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(11)

EP 1 580 127 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.09.2005 Bulletin 2005/39

(51) Int Cl.7: **B65B 9/13**

(21) Application number: **05425163.2**

(22) Date of filing: **23.03.2005**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL BA HR LV MK YU

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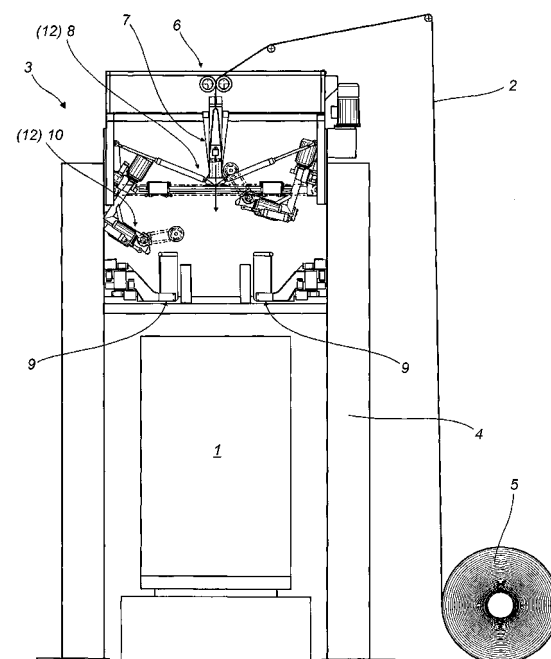
(30) Priority: **26.03.2004 IT BO20040173**

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(54) **Apparatus for covering groups of products with tubular stretch film**

(57) An apparatus for covering groups (1) of products with tubular stretch film (2) comprises: a frame (4) inside which the group (1) of products is placed; a roll (5) of stretch film (2) controlled by film (2) feed means (6) located at the top of the frame (4); a unit (7) for spreading open the pleated sides (2a) of the film (2); means (8) for gripping and opening the mouth of the film (2), located under the spreading unit (7); a stretching unit (9) which receives the film (2) from the gripping means (8) in the spread open configuration and stretches it to a size larger than the perimeter of the product group (1); means (10) for folding the film (2) in concertina fashion in such a way as to gather up a quantity of film (2) sufficient to cover the product group (1), these means acting by pressure against the stretching unit (9); the means (8) for gripping and opening the film (2) and the means (10) for folding the film in concertina fashion are made as a single unit (12) operating between the spreading unit (7) and the stretching unit (9).

FIG. 1



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Description

[0001] The present invention relates to an apparatus for covering groups of products with tubular stretch film.

[0002] Prior technology for wrapping groups of products, including palletised loads, teaches the use of machinery, known in the trade as "hood stretch machines" which cover the products with a "hood", that is to say, a tubular length of film closed at the top end to form a sleeve-like covering that is stretched over the stacked products and allowed to return to its original size, thanks to the elastic properties of the film, in such a way as to tightly hold the products together.

[0003] This type of covering is used, for example, to protect stacked products comprising sacks of loose material such as cement, flour or grain and is applied by machinery typically consisting of:

- a main portal frame structure inside which the palletised group of products is placed and which mounts a plurality of units for handling and forming the stretch film;
- a roll of tubular stretch film whose longitudinal edges are pleated to form an initially flat configuration, said roll being positioned on the side of the frame and being controlled by film feed means located at the top of the frame itself;
- a unit, located in the vicinity of the top end of the frame, for spreading open the flattened film tube;
- a unit for opening the mouth of the film to at least form a cross section corresponding to the cross section, usually quadrangular, of the group of products located under the spreading unit;
- a film stretching unit to which the film is fed in the spread open configuration and which is designed to stretch the film to a size larger than the perimeter of the palletised group of products;
- means for "pleating" or folding the film in concertina fashion in such a way as to gather up a quantity of film at least corresponding to the height of the palletised group of products; these means acting by pressure against the stretching unit prior to the stretching of the film;
- a unit, operating at the top end of the frame, for sealing and separating the film portion to be used from the rest of the film in such a way as to form a sleeve-like cover.

[0004] The stretching unit is also equipped with drive means that move the unit down along the frame in such a way as to draw the film over the products, allowing it to gradually release the concertina folds until the film reaches the base of the products at the pallet. Here the film is released completely so that it covers all the products and, if necessary, also the pallet.

[0005] Over time, many parts of this general machine structure have developed according to different constructional philosophies.

[0006] Several of the units relevant to these specifications are described below.

[0007] In particular, the spreading unit usually works in close cooperation with the film opening unit, such as, for example, in the solution described in US patent 3,925,964 where a fixed, wedge-shaped element starts spreading the sides of the film tube apart and directs the tube towards a double pair of inclined conveyor belts that fully open and stretch the film tube and then place it on at least four arms that constitute the unit for stretching and vertically moving the film.

[0008] Another solution is described in patent GB 1,274,576 where the film tube in an initially flattened form is spread apart by suction devices so that it is open when it reaches the stretching unit.

[0009] In yet another solution, described for example in patent DE 4326872, the film tube is spread apart by the combined action of suction devices, which start pulling the corners of the tube apart from the outside, and mechanical grippers, located on both sides of each suction device, which grip the corners of the film tube and feed it to the stretching unit below.

[0010] The stretching unit usually consists of four substantially L-shaped arms positioned diagonally on the frame in such a way as to enable the related vertical portion to keep the corner of the film mouth open.

[0011] The horizontal portion of each arm may comprise:

- translational drive means for stretching the film by pulling it in a horizontal direction; and
- the aforementioned vertical drive means for movement along the frame, usually associated with the free end of the arm.

[0012] In some prior art arrangements, the concertina folding means are applied directly to each arm (see patents US 3,902,303 and FR 2.234.509). This unit consists of a power-driven wheel or track which, when the film reaches the vertical portion of the arm, is brought into contact with the film and gathers the latter up in concertina fashion. After making the concertina folds, the wheel or track may be moved away from the film or it may also be used to guide the film downwardly along the sides of the product group.

[0013] In yet another solution (see patents DE 3918311 and DE 3908957), independent power-driven rollers mounted on arms pivoted to the frame are used. The arms move the rollers against the vertical portion of the arms in such a way as to make the concertina folds.

[0014] Yet another, different arrangement is disclosed in patent applications WO 01/83301 and WO 02/058997 where the concertina folds are made on a specially designed frame placed over the stretching arms and consisting of respective second arms for retaining the film after it has been opened out but before being stretched.

[0015] The frame mounts power-driven rollers for concertina folding the film by pushing it against the sec-

ond arms or into contact with an idle roller connected to the second arms.

[0016] All the above arrangements for opening and concertina folding the tubular film have disadvantages, however.

[0017] The arrangements for opening the film with suction devices or pairs of belts have shown lack of precision in gripping the film and drawing it over the products. In many cases this lack of precision is due to the type of film used and the properties of the film (for example static electricity making it difficult to grip and feed the film).

[0018] The arrangement that combines suction devices and grippers is more effective than the previous arrangements, although the suction devices may, for the same reasons, still present problems initially positioning the corners of the film close to the grippers. In addition to that, the cost of the unit is much higher than in the previous arrangements.

[0019] As regards the units for concertina folding and stretching the film, on the other hand, the arrangements described above are extremely complex and expensive since the four stretching arms have to be combined with power-driven roller units. These additional units may be built into, or separate from, the stretching arms. This involves a higher number of intermediate mechanisms to make the concertina folds which significantly reduce productivity and increase the production costs and the overall dimensions of the apparatus as a whole. Dividing the frame into two parts to enable the concertina folds to be made outside the frame, although it improves productivity, increases the overall dimensions of the apparatus and further raises production costs.

[0020] The aim of this invention is to overcome the above mentioned disadvantages by providing a reliable and efficient apparatus for covering groups of products with tubular stretch film capable of precisely gripping and concertina folding the film with a limited number of operating units, thereby reducing the overall dimensions and production costs.

[0021] According to the invention, this aim is achieved by an apparatus for covering groups of products with tubular stretch film, comprising: a frame inside which the group of products is placed; a roll of stretch film controlled by film feed means located at the top of the frame; a unit for spreading open the pleated sides of the film; means for gripping and opening the mouth of the film, located under the spreading unit; a stretching unit which receives the film from the gripping means in the spread open configuration and stretches it to a size larger than the perimeter of the product group; means for folding the film in concertina fashion in such a way as to gather up a quantity of film sufficient to cover the product group, these means acting by pressure against the stretching unit; the means for gripping and opening the film and the means for folding the film in concertina fashion are made as a single unit operating between the spreading unit and the stretching unit.

[0022] The technical characteristics of the invention, with reference to the above objects, are clearly described in the claims below and its advantages are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate a preferred embodiment of the invention provided merely by way of example without restricting the scope of the inventive concept, and in which:

- 10 - Figure 1 is a schematic front view, with some parts cut away to better illustrate others, of an apparatus according to the present invention for covering groups of products with tubular stretch film;
- 15 - Figure 2 is a schematic side view with some parts cut away to better illustrate others of an upper section of the apparatus illustrated in Figure 1;
- Figure 3 is a scaled-up front view, with some parts cut away to better illustrate others, of an upper section of the apparatus of Figure 1;
- 20 - Figure 4 is a scaled-up, schematic top plan view, with some parts in cross-section and others cut away, of a detail from Figure 3;
- Figure 5 is a top plan view of another detail from Figure 3 with some parts in cross section and others cut away;
- 25 - Figure 6 is a schematic side view, with some parts cut away, of a constructional element of the apparatus shown in Figure 2;
- Figure 7 is a scaled-up front view of a detail from Figure 6;
- 30 - Figure 8 is a front view from Figure 3, with some parts cut away to better illustrate others, of an operating unit of the apparatus in a first working configuration;
- 35 - Figures 9 and 10 schematically illustrate a first step of feeding the tubular film in a side view and in a top plan view, respectively;
- Figures 11 and 12 schematically illustrate a second step of opening the mouth of the tubular film in a side view and in a top plan view, respectively;
- 40 - Figures 13 and 14 schematically illustrate, in a side view and in a top plan view, respectively, a third step in which the edges of the tubular film are gripped by a film gripping/opening and concertina folding unit;
- 45 - Figures 15 and 16 schematically illustrate, in a side view and in a top plan view, respectively, a fourth step in which the tubular film is unwound, opened and positioned on a stretching unit by the film gripping/opening and concertina folding unit;
- 50 - Figures 17 and 18 schematically illustrate, in a side view and in a top plan view, respectively, a fifth step in which the film is concertina folded on the stretching unit by the film gripping/opening and concertina folding unit;
- 55 - Figure 19 is a front view, with some parts cut away to better illustrate others, of an operating unit of the apparatus of Figure 3 in a second working configuration.

[0023] With reference to the accompanying drawings, in particular Figures 1 to 3, the apparatus according to the invention, labelled 3 in its entirety, is used to cover with tubular stretch film 2 one or more products forming product groups 1.

[0024] Hereinafter, the term product group 1 will be used, without thereby limiting the scope of the inventive concept, to denote any entity consisting of a single product or two or more stacked products to be wrapped and sealed by the tubular film.

[0025] In particular, but without restricting the scope of the invention, the apparatus is used for groups 1 of products stacked on a pallet.

[0026] The apparatus 3 according to the invention is of the type essentially comprising the following elements of particular relevance to this specification:

- a frame 4 within which the palletised product group 1 is positioned;
- at least one roll 5 of tubular stretch film 2 whose sides are pleated (as shown in Figure 10) to form an initially flattened configuration and which is controlled by film 2 feed means 6 located at the top of the frame 4;
- a unit 7, also located near the top end of the frame 4, for spreading open the pleated sides 2a of the film 2 fed in a vertical direction V (see also Figure 9);
- means 8, located under the spreading unit 7, for gripping and opening the mouth of the film 2 to at least form a quadrangular cross section;
- a film 2 stretching unit 9 which receives the film 2 from the gripping means 8 in the spread open configuration and stretches it to a size larger than the perimeter of the product group 1;
- means 10 for "pleating" or folding the film 2 in concertina fashion in such a way as to gather up a quantity of film 2 at least sufficient to cover the product group 1, these means acting by pressure against the stretching unit 9 before the film is stretched.

[0027] The drawings of the preferred embodiment also partly illustrate a unit 11 for sealing the top of the unwound portion of film 2, to form a sleeve-like cover, and separating it from the rest of the film 2; the unit 11 being located at the top end of the frame 4.

[0028] Again with reference to Figures 1 to 3, in the apparatus 3, the means 8 for gripping and opening the film 2 and the means 10 for concertina folding the film 2 are made as a single unit 12 mounted on the frame 4 and operating between the spreading unit 7 and the stretching unit 9.

[0029] Looking more closely at the constructional details, the frame 4, preferably, but without restricting the scope of the invention, has a portal structure that enables it to support at its upper end a part of the feed means 6 which, in the embodiment illustrated in Figures 1 and 3, comprise rubber coated rollers 6a for transporting the film 2 along the vertical of the frame 4 in the di-

rection V. Figures 1, 8, 19 and from 15 to 18 schematically illustrate the stretching unit 9, which is of known type and comprises four arms 9a, 9b, each consisting of a first, substantially vertical section 13 for receiving the film 2 and a second section 14 by which each arm 9a, 9b, is connected to the frame 4, the arms also being able to run in both directions along a vertical axis Z of the frame 4.

[0030] The gripping/opening and concertina folding unit 12 in turn comprises four gripping roller units 15 mounted on respective arms 16 pivoted at their free ends to the frame 4 and equipped with respective first synchronised drive means 17 (described in more detail below).

[0031] The arms 16 are arranged in adjacent operating pairs on opposite sides of the product group 1 to be covered.

[0032] As illustrated in Figures 3, 4 and 5, each gripping roller unit 15 comprises two opposite rollers 18, 19 keyed to a shaft 20 on which they are rotatably mounted.

[0033] Each of these pairs of rollers 18, 19 is acted upon by sliding actuator means 21 for moving the rollers 18, 19 relative to each other between a first end position in which the rollers 18, 19 are apart (illustrated by the continuous line in Figures 4 and 5), and a second end position in which the rollers 18, 19 are in contact with each other in such a way as to grip an end edge 2b of the film 2 (see dashed line and arrow F18 in Figure 5).

[0034] As shown in Figures 3, 8 and 19, each of the arms 16 that supports a gripping roller unit 15 comprises a first L-shaped rigid section 16a pivoted at a free end of it to a carriage 22 that is slidably mounted on the frame 4. The above mentioned drive means 17 are located at the first section 16a and operate between the carriage 22 and the arm 16 in such a way as to turn the latter about the respective pivot point A and B between a first raised position in the vicinity of the spreading unit 7 and a lowered position in the vicinity of the stretching unit 9 (these two positions being indicated by arrows F17 in Figures 8 and 19, respectively).

[0035] Each arm 16 is also equipped with second, horizontal drive means 23 for translationally moving each arm 16 along the frame 4 towards and away from the other arm 16 constituting the aforementioned adjacent operating pair of arms 16 (see arrows F23, Figure 2).

[0036] As illustrated in Figures 5, 8 and 19, the end of each first section 16a of each arm 16 opposite the end pivoted to the carriage 22 is linked to a second, movable section 16b equipped, at its other end, with the above mentioned pair of rollers 18, 19. Between the first and the second section 16a and 16b there are third drive means 24 acting in conjunction with the first drive means 17 in order to permit a further rotation of the second section 16b relative to the first section 16a, between at least one first raised end position in which the pair of rollers 18 and 19 is close to the spreading unit 7 so as to grip the respective free end 2b of the film 2 (see Figure 8

again), and a second, lowered end position in which the pair of rollers 18 and 19 is close to the stretching unit 9 so as to release and concertina fold the film 2 (see arrows F24, Figure 19).

[0037] As shown in Figure 5, each second section 16b of each arm 16 is also equipped with motorising means 25 acting on the pair of rollers 18 and 19 to simultaneously rotate the rollers 18 and 19 in such a way as to concertina fold the film 2.

[0038] By way of example, the motorising means 25 may consist of a gear motor connected, through a kinematic chain 26, to a pinion 27 which is keyed to the shaft 20 that mounts the rollers 18 and 19 and which is designed to permit the rotation of the rollers 18, 19 while they are apart in such a way as to gather up the film 2 by concertina folding it against the respective first section 13 of each arm 9a, 9b.

[0039] The aforementioned sliding roller 18 must be linked to a pin 28 that slides axially inside the hollow mounting shaft 20 connected to the relative sliding actuating means 21, consisting (for example) of a pneumatic actuator, in such a way as to move the sliding roller 18 towards and away from the fixed roller 19.

[0040] Since the mobile roller 18 must slide longitudinally and rotate about its own axis, the roller 18 itself may be connected to the pin 28 through a slot 29 made in the hollow shaft 20 and whose length defines the distance travelled to come into contact with the fixed, opposite roller 19: thus, the roller 18 is always linked to the shaft 20 to permit the rotational concertina folding action.

[0041] The second section 16b of each arm 16 may be equipped with means 39 (for example, proximity sensors, illustrated schematically as a block) for detecting the contact between each pair of rollers 18 and 19 and the respective first vertical section 13 of the stretching unit 9 so as to grip the film 2 securely between the rollers 18 and 19 and the first section 13.

[0042] In a preferred, non-restricting embodiment, the first drive means 17 of each first L-shaped section 16a may comprise a twin lever system (see Figures 8 and 19) with levers 40 and 41 pivoted, respectively, at A and B, to the aforementioned pairs of arms 16, and joined to each other at diagonally opposite ends by a first tie rod 42.

[0043] The end of one of the levers 40 and 41 is pivoted to a second tie rod 43 connected to a motor 44 causing the levers 40 and 41 to rotate in such a way as to permit the relative coordinated rotation of the first sections 16a from the raised position to the lowered position and vice versa.

[0044] The second drive means 23 for actuating each arm 16 may comprise the aforementioned power-driven carriage 22 that runs in a respective supporting guide 45 made on the frame 4 in such a way as to enable the pairs of arms 16 to move towards and away from each other.

[0045] Also in preferred constructional arrangements,

the third drive means 24 for actuating the second section 16b of each arm 16 may comprise a cylinder 46 which is connected, at one end, to the first section 16a, and whose piston stem 46a is linked to the second section 16b in such a way as to enable the latter to rotate from the first, raised end position to the second, lowered end position and vice versa.

[0046] Each roller 18 and 19 has an enlarged, cylindrical outer portion 47 designed to enable the free ends 2b of the film 2 to be gripped and a flat front surface 48 designed to hold the film 2 against the respective stretching arm 9a and 9b in such a way as to gather the film up on the arm 9a, 9b itself when the rollers 18 and 19 move apart and turn.

[0047] The spreading unit 7 acts in conjunction with the unit 12 just described.

[0048] The unit 7 (see Figures 2, 3, 6 and 7) may comprise a pair of vertical walls 30 and 31 positioned under the aforementioned film 2 feed means 6.

[0049] Each of the vertical walls 30 and 31 is shaped, in vertical cross section, like an upturned V at least at its lower end so that it can spread open at least the free end portions 2b of the tubular film 2 as it is unwound in a vertical direction.

[0050] Each wall 30 and 31, as also schematically illustrated in Figures 4 and 12, is divided into two halves joined at the top and having the shape, in cross section, of opposing pentagons separated centrally.

[0051] As illustrated in Figures 6 and 7, each of the walls 30 and 31 also has, at its lower end, guide means 32 acting on the ends 2b of the film 2 in such a way as to deflect the ends 2b outwardly with respect to the respective vertical wall 30, 31, thereby forming grip areas for the rollers 18 and 19, located in the vicinity of the guide means 32.

[0052] The guide means 32 may comprise a pair of opposite levers 33 and 34 for the lower ends of each vertical wall 30 and 31.

[0053] These two levers 33 and 34 are linked to and driven by an actuating cylinder 35 in such a way as to move between a retracted idle position, in which the levers 33 and 34 are within the area defined by the respective vertical wall 30 and 31 (see continuous line in Figure 7), and an advanced working position in which the levers 33 and 34 are turned in opposite directions outside the area defined by the respective vertical wall 30 and 31 (see dashed line and arrows F35 in Figure 7) in such a way as to fold the edges 2b of the film 2 outwardly for the rollers 18 and 19.

[0054] In practice, the two levers 33 and 34 are connected and driven by the actuating cylinder 35 which turns them about two parallel axes in opposite directions towards the outside of the respective vertical wall 30, 31 so as to fold the edges 2b of the film 2 outwards so they can be gripped by the rollers 18 and 19.

[0055] In addition to this structure formed by the vertical walls 30 and 31, there may be provided, on both sides of each vertical wall 30 and 31, a rod 37 for coming

into contact with the film 2 unwound and extending in a direction parallel with the walls 30 and 31 to a point in the vicinity of the lower ends of the vertical walls 30 and 31 themselves.

[0056] Each rod 37 may be connected at one end to the respective wall 30 and 31 and is inclined towards the surface of the wall 30, 31 itself in such a way as to define, with its free end, a contact for the film 2 when the guide means 32 spread open the free edges 2b.

[0057] As shown in Figures 2 and 6, each vertical wall 30 and 31 may have positioned near it a respective plate 49 and 50 that can be moved by suitable means 51 (for example, a cylinder) between a retracted idle position in which each plate 49 and 50 is within the area defined by the respective vertical wall 30 and 31 (see dashed line in Figures 2 and 6) and an advanced working position in which each plate 49 and 50 is turned towards the inside of the frame 4 so as to correctly part the pleated sides 2a of the film 2 being unwound.

[0058] An apparatus structured in the manner described above works as follows, starting from a situation in which the product group 1 is positioned inside the frame 4 and the film is fed by the feed means 6 in the vertical direction V in the configuration illustrated in Figures 9 and 10.

[0059] During its downward motion, the film 2 comes into contact with the shaped vertical walls 30 and 31 designed to spread the film 2 open, in particular at the pleated sides 2a, thanks also to the plates 49 and 50 which move forward to the advanced working position at least during the downward feed of the film 2 (see Figures 11 and 12).

[0060] When the mouth at the bottom end of the film 2 reaches the lower end of the walls 30 and 31, and the mouth of the film 2 extends a little way beyond the walls 30 and 31 themselves and is in the vicinity of the four gripping roller units 15 already in position, film 2 feed is stopped.

[0061] At this point, the guides means 32 on the walls 30 and 31 come into action to spread open the four ends 2b of the film 2 in such a way as to position them exactly between the four pairs of rollers 18 and 19 in the open configuration (see Figures 13 and 14).

[0062] Next, the four pairs of rollers 18 and 19 are moved towards each other to the working position so as to grip the respective ends 2b of the film 2 and, in sequence, the first drive means 17 are activated in order to lower the four units 15 towards the stretching unit 9 and in such a way as to start opening the mouth of the film 2.

[0063] After or at the same time as the first drive means 17 are activated, the third drive means 24 are also activated in order to move the second section 16b further down.

[0064] At this point, the stretching unit 9, that is to say the four arms 9a and 9b and the respective second sections 16b move towards each other (see arrows F9a and F9b, Figures 15 and 16) until the gripping roller units 15

and the respective first sections 13 come into contact with each other. Stable contact between them is detected by the detection means 39.

[0065] Once the rollers 18 and 19 and the vertical sections 13 are in stable contact, the rollers 18 and 19 are opened by the sliding actuator means 21, keeping the film 2 in contact with the respective first vertical section 13 and, the motorising means 25 are then activated to fold in concertina fashion the predetermined quantity of film 2 sufficient to cover the product group 1 (see Figures 17 and 18).

[0066] When this has been done, the film 2 is sealed and cut at its upper end in such a way as to form a sleeve-like cover to be placed over the product group 1 (see Figure 17 again).

[0067] Next, the stretching unit 9 stretches the film 2 according to a known process and moves down vertically along the sides of the product group 1 in such a way as to cover it, while the unit 12 moves back to the raised position to pick up and open another portion of film 2.

[0068] An apparatus structured in this way, therefore, fulfils the preset aims thanks to the combination into a single unit of separate components and units which, prior to the invention, were controlled independently of each other.

[0069] This provides the following important advantages:

- there are less mechanical units and related control systems within the apparatus, which means that the machine occupies less space and is more economical;
- the steps of gripping, pre-opening and gathering up the film are simplified;
- all the steps in the cycle are performed more precisely since there is only one control system operating on a single unit;
- the machine can work more quickly thanks to the multi-purpose rollers which not only grip and open the film but also concertina fold it.

[0070] The invention described has evident industrial applications and may be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. An apparatus for covering one or more products forming a product group (1) with tubular stretch film (2), the apparatus (3) being of the type comprising at least:
 - a frame (4) within which the product group (1)

- is positioned;
- a roll (5) of tubular stretch film (2) whose sides are pleated to form an initially flattened configuration and which is controlled by film (2) feed means (6) located at the top of the frame (4); 5
 - a unit (7), located near the top end of the frame (4), for spreading open the pleated sides (2a) of the film (2) fed in a vertical direction (V);
 - means (8), located under the spreading unit (7), for gripping and opening the mouth of the film (2) to at least form a quadrangular cross section; 10
 - a film (2) stretching unit (9) which receives the film (2) from the gripping means (8) in the spread open configuration and stretches it to a size larger than the perimeter of the product group (1); 15
 - means (10) for "pleating" or folding the film (2) in concertina fashion in such a way as to gather up a quantity of film (2) at least sufficient to cover the product group (1), these means acting by pressure against the stretching unit (9) before the film is stretched; the apparatus (3) being **characterised in that** the gripping and opening means (8) and the concertina folding means (10) are made as a single operating unit (12) acting between the spreading unit (7) and the stretching unit (9). 20 25
2. The apparatus according to claim 1, where the stretching unit (9) comprises four arms (9a, 9b) each consisting of a substantially vertical first section (13) for receiving the film (2) and a second section (14) by which each arm (9a, 9b), is connected to the frame (4), **characterised in that** the gripping/opening and concertina folding unit (12) comprises four gripping roller units (15) mounted on respective arms (16) pivoted to the frame (4); said arms (16) being equipped with respective first synchronised drive means (17). 30 35 40
3. The apparatus according to claim 2, **characterised in that** each gripping roller unit (15) comprises two opposite rollers (18, 19) keyed to a shaft (20) on which they are rotatably mounted; the rollers (18, 19) being acted upon by sliding actuator means (21) so as to move the rollers (18, 19) relative to each other between a first end position in which the rollers (18, 19) are apart and a second end position in which the rollers (18, 19) are in contact with each other in such a way as to grip an end edge (2b) of the film (2). 45 50
4. The apparatus according to claim 2, where the arms (16) are arranged in adjacent operating pairs on opposite sides of the product group (1), **characterised in that** each arm (16) comprises a first L-shaped rigid section (16a) pivoted at a free end of it to a carriage (22) mounted on the frame (4) and equipped with the first drive means (17) which operate between the carriage (22) and the arm (16) in such a way as to turn the latter about its pivot point between a first raised position in the vicinity of the spreading unit (7) and a lowered position in the vicinity of the stretching unit (9); second, horizontal drive means (23) also being provided for translationally moving each arm (16) along the frame (4) towards and away from the other arm (16) constituting the adjacent operating pair. 55
5. The apparatus according to claims 2 and 4, **characterised in that** the end of each first section (16a) of each arm (16) opposite the end pivoted to the carriage (22) is linked to a second, movable section (16b) equipped, at its other end, with the above mentioned pair of rollers (18, 19); third drive means (24) being provided to act between the first section (16a) and the second section (16b) in such a way as to rotate the second section (16b) relative to the first section (16a); each second section (16b) being able to move, thanks to the joint action of the first and third drive means (17, 24), between a first raised end position in which the pair of rollers (18, 19) is close to the spreading unit (7) so as to grip a respective free end (2b) of the film (2), and a second, lowered end position in which the pair of rollers (18, 19) is close to the stretching unit (9) so as to release and concertina fold the film (2).
6. The apparatus according to claims 3 and 5, **characterised in that** each second section (16b) of each arm (16) is also equipped with motorising means (25) acting on the pair of rollers (18, 19) to simultaneously rotate the rollers (18, 19); the motorising means (25) consisting of a gear motor connected, through a kinematic chain (26), to a pinion (27) which is keyed to the shaft (20) that mounts the rollers (18, 19) and which is designed to permit the rotation of the rollers (18, 19) while they are apart in such a way as to gather up the film (2) by concertina folding the film (2) against the stretching unit (9).
7. The apparatus according to claims 3 and 6, **characterised in that** at least one of the rollers (18, 19) is linked to a pin (28) that slides axially inside the hollow mounting shaft (20) connected to the relative sliding actuating means (21), consisting of a cylinder, in such a way as to move the sliding roller (18) towards and away from the fixed roller (19); the sliding roller (18) being connected to the pin (28) through a slot (29) made in the hollow shaft (20) and whose length defines the distance travelled to come into contact with the fixed, opposite roller (19).
8. The apparatus according to claim 1, **characterised**

in that the spreading unit (7) comprises a pair of vertical walls (30, 31) positioned under the film (2) feed means (6); each of the vertical walls (30, 31) being shaped, in vertical cross section, like an up-turned V at least at its lower end so that it can spread open at least the free end portion of the tubular film (2) as it is unwound in a vertical direction; each of the walls (30, 31) being also equipped, at its lower end, with guide means (32) acting on the ends (2b) of the film (2) in such a way as to deflect the ends (2b) outwardly with respect to the vertical wall (30, 31), thereby forming grip areas for the gripping rollers (18, 19), located in the vicinity of the guide means (32).

9. The apparatus according to claim 8, **characterised in that** the guide means (32) comprise a pair of opposite levers (33, 34) for the lower ends of each vertical wall (30, 31), and being linked to and driven by an actuating cylinder (35) in such a way as to move between a retracted idle position, in which the levers (33, 34) are within the area defined by the respective vertical wall (30, 31), and an advanced working position, in which the levers (33, 34) are turned in opposite directions outside the area defined by the respective vertical wall (30, 31) in such a way as to fold the edges (2b) of the film (2) outwardly for the gripping rollers (18, 19).

10. The apparatus according to claim 9, **characterised in that** the two levers (33, 34) are connected to and driven by the actuating cylinder (35) which turns them about two parallel axes in opposite directions towards the outside of the respective vertical wall (30, 31) so as to fold the edges (2b) of the film (2) outwards so they can be gripped by the gripping rollers (18, 19).

11. The apparatus according to claim 8, **characterised in that** on both sides of each vertical wall (30, 31) there is a horizontal rod (37) for coming into contact with the unwound film (2) in the vicinity of the lower ends of the walls (30, 31); each rod (37) extending in the region of the vertical walls (30, 31) to a point near the lower ends of the vertical walls (30, 31) themselves; each rod (37) being connected at one end to the respective wall (30, 31) and being inclined towards the surface of the wall (30, 31) itself in such a way as to define, with its free end, a contact for the film (2) when the guide means (32) spread open the free edges (2b).

12. The apparatus according to claim 5, **characterised in that** the second section (16b) of each arm (16) is equipped with means (39) for detecting the contact between each pair of rollers (18, 19) and the stretching unit (9).

13. The apparatus according to claim 4, **characterised in that** the first drive means (17) for actuating each first L-shaped section (16a) comprise a twin lever system with levers (40, 41) pivoted, respectively, at (A, B), to the pairs of arms (16), and joined to each other at opposite ends by a first tie rod (42); the end of one of the levers (40, 41) being pivoted to a second tie rod (43) connected to a motor (44) causing the levers (40, 41) to rotate in such a way as to permit the relative coordinated rotation of the first sections (16a) from the raised position to the lowered position and vice versa.

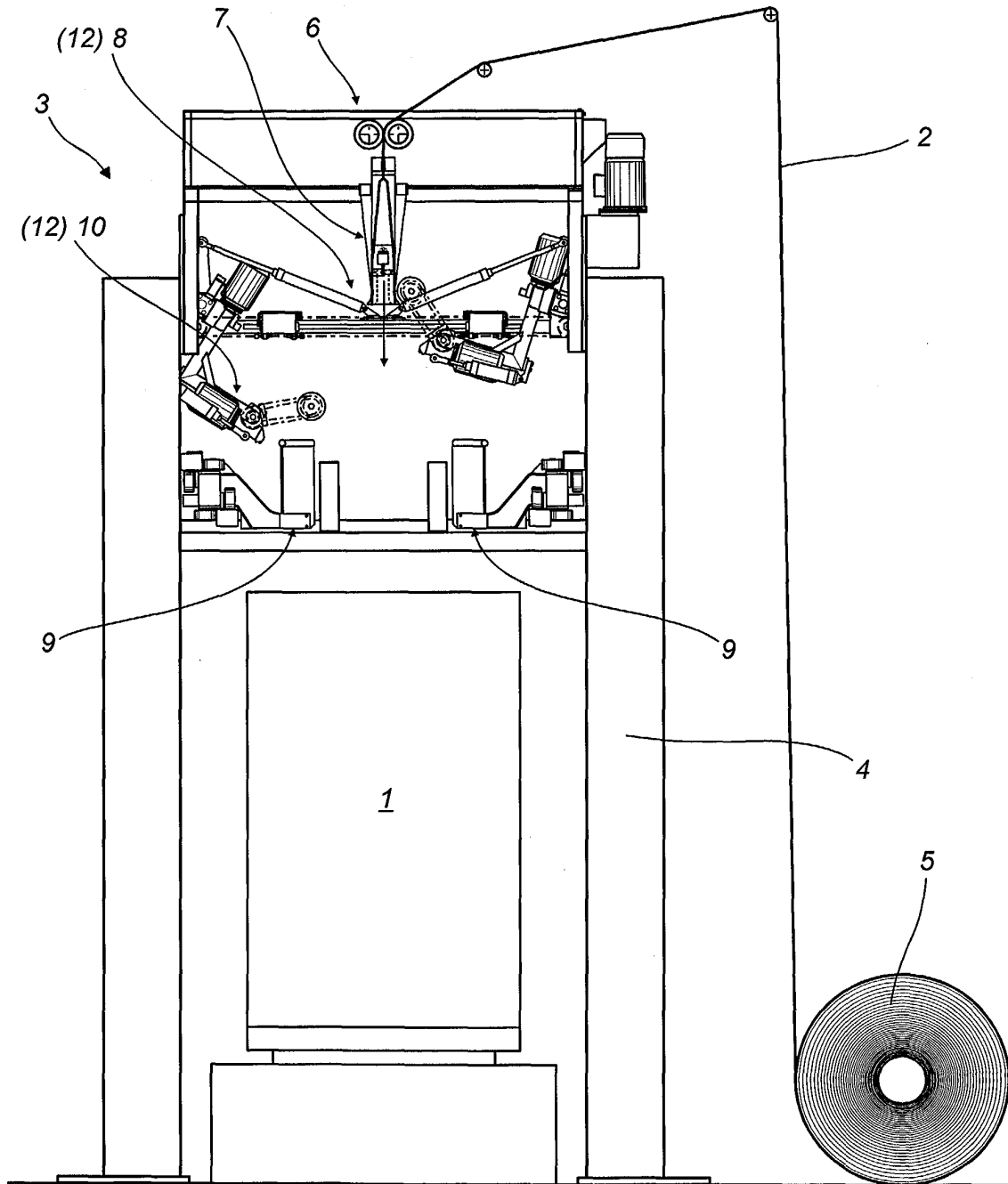
14. The apparatus according to claim 4, **characterised in that** the second drive means (23) for actuating each arm (16) comprise the power-driven carriage (22) that runs in a respective supporting guide (45) made on the frame (4) in such a way as to enable the pairs of arms (16) located on the same side of the frame (4) to move towards and away from each other.

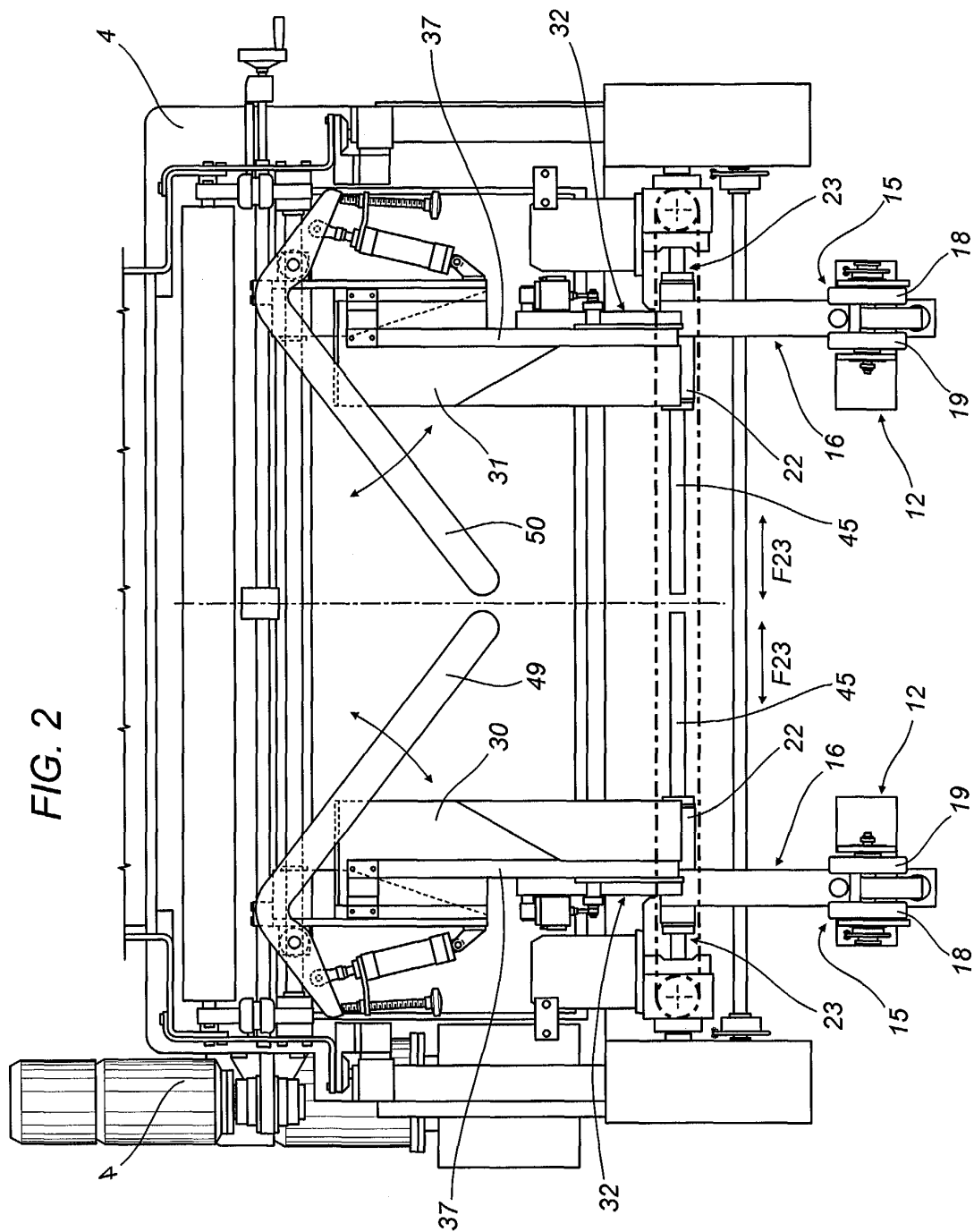
15. The apparatus according to claim 5, **characterised in that** the third drive means (24) for actuating the second section (16b) of each arm (16) comprise a cylinder (46) which is connected, at one end, to the first section (16a), and whose piston stem (46a) is linked to the second section (16b) in such a way as to enable the latter to rotate from the first, raised end position to the second, lowered end position and vice versa.

16. The apparatus according to claims 2 and 3, **characterised in that** each roller (18, 19) has an enlarged, cylindrical outer portion (47) designed to enable the free ends (2b) of the film (2) to be gripped and a flat front surface (48) designed to hold the film (2) against the respective stretching arm (9a, 9b) in such a way as to gather the film up on the arm (9a, 9b) itself when the rollers (18, 19) move apart and turn.

17. The apparatus according to claim 8, **characterised in that** each vertical wall (30, 31) may have positioned near it a respective plate (49, 50) that can be moved by suitable means (51) between a retracted idle position in which each plate (49, 50) is within the area defined by the respective vertical wall (30, 31) and an advanced working position in which each plate (49, 50) is turned towards the inside of the frame (4) so as to correctly part the pleated sides (2a) of the film (2) being unwound.

FIG. 1





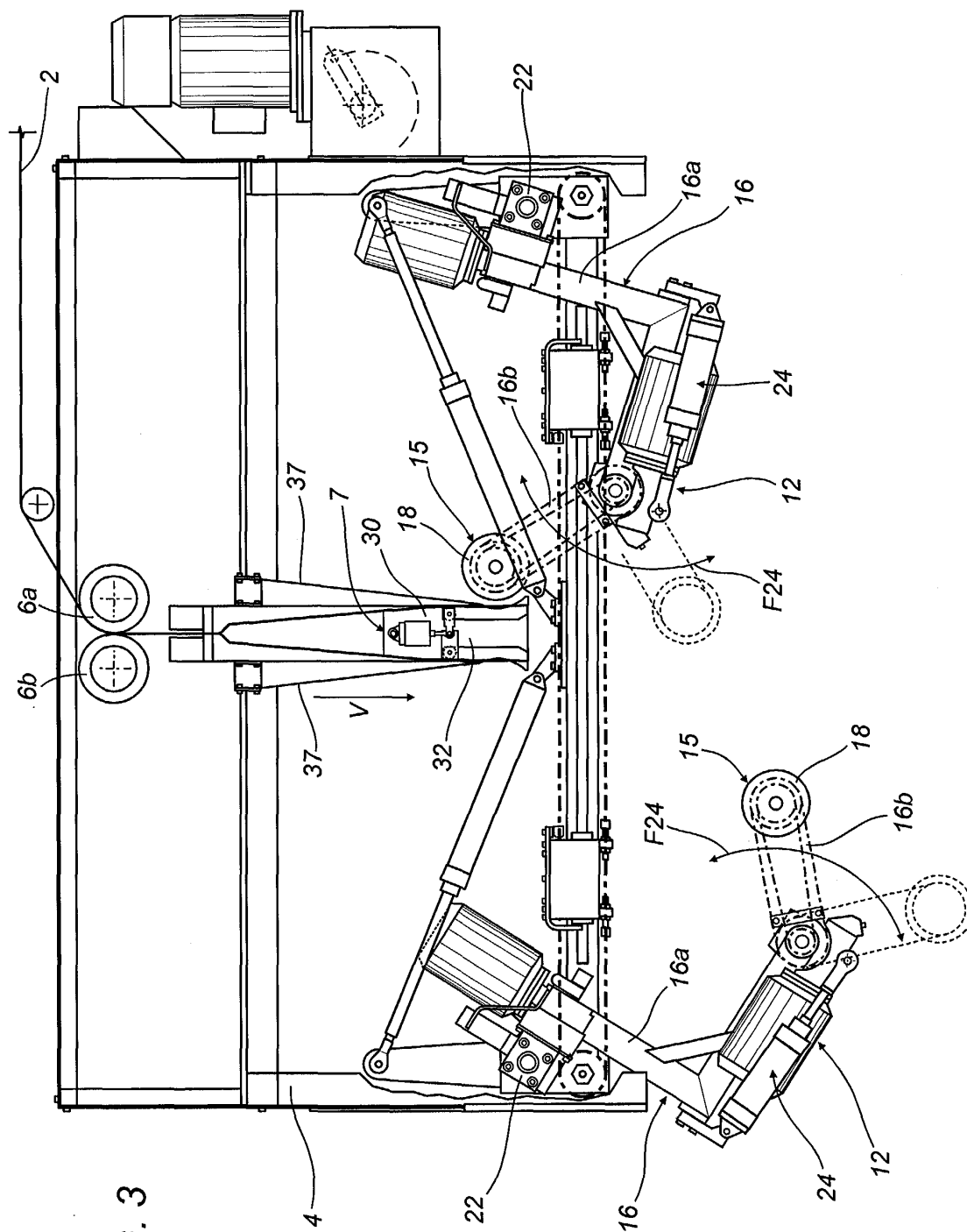


FIG. 3

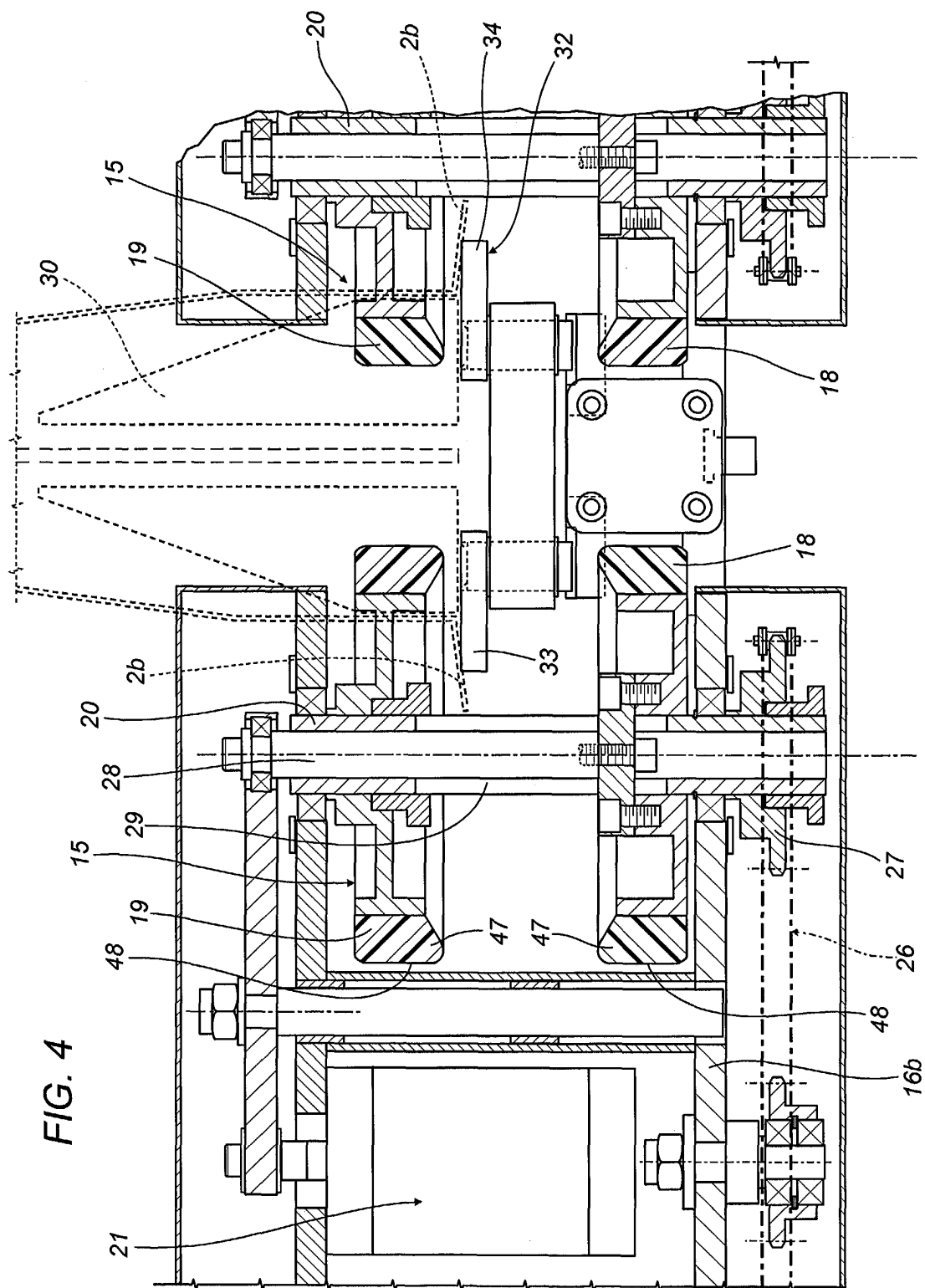


FIG. 5

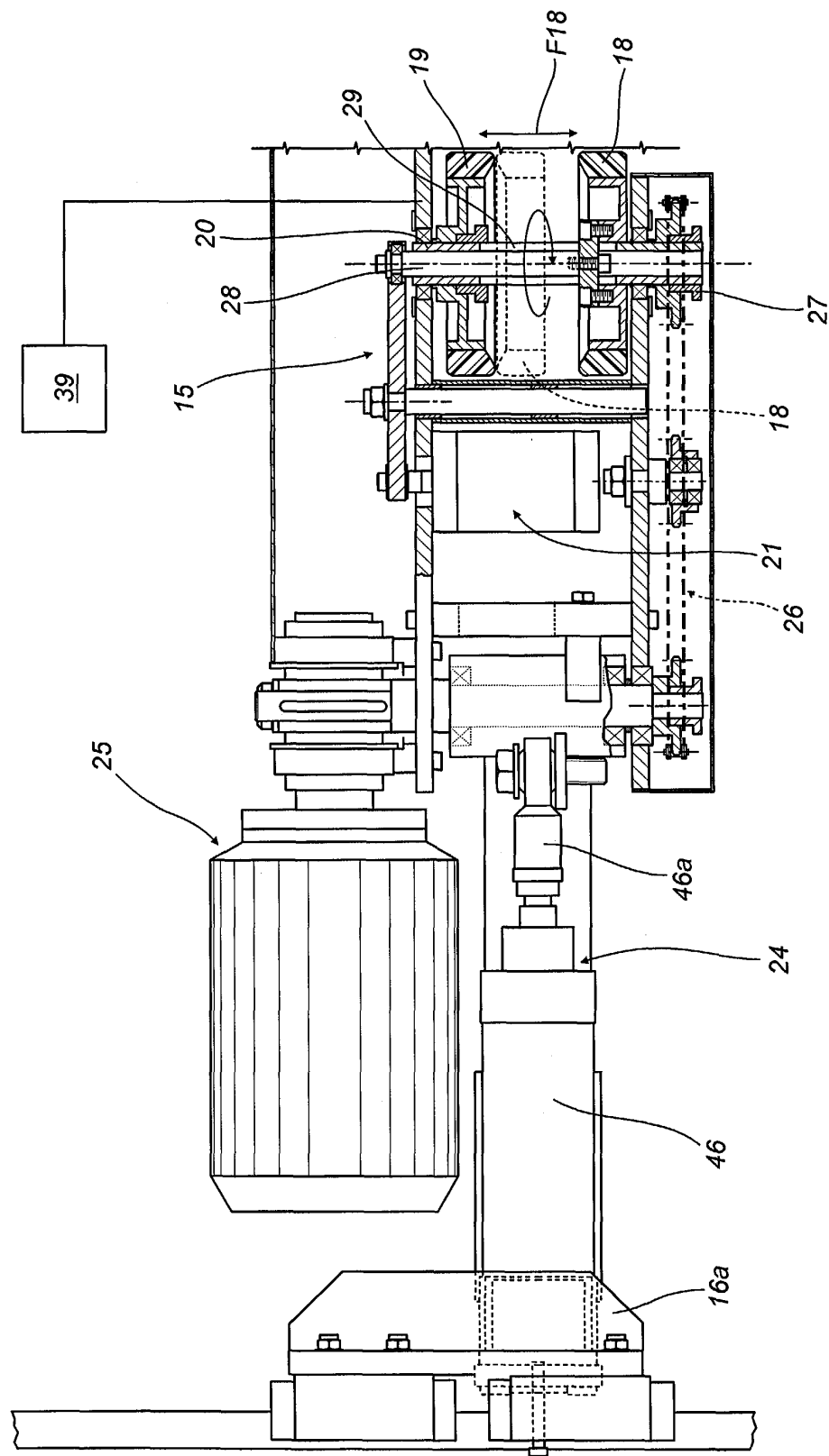


FIG. 7

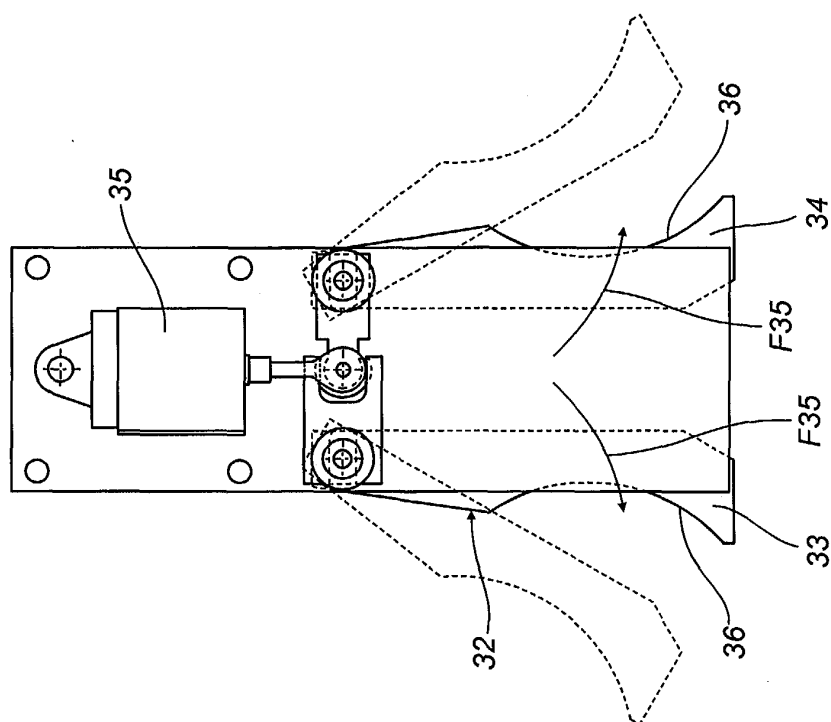


FIG. 6

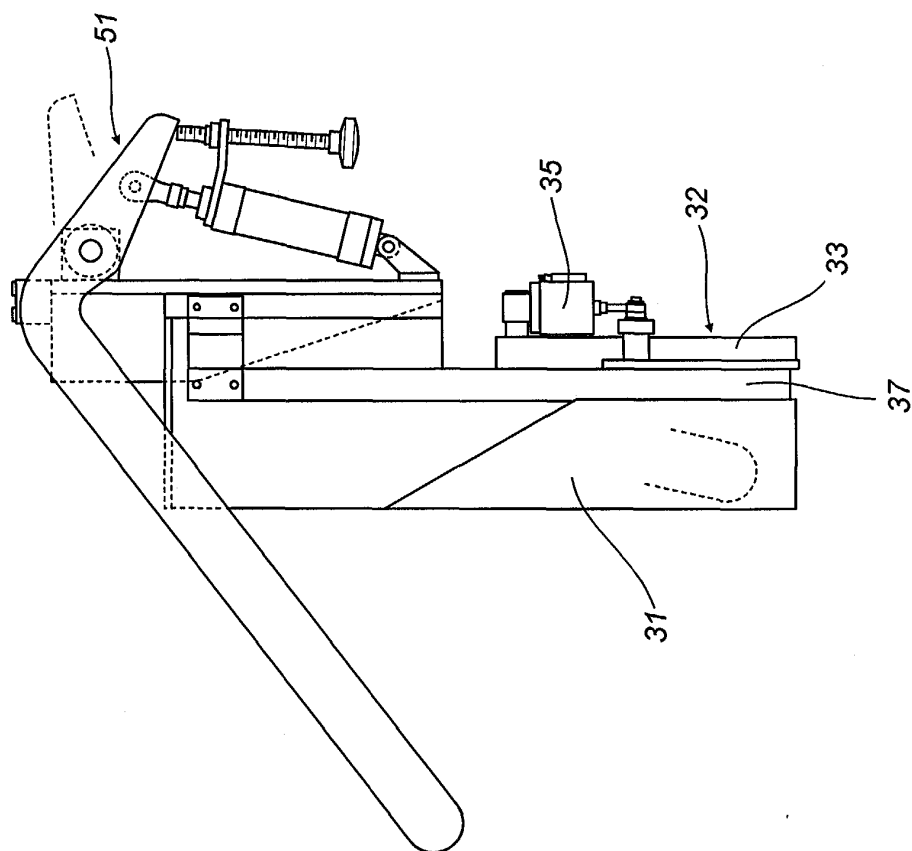


FIG. 8

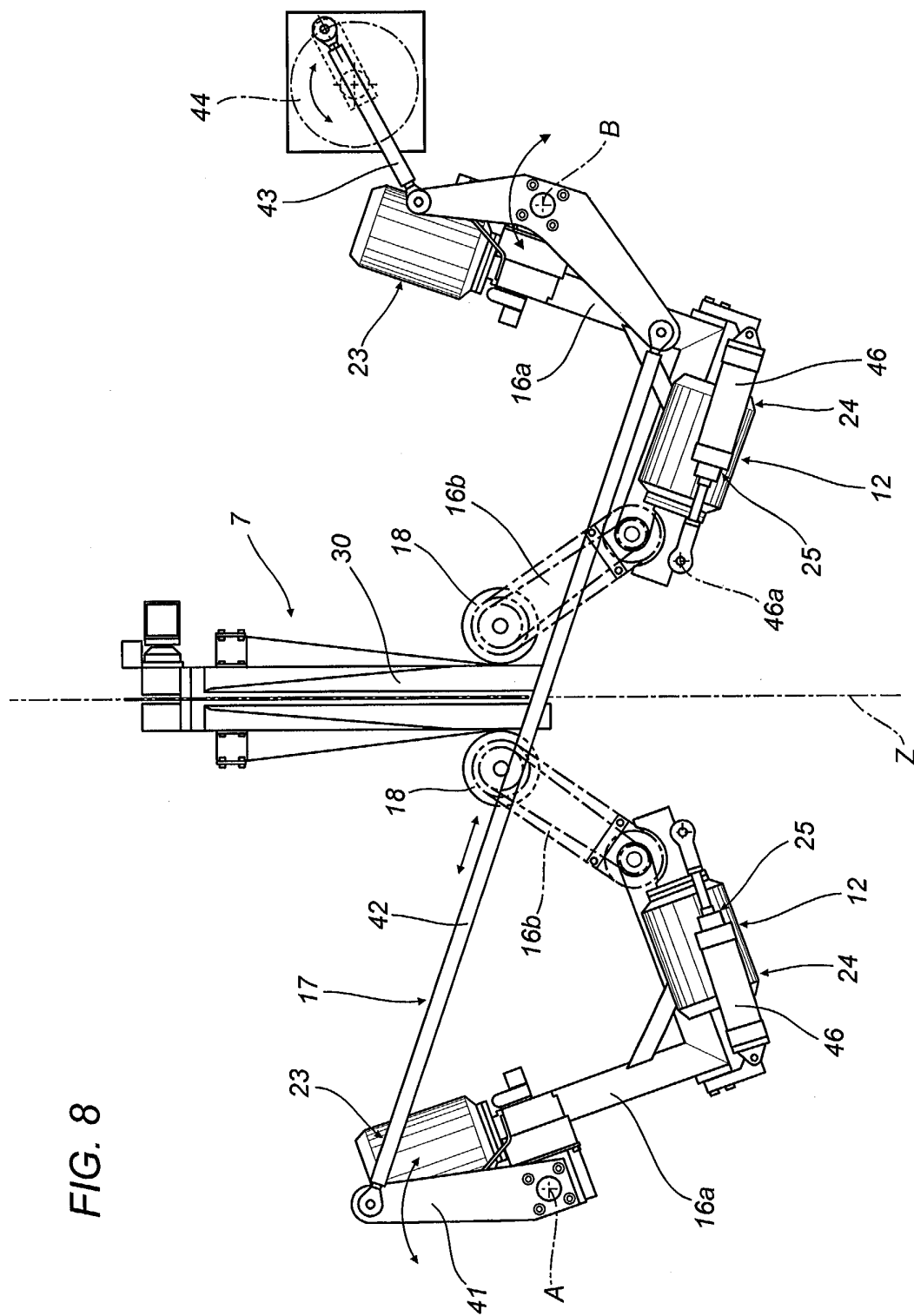


FIG. 9

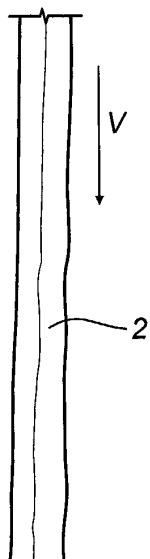


FIG. 10

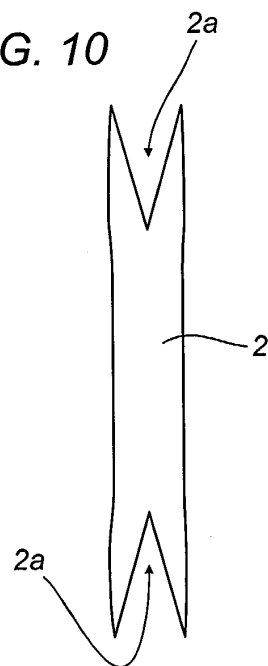


FIG. 11

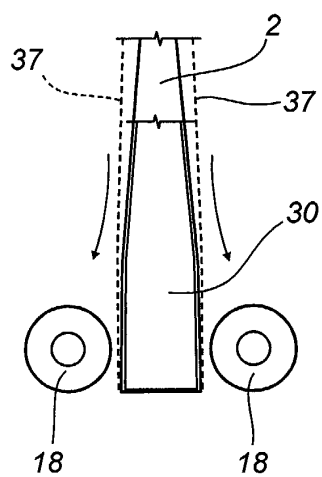
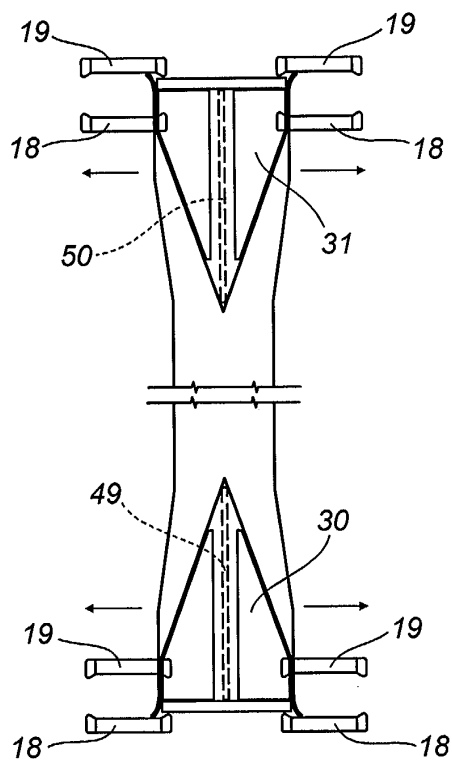


FIG. 12



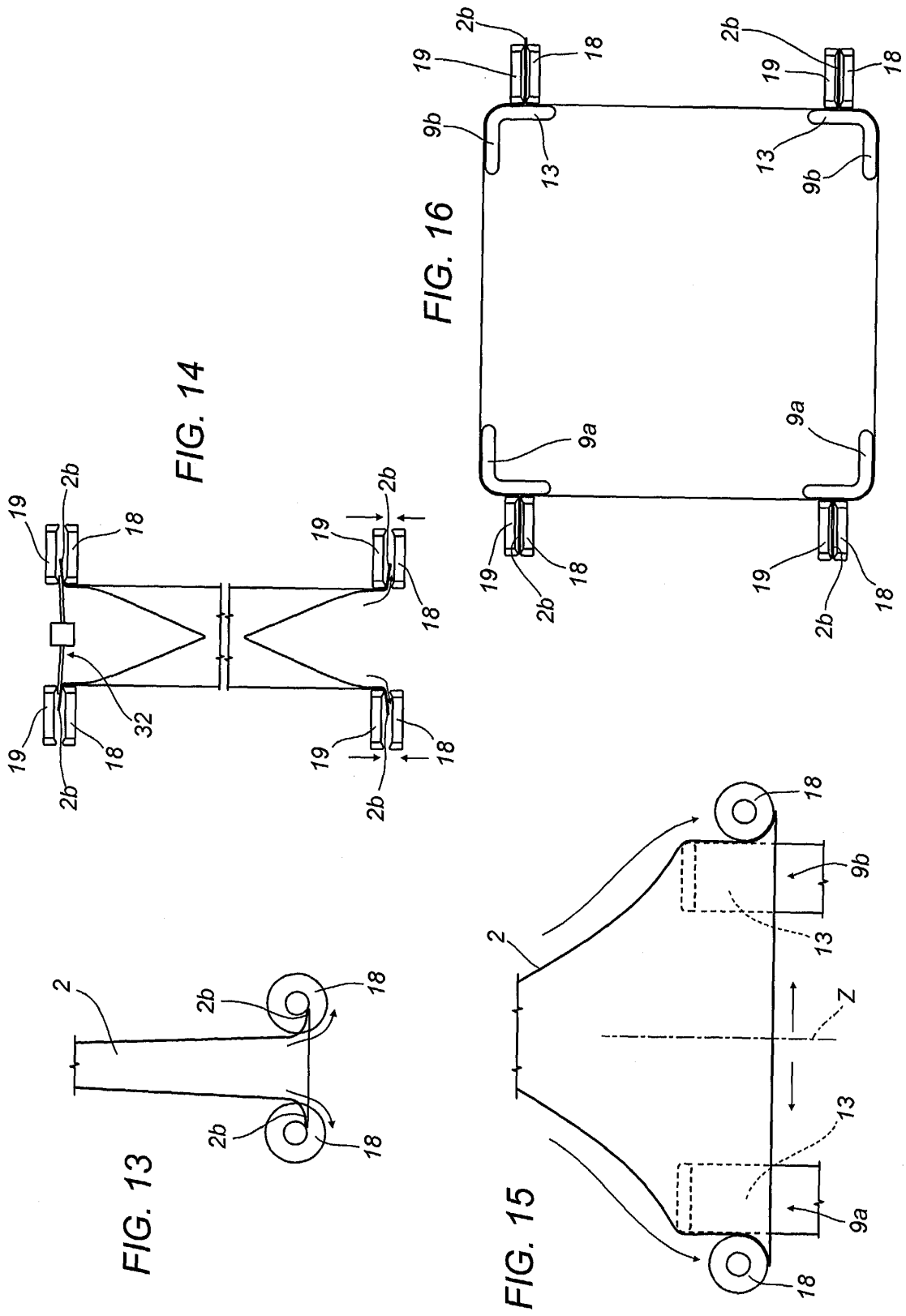


FIG. 17

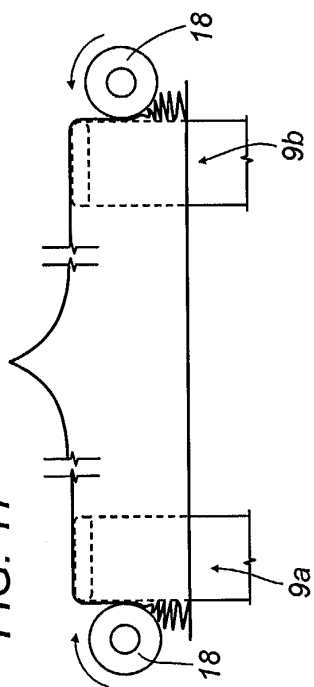
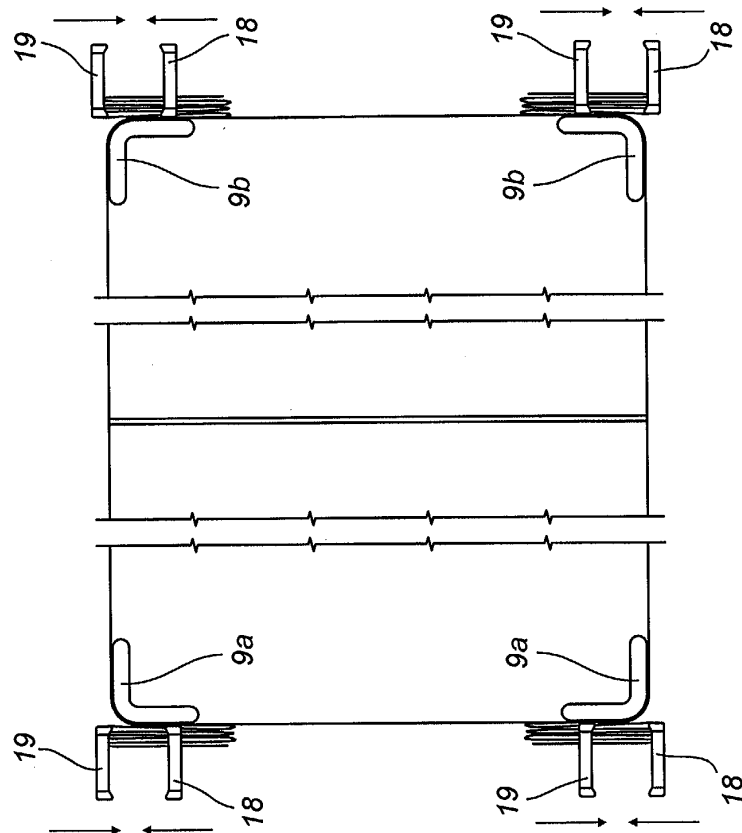
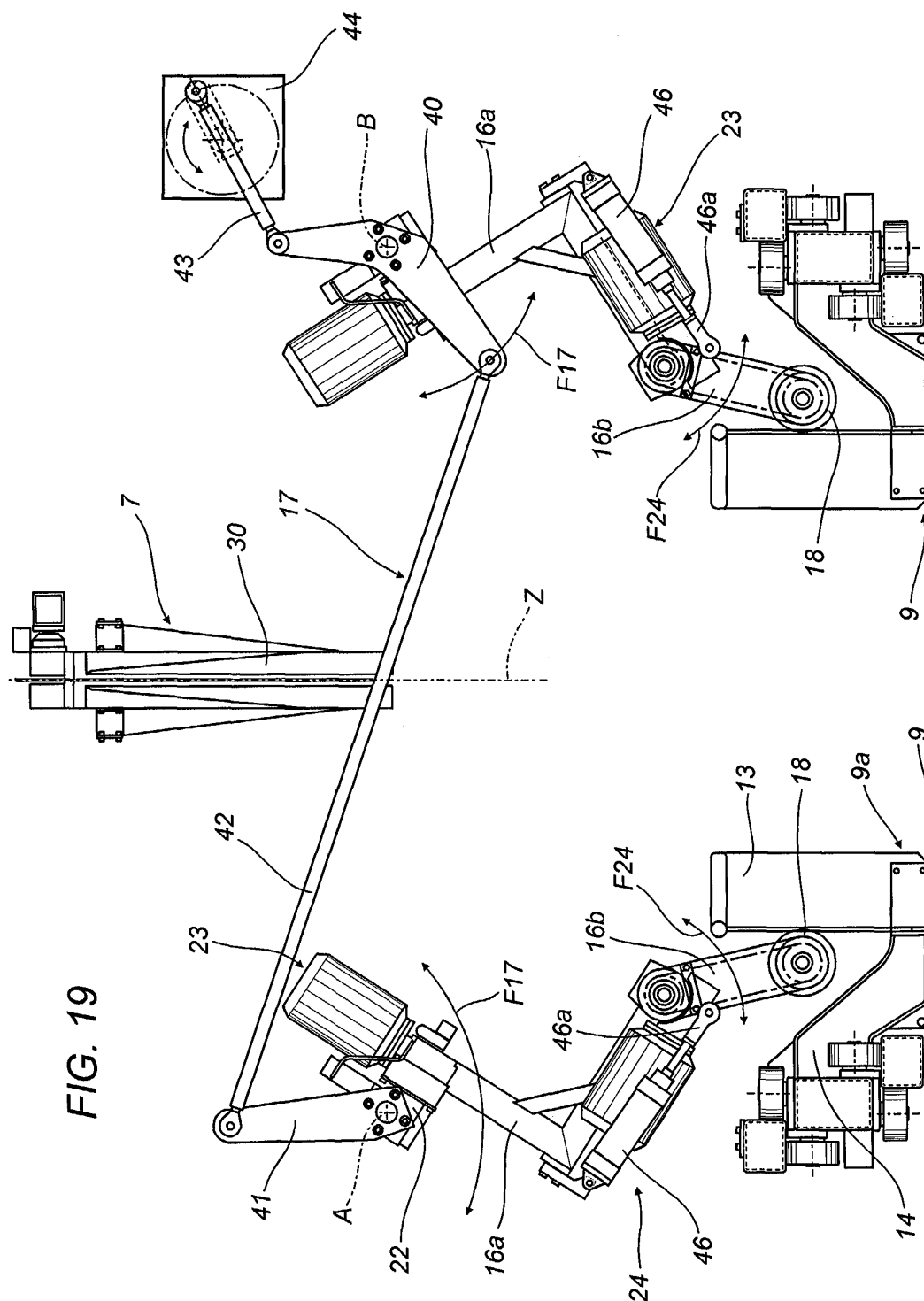


FIG. 18







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Place of search Munich		Date of completion of the search 4 July 2005	Examiner Ungureanu, M
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