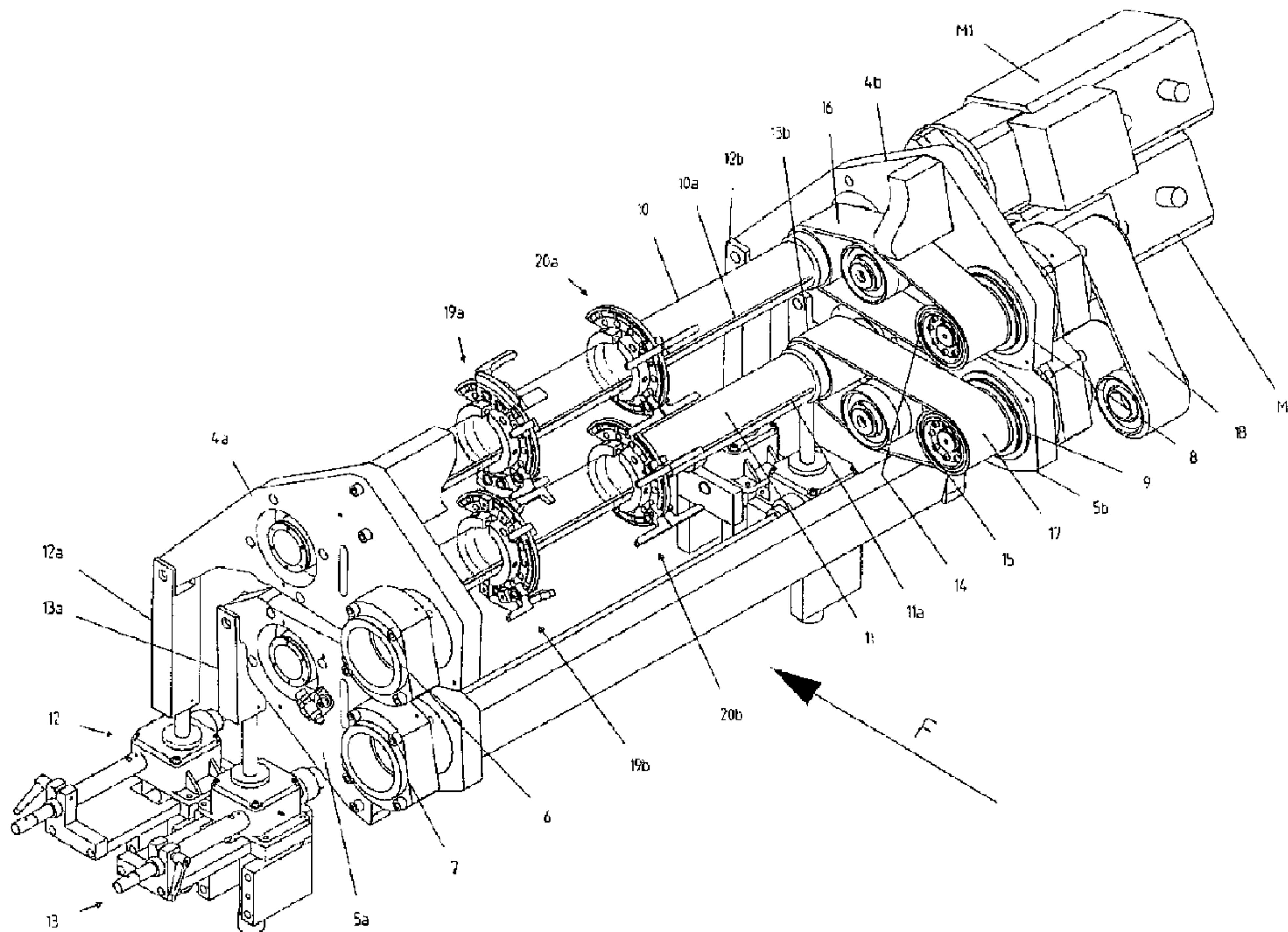




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 (72) Inventeur/Inventor:  
 LOEWENSBERG, DENIS, CH  
 (73) Propriétaire/Owner:  
 BOBST S.A., CH  
 (74) Agent: SMART & BIGGAR

(54) Titre : APPAREIL POUR BRISER LES POINTS DE CONTACT LIANT LES DEUX BORDS D'UNE LIGNE DE DECOUPAGE  
 (54) Title: DEVICE FOR BREAKING NICKS CONNECTING TWO EDGES OF A CUTTING LINE



(57) Abrégé/Abstract:

This device comprises a frame carrying means for conveying blanks along a substantially planar path and two parallel shafts (10, 11), which are mounted so as to be rotatable on opposite sides of the plane of the path and comprising tool supports (19a, 19b, 20a, 20b) for inducing a shearing between the adjacent edges of a cutting line during their displacement, in order to break nicks on the cutting line. Each parallel shaft (10, 11) comprises at least one tool support (19a, 19b, 20a, 20b) for connecting the shearing tools to the respective shafts (10, 11) and means for angularly (10a, 11a) and longitudinally positioning these tool supports (19a, 19b, 20a, 20b) on the respective shafts (10, 11).

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**ABSTRACT**

This device comprises a frame carrying means for conveying blanks along a substantially planar path and two parallel shafts (10, 11), which are mounted so as to be  
5 rotatable on opposite sides of the plane of the path and comprising tool supports (19a, 19b, 20a, 20b) for inducing a shearing between the adjacent edges of a cutting line during their displacement, in order to break nicks on the cutting line. Each parallel shaft (10, 11) comprises at least one tool  
10 support (19a, 19b, 20a, 20b) for connecting the shearing tools to the respective shafts (10, 11) and means for angularly (10a, 11a) and longitudinally positioning these tool supports (19a, 19b, 20a, 20b) on the respective shafts (10, 11).

15 (Fig.3)

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**DEVICE FOR BREAKING NICKS CONNECTING TWO**  
**EDGES OF A CUTTING LINE**

The present invention relates to a device for breaking nicks connecting two edges of a cutting line which is provided on blanks of cardboard before folding them, comprising  
5 a frame carrying means for conveying said blanks in a substantially planar path and two parallel shafts, rotatably mounted on opposite sides of the plane of said path, comprising tools for inducing a shearing between the edges adjacent to  
10 said cutting line, during their displacement, in order to break nicks.

When cutting certain cardboard blanks to be folded according to folding lines, to form boxes in particular, it is often useful or even necessary, to maintain a connection bridge  
15 between the adjacent edges of at least some cutting lines, in order to prevent the blanks clinging to one another. Generally, these bridges are point form connections between the edges of the cutting line and spaced from one another along the cutting line.

20 When introducing such blanks into a folder-gluer, these connections must be broken before performing the folding operations of the blanks.

A similar device has already been proposed, for example, in patent EP 0 680 821. This device is more  
25 particularly intended to break the fibres of cardboard which can accidentally remain in blanks from which the various panels are separated by simple cutting lines. Even if these connections are involuntary, the problem to be solved is, however, completely comparable with that evoked above.

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The solution suggested by the above-mentioned document has a plurality of disadvantages, primarily related to its lack of flexibility, the tools for inducing the shearing in order to break uncut fibres being directly formed on the rotary shafts. Therefore, to change the type of cardboard blanks requires changing of the two shafts, involving a significant disassembling operation of the device. Moreover, the swivel pins of these shafts on the frame being fixed, such a device can only be used for a same type of box, in this case cigarette packagings, so that this device is not usable to process cardboard blanks of substantially different sizes.

Another disadvantage, related to this of prior art solution, lies in the fact that the cardboard blanks must be spaced from one another at very precise spacings, or else, if the relative position of the tools and blanks varies, there will be a shift between the tools and the parts of the cardboard blanks to be worked, making it impossible to achieve the goal required and likely damaging the cardboard blanks. However, maintaining this precise spacing requires adjustment operations which are long and meticulous so that the productivity is limited, owing to the fact that the number of blanks processed per unit of length cannot be optimized.

The aim of the present invention is to meet, at least partly, the difficulties of the above-mentioned device.

To this end, this invention provides a device for breaking nicks connecting two edges of a previously cut line on a cardboard blank, the device comprising: a frame; a conveyor supported by the frame for conveying cardboard blanks along a path that is substantially planar; first and second parallel shafts rotatably mounted to the frame and disposed on both sides of the substantially planar path of the blanks; first and

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second annular tool supports respectively disposed on the first and second shafts; a mechanism operative to move the tool supports both rotatively and linearly on the first and second shafts to position the tool supports both angularly and  
5 longitudinally on the respective shafts; first and second shearing tools respectively supported on the tool supports the first and second shearing tools being configured and positionable to cut through all uncut portions of the cardboard blanks which pass between them; and a respective synchronous  
10 drive motor connected to each of the shafts for driving the shafts to rotate, and the shafts being connected to each other by a connection; one of the motors being a main motor and the other motor being controlled by the main motors, whereby the shearing tools are rotatable with the respective shafts; and a  
15 drive mechanism for rotating the shafts and the tools thereon.

The device disclosed herein allows a great flexibility of use and adaptation to cardboard blanks of sizes likely to vary in significant proportions. This new design also facilitates the adjustment of the position of the tools,  
20 thus increases productivity.

Numerous other particularities and significant advantages of this device will become evident from the following description and from the enclosed drawings which illustrate, schematically and by way of example, an embodiment  
25 of the device for breaking the nicks connecting two edges of a cutting line.

Fig. 1 is a front view of the embodiment, seen from the left side with respect to the travelling direction of the cardboard blanks;

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Fig. 1a is a front view of the embodiment, seen from the interior right side with respect to the travelling direction of the cardboard blanks;

Fig. 2 is a perspective view from the other side of  
5 the device;

Fig. 3 is a perspective view of a detail in fig. 1 showing to the actual mechanism for breaking the nicks;

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Fig. 4 is an enlarged perspective view of a detail in fig. 3;

Fig. 5 is a lateral front view from the left side of the single conveying mechanism of this embodiment;

5 Fig. 6. is a block diagram of a control of the angular position of the tools with respect to the position of the blanks upstream of the working tools.

10 Hereinafter in the description, references to the left side and the right side of the device, are relative to the travelling direction of the cardboard blanks, shown by an arrow F. The device illustrated by figs. 1-3 comprises a frame primarily formed of two vertical parts, left and right, respectively 1 and 2, maintained spaced from one another by a plurality of spacers 3.

15 Two cradles, an upper cradle 4a and a lower cradle 5a, are secured to the left part 1 of the frame and two other cradles, an upper cradle 4b and a lower cradle 5b are secured to the right part 2 of the frame. Each cradle 4a, 5a, is pivotally mounted on the left part 1 of the frame by a swivel  
20 pin 6, respectively 7. Each cradle 4b, 5b, is pivotally mounted on the right part 2 of the frame by a swivel pin 8, respectively 9. The two upper cradles 4a, 4b carry a first tool holder shaft 10, whereas the two lower cradles 5a, 5b carry a second tool holder shaft 11.

25 The two upper cradles 4a, 4b are secured to an adjusting device 12 with endless screw, acting on two rods 12a, 12b connected to the ends of the respective cradles 4a, 4b opposite to the swivel pins 6, 8 for pivoting these upper cradles 4a, 4b about these swivel pins 6, 8. Another similar

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adjusting device 13 allows to pivot the lower cradles 5a, 5b about swivel pins 7, 9, by means of two rods 13a, 13b.

Each tool holder shaft 10, 11 is fixedly attached to a synchronous drive motor M1, respectively M2. The tool holder shafts 10, 11 are kinematically connected to shafts 14, respectively 15, coaxial to the swivel pins 8, 9 of the cradles 4b, 5b, by toothed belts 16, respectively 17. The shafts 14, 15 cross the right part 2 of the frame, as can be seen in fig. 3, and extend on the two sides of this right part 2.

The external portions of the shafts 14, 15 are kinematically connected by a belt 18 toothed on its two faces, so that the angular positions of the two tool holder shafts 10, 11 are constantly synchronous. To obtain this result, one of the motors M1, M2 must be controlled by the other one. In this example it is the motor M1 which is controlled by the motor M2. The control device will be described in relation to fig. 6.

Each tool holder shaft 10, 11 is provided with a keyslot 10a, 11a for the angular positioning of supports of annular tools 19a, 19b, 20a, 20b. These tool supports are always provided in pairs and face one another, the tools of a tool support 19a fixedly attached to the upper tool holder shaft 10 co-operating with the tools of the tool support 19b fixedly attached to the lower tool holder shaft 11.

These annular tool supports 19a, 19b, 20a, 20b are illustrated on a large scale by fig. 4. Only one, 19b, will be described here in detail, insofar as they all are identical. This tool support 19b comprises a discoidal ring 21 in the form of a sector of a circle leaving an angular gap that is dimensioned to allow passage of one of the tool holder shafts 10, 11. The discoidal rings 21 of two tool supports 19a, 19b of a pair are coplanar, i.e. they are positioned to occupy the

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same axial positions along their respective tool holder shafts 10, 11.

The ring 21 is fixedly attached to a first half clamping collar 22 of a diameter corresponding to that of said tool holder shafts 10, 11, provided with an internal groove 22a cooperating with one of the keyslots 10a, 11a of the tool holder shafts 10, 11. A second half clamping collar 23 of a diameter corresponding to that of said tool holder shafts 10, 11, connected to the first half clamping collar 22 by two tightening screws 24, 25, allows axially locking of the tool support 19b along the tool holder shaft 11 by gripping this shaft between the two half clamping collars 22, 23.

The discoidal ring 21 comprises an annular positioning projection 21a, provided with a plurality of arcuate openings 26 coaxial to the discoidal ring 21. A similar annular positioning projection of the same diameter as the projection 21a (not shown) is provided on the other face of the discoidal ring 21. Various tools 27 for breaking the nicks connecting two edges of a cutting line of a cardboard blank are positioned angularly along these annular projections by positioning shoes 27a in which is provided a positioning groove 27b for engagement with the annular projection 21a.

These tools 27 are fixed along the annular projections 21a by fastening bolts 28 which extend through the positioning shoes 27a and the arcuate openings 26 so as to be engaged by nuts 29, contacting the annular projection provided on the opposite face of the ring 21.

As can be seen in fig. 4, a part of the tools 27 extends from one side of the median plane of the ring 21, whereas the other part of these tools extends from the other side of this same median plane. Therefore, the tools 27 of two

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tool supports 19a, 19b of a pair which extend from a side of this median plane and those which extend from the other side of this median plane describe two circular parallel and adjacent trajectories, since the discoidal rings 21 of the two tool  
5 supports 19a, 19b are coplanar.

It can also be observed that the peripheral edges of certain of these tools 27 describe circular trajectories of larger diameters than the peripheral edges of the other tools 27. The trajectories of smaller diameter of the peripheral  
10 edges of the tools 27 are chosen to be substantially tangent to the planar path of the blanks moved by the conveying device (which will be described hereafter) so that these tools 27 act as support of the blanks. The peripheral edges of the other  
15 tools 27, whose trajectories are of larger diameters, are adjusted to penetrate in the planar path of the cardboard blanks conveyed by the conveyor.

Therefore, when a cutting line, provided in a cardboard blank, passes between these tools 27, parallel to the median plane of the discoidal rings 21 of the tool supports  
20 19a, 19b, the two edges of the cutting line of this cardboard blank are subject to a shearing which break the nicks or bridges connecting these two edges to one another, since one tool 27, describing a circular path extending from a side of the median plane of the discoidal rings 21, cuts the planar  
25 path of the blanks, whereas the other tool 27, describing a circular parallel and adjacent path extending from the other side of this median plane, is substantially tangent to the planar path of the cardboard blanks.

The conveying mechanism which will now be described  
30 is arranged between the left 1 and right 2 parts of the frame. As the situation of this mechanism would not make it easily

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visible, it is separately represented in fig. 5 to facilitate reading of the drawing. It presents a lower part 30 and two upper parts 31a, 31b. The lower part comprises an endless conveying belt 32 guided by a plurality of rollers 33 and driven by a motor 34. A part of the rollers 33 are arranged in a plane corresponding to the conveying path of the cardboard blanks.

In the center of the conveying plane formed by rollers 33, the endless conveying belt 32 is guided by a series of rollers 33a, to form a loop 32a extending below the plane of the conveying path. This loop 32a provides a space corresponding to the requirement of the tool support 19b carried by the lower tool holder shaft 11. On fig. 5, the loop 32a is represented closed, its two ends 32b substantially meeting at the tangent point of the conveying belt 32 with the circular path of the tool support 19b.

On each side of this tangent point, the rollers 33 of the conveyor defining the lower part of the horizontal conveyor mechanism, divides symmetrically with respect to this tangent point, in three sections, a section in which the rollers 33 are mounted on a slide 35, followed by a section comprising, in this example, two rollers 33b fixedly attached to a removable support 36 and finally a section where the rollers 33 are directly mounted on the frame 37 of the conveying mechanism 30. Some guide rollers 33 of the conveying belt 32 also act as idler rollers 33c, mounted on movable supports (not shown), stressed by mechanical means (not shown) which constantly maintain the conveying belt tight. The adjustment of the opening and the closing of the loop 32a of the conveying belt 32 will be explained hereafter.

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The two upper parts 31a, 31b of the conveying mechanism are arranged in mirror symmetry with respect to the axis connecting the centers of the two tool holder shafts 19a, 19b. These two parts 31a, 31b being similar, only one of them will be described. Each part 31a, 31b presents an endless conveying belt 38a, 38b guided by rollers 39, of which a part forms a plane surface parallel and adjacent to the plane part formed by the rollers 33 of the lower part 30 of the conveyer. Apart from rollers 39 forming the plane surface, certain rollers also act as idler rollers 39c, like the rollers 33c of the lower part 30 of the conveying mechanism.

The rollers 39 forming the plane conveying parts are grouped in a plurality of bogies 40 subjected to elastic pressure means (not shown), in order to press the conveying belts 32, on the one hand, and 38a, 38b, on the other hand, one against the other. A first part of these bogies 40 are articulated around horizontal axes which are parallel to the axes of the rollers 39 on a slide 41. The following bogie is fixedly attached to a removable support 42. Finally, the following bogies 40 are fixedly attached to a fixed support 43. A photocell 44 is arranged at the input of the conveying device for detecting the front edge of each cardboard blank arriving in the device for breaking the nicks.

As soon as the front edge of a cardboard blank is detected by the cell 44, the exact distance separating this front edge from the tools 27 for breaking the nicks, between which the cardboard blank must pass, is known. This cell 44 generates a signal which is sent to a microprocessor 45 for regulation of the angular position of the tool holder shafts 19a, 19b by adjusting the speed of the drive motors M1, M2 (fig. 6).

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This angular position of the tool holder shafts 19a, 19b is constantly known owing to two pulse generators G1, G2 secured to the respective synchronous drive motors M1, M2 and transmitting their information to the microprocessor 45. Thus, 5 when the front edge of a blank is detected, the microprocessor 45 knows the angular position of the tools 27 on the tool supports 19a, 19b, 20a, 20b mounted on the tool holder shafts 10 and 11. It also knows the distance between the front edge of the blank and the line joining the axes of the tool holder 10 shafts, 10, 11. It can then determine the angular correction to be applied. The microprocessor 45 carries out this correction by calculating, starting from the data collected, an acceleration or a deceleration, as well as a duration during which this correction must be applied to the synchronous drive 15 motors M1, M2, so that tools 27 are in the desired angular position for breaking the nicks at the determined place of the cardboard blank.

The operation and the use of the described device are as follows:

20 When the device for breaking the nicks connecting two edges of a cutting line is used for a new type of cardboard blanks, the first work is to choose the tool supports 19a, 19b, 20a, 20b according to the size of the blank. The peripheral length of the tool support should correspond to the length of 25 the blank measured in its travelling direction F, to which a certain length corresponding to an average spacing between the blanks is added, the precise adjustment being performed by the microprocessor 45 (fig. 6), further to the detection of the front edge of each blank by the cell 44, as explained above.

30 Once the diameters of the tool supports are chosen, the various tools 27 are positioned angularly fixing them by

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means of nuts 29 and bolts 30. Then, the position of the cradles 4a, 4b, 5a, 5b is adjusted with respect to the horizontal path of the blanks moved by the conveyor 30, 31a, 31b, by means of adjusting devices 12, 13 (fig. 3). This  
5 adjustment allows to accurately and simultaneously adjust the depth penetration of all tools 27. This represents a saving of time since it is not necessary to adjust tool by tool.

The following operation consists in positioning and fixing the annular tool supports 19a, 19b, 20a, 20b, on the  
10 tool holder shafts 10, 11. These annular tool supports 19a, 19b, 20a, 20b, are laterally introduced owing to the angular openings of the discoidal rings 21 in the form of circular sectors, forming these tool supports. Accurate angular positioning is ensured owing to the internal groove 22a of the  
15 half clamping collar 22 which can be engaged by means of a key (not shown) in the keyslots 10a, 11a of the tool holder shafts 10, respectively 11. Then, and before tightening both half clamping collars 22, 23 by the screws 24, 25, the tool supports 19a, 19b, 20a, 20b are longitudinally positioned along the tool  
20 holder shafts 10, 11.

It can happen that the axial position of one or the other pair of tool supports 19a, 19b, 20a, 20b on the tool holder shafts 10, 11, interferes with the conveying mechanism. This problem is solved owing to the device according to the  
25 present invention, since the upper parts 31a, 31b of this conveyor can be spaced from one another to allow the passage of one of the upper tool supports 19a, 20a, whereas the loop 32a formed by the guide rollers 33a under the lower part 30 of the conveyor can open to let pass one of the lower tool supports  
30 19b, 20b.

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To carry out this modification of the conveying mechanism, it is first necessary to remove the two removable supports 36 carrying the rollers 33b, on the lower part 30 and the two removable supports 42 each carrying a bogie 40. Then, 5 by sliding motion, the slide 35 of the lower part 30, and the slides 41 of the upper parts 31a, 31b, must be spaced from one another. The idler rollers 33c thus allow to maintain the endless conveying belts 32, 38a, 38b tight. When useful information, particularly about blank sizes, is introduced into 10 the microprocessor 45, the described device is ready to operate.

It can be noted from this description that the device according to the invention can be adapted to an extremely broad range of sizes and types of cardboard blanks and that the 15 adjustment operations are simple to carry out. This device not only allows the tools 27 to be angularly and longitudinally positioned (or transversely if referred to the travelling direction F of the blanks), but also allows change of the diameters of the tool supports 19a, 19b, 20a, 20b in order to 20 adapt to blanks of different sizes. The possibility of spacing the conveying belts 32, 38a, 38b for positioning the tool supports 19a, 19b, 20a, 20b in any axial position along the tool holder shafts 10, 11 according to the location of the cutting lines on the blanks, enables operation over the entire 25 width of the blanks.

The detection of the front edges of the blanks by the cell 44 and the adjustment of the angular position of the tools 27 by the microprocessor 45 allow a greater flexibility and a saving of the time required for the adjustment, since the 30 spacing between the blanks can vary. The angular adjustment of the tools 27 according to variable spacings of the cardboard

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blanks leads to a productivity gain, since the number of blanks processed per unit of length by the device according to the present invention can be increased.

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CLAIMS:

1. A device for breaking nicks connecting two edges of a previously cut line on a cardboard blank, the device comprising:

5 a frame;

a conveyor supported by the frame for conveying cardboard blanks along a path that is substantially planar;

10 first and second parallel shafts rotatably mounted to the frame and disposed on both sides of the substantially planar path of the blanks;

first and second annular tool supports respectively disposed on the first and second shafts;

15 a mechanism operative to move the tool supports both rotatively and linearly on the first and second shafts to position the tool supports both angularly and longitudinally on the respective shafts;

20 first and second shearing tools respectively supported on the tool supports the first and second shearing tools being configured and positionable to cut through all uncut portions of the cardboard blanks which pass between them; and

25 a respective synchronous drive motor connected to each of the shafts for driving the shafts to rotate, and the shafts being connected to each other by a connection; one of the motors being a main motor and the other motor being controlled by the main motors,

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whereby the shearing tools are rotatable with the respective shafts; and a drive mechanism for rotating the shafts and the tools thereon.

2. The device of claim 1, wherein each of the tool  
5 supports includes an annular positioning projection for positioning the tool support on the respective shaft.

3. The device of claim 1, wherein each of the tool supports comprises:

10 a discoidal ring in the form of a sector of a circle and having an angular opening through the ring for passage therethrough of a respective one of the shafts for enabling each tool support to be mounted on the respective shaft;

15 a first half clamping collar having a diameter corresponding to the diameter of the tool head of the shaft and being fixedly attached to each of the discoidal rings;

a second half clamping collar having the same diameter as the first half clamping collar; and

a closing mechanism for tightening the first and second half clamping collars together.

20 4. The device of claim 1, further comprising: first and second cradles spaced apart along the length of and supporting the first shaft; and third and fourth cradles spaced apart along the length of and supporting the second shaft, the cradles being connected to the frame for connecting the shafts  
25 of the frame; each cradle being pivotally mounted on the frame around an axis parallel to the shafts, so that the cradles and the shafts thereby supported can occupy a selected one of a plurality of pivot positions with respect to the planar path of

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the cardboard blanks, and enabling the parallel shafts to receive annular tool supports of differing diameters.

5.           The device of claim 4, wherein the tool supports each have a diameter corresponding to a multiple length of the  
5 cardboard blanks that are conveyed along the conveyor in the travel direction on the path of the blanks through the device plus a predetermined spacing between successive cardboard blanks moving along the conveyor.

6.           The device of claim 1, further comprising:

10           a detector for detecting the passage of a leading front end of a cardboard blank as it passes a predetermined point along the path of the blank; and

              a speed controller for the main motor responsive to detection of the front edge of the blank so that the angular  
15 rotative position of the tools supported will coincide with the position of the nicks on the blank to be broken.

7.           The device of claim 1, wherein the conveyor for the blanks comprises:

              upper belts above the blanks and lower belts below  
20 the blanks, the belts being moveable for conveying the belts in a conveying direction;

              the conveyor belts above and below the blanks being divided in two with the parts of the belts being on both sides of a plane defined by a respective axis of rotation of each of  
25 the two holder shafts; and

              respective supports for each part of the conveyor belt located at each side of and adjacent to the plane through the holder shaft axes; the respective supports for each part of

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the conveyor belts being movable parallel to the path of the blanks to allow spacing of each of the conveyor belt parts to be adjusted adjacent to the plane through the axes of rotation of the shafts and thereby enabling positioning of the tool supports between the conveyor belt parts.

8. The device of claim 1, wherein the shafts are connected to rotate synchronously and further including a motor for driving the shafts.

9. The device of claim 1, wherein each of the tool supports comprises a discoidal ring in the form of a sector of a circle and having an angular opening through the ring for passage therethrough of a respective one of the shafts for enabling each respective tool support to be mounted on the shaft.

10. The device of claim 1, wherein the tool supports are constructed and configured to support the respective first and second shearing tools at a fixed separation distance from each other, independent of the angular positions of the tool supports relative to the shafts on which they are supported.

SMART &amp; BIGGAR

OTTAWA, CANADA

PATENT AGENTS

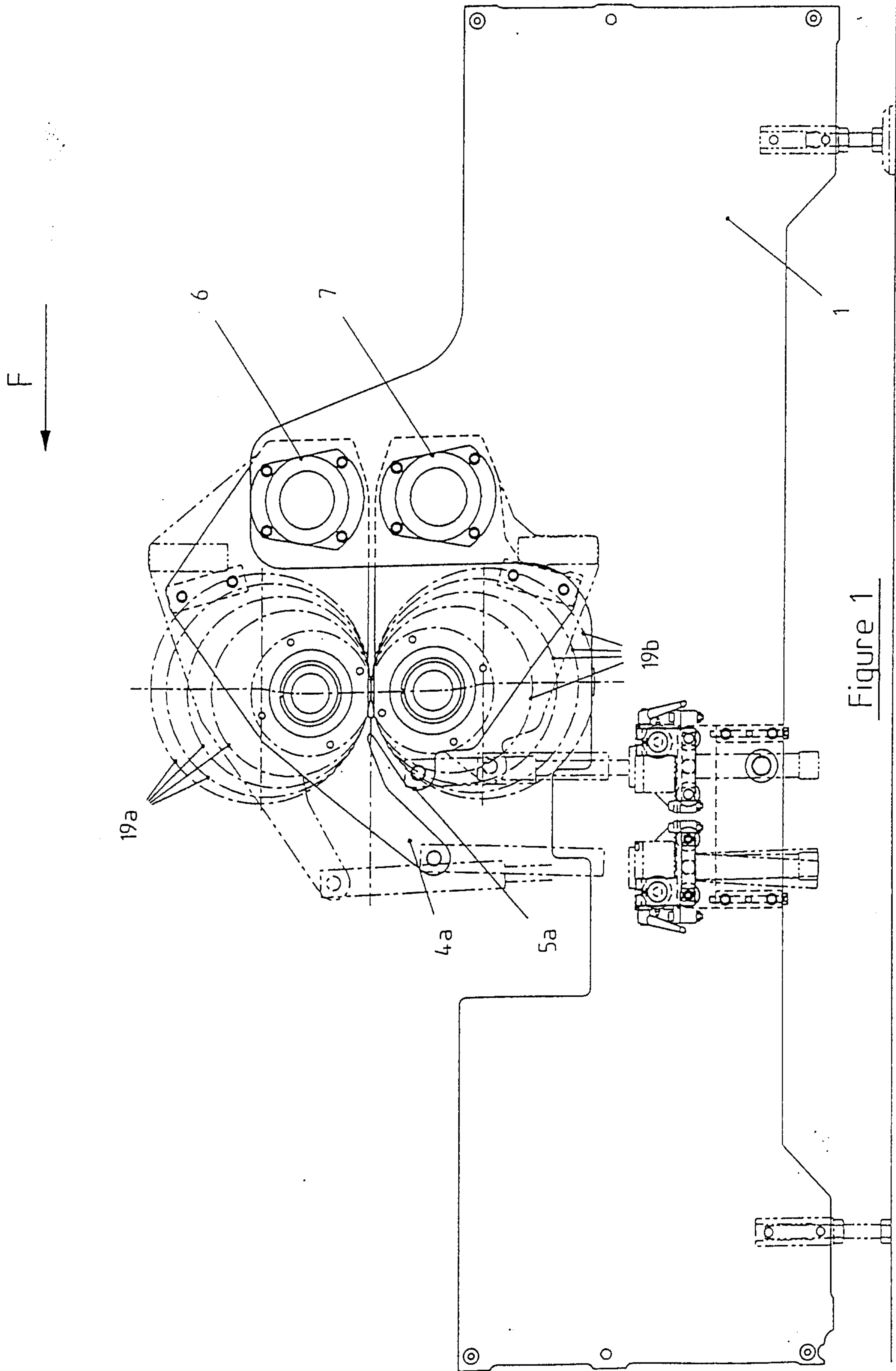


Figure 1

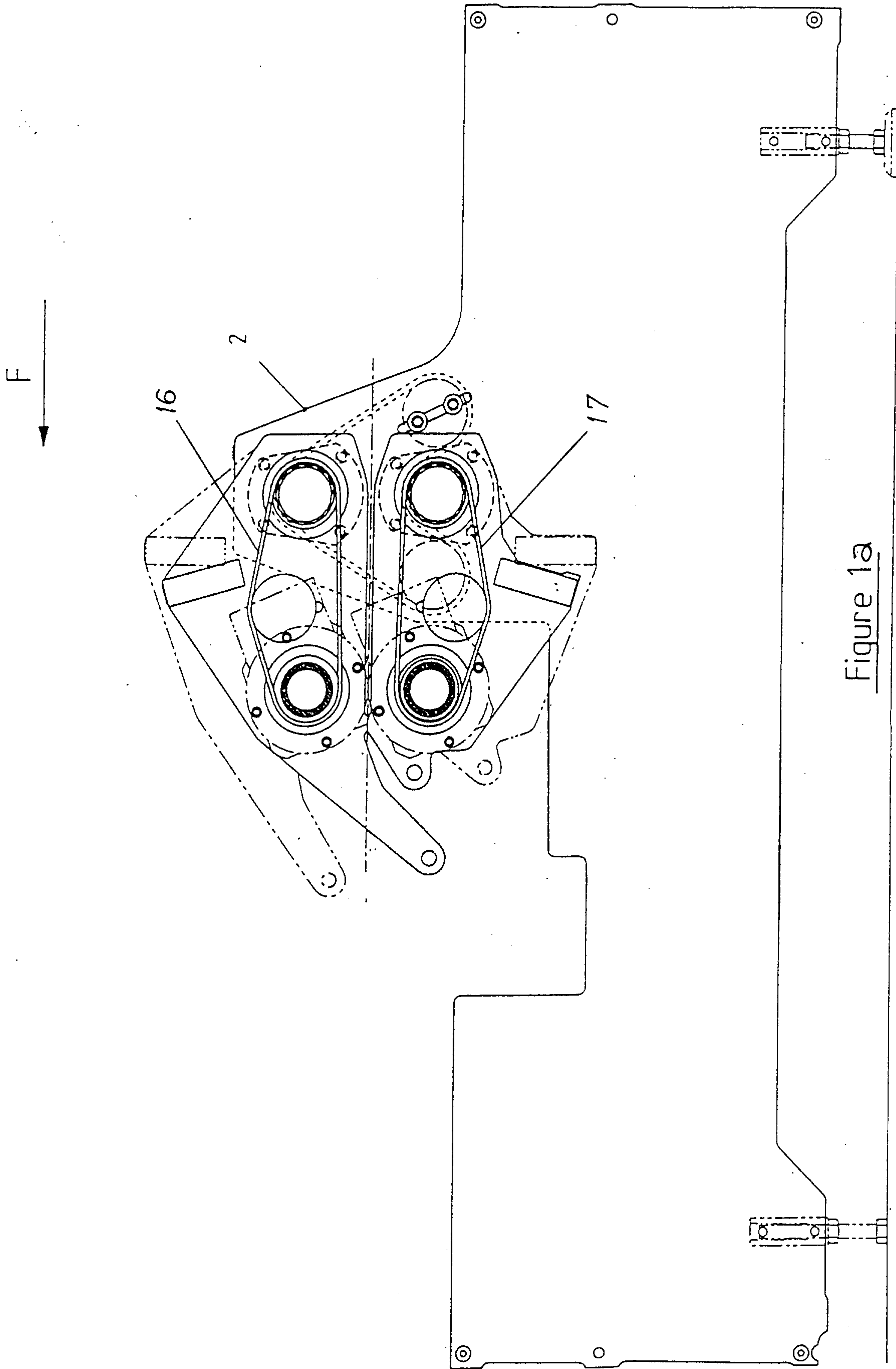
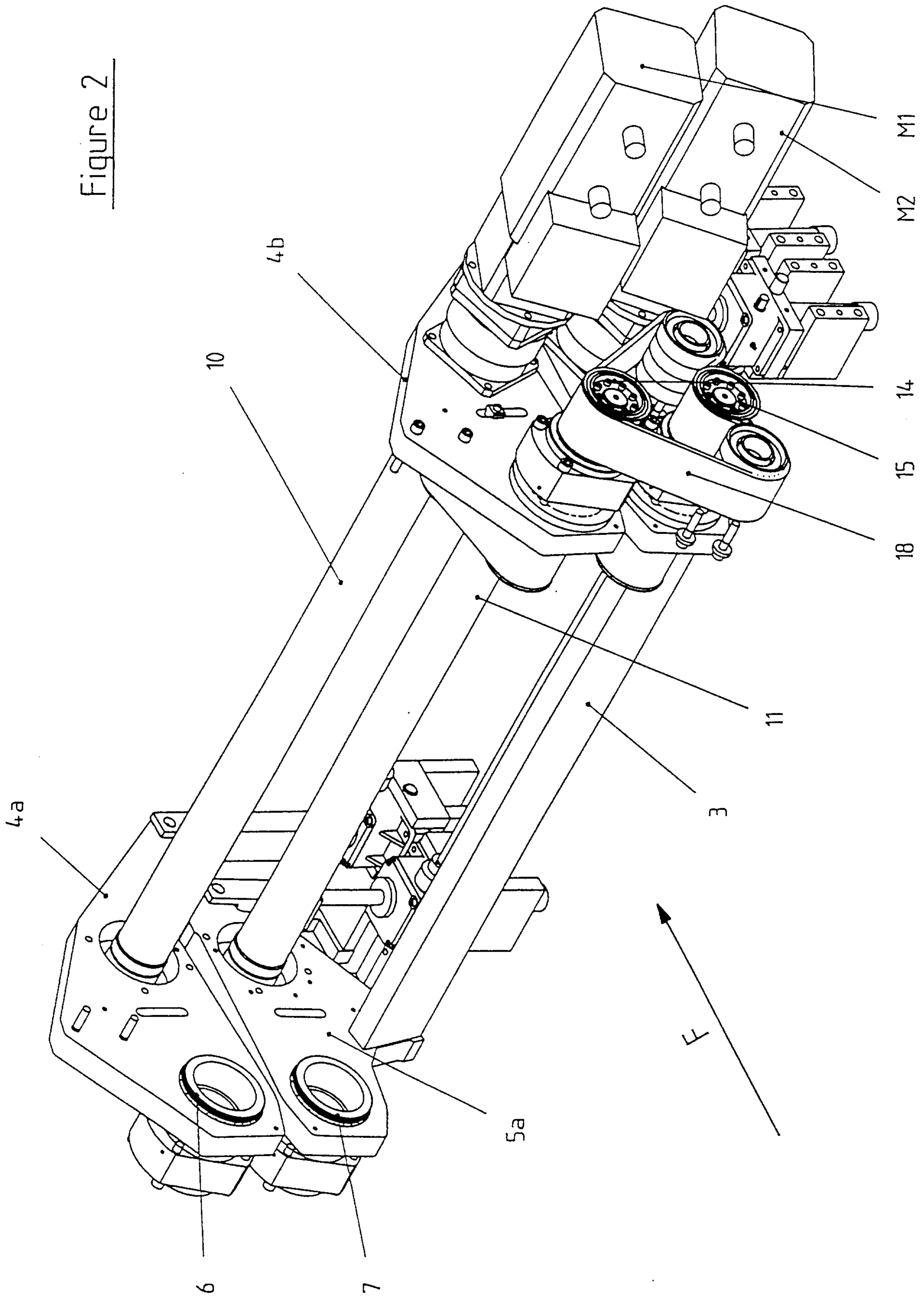


Figure 1a

Figure 2



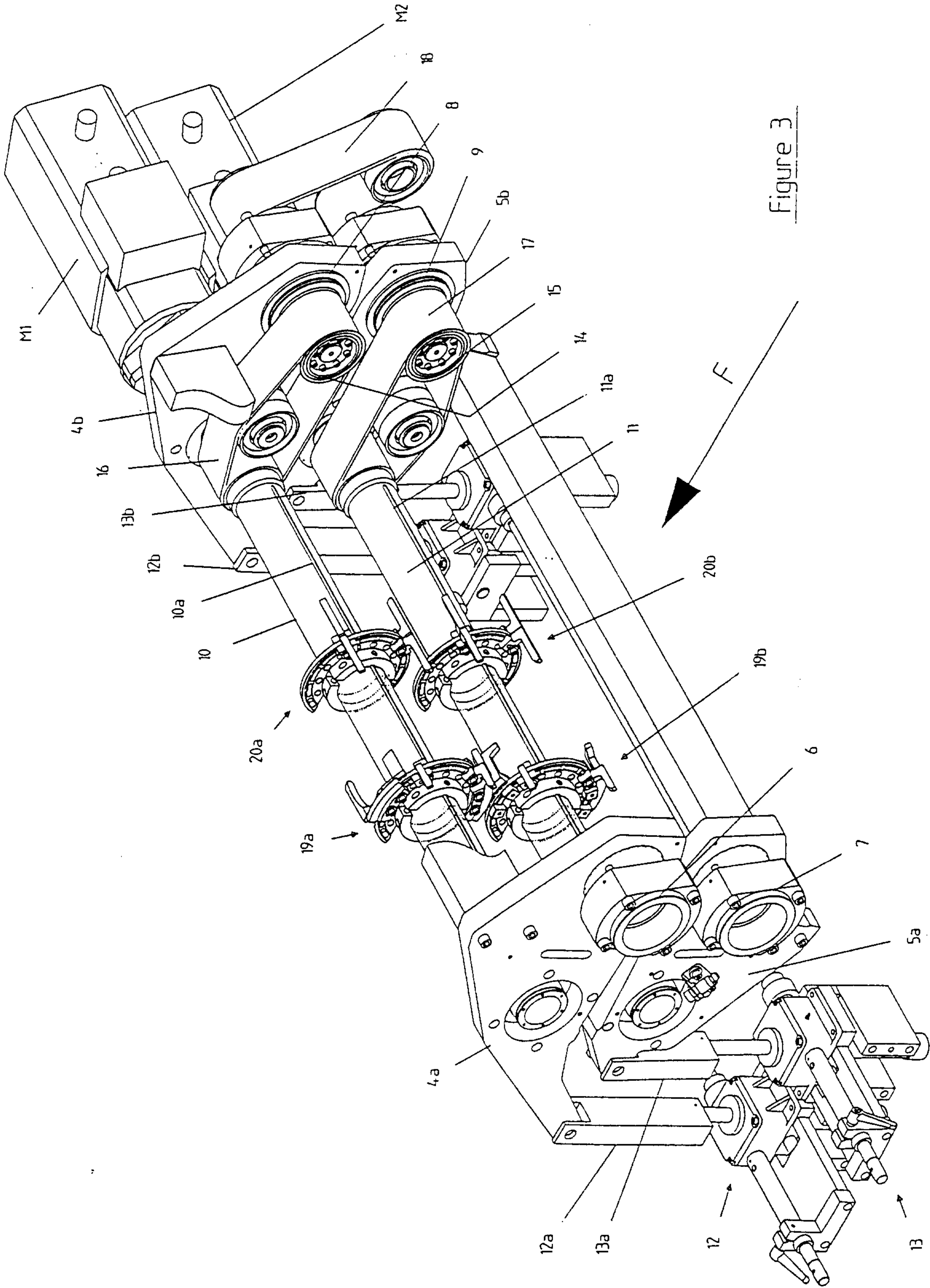


Figure 3

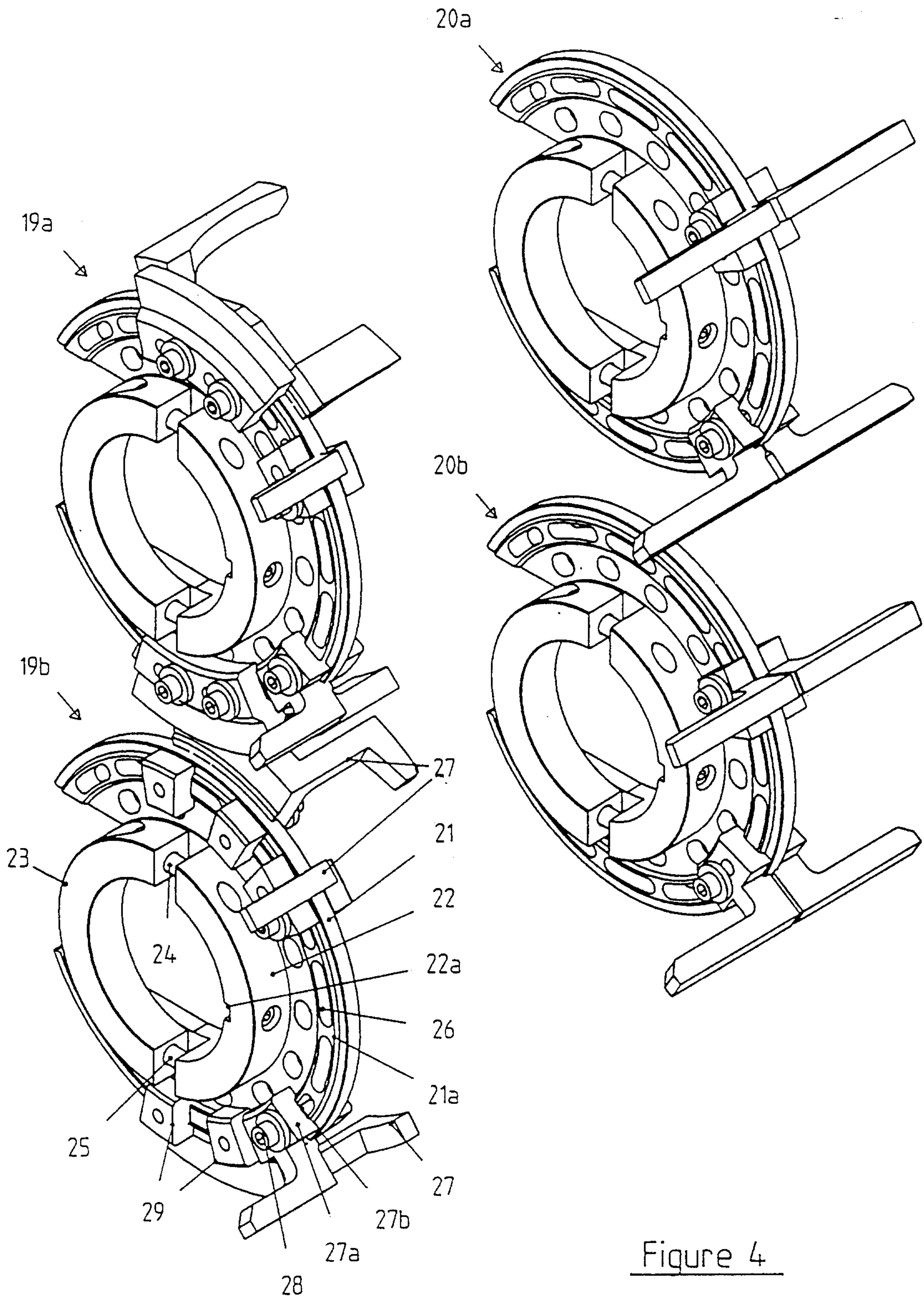


Figure 4

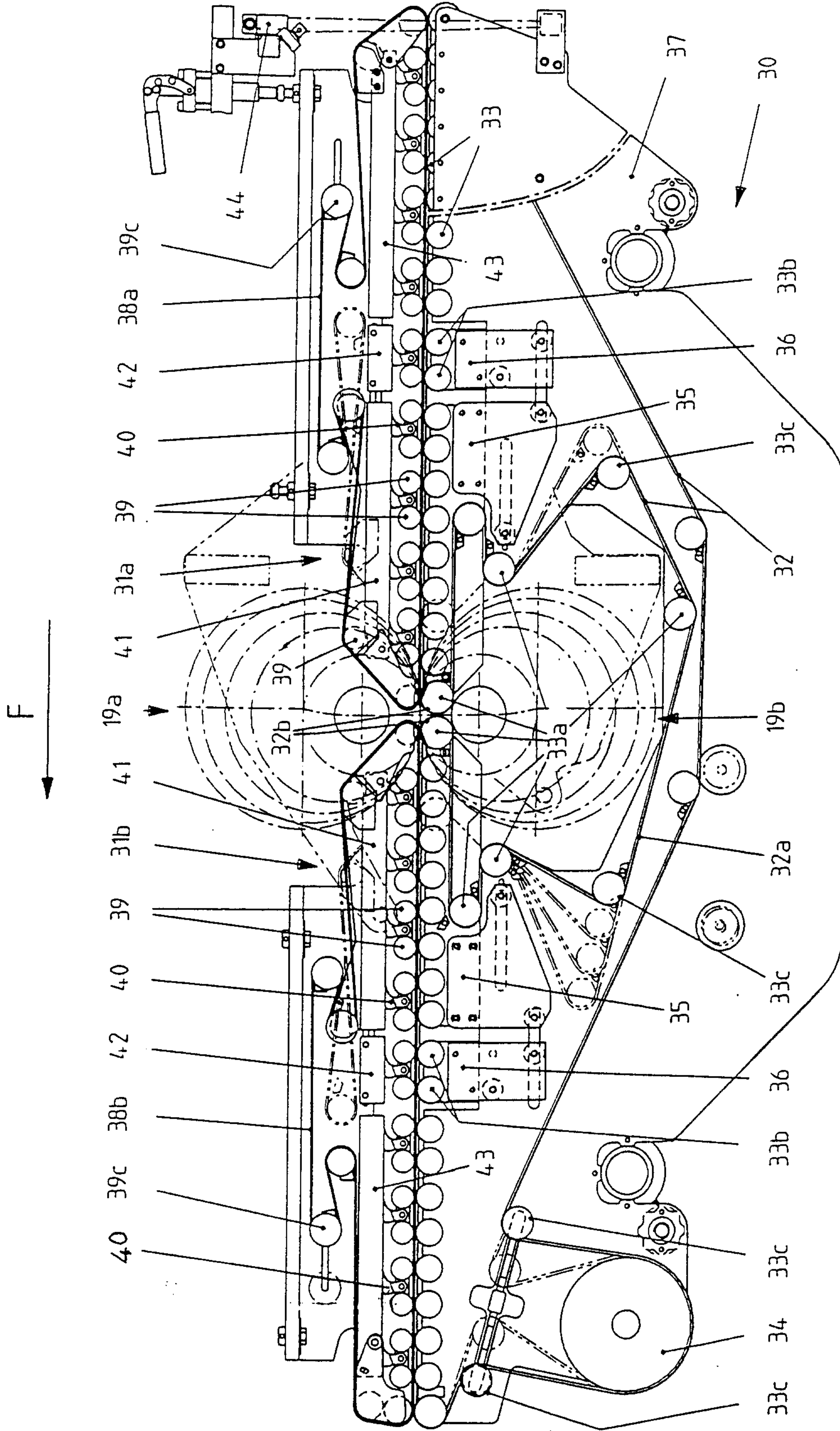


Figure 5

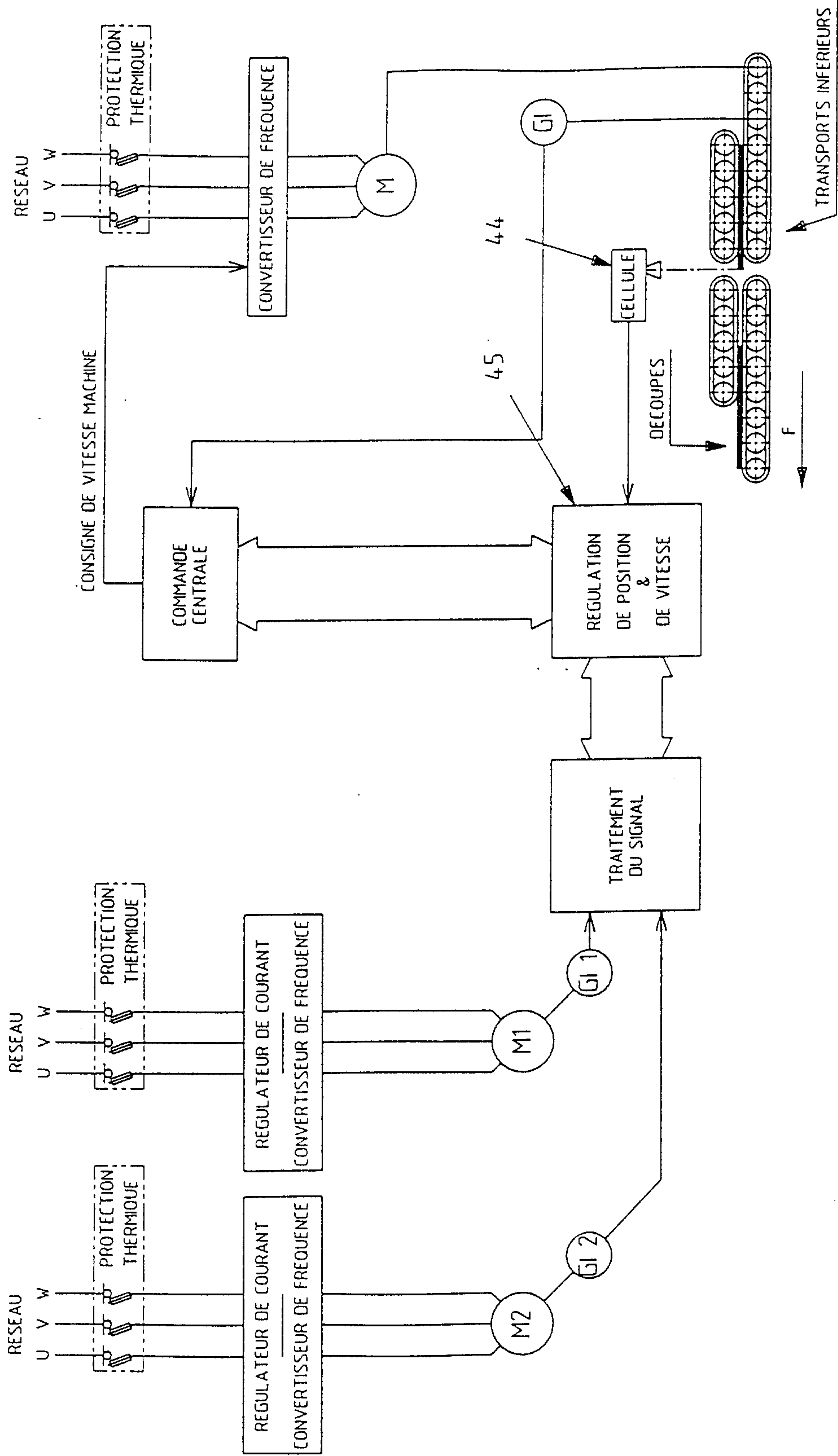


Figure 6

