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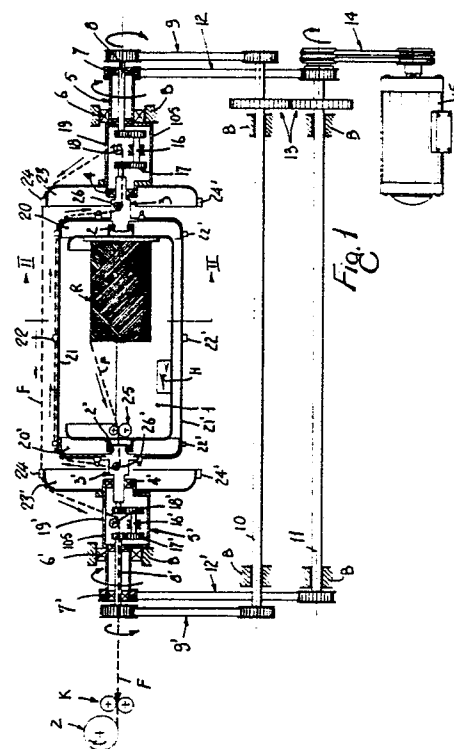
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Four-twist twisting frame.

The twisting frame is provided with two pairs of coaxial flyers (20-20', 23-23'), one of said pairs (23-23') being positioned at the side of the other flyers - (20-20') and externally thereof, and presenting a greater dimension in length, while the flyers of each pair are of equal size. Means are provided for mutually synchronizing the flyers of each pair, while other means are provided for causing the outer flyers (23-23') to rotate in the opposite direction with respect to the inner flyers (20-20'), preferably at the same speed. The hollow shafts (5-5') carrying the outer flyers (23-23'), which are rotatably supported by the base structure (B) of the twisting frame, rotatably support the hollow shafts (3-3') of the inner flyers - (20-20'), and these latter shafts in their turn rotatably support a cradle (1) inside which there are arranged the means (R) for feeding the yarn or sliver (F) to be twisted. The yarn (F) is subjected to a first twist as it reaches one flyer (20'), then it is subjected to a second and third twist as it is passed from one pair of flyers (20-20') to the other pair of flyers (23-23') and finally it is subjected to a fourth twist as it comes out of the last pair of flyers while cooperating with the drawing and collecting means (K, Z).



"Four-twist twisting frame"

The present invention relates to a twisting frame which is substantially adapted to double the output of the presently used two-twist twisting frames, and which in any case makes it possible to have a higher output per hour of such frames, with a lower speed of rotation of the rotating units thereof, thus resulting in a longer life of the several bearings, of the thread guides and in a more delicate handling of the yarn or sliver during the twisting operation.

According to the invention, there is provided a twisting frame in which the thread-like material - (yarn, sliver, filament, either of natural or synthetic material, or bundles of wire of any suitable metal) is subjected to four twisting operations, and comprises in combination:

- a cradle structure idly supported at its ends by a first pair of equal, coaxial and opposite inner flyers, provided with suitable thread guides and kinematically interconnected for rotation in the same direction and at the same speed, said inner flyers being radially supported by hollow shafts axially aligned and provided at their interior with respective idle pulleys and with apertures for permitting the passage of the thread;
- a second pair of equal outer flyers having a greater diameter than the inner flyers, arranged at the exterior and coaxially thereto, provided with suitable thread guides and supported by respective second hollow shafts which in their turn rotatably support the hollow shafts of the inner flyers, said second hollow shafts being supported by the base structure of the twisting frame and being provided at their interior with suitable idle pulleys;
- drive means for rotating in one direction the inner flyers and for rotating in the opposite direction the outer flyers, preferably at the same angular speed;
- supply means for feeding the thread-like material to be twisted, arranged at the interior of the cradle, and collecting means for collecting the thread-like material which has been subjected to the twisting operation, arranged at the end of the hollow shaft which carries the outer flyer opposite to the other outer flyer which has been first engaged by the thread-like material during the twisting operation.

The above and other features of the twisting frame according to the invention, and the advantages deriving therefrom, will appear better evident from the following description of some preferred embodiments of same, shown merely by way of non-limiting example in the Figures of the two annexed sheets of drawings, in which:

Figure 1 is a side view, with parts in section, diagrammatically showing the twisting frame according to the invention.

Figure 2 is a view taken along line II-II of Figure 1, showing further constructional details of the twisting frame.

Figure 3 is a view similar to that of Figure 1, showing a modified embodiment of the twisting frame.

Figure 4 diagrammatically shows a different method of using the twisting frame.

With reference firstly to Figures 1 and 2, it appears that according to one preferred embodiment of the invention, the twisting frame comprises a cradle 1 which, with the interposition of bearings 2-2', is idly supported at its ends by mutually aligned, horizontal hollow shafts 3-3' which are rotatably supported through bearings 4-4' by further hollow shafts 5-5' which are in turn rotatably supported through bearings 6-6' coaxial to the said shafts 3-3' by the base structure B of the twisting frame. Shafts 8-8' are rotatably mounted through bearings 7-7' within the hollow shafts 5-5' and are axially aligned with shafts 3-3', the said shafts 8-8' being so synchronized as to be rotated at the same speed and in the same direction by means of identical positively actuated transmission drives 9-9', for example of the toothed pulley and toothed belt type, which are connected to a shaft 10 rotatably supported by the base structure B. The base structure B rotatably supports another shaft 11 arranged at a short distance from shaft 10, parallelly thereto, which by means of identical positively actuated drives 12-12' synchronizes the shafts 5-5' with each other. The shafts 10 and 11 are connected to each other through the gear unit 13 formed by two gearwheels of the same diameter and the said shaft 11 is connected by means of a motion transmission drive 14 to a motor unit 15 consisting, for example, of a variable-speed electric motor. From the foregoing, it follows that as a result of the actuation of motor 15, the shafts 10 and 11 are rotated at the same speed but in opposite directions, and the same condition is transmitted to the shaft 3-3' and to the outer shafts 5-5'. It is understood that for the purposes of the invention, the angular speeds at which the shafts 3-3' and 5-5' are rotated need not to be equal. The shafts 5-5' have each an enlarged section 105-105' in which the shafts 3-8 and 3'-8' are fitted endwise in front of each other, and are interconnected by means of respective idle shafts 16-16' and of gears 17-17', or through any other suitable means such as for example toothed pulleys and toothed belts, the whole in such a manner that the said shafts 3-8

and 3'-8' will be rotated at the same speed and in the same direction, and that in the space which is obtained between said pairs of shafts there can be positioned respective idle pulleys 18-18'. These pulleys 18-18' and the idle shafts 16-16' are rotatably supported at the interior of the hollow shafts 5-5' which in the zone of said pulleys are each provided with an aperture 19-19' in their sidewalls, the use of which apertures will be described later.

On the shafts 3-3' there are radially mounted equal flyers 20-20' which preferably consist of convex disks with their convexity directed towards the exterior (Figure 2) and which are interconnected at diametrically opposed points by pairs of well tensioned cables 21-21' arranged parallel to the axis of rotation of shafts 3-3'. On the said pairs of cables there are secured loops or eyelets 22-22' of any suitable material, which are used as thread guides.

Externally to the inner flyer 20-20' and at a short distance therefrom, there are arranged equal outer flyers 23-23' which have a greater diameter than the inner flyers 20-20', said outer flyers 23-23' being provided at least at their extremities with thread guides 24-24' and being keyed onto the respective hollow shafts 5-5'.

Mounted within the cradle 1 there is the bobbin or package R with the material to be twisted, in the form of yarn or sliver, the said cradle 1 being provided at its sides with suitable grate-like covers 101 forming with the cradle a closed cage-like structure from which the yarn unwound from the bobbin R cannot protrude and therefore cannot adversely interfere with the yarn guided on the flyers 20-20' for the twisting operation. Reference letter H indicates a counterweight which stabilizes the position of the cradle.

The yarn F unwound from the bobbin R is passed through friction means 25 supported by the cradle 1 and subsequently this yarn is inserted into the hollow shaft 3' and is led about a pulley 26' idly mounted at the interior of shaft 3' and subsequently, through an aperture in the sidewall of said shaft 3', the yarn is passed through the thread guides 22 of the pairs of cables 21, so as to reach the opposite flyer 20. From said flyer 20, the yarn F is inserted into the hollow shaft 3 through the aperture in the sidewall thereof, is led about the pulley 26 idly mounted at the interior of said shaft, and then it enters axially into the hollow shaft 5, where it is led about the pulley 18 and it is caused to come out through the aperture 19 in the sidewall of this latter shaft. From this aperture 19, the yarn is guided between the flyers 23-23' by being passed through the thread guides 24, after which the yarn is caused to enter into the hollow shaft 5' through the aperture 19' obtained in the sidewall thereof, it is led around the pulley 18' and it is

finally caused to axially come out of this latter shaft for its connection with the drawing means K and with the final collecting means Z. The lengths of yarn guided between the flyers 20-20' and 23-23' are parallel to the common axis of rotation of the said flyers.

The operation of the thus just described twisting frame is simple and evident. As already mentioned, as a result of the actuation of electric motor 15, the outer flyers 23-23' are rotated in opposite direction to, and at the same angular speed as the inner flyers 20-20'. It results therefore that the yarn F is subjected to a first twist as it is drawn out of the cradle 1 and is led about the pulley 26' and then to a second and third twist as it is led about the pulleys 26-18, thanks to the reversal of rotation of the flyers, and finally to a fourth and last twist as it is led about the pulley 18' and it caused to cooperate with the drawing means K.

The twisting flyers are equipped with a number of thread guides which is the double with respect to those required for the normal working requirements of the twisting frame, due to evident problems of dynamic balancing, and in order to enable to dispose of thread guides which are ready at hand whenever the thread guides of a path are worn out.

In Figure 3 there is shown a modified embodiment of the twisting frame according to the invention. In consideration of the fact that the inner flyers 20-20' are interconnected by the pairs of cables 21-21', the said flyers are in fact kinematically connected for rotation, so that the positive drive 9' of the embodiment of Figure 1 can be eliminated, together with the shafts 8'-16' as well as the gear 17', while the shaft 10 can be limited to the only section which is required for supporting the gear 13.

Still according to a further modification (not shown) in the transmission of the rotary motion to the flyers, the outer flyers 23-23' can be interconnected by means of steel cables, strips or tie rods, similarly to the inner flyers, so that also the means for driving the said outer twisting flyers can be further simplified.

It is evident that the twisting frame according to the invention may be used in case it is desired that a plurality of yarns or wires be collected into a bundle and twisted: the said yarns will be unwound from respective bobbins or packages arranged on the cradle 1 in any suitable manner, known to any person skilled in the art.

The twisting frame according to the invention may be advantageously used with the yarn F following a path different from the path described in connection with the embodiment of Figures 1 and 3, as diagrammatically shown in Figure 4, in which

the feeding of the yarn is effected from the exterior of shaft 5' and the collection of the twisted yarn is effected inside the cradle 1 which is conveniently equipped for this purpose.

As already mentioned, the terms "yarn" or "sliver" which have been used throughout the present description must not be intended as a limitation of the material processed by the twisting frame: in fact, the twisting frame according to the present invention can be used with any suitable thread-like material, either natural or synthetic, or even with wires of any suitable metal (such as copper, aluminum or steel). Said materials can present any suitable section, and can be processed alone or combined with one another, as it is known in the art.

It is therefore also evident that by adopting the just described apparatus (with modifications which will be evident to any person skilled in the art), it will be possible to construct machines for the manufacture of ropes, cables or cords. However, these and similar variations and applications of the described machine fall within the scope of the present invention.

Claims

1) A four-twist twisting frame, characterized by the fact of comprising:

(a) a cradle or cage-like structure (1) idly supported at its ends (2-2') by a first pair of equal, coaxial and opposite inner twisting flyers (20-20') provided with suitable thread guides (22-22') and kinematically interconnected for rotation in the same direction at the same speed, said inner twisting flyers (20-20') being radially supported by respective first hollow shafts (3-3') which are axially aligned and provided at their interior with respective idle pulleys (26-26'), suitable apertures being provided in the said first hollow shafts (3-3') in the zone of the said idle pulleys (26-26');

(b) a second pair of equal outer twisting flyers (23-23') having a greater rotational diameter than the said inner twisting flyers (20-20'), arranged externally thereof and coaxially thereto, provided with suitable thread guides (24-24') and supported by respective second hollow shafts (5-5') which in their turn rotatably support the said first hollow shafts (3-3') of the inner flyers (20-20'), and are rotatably supported by a base structure (B), said second hollow shafts (5-5') being provided at their interior with idle pulleys (18-18');

(c) drive means (8, 9, 12, 16, 17) for imparting a rotary motion in one direction to the inner twisting flyers (20-20') and for imparting to the outer twisting flyers a rotary motion in the opposite direction;

(d) supply means (R, 25) for feeding the thread-like material (F) to be twisted, and collected means (K, Z) for collecting the thread-like material - (F) which has been subjected to the twisting operation.

2) A twisting frame according to claim 1, characterized by the fact that the supply means (R, 25) of the thread-like material are arranged at the interior of the cradle structure (1), and the collecting means (K, Z) are arranged at the end of the hollow shaft (5') which carries the outer flyer (24') opposite to the other outer flyer (24) which is first engaged by the thread-like material (F) during its twisting operation.

3) A twisting frame according to claim 1, characterized by the fact that the supply means (R, 25) of the thread-like material are arranged at the outer end of one of said second hollow shafts (5-5') carrying an outer flyer (23-23'), while the collecting means (K, Z) are arranged at the interior of the cradle structure (1).

4) A twisting frame according to claim 1, characterized by the fact that at least the inner flyers - (20-20') consist of convex disks interconnected by pairs of well tensioned cables or similar connecting means (21-21'), provided with suitable thread guides (22-22').

5) A twisting frame according to claim 1, characterized by the fact that the drive means for imparting a rotary motion to the inner flyers (20-20') comprise inner shafts (8-8') coaxially mounted at the interior of the said second hollow shafts (5-5') of the outer flyers (23-23'), and which terminate at a short distance from the said first hollow shafts (3, 3') of the inner flyers, to which shafts they are kinematically connected by means of respective idle shafts (16-16') and gears (17-17'), so as to form loop-like spaces in the drive gearings, inside which spaces there can be positioned the idle pulleys (18-18') around which the thread-like material (F) is led while passing from the inner to the outer flyers and while going out or into the twisting frame.

6) A twisting frame according to claim 1, characterized by the fact that drive means are provided to impart a rotary motion only to one of the two inner flyers (20), the opposite inner flyer - (20') being kinematically connected to the said first named inner flyer by means of suitable cables, strips or tie rods (21-21').

7) A twisting frame according to claim 1, characterized by the fact that drive means are provided to impart a rotary motion only to one of the two outer flyers (23-23'), the opposite outer flyer being kinematically connected to the said first named outer flyer by means of suitable cables, strips or tie rods.

8) A twisting frame according to claim 1, characterized by the fact that each pair of twisting flyers (20-20', 23-23') is equipped with a number of thread guides (22-22', 24-24') which is at least the double with respect to those required for the normal operation of the twisting frame, in order to provide for dynamic balancing of the said flyers and to dispose of reserve thread guides.

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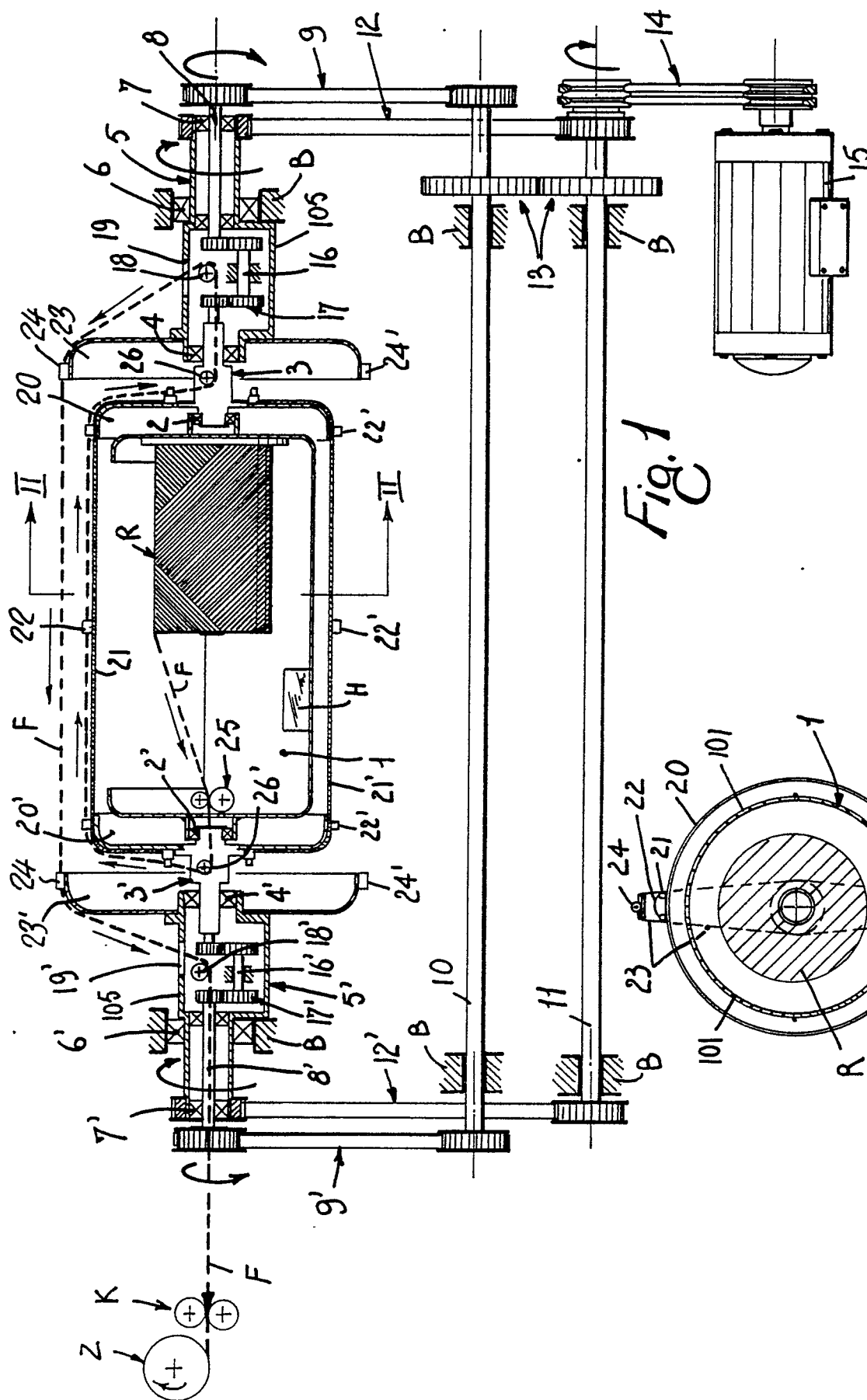
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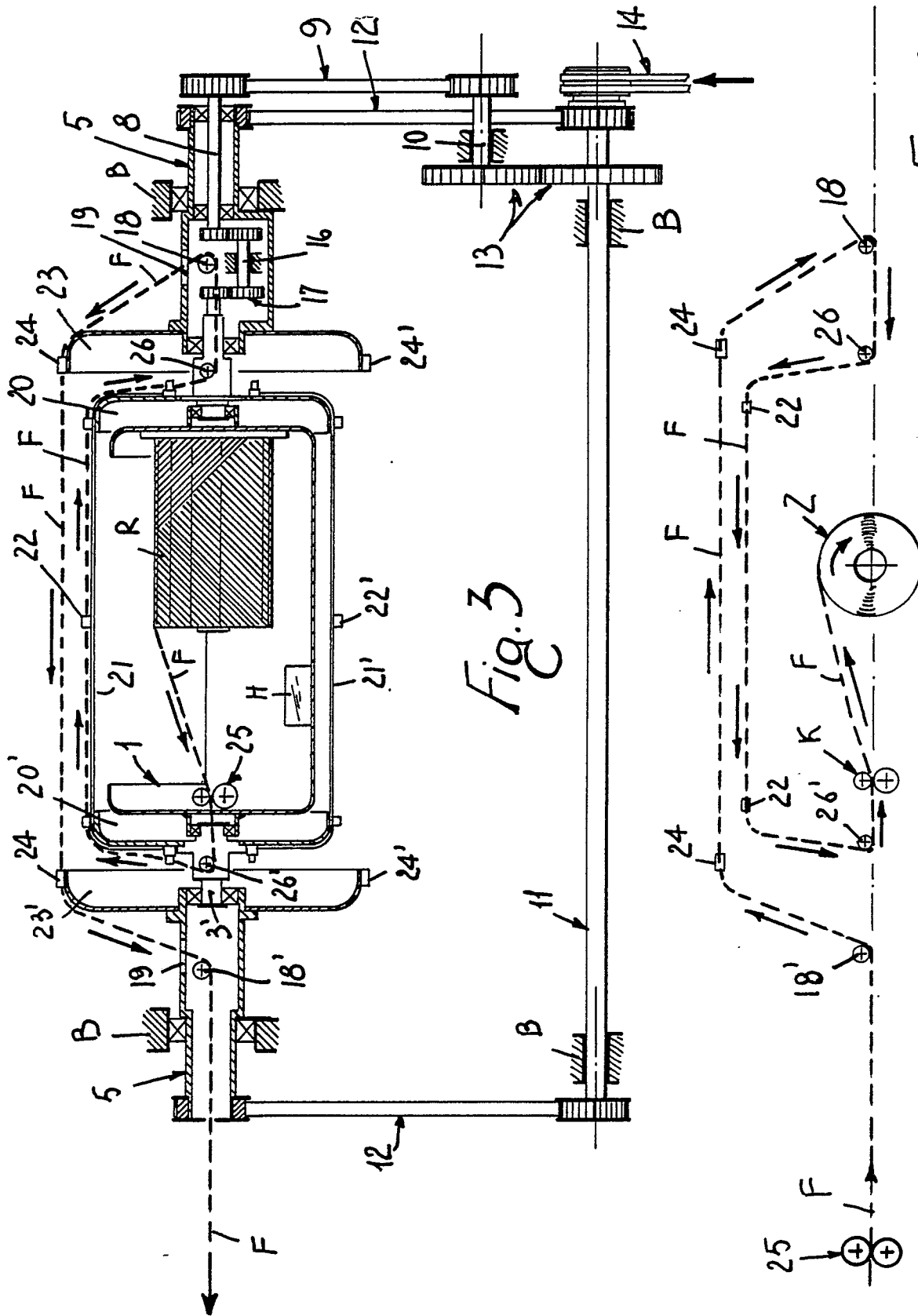


Fig. 3

Fig. 4