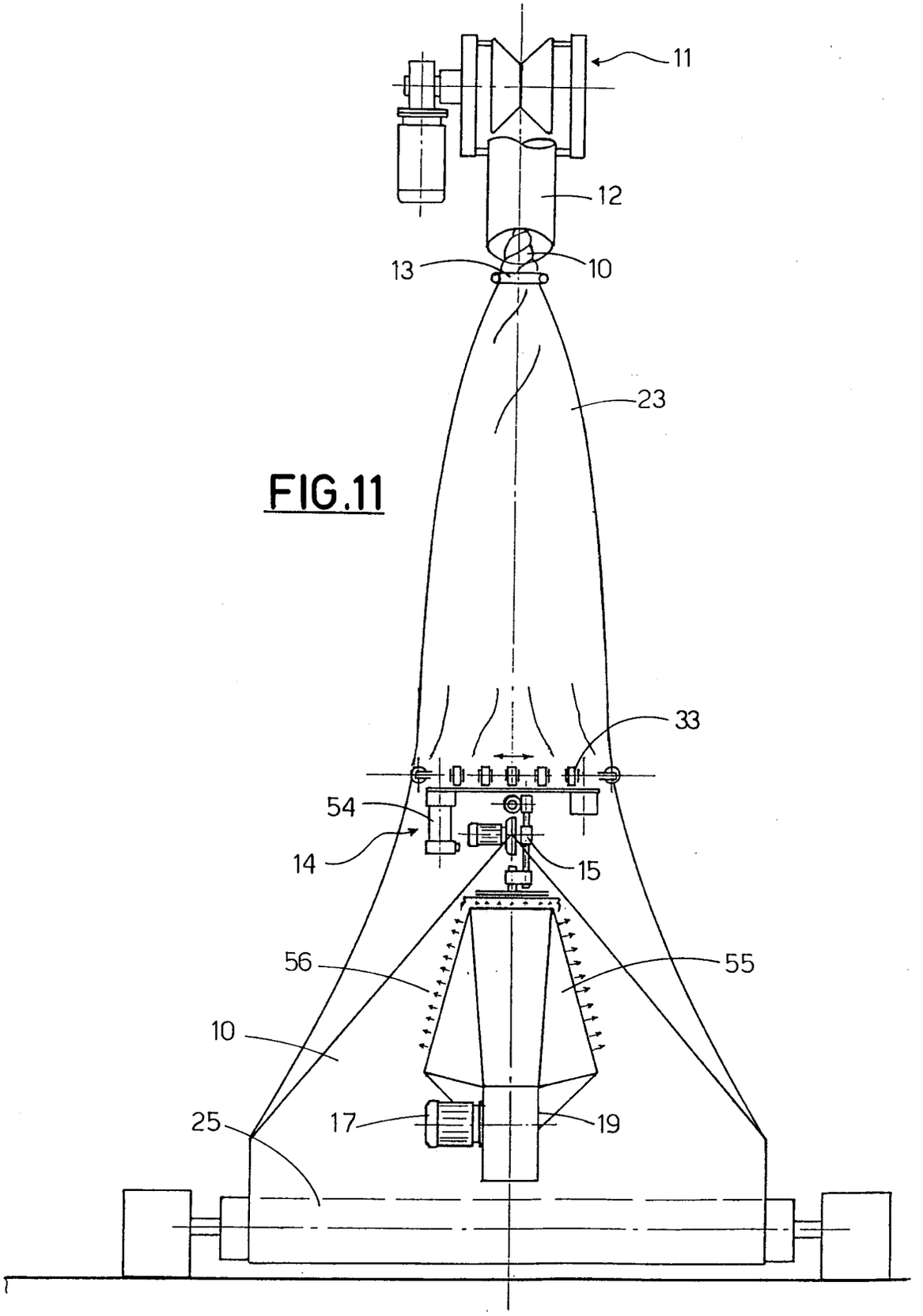


FIG.11

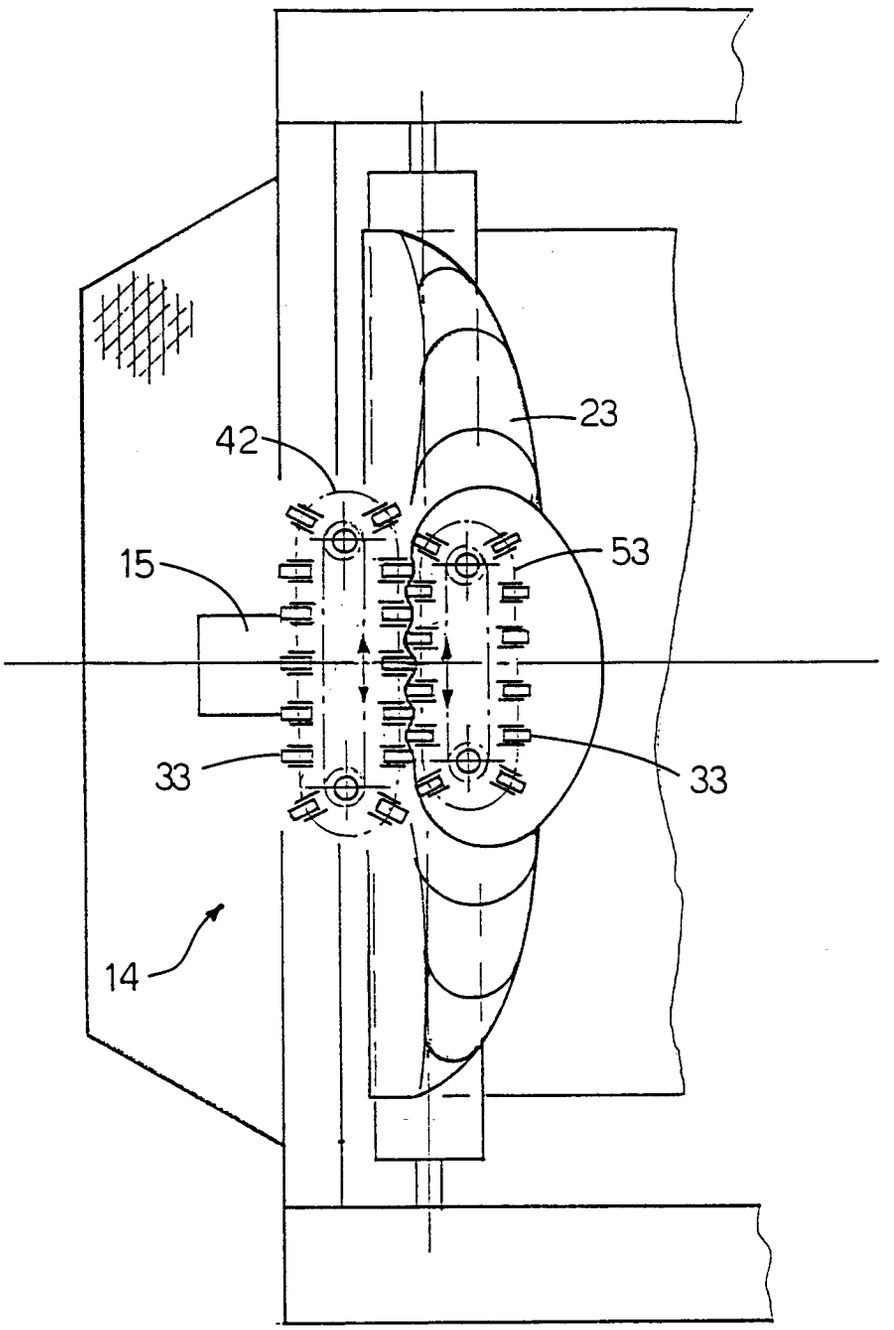


FIG.12

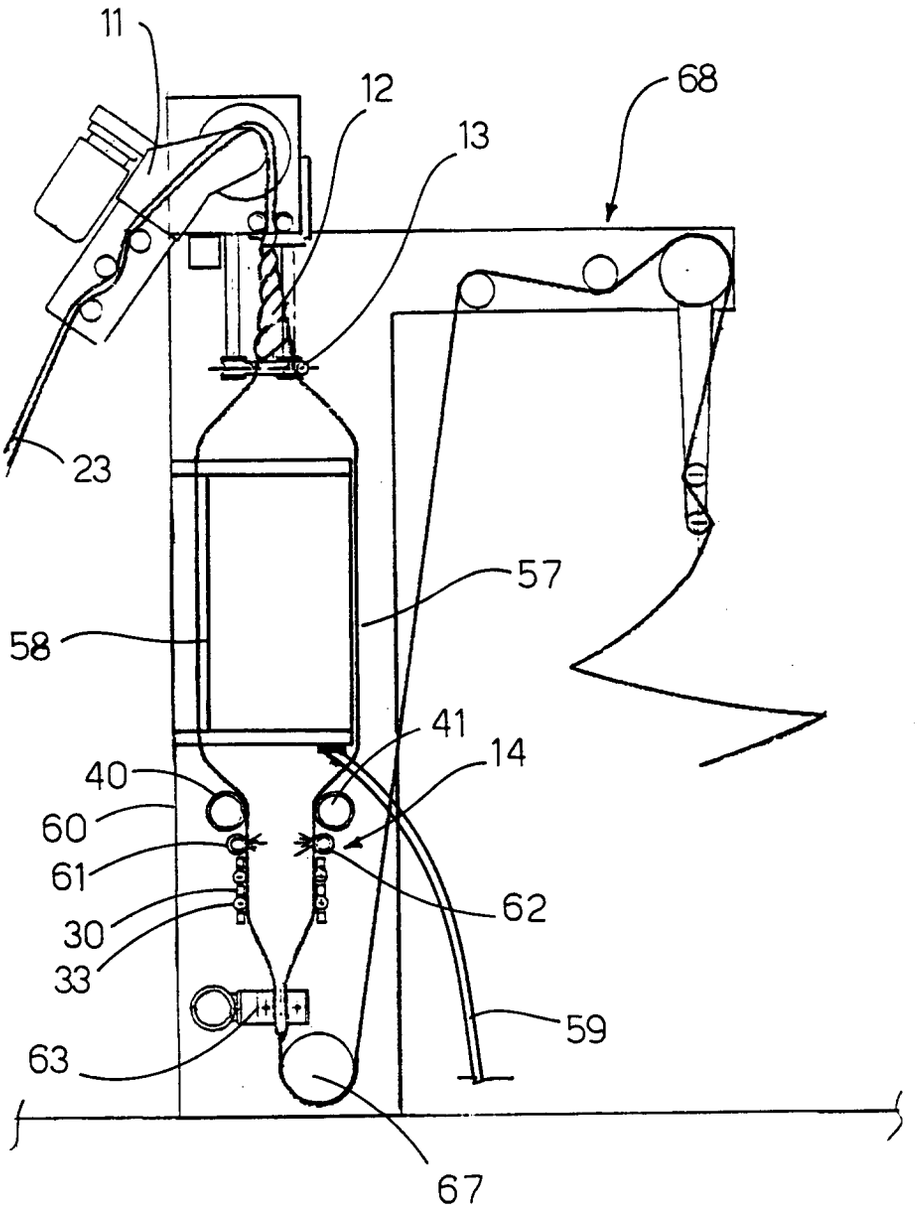


FIG.13

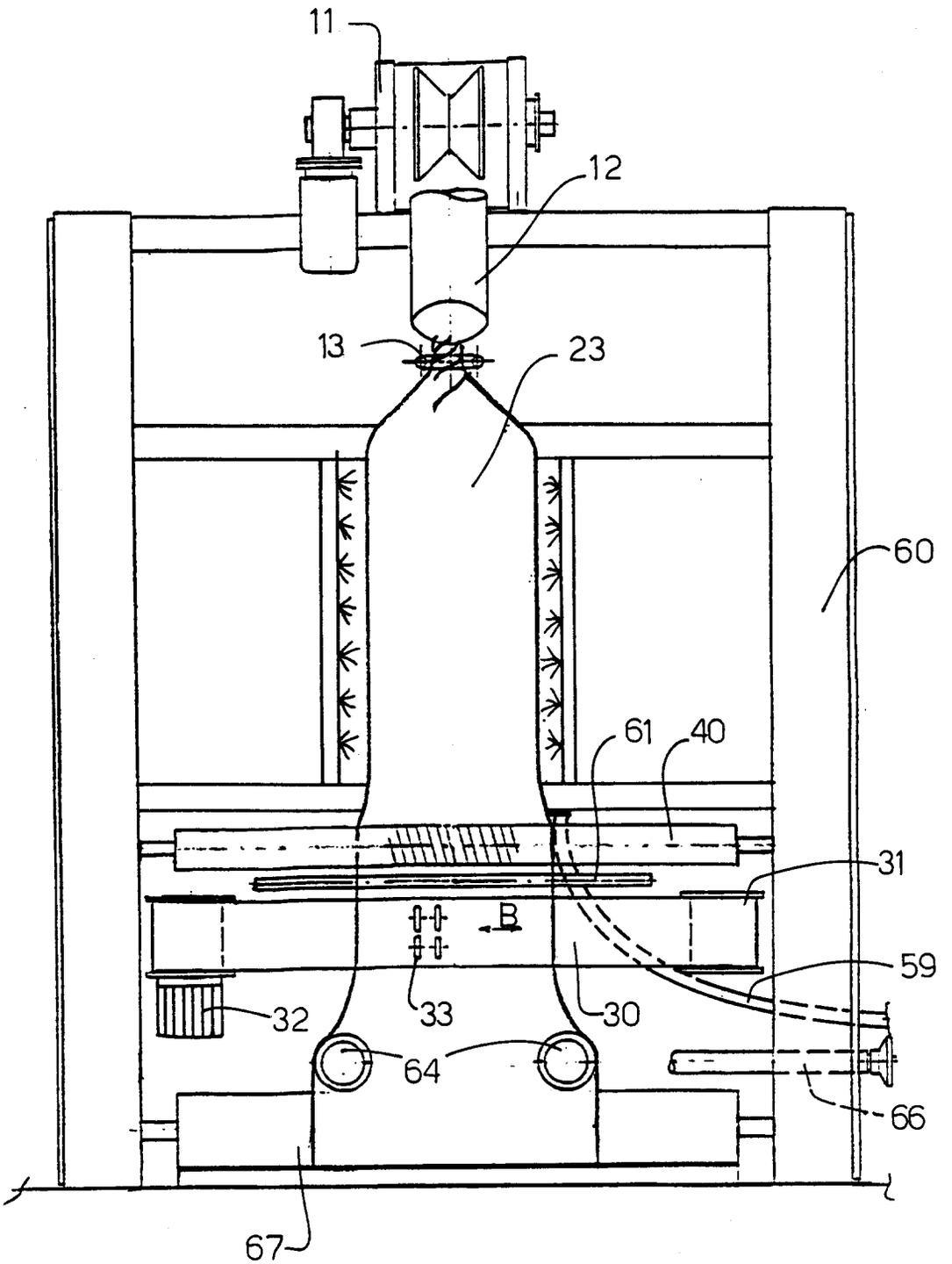


FIG.14

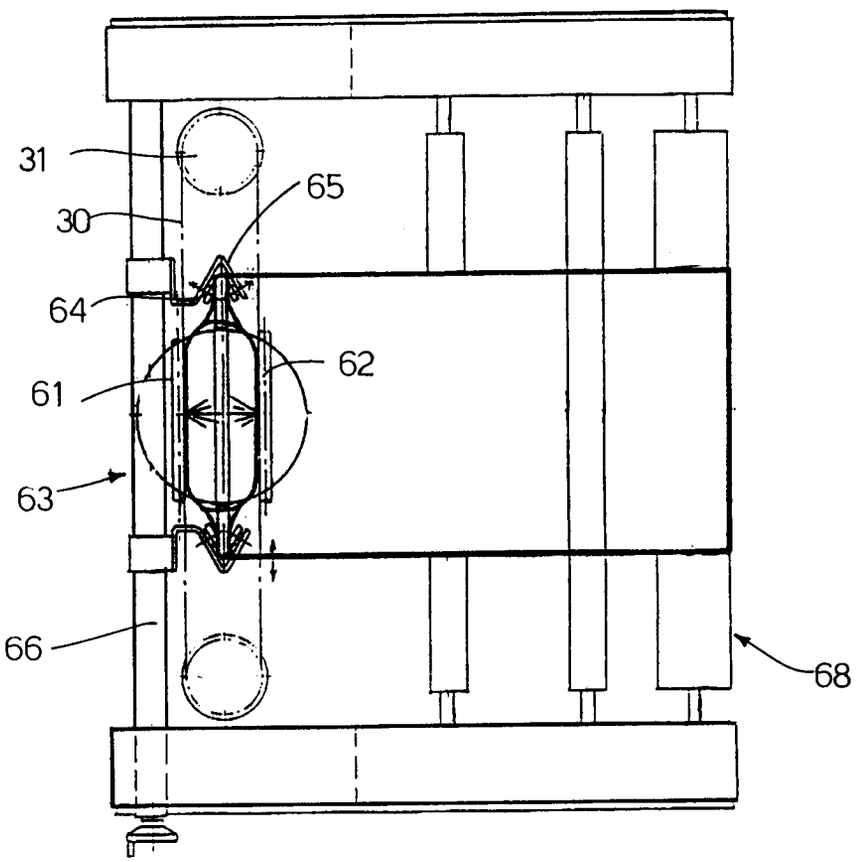


FIG.15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 11 9759

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	GB-A-2 070 660 (OFFICINE BIANCO) * the whole document *	1,6	D06B23/08 D06C5/00 D06H7/08
X	FR-A-2 567 164 (DOMISSE) * claim 1; figure 1 *	1,6	
A	EP-A-0 264 677 (BRÜCKNER) * claims 1,5; figures 1-3 *	4	
A	DE-A-28 44 663 (ETS MAURICE HELIET) * figure 3 *	10	
A	US-A-3 813 862 (ISAMU TSUCHIDA)		
A	FR-A-2 394 632 (BASSANI & BIANCO)		
A	DE-A-22 54 371 (ERHARDT & LEIMER)		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
D06B D06C D06H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 April 1994	Petit, J-P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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