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(54) Opposite bobbins wrapping machine and relative wrapping method

(57) A wrapping machine and respective wrapping method are described, wherein two stretchable film dispensing units (3a,3b) facing each other are provided, and wherein the stretchable film coming from the first dispensing unit is joined to the film coming from the second dispensing unit at least during the wrapping step. A preferred joining device (4) is further described for separating the film from the wrapped load and restoring the film continuity between the two dispensing units.

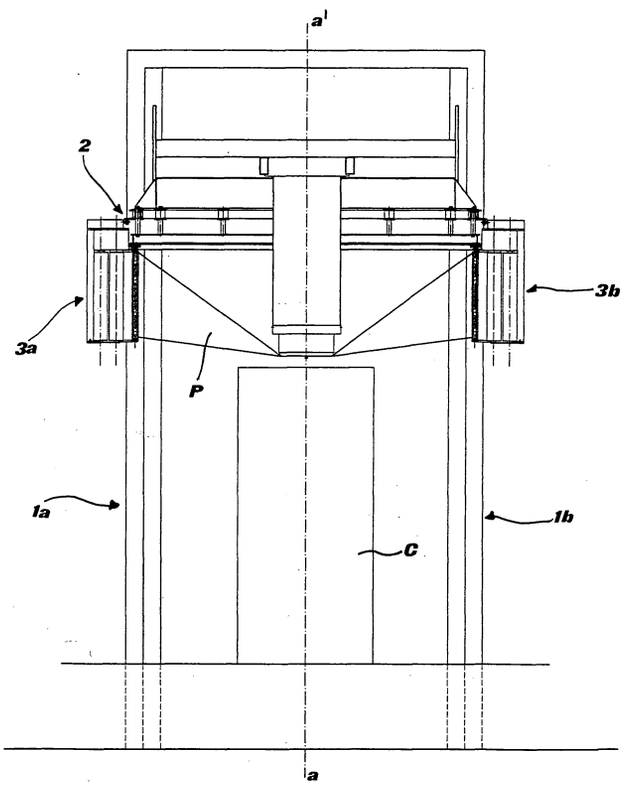


FIG.2

EP 1 332 968 A1

Description

[0001] The present invention relates to a wrapping machine and the respective wrapping method, in particular a wrapping machine provided with two opposite bobbins.

[0002] As known, wrapping machines are machines apt to wrap a load in a plastic film, usually a stretchable film. The wrapping of the load occurs by setting a rotational-translational relative movement between a stretchable film bobbin and said load: usually this may occur by either keeping the load fixed and moving the bobbin around it or combining the rotation of the load with the translation of the bobbin parallel to the rotation axis of said load.

[0003] It is also known that one of the most relevant problems of this field is that of managing the releasing point of the film on the load to be wrapped, both at the start and at the end of the wrapping operation. In fact, on the one hand, the free end of the film must be made to adhere to the load in the initial phase of the wrapping, and, on the other, in the final phase of the wrapping the terminal end of the film must be fixed to the load, cut and re-gripped.

[0004] These operations, according to the prior art, are performed by means of a complex gripping device that is apt to grip the end of the film, take it onto the load, keep it in position until it is blocked by the following film layers, attach it (for example through welding) to the final package and then separate it from the said package.

[0005] In order to do this, the gripping device is highly complex and expensive, both to manufacture and to maintain.

[0006] Besides, in order to intervene on the film adhering to the lateral side of the load, the gripping device must be moved from a side position to a position wherein it intercepts the area near the load, resulting in safety problems for its users.

[0007] It is thus desirable to avoid using this kind of device.

[0008] Another problem regards the efficiency of wrapping machines, which is limited by the maximum rotational speed (of the bobbin or of the load) which may be undertaken in order for the machine to operate regularly. In fact, in the rotating load version, for speeds over the typical 15 turns/minute, unbalancing torques occur which are caused by the inevitable eccentricity of the load, while in the rotating bobbin version, for speeds over 40-50 turns/minute, high inertial stress occurs and the so-called "parachute effect" is produced on the stretchable film, which compromises the wrapping stability.

[0009] Moreover, it should also be noted that the maximum rated speed cannot be reached in a very short time, as considerable inertial masses are involved. Therefore, part of the efficiency is lost also due to the start/stop transients.

[0010] It would thus be desirable to have a wrapping machine dispensing a higher quantity of film per turn, so as to increase the efficiency, although within the wrapping speed tolerance range.

[0011] Such objects are achieved by means of a wrapping machine as described in its essential features in the appended claims.

[0012] In particular, according to the invention, a wrapping machine is provided having two opposite bobbins rotating at a relative speed with respect to a load placed in the rotation centre, wherein the two film ends coming from the bobbins are joined together at the start of the wrapping operation and are separated and rejoined at the end of said operation.

[0013] According to another aspect of the invention, a wrapping machine is provided having a pair of plastic film bobbins - connected each other - and a joining device apt to intercept, at the rotation axis, the film coming from the bobbins and from the load, separating it from the respective application points and then re-attaching the ends thereof on one side to the load and, on the other side, in order to restore the film junction between the two bobbins.

[0014] According to another aspect of the invention, said joining device is made of a plurality of gripping pins apt to bind the opposite stretchable film ends.

[0015] Further characteristics and advantages of the machine according to the invention will be evident from the following detailed description of a preferred embodiment thereof, given by way of example and illustrated in the appended drawings, wherein:

fig. 1 is a plan view of an embodiment of the invention;
fig. 2 is a front elevation view of the embodiment of fig. 1, wherein the dispensing units are raised;
fig. 2A is a sectional view taken along line II-II of fig. 1;
fig. 3 is a view similar to that of fig. 2, with the wrapping machine in operation;
fig. 4 is a longitudinal sectional view of a preferred embodiment of the joining device according to the invention;
fig. 5 is a sectional view taken along line V-V of fig. 4;
figs. 6A and 6B are plan and side elevation views, respectively, of the cutting cup mounted on the device of fig. 4;
figs. 7-18 marked with A are partial longitudinal sectional views of the device of fig. 4 during the different knotting steps; and
figs. 7-18 marked with B are partial bottom views of the device of fig. 4 during the different knotting steps.

[0016] In fig. 1 an exemplary wrapping machine is illustrated. It comprises two vertical supporting columns 1a and 1b, onto which an annular structure 2 is translatably mounted, which is designed to support and guide stretchable film dispensing units during rotation. An an-

nular track located on the structure is placed so as to encircle a load C to be wrapped. These elements shall not be described more in detail, as they belong to the prior art known to experts in the field.

[0017] According to the invention, onto the annular structure 2 two dispensing units are mounted facing each other, a stretchable film P continuously extending between one unit 3a to the other unit 3b (as can be seen in fig. 2). The dispensing units are made, in a *per se* known manner, of a shelf rotatively supporting a stretchable film bobbin B and a plurality of cooperating cylinders of a pre-stretching unit.

[0018] Since the film P extends between one unit and the other along the diameter of the annular structure, it is possible to engage it with the top portion of the load C without using a gripping device for handling a free end of the film.

[0019] The operation of the machine according to the invention provides that the load C be moved to a position corresponding to the rotation axis a-a' when the annular structure 2 is in its completely raised position. In this condition the film P, extending along the diameter of the ring 2, does not intercept the load C: it is therefore possible to provide that the two dispensing units 3a and 3b be already rotating.

[0020] After that, the annular structure 2 is lowered until the film engages the top portion of the load C: the film P is then naturally gripped and held by the upper edges of the load C, causing the actual wrapping to start.

[0021] Since the film application points are two at a time, it is possible to set a lager wrapping pitch (proportional to the V/R ratio, where V = ring vertical translation speed, and R = dispensing unit rotational speed around the load) than when a single bobbin is used, because the wrapping cohesion is also obtained due to the partial overlapping of the two opposite pitch lines of stretchable film (see fig. 3).

[0022] This, in brief, allows increasing the productivity, and thus achieves a first object of the invention. The fact that the two stretchable film bobbins are continuously joined, as seen above, right from the start does not require the wrapping cycle to start from a stop condition of the bobbin and thus prevents most productivity losses due to the start transient.

[0023] Furthermore, since the bobbins face each other, the machine has balanced masses, thus resulting in less stress, and may be supported by a lighter structure.

[0024] The possibility of almost doubling the productivity relative to the prior art machines may be exploited in order to obtain "standard" results in terms of dispensed film per unit of time, but reducing the rotational speed of the dispensing units, thus further reducing the stress and offering an advantageously lighter and more economical structure. A lower rotational speed also results in a reduced parachute effect on the film, improving the wrapping quality.

[0025] As may be guessed, once the wrapping is over, the film must be separated from the load and restored to the initial continuous conditions. To this purpose, according to the invention, a joining device 4 placed above the load is provided.

[0026] Due to the fact that the film extends along the diameter of the annular structure 2, it is very easy to determine, in the rotational centre, a sole film joining point wherein the joining device is to be placed.

[0027] It follows that the joining device 4 may avoid using complicated feelers or other film locating and gripping elements.

[0028] According to a preferred embodiment of the invention, the joining device 4 is mounted, at the rotational axis a-a', onto a frame 5 placed above the annular structure 2. The frame is translatably mounted onto columns 1a and 1b (fig. 2A). For example, the ring 2 and the frame 5 may be both mounted on respective supporting shelves engaged with a common fixed chain 6 (only a portion of which is shown in fig. 2A). During the raising step, the frame 5 is lying upon the upper part of the annular structure 2. Once the desired height is reached, a suitable ratchet 7 prevents the relative movement between the frame 5 and the chain 6, so as to keep the joining device 4 in position in spite of possible lowerings of the ring 2.

[0029] The joining device 4 must be apt to join the two film ends coming from the load, once the wrapping is over, separate them from the respective bobbins and rejoin the free ends of the two bobbins in order to restore the initial conditions.

[0030] This operation may be done with different techniques, for example by welding, gripping, stapling, gluing, etc. Hereinafter, a preferred embodiment of the joining device will be illustrated, with reference to figs. 4-18B.

[0031] In fig. 4 a preferred joining device is illustrated in detail. It is made of a housing and supporting structure 10, wherein there are a main gripping element 11 and a pair of secondary grippers 12a and 12b, which are placed opposite relative to the main gripping element 11. The housing structure has a protective casing 10a at its lower end, from which several gripping elements may project.

[0032] The secondary grippers 12a and 12b are mounted onto fifth wheel means 13 allowing the concentrical rotation thereof relative to the main gripping element 11. The fifth wheel means 13 are made to rotate, for rotation angles of $\pm 180°$, by means of a driving element 14 and a drive chain 14a (fig. 5).

[0033] The secondary grippers are made of gripping pins 15a and 15b that are translatable, through actuators 16a and 16b, within small hollow cylinders 17a and 17b.

[0034] The main gripping element 11 is made of a main gripping pin 18 that may slide, through an actuator A1, within a hollow pin or cylinder 19 which, integrally with the actuator A1, may in turn slide within a liner 20 by means of a second actuator A2.

[0035] A cutting cup 21 is further integrally connected

to the liner structure 20, in a concentrical position relative to the main gripping element 11. Said cutting cup 21 is well illustrated in figs. 6A and 6B: it is made of protective cylindrical walls 21a, interrupted by windows onto which cutting blades 21b are mounted at opposite facing edges.

[0036] The combination of the gripping operations of the four actuators 16a, 16b, A1 and A2, together with the alternate rotation of the two secondary grippers is apt to produce a knot in the stretchable film, separating it from the load and forming again another joining knot in order to start a new wrapping cycle. This operation is hereinafter illustrated in detail.

[0037] The joining device is moved close to the top of the load C; initially, the secondary gripping pins 15a and 15b are inwardly withdrawn (i.e. not projecting from the lower profile of the casing 10a), while the main gripping element 11 is in its completely extracted position. This way, the two bobbins, while rotating and vertically rising, also apply some turns (2 or 3) of stretchable film onto the external surface of the cylinder 19, then further rise upwards before being stopped. In this condition, which is illustrated in fig. 7A, two portions of film come upwardly from the load C, wrap the cylinder 19 in a plurality of turns and then move upwards in the direction of the respective bobbins B.

[0038] At this point, the cylinder 19 is raised until the film turns are abutting against the mouth of the liner 20. The gripping pin 18 is then lowered, which pin is provided with a gripping flange 18a, and then the bobbins are made again to rotate around the axis a-a' in order to apply at least a further turn of film below the previous ones (fig. 8A).

[0039] At this point, also the gripping pins 15a and 15b of the secondary grippers are lowered and the film P is wrapped around them by a certain angle apt to guarantee a good retaining effect once the gripper is closed again (fig. 9B).

[0040] Until this moment the film passes always below the profile of the casing 10a and of the cutting cup 21.

[0041] Subsequently, the gripping pins 15a and 15b are closed and, during this clamping operation, they drag and block the film P. Since the gripping plane of the pins15a and 15b is placed at a higher level than the lower profile of the casing 10a and of the cup 21, the film P, stretched into a cord, is moved inside the windows of the cup 21 (see figs. 10A and 10B). At the same time, also the central gripping pin 18 clamps the last turn of film P applied against the edge of the cylinder 19.

[0042] At this point the actuator 14 is operated in order to make the two secondary gripping pins rotate according to the arrows G (fig. 11B).

[0043] As soon as an angle of about 30° is covered, the two portions of film extending between the central pin and the two secondary pins intercept the two cutting blades 21b, getting cut (fig. 12B): in this cutting step, the film coming from the wrapped up load C (whose ends remain hanging from the central gripping pin) is separated from the two film portions coming from the two bobbins (which remain gripped and held by the two secondary pins).

[0044] Then the cylinder 19 together with the gripping pin 18, between which the last turn of film is clamped, integrally rise up along liner 20, moving the last turn of film inside and above the previously applied turns: this way, a raw knot is obtained which, also by exploiting the elasticity of turns material, establishes a stable junction between the two ends of the film coming from the wrapped load C (fig. 13B).

[0045] Meanwhile, the two secondary pins have completed a rotation of about 180° in the direction of the arrow G.

[0046] Subsequently, the main pin 18 and cylinder 19 are lowered again (fig. 14A) in order to apply some new turns (2 or 3) of stretchable film through a further rotation of the two bobbins. Then the step described with reference to figs. 9 and 10 is again performed, i.e. the cylinder 19 rises until pushing the layers against the edge of the liner 20, while the pin 18 is lowered by a small section. A portion of the film held by the secondary grippers is wrapped on this latter section of the pin, forming at least one half-turn: this is obtained by means of an inverted rotation of about 180° (in the direction of he arrow G') of the two gripping pins 15a and 15b (fig. 15B). The latter rotation is possible, despite the film cord being clamped at both ends, due to the film high elasticity. In this counter-rotation there is no risk of the film getting cut by the blades 21b because, in this rotation direction, the cup 21 has a shielding function.

[0047] The gripping pin 18 is then lifted and the last half-turn is gripped between the flange 18a and the mouth of the cylinder 19. The film ends that are still held by the secondary pins may be freed (fig. 16B) and the actuator A2 is again operated in order to perform a knot - identical to the previously described one - also between these latter turns (figs. 17A and 17B): this way, the continuity of the film extending between the opposite bobbins is restored (fig. 18B), so that the initial conditions are reestablished in order to perform a new wrapping cycle.

[0048] An expert in the field will clearly appreciate that the above described joining device and method should not be intended as limiting the invention, but only represent a preferred embodiment thereof.

[0049] By means of a generic joining device, according to the teachings of the invention, it is possible to join the free ends of the film to the wrapped load, without using complicated feeling devices nor gripping systems that should be moved transversely relative to the wrapping machine, thus a further object set out is achieved.

[0050] Moreover, the central position of the joining device allows it to be incorporated into another equipment useful for the wrapping, for example a so-called "small press" for unstable loads.

[0051] The specific joining device illustrated in the preferred embodiment advantageously allows to join the

film ends by knotting them: this technique is much more reliable and less unstable than the traditional welding technique, thus resulting in a further advantage.

Claims

1. Wrapping machine of the type comprising at least one stretchable film dispensing unit mounted in rotation-translation around a load to be wrapped, **characterised in that** it further comprises a second dispensing unit, opposite to the first one, the stretchable film coming from the first unit being connected to that of the second group at least during a wrapping step.

2. Machine as in claim 1), further comprising a joining device apt to intercept, at the rotation axis, the film portions coming from the load and directed towards the opposite bobbins, separating them and re-establishing the continuity thereof, on one side, on the load and, on the other side, between the two bobbins.

3. Machine as in claim 2), wherein said joining device is apt to cut said film portions and to knot the freed ends thereof.

4. Machine as in claims 1), 2) or 3), wherein said dispensing units comprise at least one stretchable plastic film bobbin and a pre-stretching unit and are mounted rotating on an annular track structure translatable, relative to the load, along the rotation axis.

5. Machine as in claim 4), wherein said joining device is mounted on a vertically translatable frame apt to bear above the annular track structure, but disengageable therefrom and blockable along the vertical direction.

6. Joining device for intercepting and joining plastic film portions extending between two opposed bobbins in a wrapping machine as in claim 1), **characterised in that** it is mounted substantially in correspondence of the rotation axis of said bobbins and fixed in the horizontal plane.

7. Joining device as in 6), comprising

   a main central gripping element (11), comprised of a gripping pin (18) slideable within a hollow cylinder (19) which in turn is slideable within a liner (20), and
   a couple of secondary grippers (12, 12b), placed opposite each other relative to the main gripping element (11) and apt to integrally pivot around the longitudinal sliding axis of said main gripping element (11) to perform a knotting sequence on said plastic film portion.

8. Joining device as in 7), further comprising blade means (21b) arranged between said main gripping element (11) and said secondary grippers (12a, 12b) and apt to intercept and severe said film in a specific step of said knotting sequence.

9. Load wrapping method, wherein a least one stretchable film dispensing unit is made to rotate and translate around the load in order to obtain a series of wrapping turns of film, **characterised in that** a second dispensing unit is made to rotate and translate in a position opposite to the position of the first dispensing unit, the film from the first unit being joined to the film from the second unit at least before and during the load wrapping operation.

10. Wrapping method as in claim 9), wherein the pair of dispensing units is made to rotate before the start of the wrapping operation, in a position that does not interfere with the load when the load is introduced into the wrapping machine at the rotation axis of said pair of dispensing units.

11. Wrapping method as in claims 9) or 10), wherein, at the end of the wrapping operation, the two film ends coming from the load and directed to the dispensing units are cut and re-joined in order to restore the film continuity between the two dispensing units and between the two ends coming from the wrapped load.

12. Wrapping method as in claim 11), wherein said rejoining step for restoring the film continuity involves knotting the film ends.

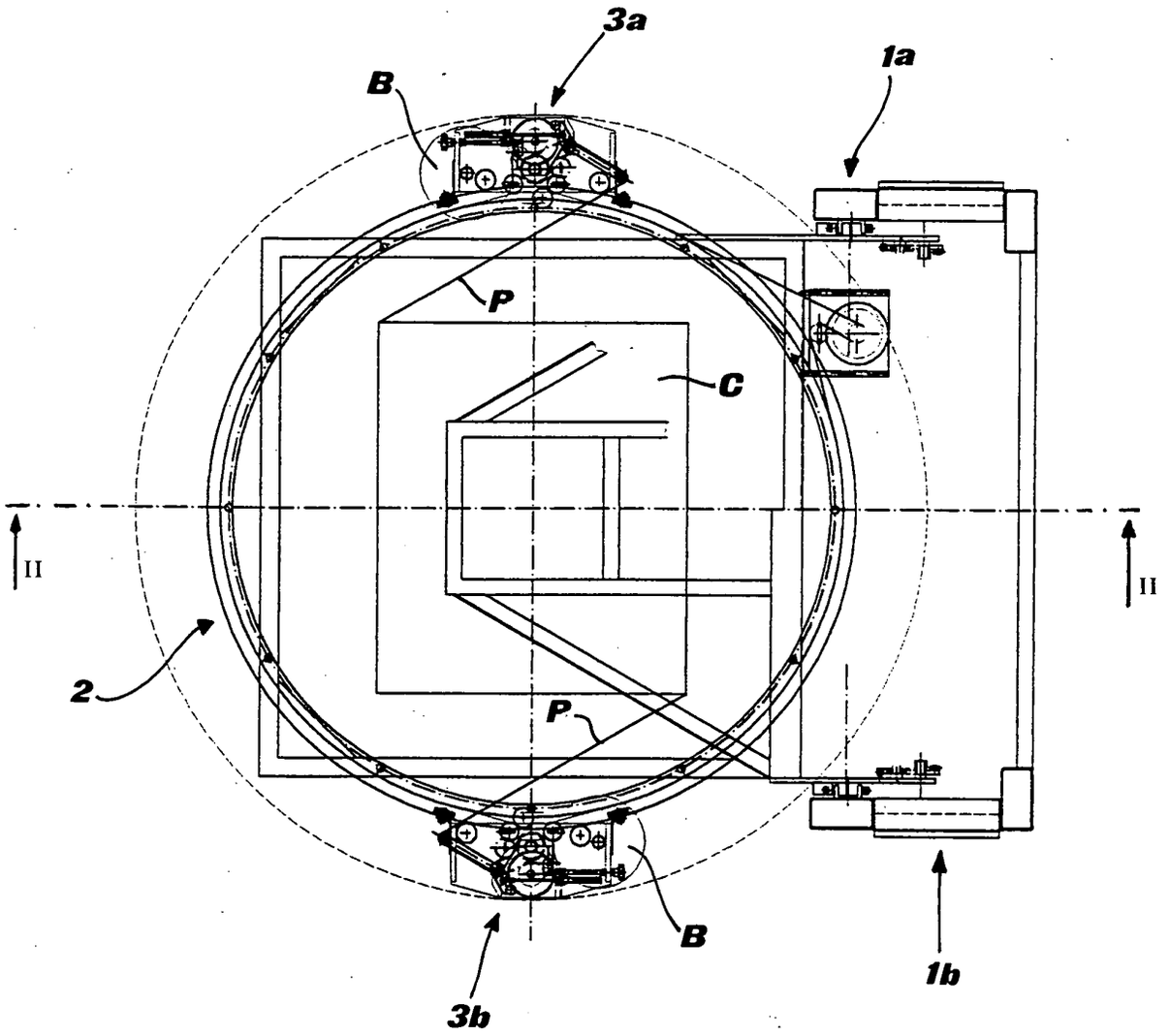


FIG.1

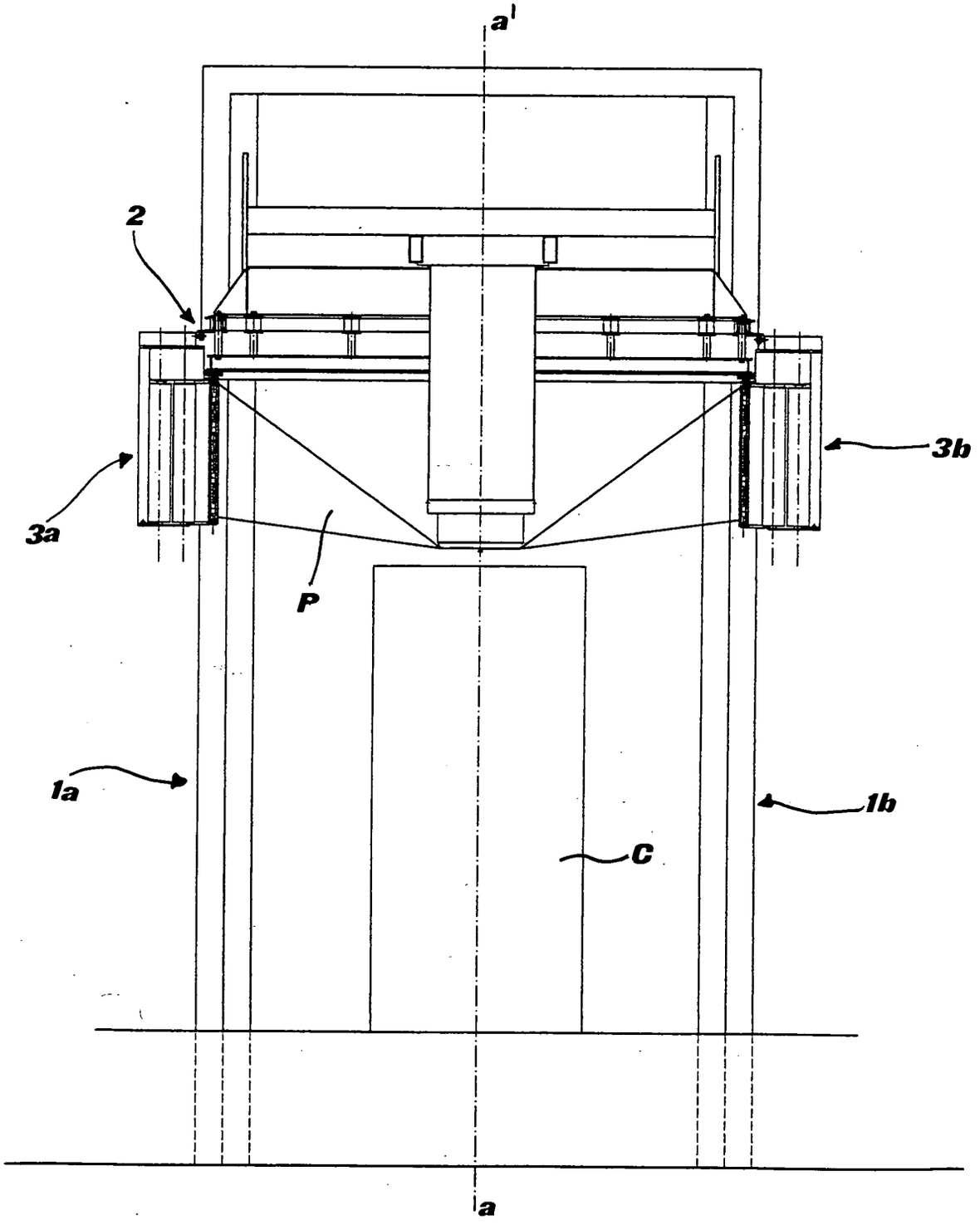


FIG.2

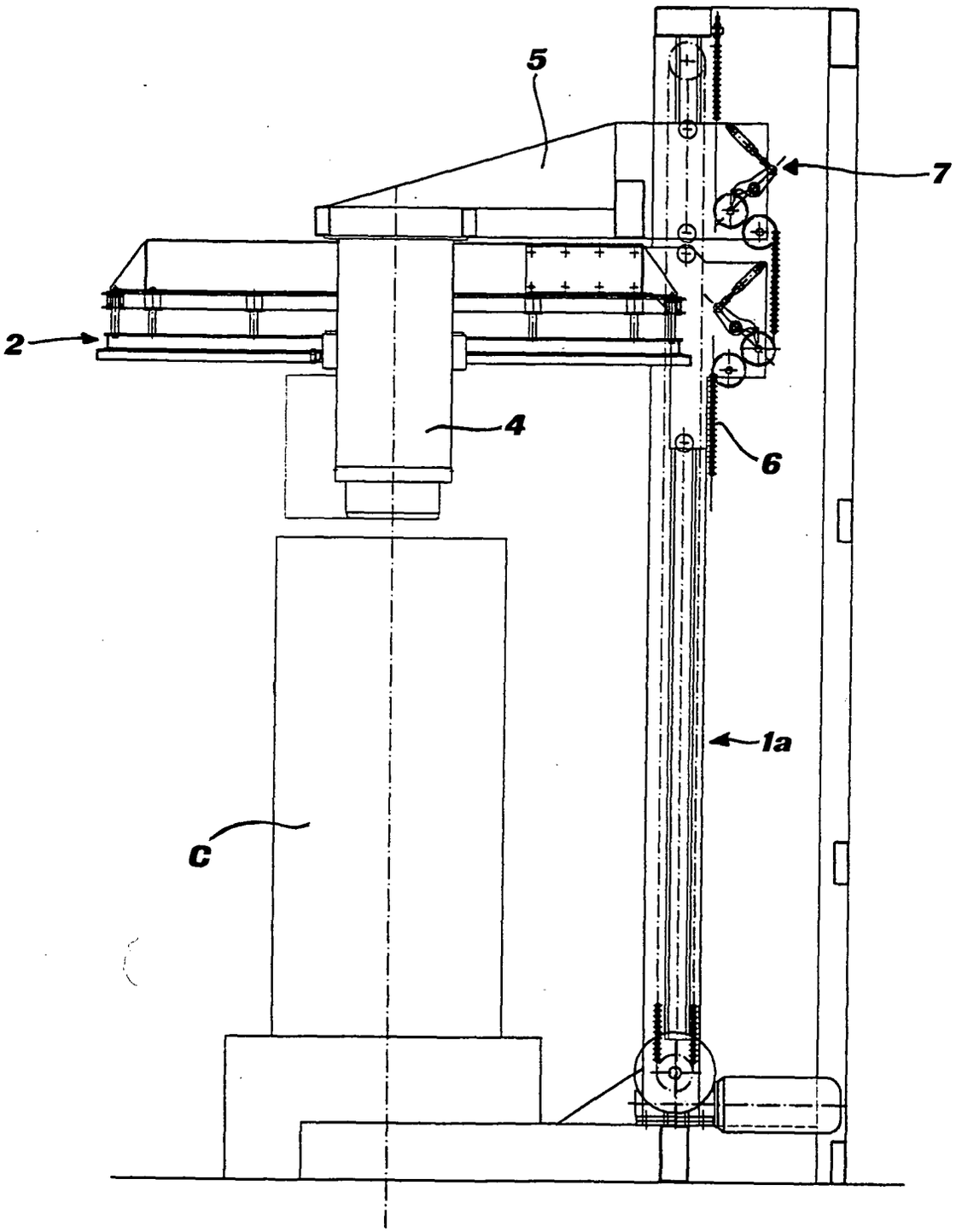


FIG.2A

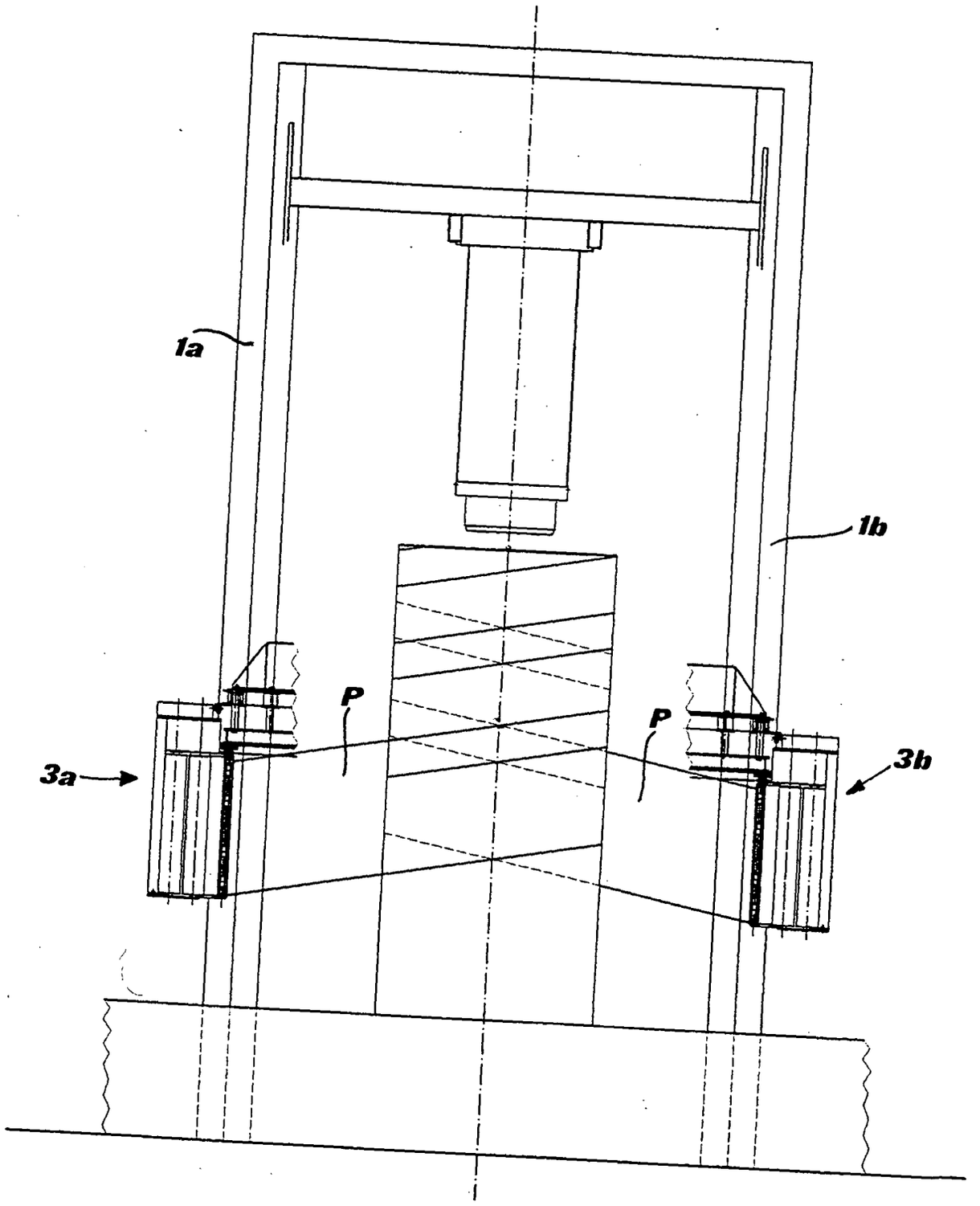


FIG.3

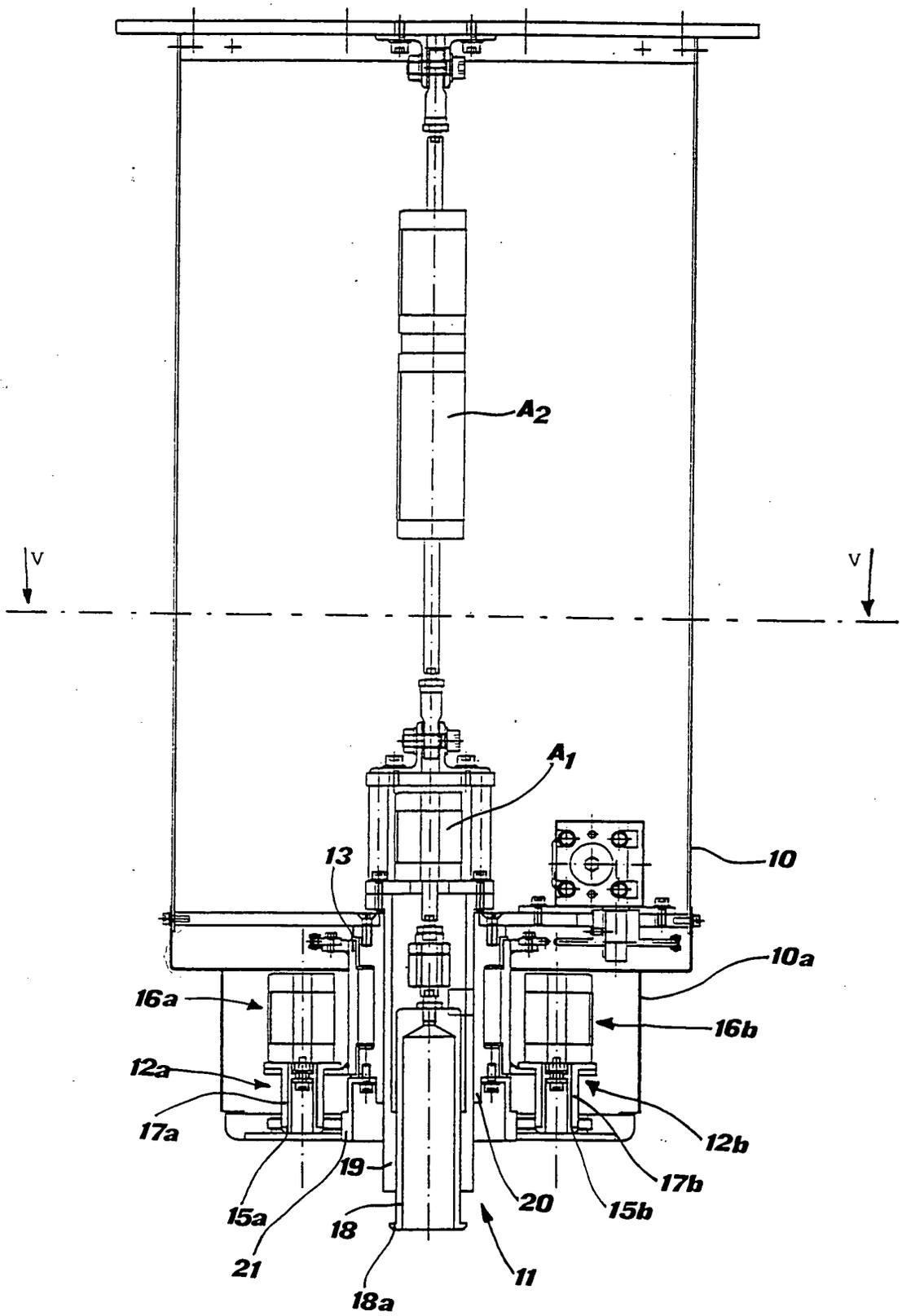

V
V
A2
A1
13
10
10a
16a
16b
12a
17a
12b
19
17b
15a
20
15b
18
21
11
18a

FIG.4

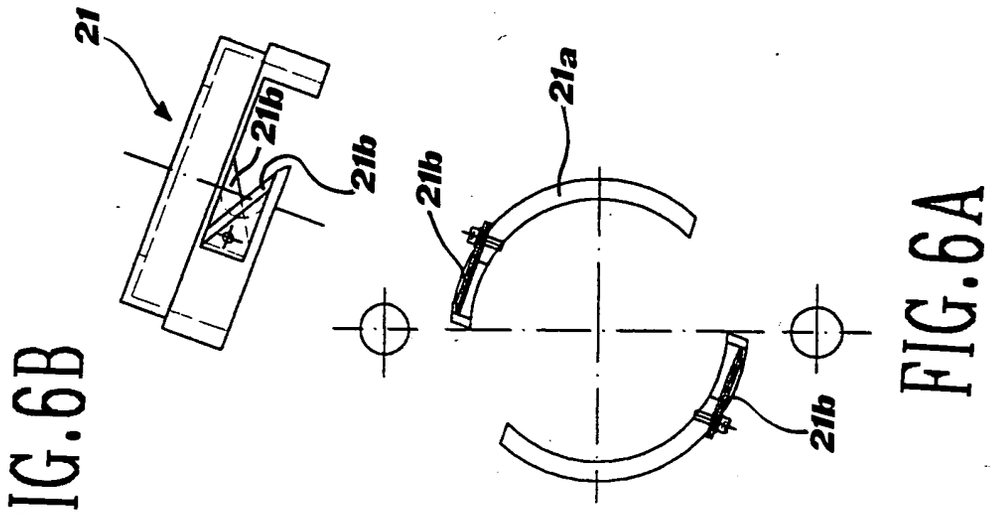


FIG.6B

FIG.6A

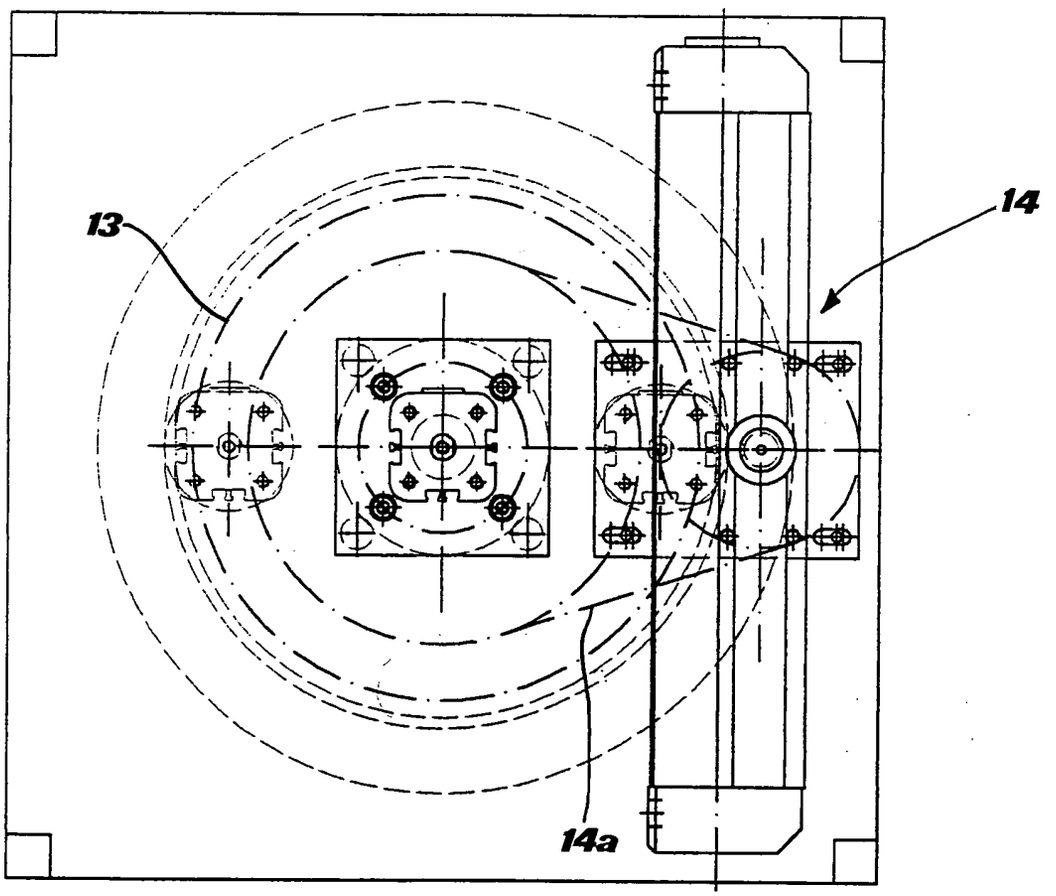


FIG.5

FIG.8A

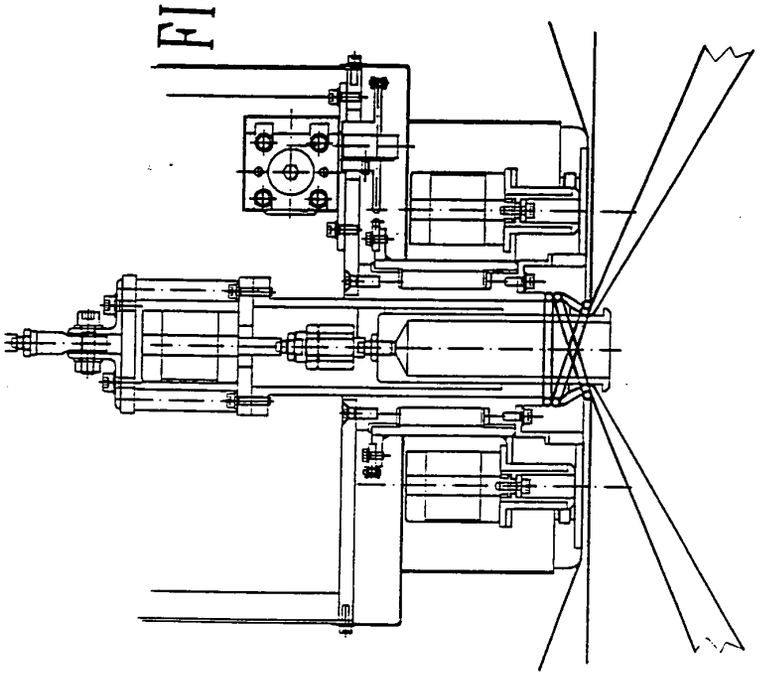


FIG.8B

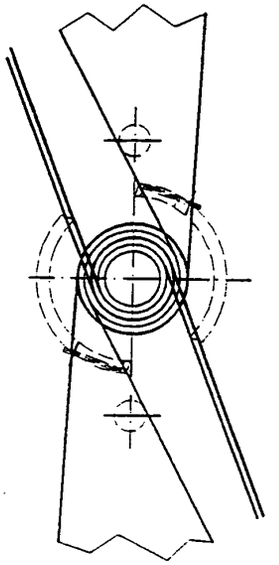


FIG.7A

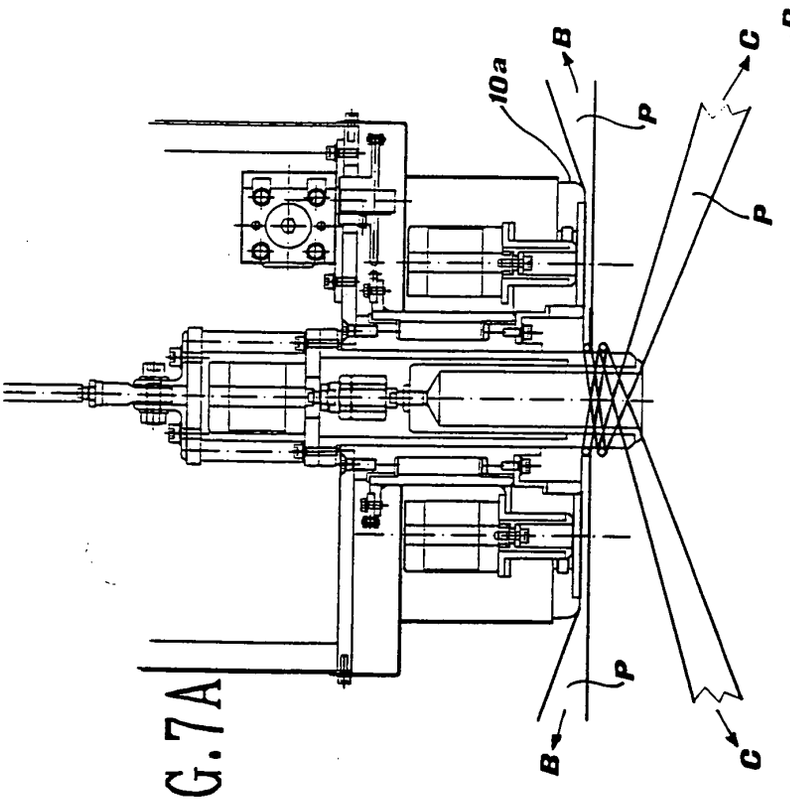
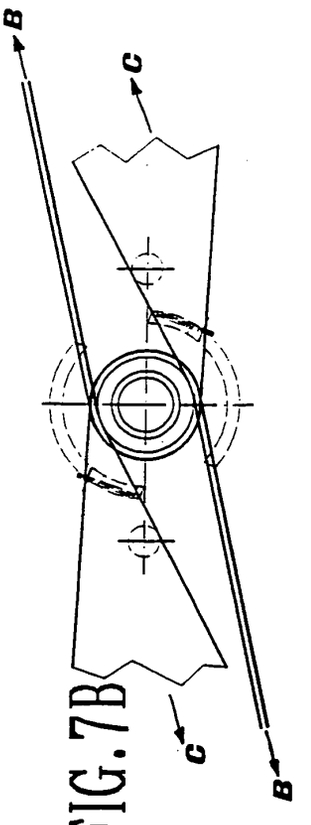


FIG.7B



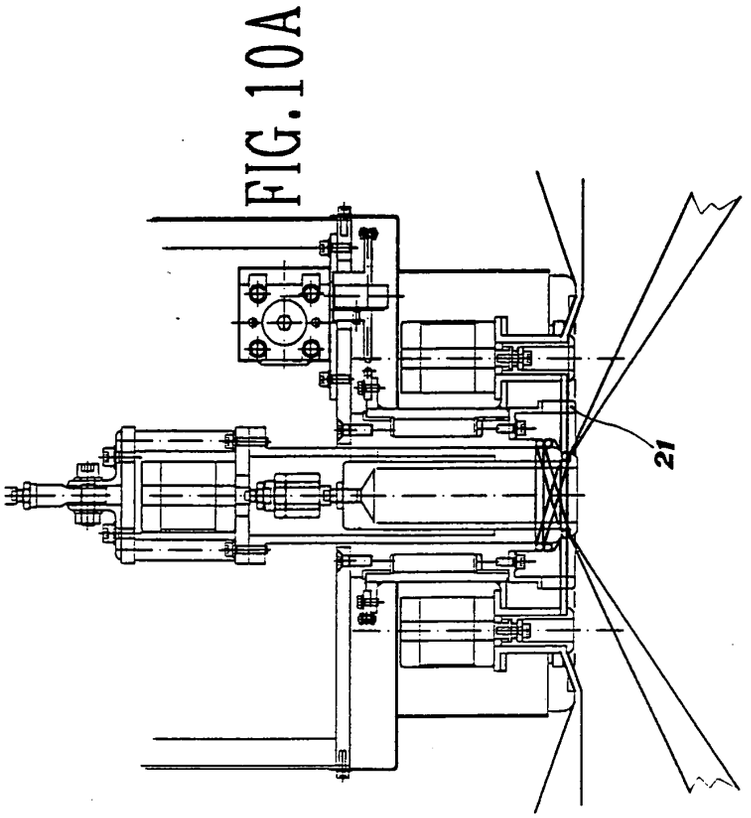


FIG.10A

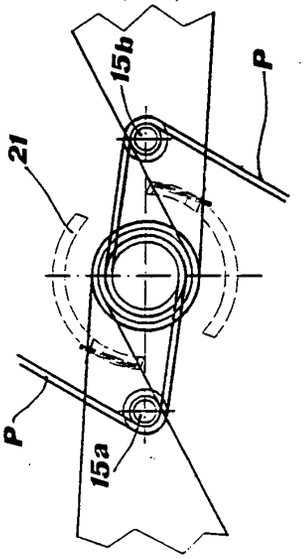


FIG.10B

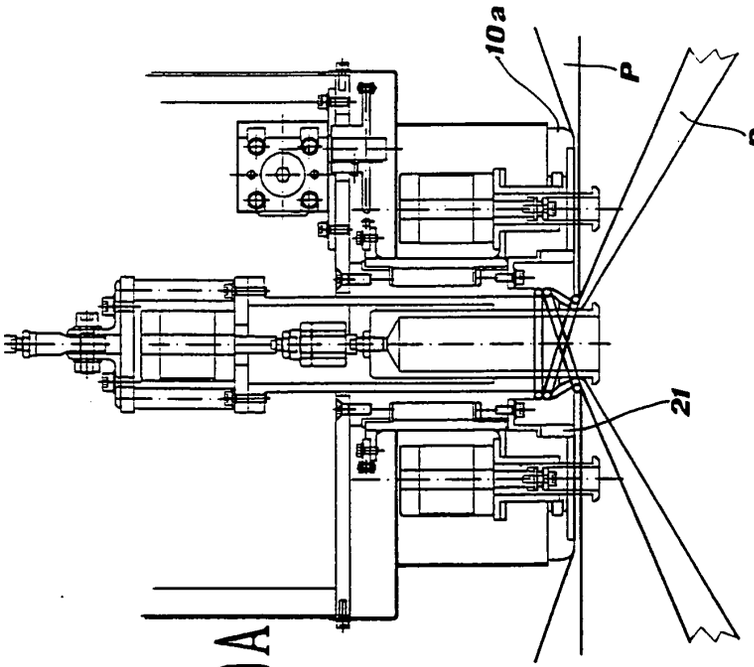


FIG.9A

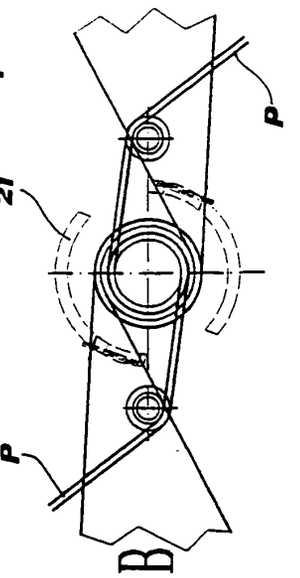


FIG.9B

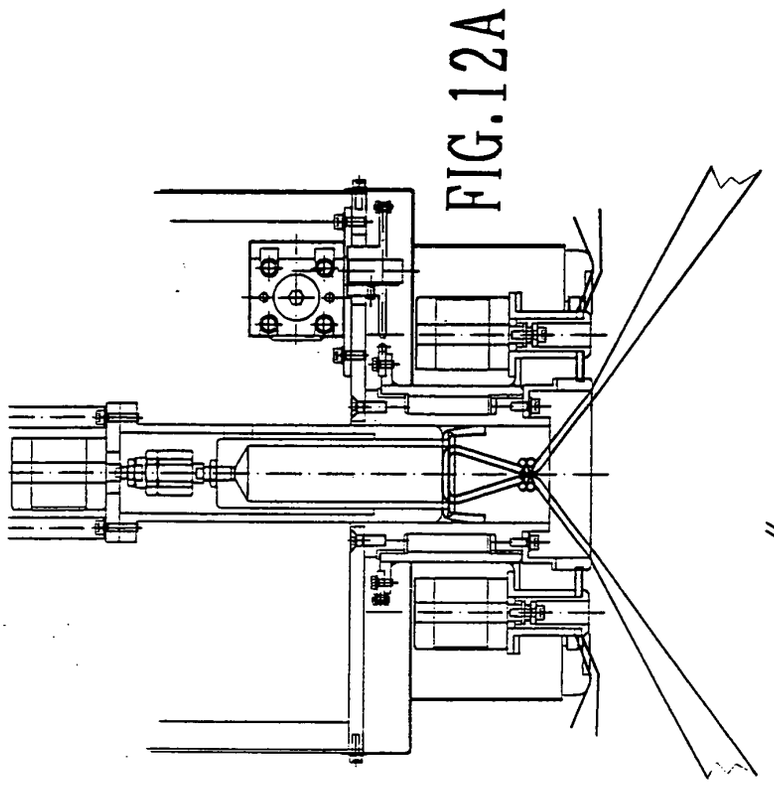


FIG.12A

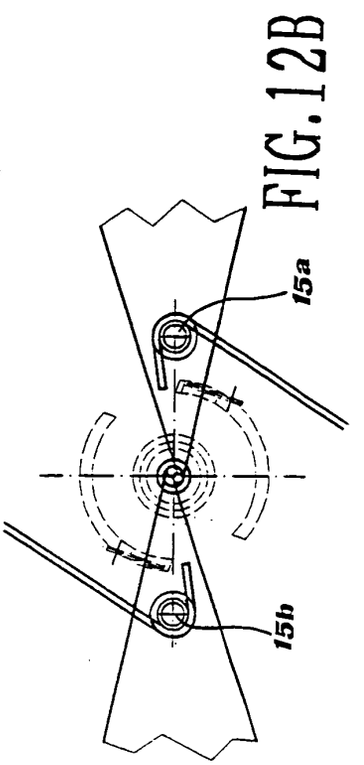


FIG.12B

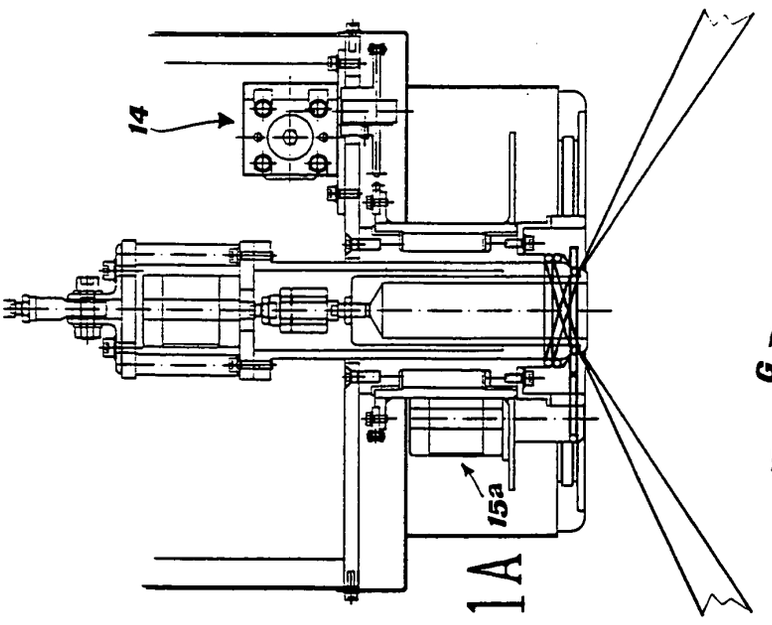


FIG.11A

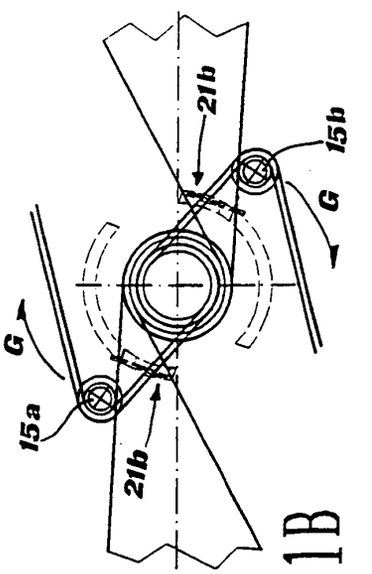


FIG.11B

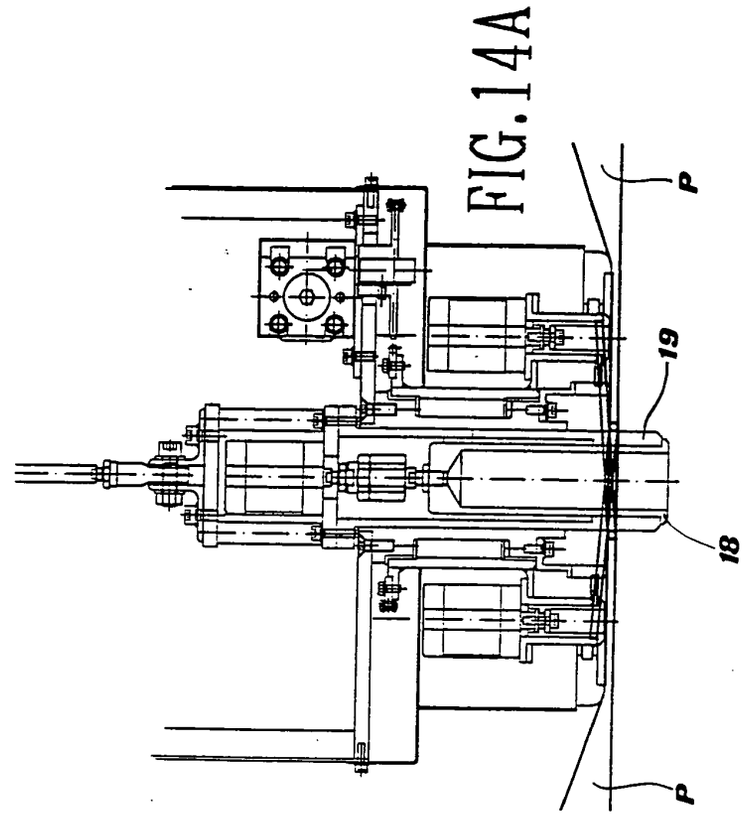


FIG.14A

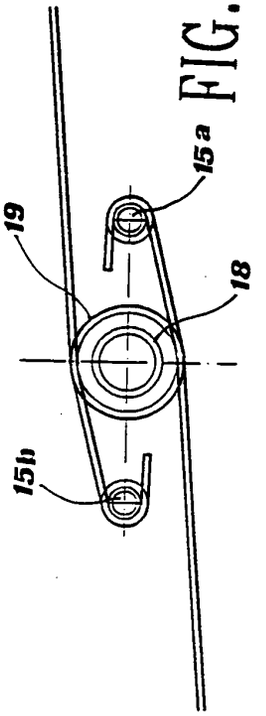


FIG.14B

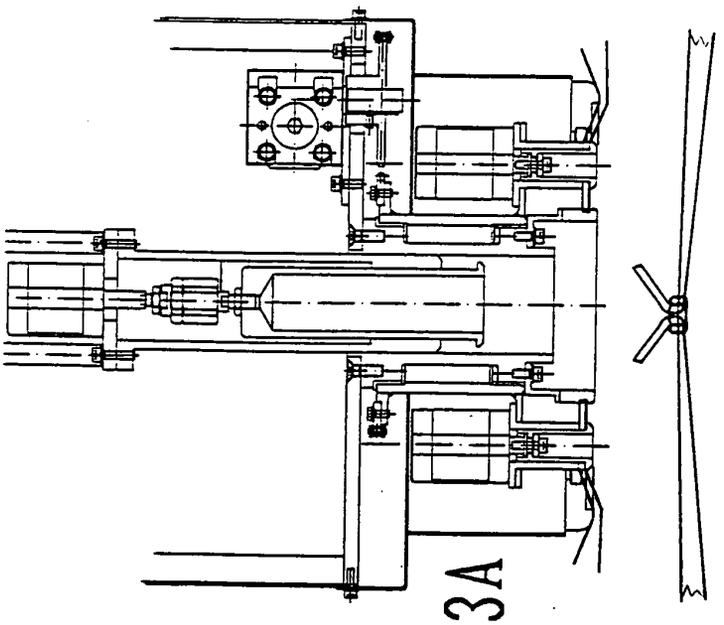


FIG.13A

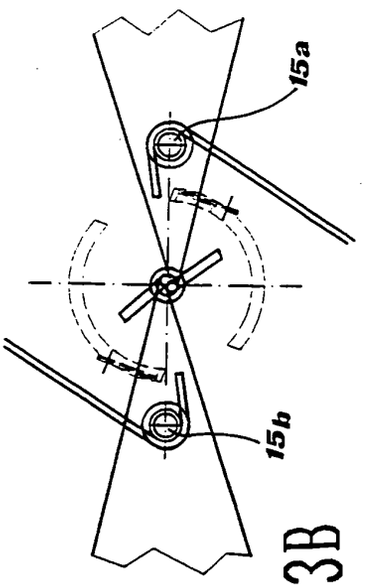


FIG.13B

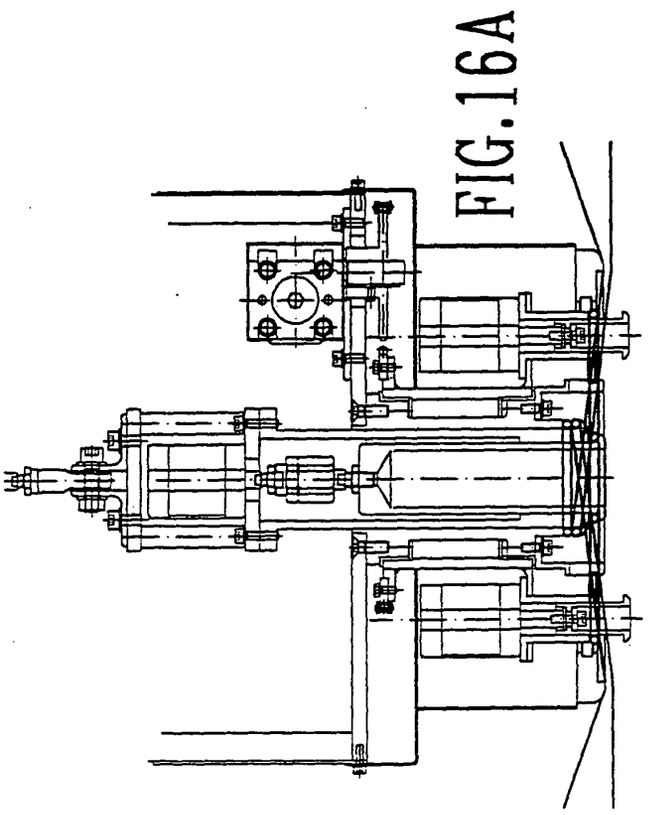


FIG.16A

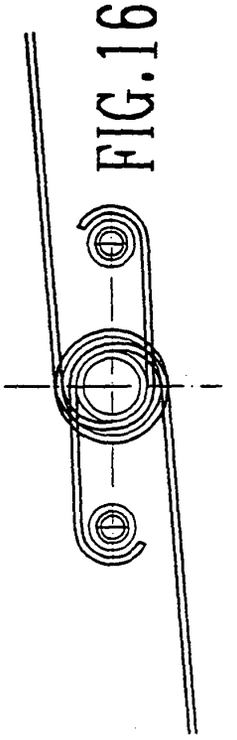


FIG.16B

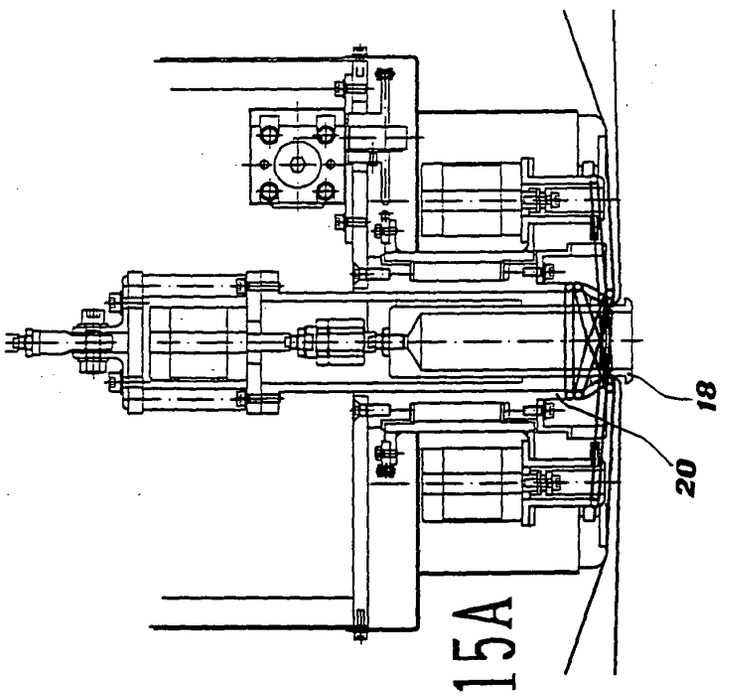


FIG.15A

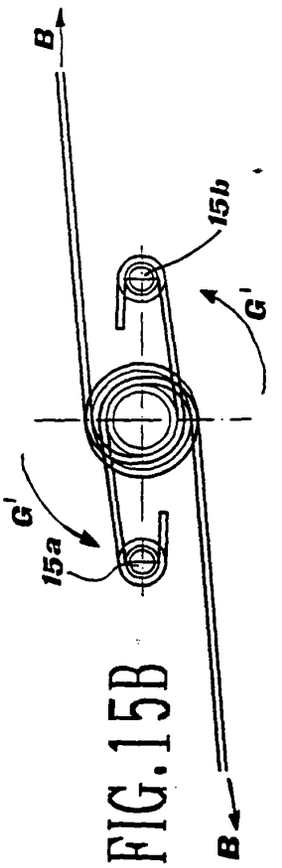


FIG.15B

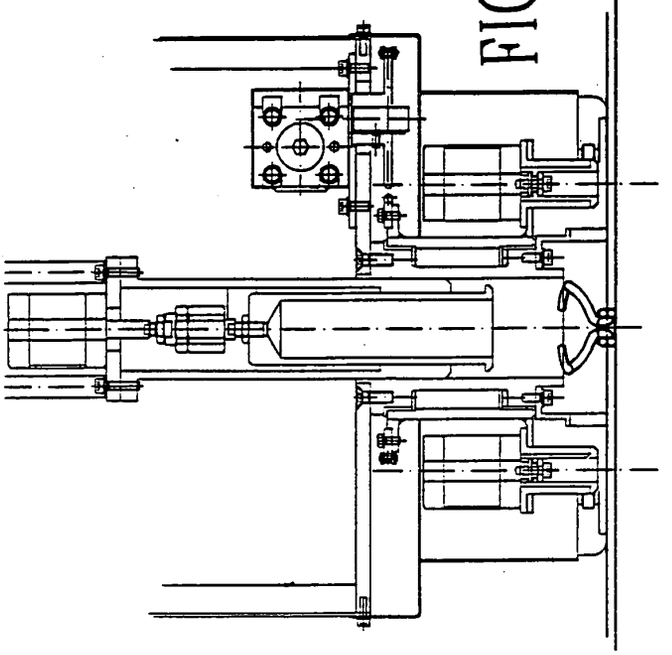


FIG.18A

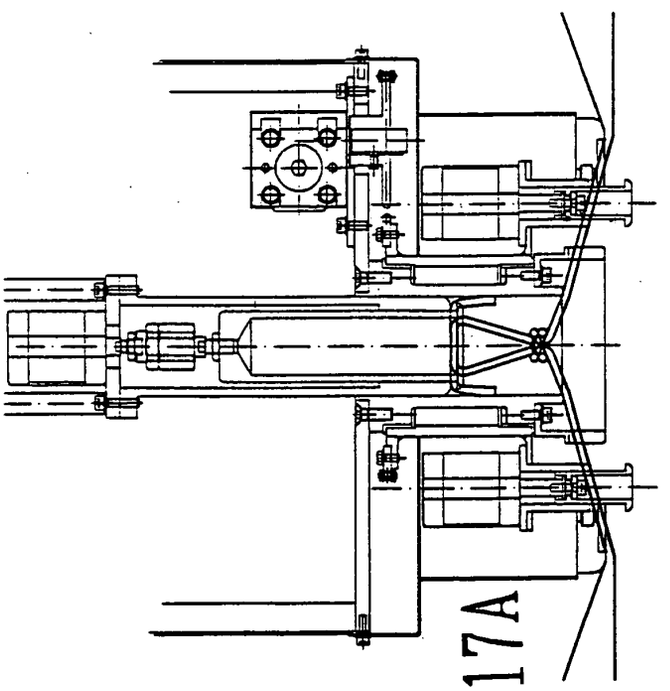


FIG.17A

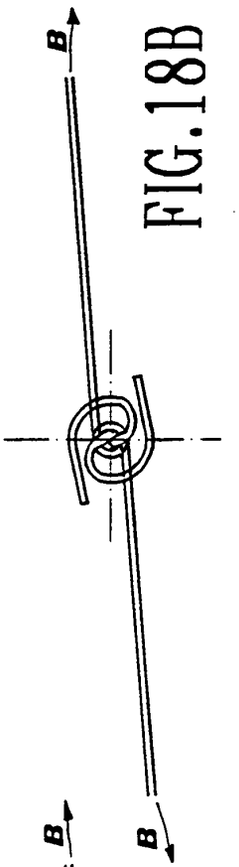


FIG.18B

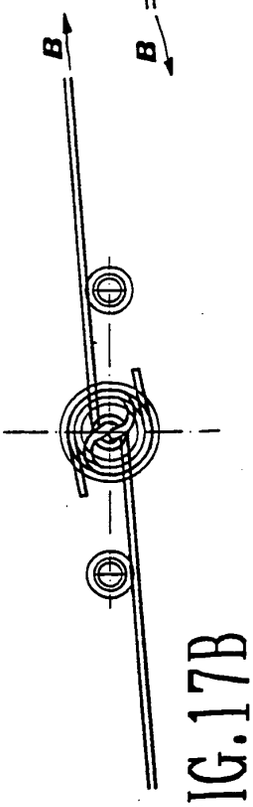


FIG.17B

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 10 0123

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 00 53497 A (SEELEN) 14 September 2000 (2000-09-14) * abstract; figure 1 *	1	B65B11/02
A		6,9	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 April 2003	Grentzius, W

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82