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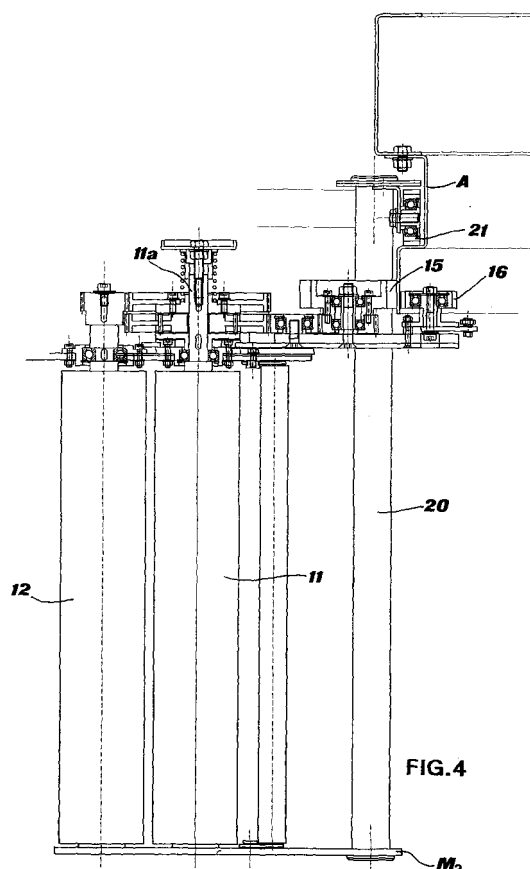
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(54) **Assisted-delivery, pre-stretching unit for a pallet-wrapping apparatus**

(57) A pre-stretching unit is disclosed for a pallet-wrapping apparatus, of the type comprising a series of driven rollers (11, 12) apt to stretch a film (P) of a stretchable material before the application thereof to a load (C) to be packaged, at least one of said driven rollers (11, 12) being connected to a power input, and wherein between said power input and said at least one driven roller a dosable energy transfer mechanism is provided, apt to transfer a constant energy which is equal or slightly below that necessary to drive into rotation the pre-stretching unit in the absence of tension on the stretch film (P).



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Description

[0001] The present invention refers to an improved pre-stretching unit for a pallet-wrapping apparatus, in particular a pre-stretching unit which may be applied both in fixed-load and spinning-load pallet-wrapping apparatuses.

[0002] As known, on pallet-wrapping apparatuses where a stretch film is used, a so-called pre-stretching unit is provided which has the function of stretching the film, exploiting its stretchability (up to 300%), immediately before applying it to the load to be packaged.

[0003] Regardless of the way of dispensing the film - for example with a stationary load and rotary bobbin, or with a spinning load and a stationary bobbin - the management of film delivery may be a problem. As a matter of fact, since the load to be packaged normally has an irregular plan shape, the amount of film to be dispensed varies during each wrapping turn, decreasing when the point of application on the load moves closer to the bobbin and viceversa when the point of application moves further away.

[0004] If the film was free to unwind off the bobbin, the problem would be marginal. But since the pre-stretching assembly introduces high frictions in the unwinding path, if dispensing was left solely to the traction action produced by the load, the film would be excessively stretched reaching yield or breakage point.

[0005] The approach used so far to overcome this drawback is that of equipping the pre-stretching assembly with a motor drive which is capable of providing sufficient power for the pre-stretching assembly (hence including the losses due to friction, as well as the film-stretching labour) to dispense the required amount of film at any given moment. The known-type mechanisms which adopt this general design also resort to a control system of the dispensing speed, so as to adjust to increases or decreases of film demand and to prevent the film from remaining excessively loose or a maximum tension threshold from being overcome, which would result in film breakage.

[0006] These control systems - among the best-known, for example, there is the so-called "dance roller" - however, introduce further problems, linked to the reaction time, sensitivity and strength of the corresponding components. Moreover, they introduce additional costs and structural complexity, especially in case they require electric power to be transferred to a spinning platform.

[0007] The present Applicant has set himself the object of overcoming these drawbacks by providing a dispensing and pre-stretching unit of a stretch wrap film which is much simpler, inexpensive and free from critical controls. Such result has been achieved by upsetting the traditional approach and refraining from achieving continuous control throughout the time a single wrapping turn is laid.

[0008] Accordingly, the set object is achieved by means of a device as described in its essential features in the first attached claim.

[0009] Other inventive aspects of the device are described in the dependent claims.

[0010] Further features and advantages of the device according to the invention will in any case be more evident from the following detailed description of a preferred embodiment of the same, given by way of example and shown in the accompanying drawings, wherein:

[0011] fig. 1 is an elevation side view of a pallet-wrapping ring apparatus;

[0012] fig. 2 is a top plan view of the apparatus of fig. 1;

[0013] fig. 3 is an enlarged top plan view of the film-dispensing unit according to the invention;

[0014] fig. 4 is an elevation side view of the unit of fig. 3; fig. 5 is an enlarged view of the drive portion of the unit of fig. 4;

[0015] fig. 6 is a plan view similar to that of fig. 3 with reference to another embodiment of the invention; and

[0016] fig. 7 is a cross-section view taken along the broken line VII-VII of fig. 6.

[0017] Fig. 1 shows a ring-type pallet-wrapping apparatus. This apparatus comprises, in a manner known per se, of a frame 1, placed across a conveyor 2 whereon a load C to be wrapped advances, which frame supports a vertically-slidable annular structure A.

[0018] On annular structure A, a shelf M (fig. 2) is mounted circumferentially slidable, which carries a bobbin B of a plastic stretch film P and a pre-stretching unit.

[0019] In the following disclosure, reference will always be made to this type of apparatus, even though the inventive concepts which are set forth below are similarly applicable to other types of pallet-wrapping machines, as will be suitably highlighted.

[0020] Fig. 3 shows in detail the path of stretch film P from bobbin B to the point of delivery towards the load to be wrapped.

[0021] Film P unwinds from bobbin B, runs on a first pair of transmission rollers 10a and 10b and adheres to a first roller 11 of the pre-stretching unit. From first roller 11, the film runs on a second, pre-stretching roller 12, where to it is made to adhere for as long a portion as possible, thanks to a second pair of transmission rollers 13a and 13b. The film finally comes out from roller 13b and runs to the load to be wrapped.

[0022] The first and second rollers 11 and 12 of the pre-stretching unit are mutually paired by means of a gear or transmission means, marked by lines 11a and 12a, which establishes such a ratio between the rotation speeds of the two rollers that the second downstream roller 12 rotates at a higher speed, so as to perform the desired pre-stretching of film P.

[0023] Generally, one of the two rollers 11 or 12 of the pre-stretching unit is driven into rotation by means of a drive input, for example by means of an electric motor or - as shown by way of example in fig. 3 - by means of a pair of wheels 14 and 15 which collect the motion from an annular track integral with annular structure A and transfer it to first roller 11.

[0024] According to the invention, instead of having a

system for the adjustment over time of the drive input power, it is provided that such drive power can be dosed and partly delivered to one of the rollers of the pre-stretching unit.

[0025] In other words, by means of a - partly adjustable - dosing mechanism, a minimum amount of power is delivered to the pre-stretching unit, which power is equal to, but preferably slightly less, than the labour required to overcome the overall frictions and the pre-stretching labour, in other words to set in motion the pre-stretching unit.

[0026] Thereby, if normally, in order to drive into rotation a pre-stretching unit, 10 kg-worth of traction on the film would be required, the dosing mechanism of the invention is capable of supplying the pre-stretching unit with 9,5 kg of auxiliary force, so that with only 0,5 kg-worth of traction on the film, the pre-stretching unit could be set in motion and film delivery on the load to be wrapped could be achieved.

[0027] Therefore, a slight traction action of the load on the film can simply be exploited in order to ensure film dispensing, without the risk of a tension overload causing the film to exceed the yield or breakage point. Of course, it is important that a certain amount of tension is always present on the film, so that dispensing only occurs when it is required, i.e. when the relative rotation of the load and of the bobbin results in film demand. On the other hand, it is possible to do without any control system of the film delivery speed during wrapping, thereby achieving a dramatic simplification.

[0028] The power required to drive into rotation the pre-stretching unit may vary by a certain degree according to the film dispensing speed, but the effect of such variation can be neglected. Conversely, greater variations are detected when a different film and a different transmission ratio, or different lubrication and wear conditions are encountered, and so on. Since these variations have a significant influence, according to the invention it is provided that the dosing mechanism be also manually adjustable, so that the operator can set the ideal conditions for each specific situation. Thereby the operator can decide the minimum amount of tension on the film which is in any case desired during operation.

[0029] The individual elements making up this mechanism, according to a first embodiment, are shown in the following with reference to figs. 4 and 5.

[0030] Shelf M, consisting of two opposite plates M1 and M2 between which the various rollers are arranged, is suspended from annular structure A, whereon it is intended to slide along a circular path, by means of an idle wheel 21. For the movement of shelf M along ring A, motor drive means which are known per se are provided, which will not be described in detail since they are beyond the teachings intended to be provided here.

[0031] As already mentioned with reference to fig. 3, wheel 15, mounted idle on a vertical axis 15a, is kept engaged with the track of ring A with the help of a counterwheel 16 which rests on the rolling track on the oppo-

site side of wheel 15. Thereby, during the motion of shelf M along annular structure A, wheel 15 is driven into rotation and is capable of transferring traction power to the pre-stretching unit. In such case, wheels 15 and 16, representing the drive input of the system, are mounted on a plate M₃ which may pivot on an axis 16a in order to achieve a certain adjustment in respect of ring A.

[0032] Moreover, wheel 15 is engaged with wheel 14, itself mounted idle on a vertical axis, which wheel is in turn engaged with a driving wheel 16 mounted idle on the same rotation axis 16a of the first roller 11 of the pre-stretching unit. In particular, the first roller 11 of the pre-stretching unit is rotatably mounted on shelf M by means of a shaft 11a integral therewith, which runs through driving wheel 16 and extends upwards by a certain length.

[0033] On shaft 11a a transmission wheel 17 is further keyed on, free to slide vertically by a certain degree, which wheel is engaged with a driven wheel 18 integral in rotation with a shaft 12a of the second roller 12 of the pre-stretching unit.

[0034] According to this first embodiment shown, the two opposite surfaces of driving wheel 16 and of transmission wheel 17 have a disc or ring D made of a material apt to operate by friction. Such intermediate disc D, which may be integral with one of the wheels or divided into two portions integral with the two wheels, is capable of transferring by friction the power coming from driving wheel 16 to transmission wheel 17.

[0035] The friction material can be for example a technopolymer with special mechanical/physical properties, such as deformability above 200-250°C, an average friction coefficient of 0.2-0.3 and a high P*V (pressure*speed) ratio, for example 1.32 MPa*m/sec.

[0036] The peculiarity of the friction material of which disc D is made - i.e. a material apt to operate continuously with relative chafing - allows to dose the power transferred from wheel 16 to wheel 17 according to the pressure existing between the two. In other words, the transferred power is proportional to

[0037] $P_r * \mu$

[0038] where P_r is the pressure existing between the coupled wheels and μ is the friction coefficient developed by the friction material.

[0039] For such purpose, according to the invention, a helicoidal spring 19 is provided above transmission wheel 17, which spring is co-axial to shaft 11a and restrained above by a vertically-adjustable flange 30. In the embodiment shown, flange 30 is part of a manually-operable knob 31, which has a threaded stem 31a apt to be screwed on or off the end of the shaft 11a within a threaded hole: the rotation of knob 31 causes the lowering or lifting of flange 30 and hence a compression or extension, respectively, of spring 19, which in turn determines an increase or decrease of the pressure of wheel 17 on wheel 16.

[0040] As can be understood from the construction illustrated above, according to the invention, the power available to wheel 15 is transferred to driving wheel 16

and hence it is partly supplied, dosing it by means of friction disc D, to transmission wheel 17 and thus to the pre-stretching unit.

[0041] Thanks to the presence of element D which operates by friction, it is possible to supply the pre-stretching unit with a desired amount of power, in particular just enough power to overcome inner frictions and drive the pre-stretching unit into motion with minimum tension on film P, for example with a traction between 0,5 and 3 kg.

[0042] In particular, an operator can adjust the dosing of power transferred from driving wheel 16 to transmission wheel 17 of the pre-stretching unit by acting on knob 31 until the correct adjustment is found which transfers the maximum energy possible, but not above the threshold which would drive the pre-stretching unit into motion even with lack of tension on film P.

[0043] In figs. 6 and 7, a second preferred embodiment of the invention is shown, wherein like components of the first embodiment are indicated by like numbers.

[0044] A shelf M is mounted circumferentially mobile (in the direction shown by arrow F) on annular structure A and supports, in a manner known per se, a bobbin B of stretchable plastic film P and at least a pair of cylinders 11, 12 of a pre-stretching unit. According to this embodiment, the power input of the system comes from a belt N, stationary with respect to annular structure A, which adheres to a number of driving rollers. As is clearly shown in the two drawings, belt N encircles ring A, passing over a driving wheel 16, over an auxiliary wheel 101 and over a transmission wheel 102; due to the friction occurring with annular track A', belt N remains stationary with respect to the apparatus and, during the motion of shelf M, causes the above-mentioned wheels to rotate.

[0045] In particular, a wheel which is caused to rotate by belt N is driving wheel 16 which is sandwiched between two flanges 103' and 103", which flanges can be drawn mutually closer by means of a dosing or adjustable knob 31 and which are integral in rotation with a transmission wheel 104 which is apt to transfer the motion to the pre-stretching unit in a manner known per se. Driving wheel 16 and the two flanges 103' and 103" are rotationally free from each other, but may be coupled in rotation by means of two discs D1 and D2 made of a friction slipping material, which discs are apt to transfer to transmission wheel 104 part of the rotation energy coming from belt N: the amount of transferred energy can be dosed, as already described for the preceding embodiment, by acting on the mutual coupling pressure existing between flanges 103', 103" and wheel 16, and which is manually adjustable by means of knob 31. Further details on the assembling of the pre-stretching unit and on the relative transmission path will not be given here, since said elements can be of a conventional type which is well known to a person skilled in the field.

[0046] Downstream of rollers 11 and 12 of the pre-stretching unit, according to this embodiment, an auxiliary delivery assembly is provided, represented by a pair of cooperating rollers, a drive roller 104 and an engaging

roller 105, respectively, and by an oscillating arm 106.

[0047] Drive roller 104 is mounted idle on shelf M and is made to rotate by wheel 101, keyed on a shaft 104' of roller 104, which receives the motion from belt N: hence, during the motion of shelf M, drive roller 104 is constantly in rotation.

[0048] Engagement roller 105 is instead mounted idle on an oscillating arm 106, hinged on axis 106' and free to oscillate between a home position marked by a dotted line in fig. 6 and a work position marked by a solid line in fig. 6. The axis of rotation of engaging roller 105, as can be appreciated in fig. 7, is offset or eccentric with respect to the rocking axis of arm 106, so that engaging roller 105 remains at a distance from drive roller 104 when the arm is in home position 106', while it comes into contact with drive roller 104 when arm 106 is brought into its work position.

[0049] The arm is mounted oscillating in opposition to a spring device 107 which tends to bring it back into its home position: in order to achieve the desired operation - which will be illustrated in the following - the elastic modulus of the spring return device 107 must be rather small because it is required that oscillating arm 106 be able to arrive at its work position with minimum effort.

[0050] Two further transmission rollers 108 and 109, idle in rotation, are further mounted on arm 106, while another transmission roller 110, idle in rotation, is mounted integral with shelf M.

[0051] As is clearly visible in fig. 6, stretchable plastic film P, by coming out from the last roller 12 of the pre-stretching unit, passes on drive roller 104, then around transmission roller 109, 109', then on idle fixed roller 110, then again on idle transmission roller 108, 108', and finally continues towards the load to be wrapped C.

[0052] When oscillating arm 106 is in its home position 106', film P passes virtually tangentially to roller 104, thereby generating substantially no effect on the film even though said roller is in rotation.

[0053] When a certain tension is imparted to film P, sufficient to overcome the elastic resistance of device 107, the oscillating arm is forced into its work position 106, and thanks to the displacement of transmission roller 109, film P is made to adhere to drive roller 104 by a certain arc of a circle; moreover, engaging roller 105 is brought against drive roller 104 with a certain pressure, which determines a forced sliding of film P on roller 104: a substantial dragging effect of film P is thereby caused.

[0054] In other words, this forced sliding effect of the film on drive roller 104, triggered by the rotation of oscillating arm 106 due to the effect of a minimum tension in film P, contributes further energy, in modest quantities, into the film-dispensing action downstream of the pre-stretching unit. The energy contributed is minimal, since it is transferred to the film substantially by friction sliding, without the risk of it causing yielding of the film already stretched downstream of the pre-stretching unit. However, this contribution can be very useful in those cases in which load C tolerates a very low tension on the film (for

example if the load consists of a plurality of small, light boxes stacked on one another). As a matter of fact, in these cases knob 31 is adjusted to transfer to the pre-stretching unit almost all the energy required for its functioning, precisely in order not to overtension film P downstream; in these extreme conditions, however, there is the risk that the friction conditions of discs D1 and D2 vary locally and cause continuous film dispensing even in the total absence of tension on the film. Instead, the fact of having an auxiliary dispensing assembly downstream of the pre-stretching unit, which introduces a certain supplementary dispensing energy which is independent from the condition of discs D1 and D2 made of friction material, can allow to slightly reduce the dispensing energy set by means of knob 31, so as to move away from a critical condition and thereby eliminate the risk of continuous delivery even in the absence of tension on film P.

[0055] Although preferred embodiments have been described in detail, wherein the power input comes from the coupling of a wheel with annular structure A, the main teaching of the invention is not superseded if the power input consists of the shaft of an electric motor connected, directly or indirectly, with driving wheel 16 and with the drive wheel 104 of the auxiliary delivery unit.

[0056] On the other hand, it is intended that the invention is not limited to the embodiments shown above, which represent only nonlimiting examples of the scope of the invention, but that a number of variants is possible, all within the reach of a person skilled in the field, without departing from the scope of the invention.

Claims

1. Pre-stretching unit for a pallet-wrapping apparatus, of the type comprising a series of driven rollers (11, 12) apt to stretch a film (P) of stretchable material before of the application thereof to a load (C) to be wrapped, at least one of said driven rollers (11, 12) receiving the motion from a power input (15, A, A', N), **characterised in that** between said power input and said at least one driven roller, power transfer means are provided, apt to transfer an amount of energy not above that necessary to drive into rotation the pre-stretching unit in the absence of tension on stretchable film (P).
2. Pre-stretching unit as claimed in claim 1), wherein said transferred energy is substantially constant at least during the time wherein a turn of plastic film is laid on the load (C).
3. Pre-stretching unit as claimed in claim 1) or 2), wherein said energy transfer means are dosable.
4. Pre-stretching unit as claimed in any one of the preceding claims, wherein said energy transfer means comprise an element of friction material (D) laid between a first driving element (16), connected to the transmission path coming from said power input (15 N), and a second transmission element (17, 103', 103'') connected to said at least one driven roller (11), the energy transmitted by said element of friction material (D) being proportional to a pressure applied between said first driving element (16) and said second transmission element (17, 103', 103'').
5. Pre-stretching unit as claimed in claim 4), wherein said first driving element (16) and second transmission element (17, 103', 103'') are mounted so that a relative approaching is possible and wherein said pressure is established by pressure members.
6. Pre-stretching unit as claimed in claim 5), wherein said pressure members are formed as an adjustable elastic element (19).
7. Pre-stretching unit as claimed in claim 6), wherein said adjustable elastic element (19) is a spring which can be compressed or extended by means of a manually-adjustable knob (31).
8. Pre-stretching unit as claimed in any one of claims 4) to 7), wherein said first driving element (16) and said second transmission element (17, 103', 103'') are wheels with a co-axial rotation axis and said element made of friction material (D) is circumferentially arranged between the two opposite surfaces of said wheels.
9. Pre-stretching unit as claimed in any one of the preceding claims, wherein said at least one driven roller is one of two different-speed rollers (11, 12) apt to perform the stretching of said plastic film (P).
10. Pre-stretching unit as claimed in any one of the preceding claims, wherein an auxiliary delivery assembly is further provided, arranged downstream of the film pre-stretching rollers (11, 12), comprising at least one drive roller (104) whereon said film (P) is apt to slide so as to impart to said film a slight traction by friction sliding.
11. Pre-stretching unit as claimed in claim 10), wherein said auxiliary assembly further comprises an oscillating arm (106, 106') equipped with an idle engaging roller (105) apt to be distanced or brought into contact with film P adhering to drive roller (104), in a home position (106') and a work position (106) of the oscillating arm, respectively, said oscillating arm being maintained in its home position by an elastic return device (107) and in its work position by the tension in said film P.
12. Pre-stretching unit as claimed in claim 10) or 11),

wherein said drive roller (104) receives itself a rotation control from said power input (15, A, A', N).

13. Pre-stretching unit as claimed in any one of the preceding claims, wherein said power input consists of a rotary wheel (15) engaged with an annular track of a guide structure (A) whereon the pre-stretching unit is apt to circumferentially translate. 5
14. Pre-stretching unit as claimed in any one of claims 4) to 12), wherein said power input is in the form of a belt (N) which statically encloses an annular guide structure (A, A') whereon the pre-stretching unit is apt to translate circumferentially, said belt also engaging at least with said driving element (16). 10 15

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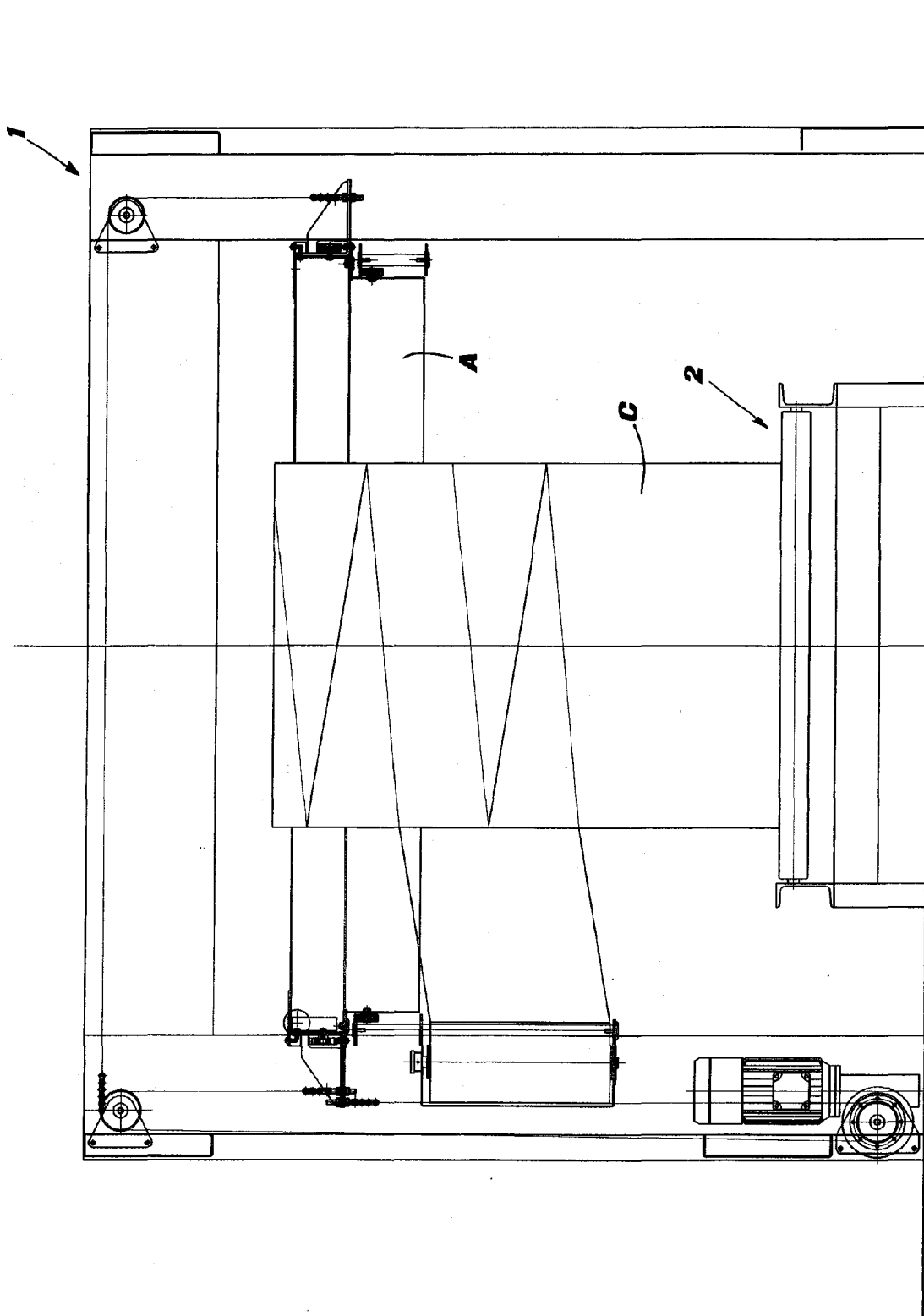


FIG.1

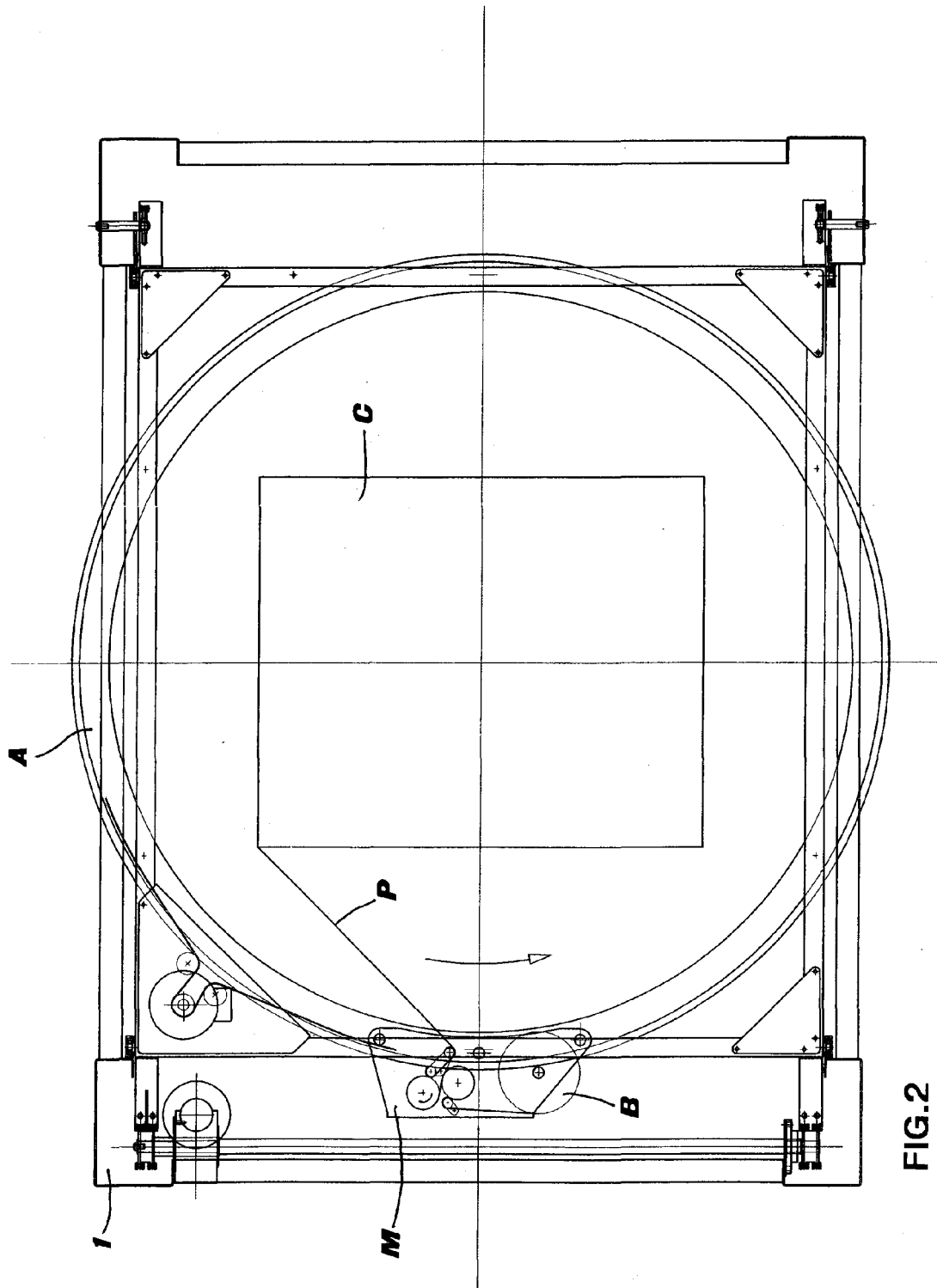


FIG. 2

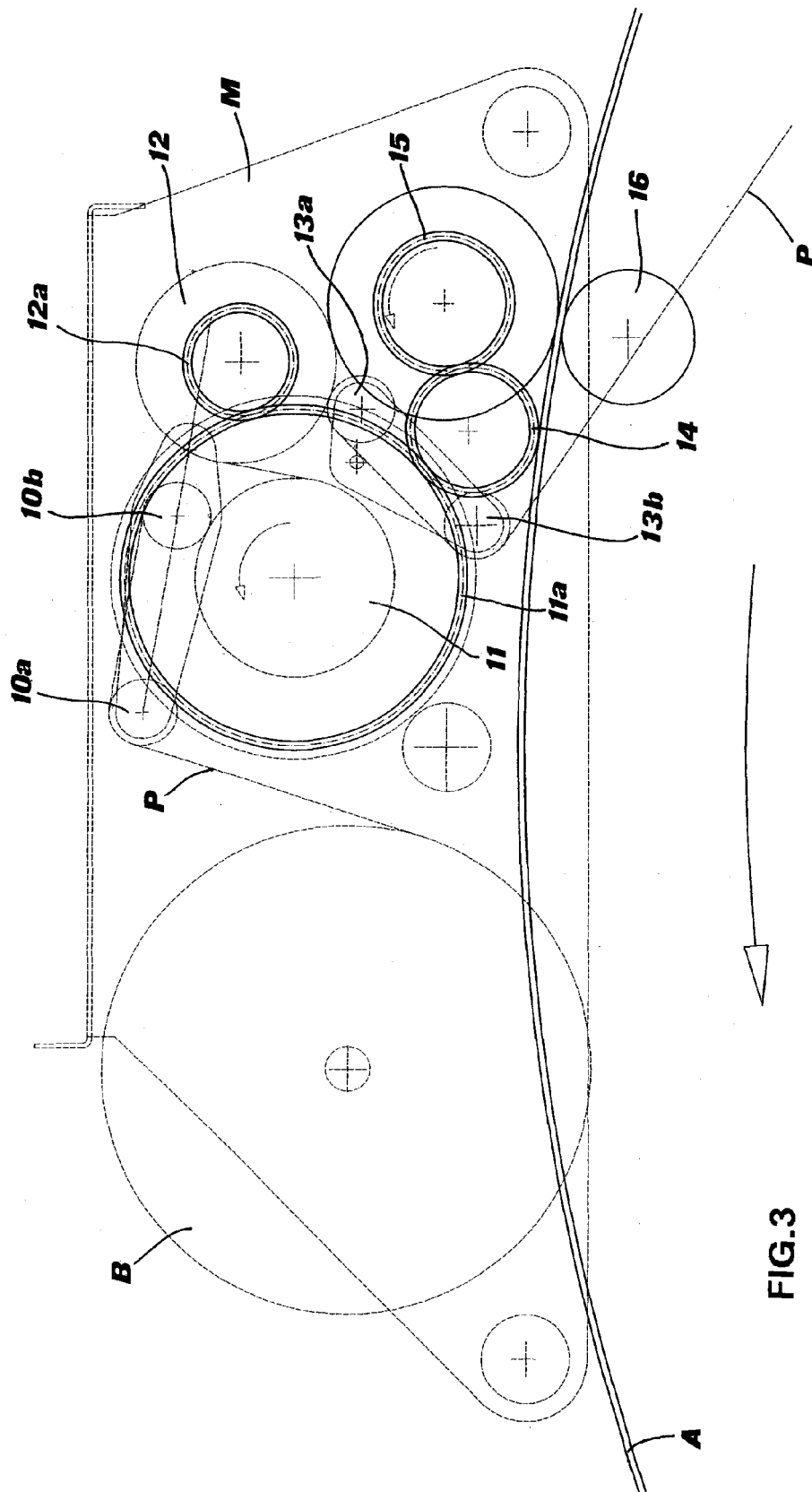
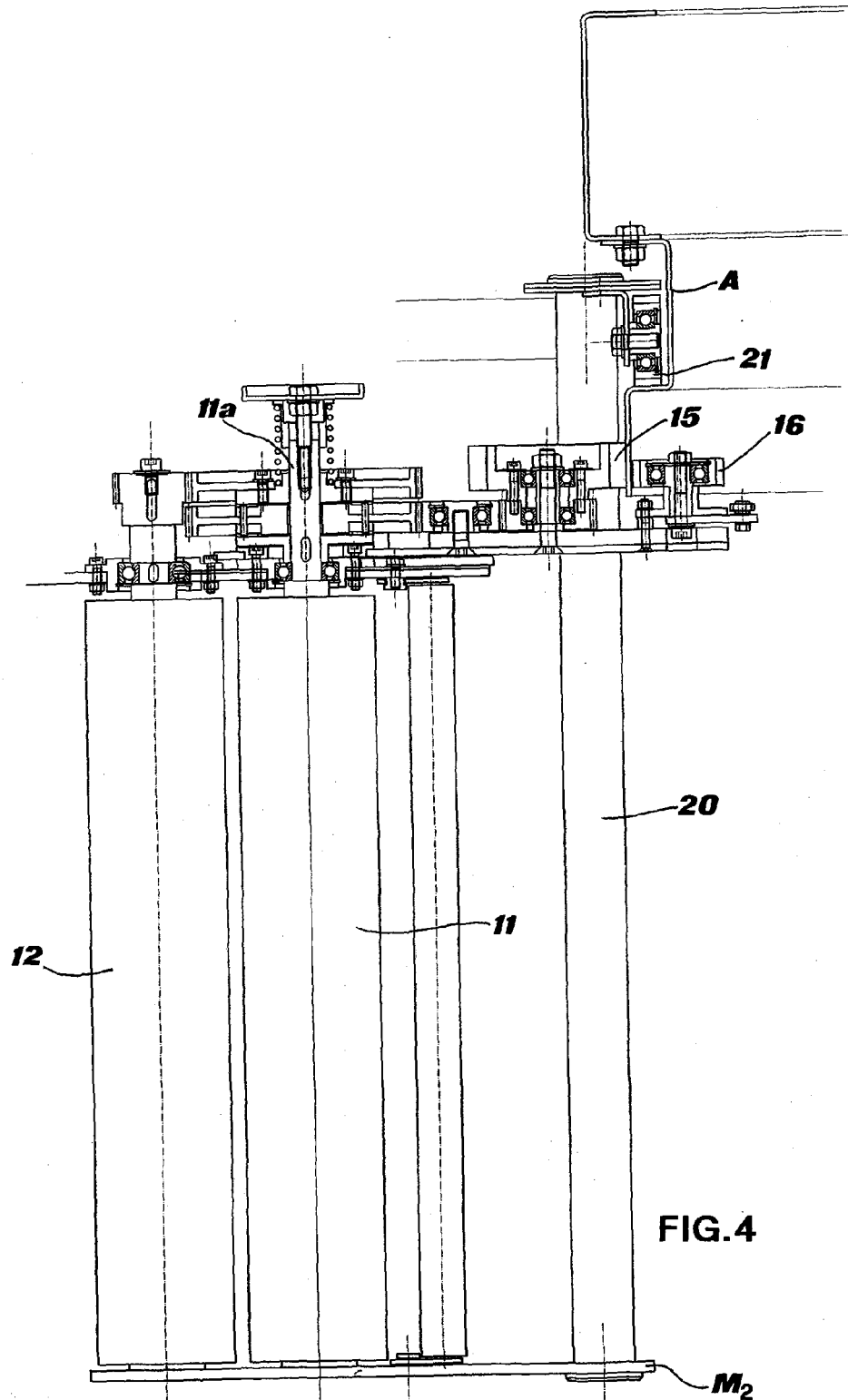
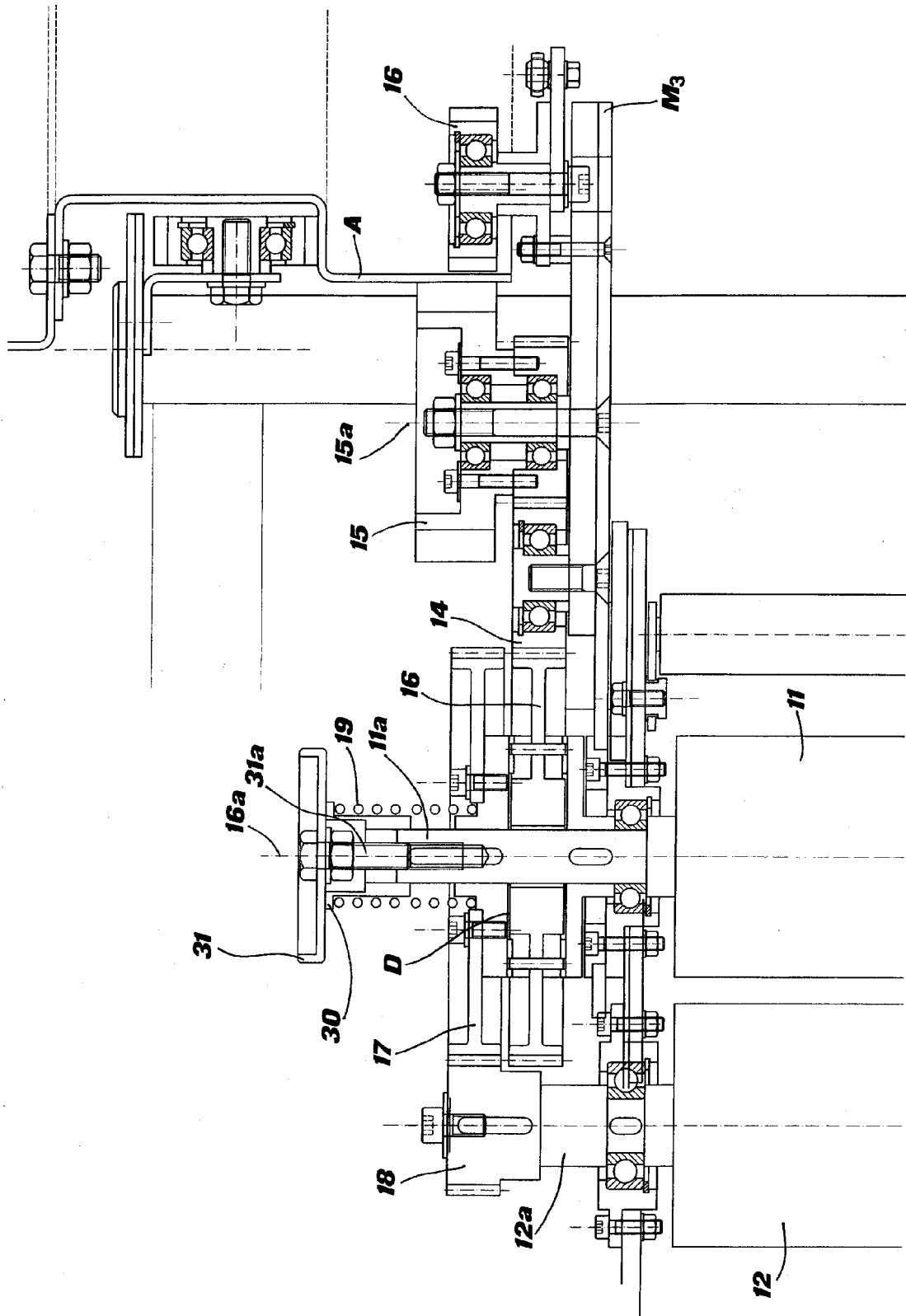


FIG. 3





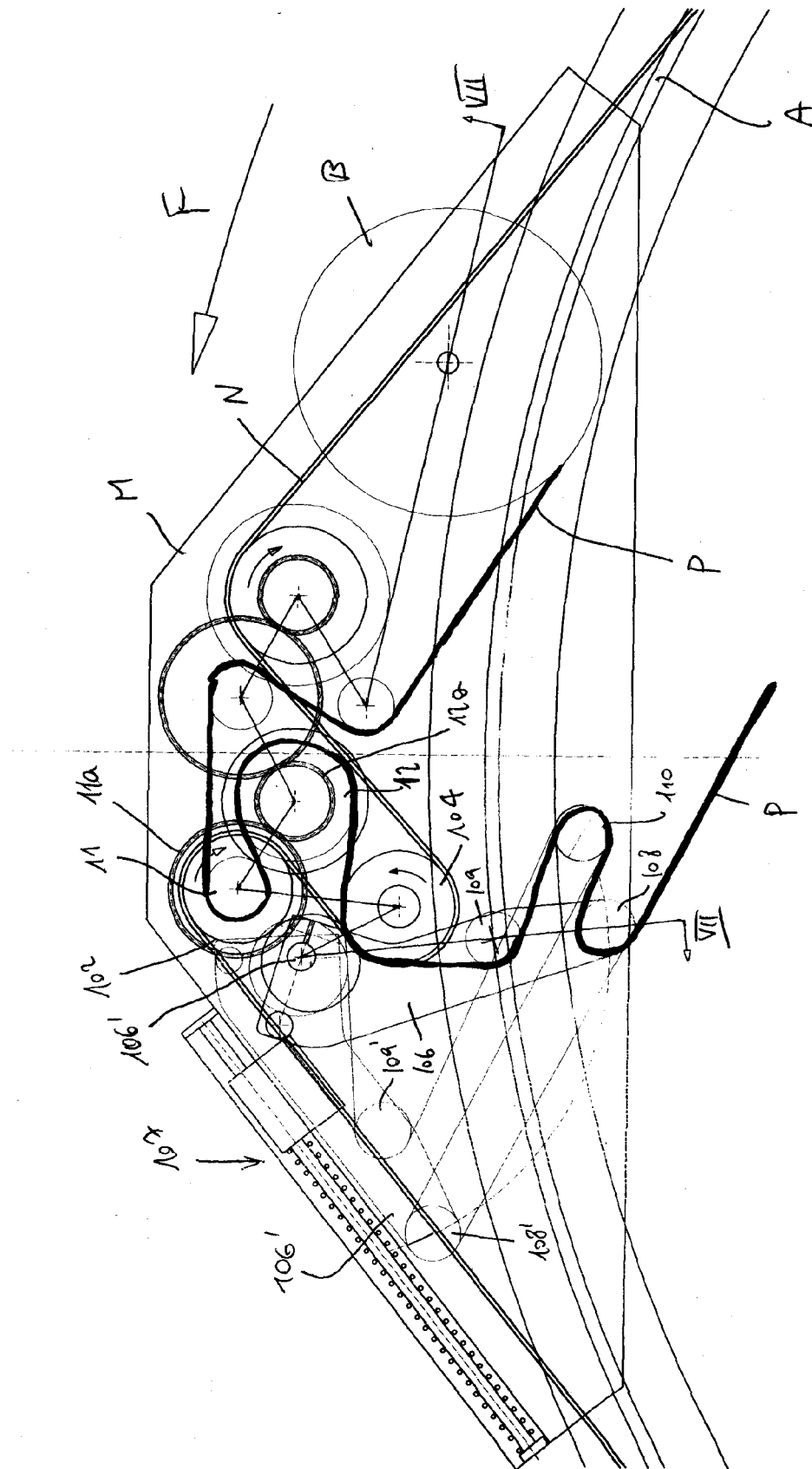


Fig. 6

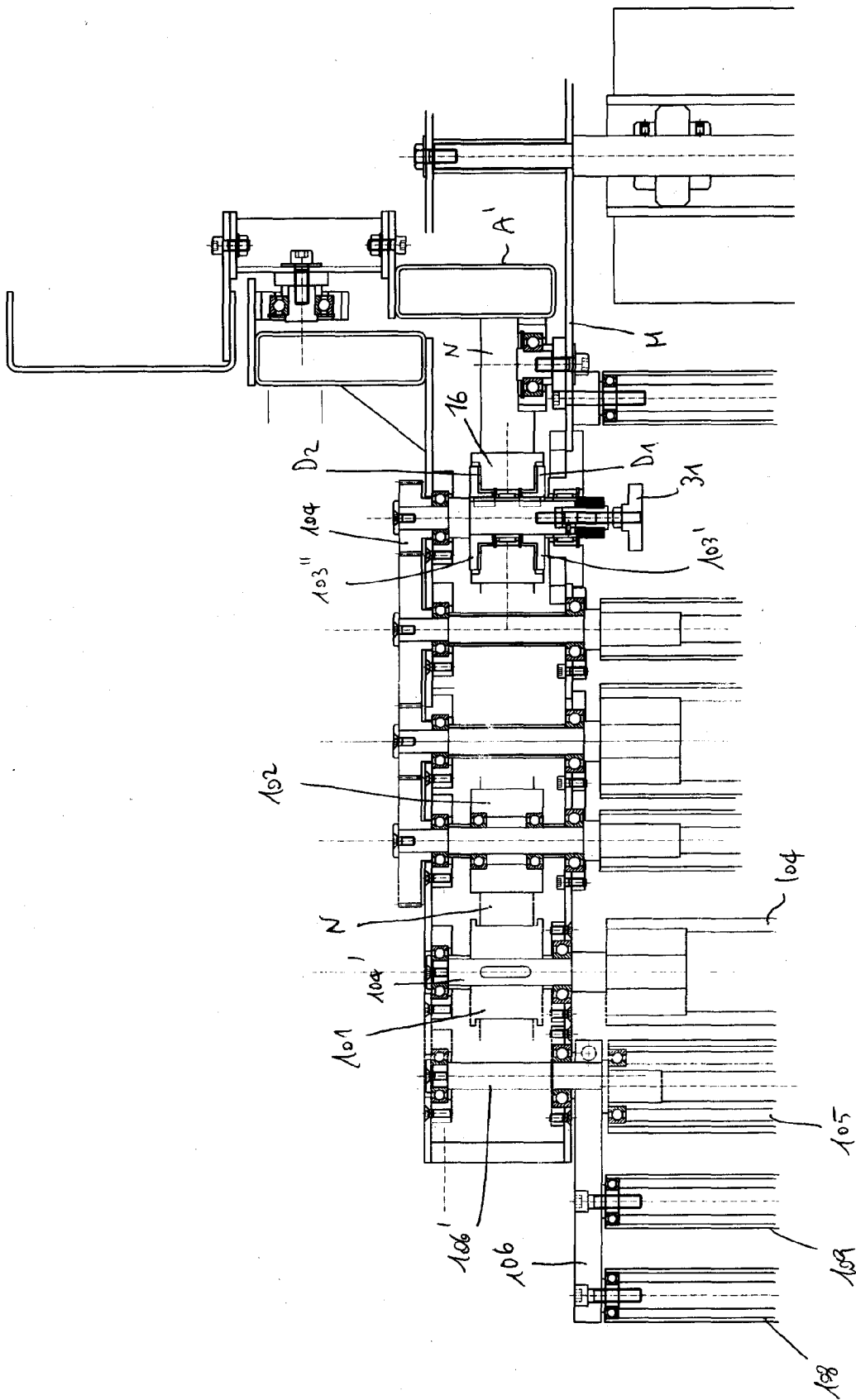


Fig. 7



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EUROPEAN SEARCH REPORT

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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