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(54) Method and apparatus for forming packaging cushions

(57) A method and apparatus for forming packaging cushions (10) containing a foamable plastic material (14); a portion of predetermined length (21') of a tubular plastic film (21) is unwound in a flattened form from a bobbin (22) and fed through a first and a second welding units (19, 20); the fore end of the tubular film (21) at the second welding unit (20) is opened and then turned forwards and/or upwards allowing the length (21') of the tubular film (21) pending between the welding units (19, 20). Through the open end of the tubular film (21) a batched quantity (14) of a foamable composition, for a example a polyurethane mixture, is then fed through the open end of the tubular film (21); cross welds (12, 13) and venting apertures (15, 16) are there upon made at both ends of the tubular film portion (21') by the two welding units (19, 20), and the tubular film portion (21') is cut at its rear end from a foamed packaging cushion (10).

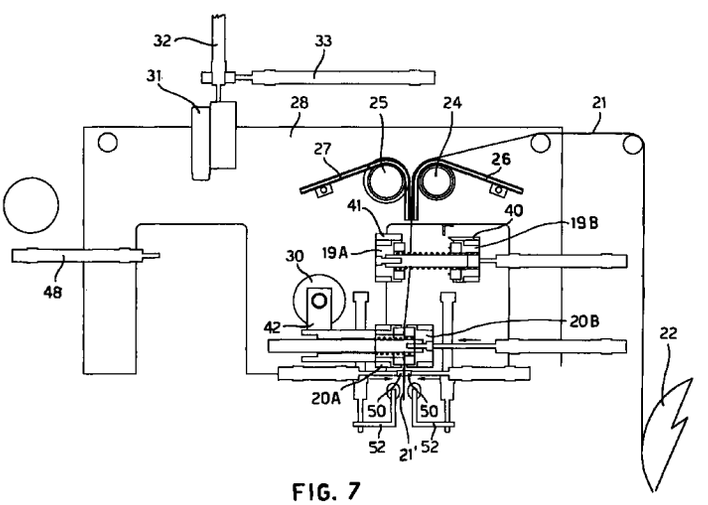

FIG. 7

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Description

FIELD OF THE INVENTION

The present invention relates to the production of packaging cushions filled with a foamable plastic material for protective purposes, wherein the cushion comprises an external envelope in the form of a closed bag, obtained from a tubular plastic film which is filled with a batched quantity of a chemically reactive foaming mixture, for example a polyurethane composition, forming venting openings for the release of the gas generated during foaming of the mixture.

STATE OF THE ART

Methods and apparatuses for producing cushions containing a rigid or flexible foam, are widely in use for forming packaging in a number of areas of application in order to protect articles and/or objects, of various shapes and sizes, inside containers or boxes.

Apparatuses and methods for the production of foamed cushions for packaging purposes are well known and described in some prior documents, for example in EP-A-O 225 976, EP-A-O 316 850, EP-A-O 395 438 and EP-A-O 557 956.

According to EP-A-O 225 976, length of a tubular plastic film, in a flattened form, is fed along a predetermined path, with the fore end of the tubular film turned downwards and appropriately welded to preform a pending bag closed at the bottom end. The flattened tubular film is then cut partially at a predetermined distance from the welded bottom end, to perform a cross slit through which a batched quantity of a foamable material is later injected, normally a foamable polyurethane mixture which is collected at the closed end.

The upper opening is then sealed and the cross cutting is completed so that a filled bag is definitively separated from the tubular film. The filled bag formed in this way is then taken by an operator who manually distributes the polyurethane mixture during foaming, in order to fill the entire bag evenly. During welding of the upper open end of the bag, venting openings are also formed to allow venting of the gases which are developed during the chemical reaction required for forming the polyurethane foam.

The remaining documents EP-A-O 316 850, EP-A-O 395 438 and EP-A-O 557 956 suggest other solutions whereby the bag is preformed from flat or longitudinally folded plastic films, which must be welded along one or both sides, as well as in a cross direction to previously preform again a bag, wherein a batched quantity of a foamable mixture is then injected.

Although the solutions proposed in these latter documents aim at improving the previous apparatus described in EP-A-O 225 976, or propose alternative solutions, in general they always require the prior formation of a downwardly pending bag, by making cross and longitudinal welds and leaving an upper opening through which the foamable material is injected. For these reasons these solutions have a somewhat complex construction and are expensive to produce. Moreover they do not allow full automation of the production of foamed cushions in that, due to the vertically or downwardly pending position of the bag, the polyurethane mixture is collected totally on the bottom of the same bag, and require later manual processing by an operator to distribute the foamable mixture inside the bag. Moreover the work cycle times are still considered excessively long in that the various welding, cutting and filling operations of the bag with the foamable polyurethane mixture, and handling by an operator must be performed at later times.

OBJECT OF THE INVENTION

The general object of the present invention is to provide a method and an apparatus for the formation of packaging cushions, containing a foamable plastic material, suitable for improving the methods and apparatuses previously known.

More particularly the main object of the present invention is to provide a method and an apparatus whereby it is possible to automate further production of packaging cushions, ensuring even distribution of the foam throughout the bag during filling, without requiring any later processing or manual intervention by an operator.

Yet a further object of the present invention is to provide a method and an apparatus as referred to above, whereby it is possible to form packaging cushions containing a foamed plastic material, from a tubular plastic film in a flattened form, eliminating certain disadvantages present in previously known apparatuses, and such as to allow a substantial reduction in the work times, thus increasing productivity.

Yet another object of the present invention is to provide a method and an apparatus as defined above, whereby it is possible to form packaging cushions having any required length, all this by means of extremely simple and inexpensive apparatus of reduced overall dimensions.

BRIEF DESCRIPTION OF THE INVENTION

According to the invention the above can be obtained by means of a method for the formation of packaging cushions according to claim 1 and an apparatus according to claim 13. More precisely, according to a first aspect of the invention a method for the production of packaging cushions has been provided according to which the cushion comprises an outer envelope obtained from a tubular plastic film fed in a flattened form through a welding zone, in which the outer envelope is filled with batched quantity of a foamable mixture, and is provided with venting openings for venting

the gases generated during foaming of the mixture, characterised by:

- moving a portion of the flattened tubular film through a first and a second welding units;
- arranging the fore end of said tubular film opened and turned upwards and/or forwards;
- feeding a batched quantity of the foamable mixture through the open end of the tubular film; and
- welding both ends of the tubular film portion comprised between the two welding units, to perform a packaging cushion, cutting said cushion from the tubular film.

According to a second aspect of the invention an apparatus for forming packaging cushions has been provided in which a tubular plastic film is fed in a flattened form along an unwinding path and towards a welding area for filling with a batched quantity of a foamable mixture by a mixture supply device, characterised by comprising:

- at least a first and a second cross welding units provided along said unwinding path;
- means for moving a portion of the tubular film along the unwinding path and through the aforementioned welding units;
- as well as means for opening and for clamping the open front end of the tubular film at the second welding unit, with the open end of the tubular film facing towards said mixture supply device.

According to a preferred embodiment of the invention, the welding unit which is first passed through by the tubular film, also referred to as upstream welding unit, is maintained in a fixed position while the second welding unit, downstream positioned to the previous one, is movably supported between a first disposition in which said downstream welding unit is vertically aligned with the upstream welding unit, and in which the fore end of the tubular film is opened and clamped in the open condition with the open mouth of tubular film facing downwards, and a second disposition, tilted through 180° in relation to the previous one, in which the open end of the tubular film is upwardly turned while maintaining the tubular film in a slanted condition and/or forming a downward loop, in such a way that the foamable mixture fed directly through the open end of the tubular film flows downwards and collects in an intermediate zone of the tubular film comprised between the welding units later closing the bag, by transverse weldings at both its ends.

Shaped cutting means are provided on welding bars of both welding units to allow venting openings to be formed at both ends of the bag, while cross cutting means are provided at the upstream welding unit to separate the tubular film from the filled bag. The closed bag containing the foamable mixture, after cutting, is allowed to automatically fall onto an underlying collection surface, or onto a conveyer to be later used in packaging operations.

Within the general principle of the invention, other solutions are possible as regards the arrangement, dispositioning and relative movement of the two welding units; for example the welding units could be vertically aligned each other and provided with a lateral translation movement only, by reversing upstream and the downstream disposition in respect to the previous case, or they could be aligned horizontally, side by side, with the same welding units suitably provided with means for guiding the fore end of the tubular film, for example by oriented air flows, to support the tubular film while it is guided and entrained between the welding bars of the two welding units.

In all cases, since the foamable mixture during feed through the open end of the tubular film is substantially collected at an intermediate portion of the tubular film hanging or restrained between the two welding units, and since the packaging cushions so formed can drop onto a substantially horizontal resting surface, in this way it is no longer necessary to perform subsequent manipulations of the cushions to distribute the mixture or the foaming material. Moreover the tubular film, clamped by the second welding unit, can be continuously fed through the first welding unit until it achieves the required length of the bag, while the foamable mixture is being fed.

BRIEF DESCRIPTION OF THE DRAWINGS

These and further features of the method and apparatus according to the invention, as well as its working mode, will be made clearer by the description which follows, with reference to the accompanying drawings, in which:

- Fig. 1 is a view of a packaging cushion obtained according to the present invention;
- Fig. 2 is a perspective view of a first embodiment of the apparatus in one of its operative conditions;
- Fig. 3 is a perspective view of the apparatus of Figure 2, with some parts removed;
- Fig. 4 is an enlarged side diagram of the apparatus of Figure 1;
- Figs. 5 to 14 show the sequence of the various operative steps for the formation of a packaging cushion by means of the apparatus of the previous figures.
- Figs. 15 to 23 show the sequence of the various operative steps for a second embodiment of the apparatus according to the invention;
- Figs. 24 to 32 show the sequence of the various operative steps for a further embodiment of the apparatus according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Figure 1 and to Figures 2 to 14, we will describe a first preferred embodiment of the apparatus according to the invention and the working method thereof.

A packaging cushion containing foamable material, according to the present invention, is denoted overall by reference 10 in Figure 1. The cushion 10 comprises an outer envelope 11 in a thermoplastic material, in the form of a tubular bag closed at both ends by means of cross welds 12 and 13 for containing a batched quantity of a foamable mixture 14, for example a liquid foamable polyurethane mixture which is allowed to expand, partially or totally to fill the entire bag.

At the two end welds 12 and 13 notches or openings 15 and 16 are provided for venting gases which develop during the chemical reaction between the components of the foamable mixture 14, and two short cross welds 17 and 18 are also provided immediately before the notches 15 and 16, in order to form a relief valve for the air and the gases inside the bag 11, preventing leakage of the mixture during foaming.

The cushion 10 is obtained from a flattened tubular film 21, by means of the apparatus and the method according to the invention described hereinunder with reference to Figures 2 to 14.

Figures 2, 3 and 4 show as a whole the general features of the apparatus according to the invention.

As noted from said figures, the apparatus comprises two welding units 19 and 20 between which a tubular film 21 is passed through in a flattened form, being unwound from a bobbin 22. The tubular film 21 is appropriately guided by means of guide rollers 23 towards a pair of drawing rollers 24 and 25 which are driven for passing the fore end 21' of the tubular film first through the cross welding unit 19 positioned upstream, and later through the cross welding unit 20 positioned downstream of the previous one. The insertion of the tubular film 21 through the upstream welding unit 19 may be aided by air jets turned downwards, supplied for example by opposite small tubes 26, 27 which are positioned on either side of the rollers 24 and 25, and connected to an appropriate source of pressurised air.

The two welding units 19 and 20 are supported at their ends by shoulders 28, in such a way that the welding unit 19 positioned upstream is substantially fixed in position, while the downstream welding unit 20 is movably supported between a first operative condition shown in Figure 4, wherein the movable welding unit 20 is vertically arranged below the fixed welding unit 19, and a second or spaced apart position, to a side of the previous one, as shown in Figures 2 and 3, for the reasons described further on.

The movement of the welding unit 20 can be performed in any appropriate manner, for example by tilting around a rotational axis 29 connected to an actuator 30.

The apparatus also comprises a mixing head 31 for supplying a metered quantity of a foamable mixture, for example a polyurethane mixture, the head 31 is movably supported to perform translation movements along two orthogonal axes defined by the two drive cylinders 32 and 33. The head 31 for supplying the mixture can be of any suitable type and can be moved in any other way, provided it is suitable for the object to be achieved.

The welding unit 19 positioned upstream consists of two opposite welding bars 19A and 19B, one of which, 19A, is attached directly to the support shoulders 28, while the other welding bar 19B is movably supported in order to be moved towards and from the previous one by means of a pair of single acting cylinders 34 in opposition to counteracting springs 35 arranged around respective guide rods 36 for the movable welding bar 19B.

As shown in the view of Figure 3, longitudinally to the welding bar 19B, on the front side of the latter facing towards the fixed welding bar 19A, two welding wires 37 and 38 are provided and which extend along the entire length of the bar itself, and wherein the welding wire 38 is partially covered by an insulating covering 39 which leaves only the two end portions uncovered. In this way it is possible to form the cross welds 12 and 17 at one side of the cushion 10 as shown in Figure 1.

The movable welding bar 19B is also provided with a cutting blade 40, opposite to a shoulder element 41 for cutting the tubular film 21 transversely during the welding step as explained further on. Both welding bars 19A and 19B of the upstream welding unit 19 are also provided with means suitable for cutting the venting notches or openings 15 at one end of the bag of Figure 1. These means are not shown, however they can be of any type and positioned in any way, provided they are suitable for allowing the formation of relief valves for venting the air, preventing leakage of the expanding foam 14.

In turn the welding unit 20 positioned downstream of the previous one comprises two welding bars 20A and 20B supported in order to be tilted around the rotation axis 29, between a position below the welding unit 19, and a lateral position wherein the welding unit 20 is made to rotate through 180°.

More particularly, as shown in Figures 2 to 4, the welding bar 20A of the movable unit is supported at its ends by a pair of pivotable arms 42 capable of rotating around the axis 29, while the other welding bar 20B can be moved away from or towards the previous one, being supported by guide rods 43 sliding in the respective arms 42 for supporting the fixed welding bar, through the action of single acting cylinders 44 and return springs 45 arranged around the guide rods 43.

The movable welding bar 20B of the tiltable welding unit is in turn provided with two welding wires 46 and 47 and a covering for one of the two wires (not shown), in a wholly similar manner to the movable welding bar 19B of the welding unit 19 positioned upstream, to perform welding 13 and 18 of the bag of Figure 1.

Since the movable welding unit 20 must assume both the position of Figure 4, underneath the fixed welding unit 19, and the lateral position of Figure 2, the drive cylinders 44 are connected to the movable welding bar 20B in a disengagable manner, for example by simple resting of the piston rod at the rear surface of the same welding bar. Therefore in the tilted position of Figure 2 two further drive cylinders 48 must be provided which in turn will rest or connect in a disengagable manner to the welding bar 20B of the tiltable welding unit, in the operative condition shown in Figure 2.

As specified previously, and as will be explained in greater detail hereinbelow, the innovative aspect of the present invention mainly resides in feeding the foamable mixture through the open end portion 21' of the tubular film 21, maintaining the mouth of the end portion 21', before the formation of the bag, facing forwards and/or turned upwards.

Therefore the movable welding unit 20 is equipped with suitable means for opening the end portion 21' of the tubular film, as well as means for clamping the fore edges of this end portion 21' in the open condition.

The means for opening and clamping the end portion 21' of the tubular film can be made in any way. For example, in the case shown in Figure 4, the means of opening the end 21' of the tubular film are formed by simple suction pads 50 carried by the rods of four cylinders 51 positioned on one longitudinal side of each of the two welding bars 20A and 20B.

Contrarily the means for clamping the open edges of the end portion 21' of the tubular film are formed by two section bars 52 attached to the rods of respective drive cylinders 53. The section bars 52 have a wing turned towards one side of the respective welding bar 20A and 20B against which a pad 54, provided along the edge of each section bar 52, rests to grip, or in other words, restrain the two edges of the open end 21' of the tubular film.

As the various Figures show, both the cylinders 51 with the suction pads 50 for opening the end of the tubular film, and the drive cylinders 53 for the gripping device, are supported to rotate with the entire cross welding unit 20. Other solutions are however possible as regards the form of the welding units, both in relation to the means for opening and clamping the open end of the tubular film 21, and to the system for driving or moving the welding unit 20, without departing form the principles of the present invention.

With reference to the remaining Figures 5 to 14, we will now describe the operation mode of the apparatus and the features of the method for forming packaging cushions according to the present invention.

At the start of formation of a cushion 10, the apparatus is in the condition shown in Figure 5, wherein the welding bars of the two units are open. The movable welding unit 20 is below the fixed welding unit 19, and the end 21' of the tubular film extends partially downwards, through the drive rollers 24 and 25, above the open bars 19A and 19B of the cross welding unit 19. The two suction pads 50 of the lower welding unit are moved away, below the latter, similar to the clamping means 52.

Now having to form a new packaging cushion, a portion of tubular film 21 is first fed by the combined action of the drive rollers 24 and 25 and of the air flows generated by the tubes 26 and 27, making the tubular film 21 pass through the open welding bars of the two units 19 and 20, until the front edge of the end portion 21' is brought slightly beyond the two suction pads 50 which are still open. This working condition of the machine and the corresponding process step are shown in Figure 6.

The subsequent phase is shown in Figure 7 where, like the other figures, the same reference numerals have been used to denote similar or equivalent parts.

From Figure 7 it can be seen that the welding bars 19A and 19B of the first welding unit are still open, while the welding bars 20A and 20B of the second welding unit have been closed by the cylinders 44 which have moved the bar 20B towards the fixed bar 20A. Since the welding wires 46 and 47 are not yet fed by electric current, in this step no welding takes place but instead simple clamping of the front part of the tubular film 21, which partially extends downwards through the closed welding bars of the welding unit 20.

As soon as the welding bars 20A and 20B have been closed on the end 21' of the tubular film, the two cylinders 51 are actuated and move the suction pads 50 towards the two opposite sides of the tubular film 21, still in a flattened condition.

The suction pads 50 adhere on the two sides of the tubular film 21, near the end 21'. At the subsequent backward movement of the two suction pads 50, again by means of the drive cylinders 51, the end 21' of the tubular film is opened and the two side edges are brought into contact with the sides of the welding bars 20A and 20B which still restrain the tubular film. This condition is shown in the subsequent Figure 8 of the accompanying drawings.

The subsequent step is shown in Figure 9; from this Figure it can be seen that the open edges of the end 21' of the tubular film are now clamped firmly against the sides of the two bars 20A and 20B, raising the section bars 52 by means of the drive cylinders 53 so that the pads 54 press the open edges 21' of the tubular film against the welding bars. The two open edges of the tubular film from this moment onwards will always be restrained against the two welding bars 20A and 20B by the clamping device formed by the two section bars 52, in the manner shown.

The subsequent step to complete opening of the mouth of the tubular film is shown in Figure 10 of the accompanying drawings. From said Figure it can be noted that, after the step of Figure 9, in which the edges of the tubular film are opened and clamped against the two bars 19A and 19B of the movable welding unit, for-

mation of the mouth of the tubular film is completed by moving the bar 20B away from the fixed bar 20A by means of the thrust exerted by the springs 45 on release of the pressure in the cylinders 44. During opening of the bars 20A and 20B the two clamping bars 52 continue to maintain the edges of the end 21' of the tubular film open, clamped against the sides of the two welding bars.

The open mouth of the tubular film 21 now has to be oriented in order to allow feeding of a batched quantity of a foamable mixture, for example a polyurethane mixture which, as is known, is formed by chemical components capable of reacting to form a foam which rapidly expands into a rigid or flexible cellular structure according to the formulation.

In order to allow the supply of the polyurethane mixture, according to an innovative aspect of the present invention, the open mouth is turned upwards, simultaneously making the portion of tubular film between the two welding units 19 and 20 pending or to assume a loop configuration, that is to say a slight downwardly slanted disposition.

This can be obtained by moving the movable welding unit 20 away from the fixed welding unit 19, for example by tilting through 180° the movable welding unit around a lateral axis, as shown in the subsequent step in Figure 11.

The moving away and tilting of the movable welding unit 20 can be performed in any appropriate manner, that is to say the welding unit and of the open mouth of the tubular film can be differently positioned and oriented, provided it is suitable for allowing supply from above or from one side of the foamable mixture into the open mouth in order to run inside the tubular film.

In the example in Figure 11, the moving away and tilting of the welding unit 20 are achieved by rotating the latter, together with the related parts, around the rotational axis 29 by means of a command given to its rotating actuator 30.

During tilting of the welding unit 20, which is performed under the control of a process unit which controls the operation of the entire apparatus, a supplemental portion of tubular film can be fed again by means of the drive rollers 24 and 25 in that the welding bars of the unit 19 are still open. The minimum length of tubular film to be fed depends on the distance between the two welding units in Figure 11. However this length can be varied by continuing feeding of the tubular film 21 until a length corresponding to the dimensions of the cushion to be formed is achieved.

During tilting of the movable welding unit 20, the welding bar 20B comes into contact with the drive cylinders 48 on the opposite side of the apparatus, disengaging however from the previous drive cylinders 44.

In the condition of Figure 11, the portion of the tubular film is maintained suspended between the two welding units 19 and 20 with a looped or downwardly curved disposition, by the nip of the two drive rollers 24 and 25 and by the clamping devices 52 which restrain the open mouth of the tubular film on the opposite side.

It is now possible to feed a batched quantity of foamable mixture 55 through the open and upwardly turned mouth of the tubular film 21. The mixing device 31 is therefore lowered and moved towards the open mouth of the tubular film between the welding bars 20A and 20B. The mixture is therefore supplied in extreme safety, preventing the same mixture from leaking and dispersing during the supply.

From Figure 12 it can be noted that, due to the loop or slanted arrangement of the open tubular film, the foamable mixture 55 tends to collect in the lowest point, at a zone intermediate to the tubular portion which extends between the two welding units.

Figure 12 of the drawings shows also in a continuous line the formation of a bag having the minimum length admitted by the apparatus, according to the minimum space assumed between the two welding units 19 and 20 in the tilted-up position of the latter. However, from the same Figure 12, it can be noted that in the case wherein it is necessary to form a cushion of greater length, it is possible to perform a further feed of the tubular film 21 during the same feeding phase of the foamable mixture. In this way, in addition to greatly simplifying the work cycle and the actual structure of the machine, the cycle times are also reduced, improving the productivity thereof.

Having ended the feeding phase of the mixture, the mixing head 31 is moved away, as shown in Figure 13, and simultaneously the welding bars 19A, 19B and 20A, 20B of both welding units are closed.

The closure of the welding bars causes formation of the cross welds 12 and 13, with the simultaneous formation and closure of the bag 11. The two side welds 17 and 18 and the venting openings 15 and 16 are also formed. In the meantime the foamable mixture 55 begins to expand, as shown in Figure 13, distributing evenly inside the bag 11 formed in this way. The closure of the welding bars of the unit 19 also causes the cut of the tubular film 21 by blade 40 from the bag 11 which is however still restrained by the closed bars of the two welding units.

On reopening of the welding bars of both the units 19 and 20, as well as the release of the bag by the clamping device 52, the bag 11 containing the mixture 55 which continues to expand, will be completely freed and will fall onto an underlying surface, not shown, where expansion of the foam will continue to complete the cushion.

At this point the movable welding unit 20 with the related parts will be rotated in an opposite direction, positioning itself once again below the fixed welding unit 19. The apparatus will return to the initial condition shown in Figure 4 and will be ready for production of a new packaging cushion 10.

In the case shown, upward tilting of the open end of the tubular film is performed by a rotational movement

of the movable welding unit. However it is also possible to operate in other ways, for example by performing separate movements of translation and rotation of the movable welding unit 20, or by moving the latter so that the open end of the tubular film is simply turned forwards, that is to say partially slanted upwards, although always maintaining a slanted or curved arrangement of the tubular film in order to allow feeding from above or introduction from one side of the foamable mixture.

With reference now to Figures 15 to 23 we will briefly describe a second embodiment of the apparatus according to the invention, where the same reference numerals have been used to denote similar or equivalent parts.

In the case of the previous example of Figures 2-14 the two welding units 19 and 20 were aligned vertically, in a position below the rollers 24, 25 for drawing the tubular film 21, maintaining the welding unit 19 placed upstream fixed, while the downstream welding unit 20 was movable for tilting in a horizontal position adjacent to the fixed welding unit 19.

In the present case of Figures 15-23, there is a reversed arrangement of the welding units 19 and 20 and the drive rollers 24, 25 which now feed the tubular film 21, from the bottom upwards, while it is guided by means of suitable and appropriately oriented air flows.

Moreover, in the present case of Figures 15-23, the welding unit 20 is movable by simple lateral translation, as shown by Figure 19, to bring the end of the tubular film into a position below the mixing head 31 for supplying the foamable mixture. After this positioning, the fore end of the tubular film is opened and the mixture supplied, as shown by the remaining figures.

In general the operation mode of this second apparatus can be traced back to that of the previous example.

The subsequent examples of Figures 24 to 32 show a third embodiment of the apparatus according to the present invention.

In this case too the same reference numerals were used to denote parts similar or equivalent to those of the two previous examples.

As shown in Figure 24, the two welding units 19 and 20 are initially aligned in a substantially horizontal disposition, so that the tubular film 21 can correspondingly be fed in a horizontal plane, supported by means of appropriately oriented air flows.

Unlike the previous examples, in this specific case both the welding units 19 and 20 are movable to allow feeding of a portion of tubular film 21 having a required length, and to position the open end of the tubular film in a direction turned or slanted upwards.

More particularly, from the sequence of the various figures, it can be noted that the downstream welding unit 20 is once again made to rotate through 90° after clamping of the edges of the tubular film and then moves the two welding bars away and causes the opening or formation of the mouth for feeding the foamable mixture. From the same figures it can however be noted that the upstream welding unit 19 is also in this case movable from above downwards to allow rotation or tilting of the welding unit 20. In all other ways the mode of operation of the apparatus of Figures 24-32 can be traced back to that of the two previous examples.

Within the sphere of the present invention other solutions are naturally possible, as regards the arrangement, orientation and way of moving one, the other or both welding units 19 and 20, providing a different combination of movements. If required the two welding units 19 and 20 could also be fixed at an appropriate distance, aligned in a horizontal plane, with the welding bars oriented differently, in any case providing suitable means of guiding and supporting the tubular film while it is made to move forwards and slide between one welding unit and the other.

From what has been said and shown in the accompanying drawings, it will therefore be understood that a new apparatus and a new method have been provided for the production of packaging cushions, by means of which it is possible to use a tubular film which previous teachings had advised against in that this involved slow production rates and complications.

According to the present invention it has however been possible to use a tubular plastic film by means of a new production method and new apparatus which ensure high production rates, comparable to those of the machines which use flat films. In fact, according to the invention, the side welds, as their times and working temperatures involving excessive crystallisation of the thermoplastic material and the risk of tearing of the bag containing the foamable mixture, have been completely eliminated.

Moreover, according to the present invention, the total time of the work cycle for forming the cushion 10 is considerably reduced in that intervention by the operator for the manual distribution of the mixture inside the closed bag is totally eliminated, contributing in this way to allowing the entire operation to be automated.

The intent however is that what has been said and shown with reference to the accompanying drawings has been given purely by way of a non-limiting example of the claimed invention.

Claims

1. Method for the production of packaging cushions, wherein the cushion (10) comprises an external envelope (11) obtained from a tubular plastic film (21) fed in a flattened form through a welding zone (19, 20), in which the envelope (11) is filled with a foamable mixture (14), and is provided with venting openings (15, 16) for venting the gases generated during foaming of the mixture (14), characterised by:

   - moving a portion (21') of the flattened tubular

film (21) forwards through a first and respectively through a second cross welding units (19, 20);

- arranging the fore end (21') of said tubular film opened and turned upwards and/or forwards;
- feeding a batched quantity of foamable mixture (55) through the open end of the tubular film (21);
- welding both ends of the tubular film portion (21') comprised between the two welding units (19, 20) and cross cutting the tubular film (21) to separate the packaging cushion (10).

2. Method for the production of packaging cushions according to claim 1 in which each of said welding units (19, 20) comprises a first and a second welding bar (19A, 19B; 20A, 20B) which are movable one in relation to the other, characterised by:

- feeding the tubular film (21) through said first and said second welding units (19, 20) by maintaining the second welding unit (20) in a first working position vertically aligned with the first welding unit (19);
- opening the front end (21') of the tubular film (21) at said second welding unit (20) to form a widened mouth at the front end of the tubular film (21) clamping the open edges of the film (21) to the welding bars (20A, 20B) of the second welding unit (20);
- drawing a portion of tubular film (21), moving said second welding unit (20) towards a second working position in which the open mouth at the front end (21') of the tubular film (21) is turned forwards and/or upwards, while maintaining feeding of the tubular film (21) through the first welding unit (19).

3. Method for the production of packaging cushions according to claim 2, characterised in that the tubular film (21) is fed vertically from above, downwards.

4. Method for the production of packaging cushions according to claim 2, characterised in that the tubular film (21) is fed vertically from below, upwards.

5. Method for the production of packaging cushions according to claim 2, characterised in that the tubular film (21) is fed horizontally, on one side.

6. Method for the production of packaging cushions according to any claim from 2 to 5, characterised by allowing feeding of the tubular film (21) to continue for a further predetermined length, through said first welding unit (19), on reaching of the second working position by said second welding unit (20).

7. Method for the production of packaging cushions according to claim 6, characterised by further feeding the tubular film (21) through the first welding unit (19) during feeding of the foamable mixture.

8. Method for the production of packaging cushions according to any claim from 2 to 7, characterised by extending the tubular film (21) between the two welding units (19, 20) according to a looped disposition, making said second welding unit (20) to perform a rotational and tilting movement between a first working position in which the open front end of the tubular film (21) is turned downwards, and a second working position in which said open front end of the tubular film (21) is turned upwards.

9. Method for the production of packaging cushions according to any one of claims 2 to 7, characterised by extending the tubular film (21) between the two welding units (19, 20) according to a looped disposition, making at least one of the welding units (19, 20) to perform a relative movement along a horizontal path.

10. Method for the production of packaging cushions according to any one of claims 2 to 7, characterised by extending the tubular film between the two welding units (19, 20) by means of a relative vertical movement of one of said welding units (19, 20) in respect to the other one.

11. Method for the production of packaging cushions according to claim 10, characterised in that the opened front end of the tubular film (21) is turned forwards and/or upwards by means of a rotational movement of the second welding unit (20).

12. Method for the production of packaging cushions according to any one of the previous claims, characterised in that the foamable mixture is collected in an intermediate area of the tubular film portion between said welding units (19, 20).

13. Apparatus for the production of packaging cushions from a tubular plastic film (21) which is fed in a flattened form along an unwinding path and towards a welding area (19, 20) for filling with a batched quantity of a foamable mixture fed by a mixture supply device (31), characterised by comprising:

- at least a first (19) and a second (20) cross welding unit provided along said unwinding path;
- means (24, 25) for moving a portion of tubular film forwards along said unwinding path through the aforementioned welding units (19, 20);
- as well as means (50, 52) for opening and for clamping the open front end (21') of the tubular

film (21) at the second welding unit (20), with the open end (21') of the tubular film (21) turned towards said mixture supply device (31).

14. Apparatus according to claim 13, characterised in that said means for moving forward the tubular film (21) comprises rollers (24, 25) as well as air flow generating means (26, 27) in a position above said welding units (19, 20).

15. Apparatus according to claim 13, characterised in that said means for moving forwards the tubular film (21) comprises drawing rollers (24, 25), as well as air flow generating means (26, 27) in a position below said welding units (19, 20).

16. Apparatus according to claim 13, characterised in that said means for moving forwards the tubular film (21) comprises drawing rollers (24, 25) and air flow generating means (26, 27) in a lateral position to the welding units (19, 20).

17. Apparatus according to claim 13 in which each of said welding units (19, 20) comprises a first and a second welding bars (19A, 19B; 20A, 20B) relatively movable one in relation to the other, characterised in that said means for opening the front end (21') of the tubular film (21) comprises suction pad members (50) related to each welding bar (20A, 20B) of the second welding unit (20).

18. Apparatus according to claim 13 in which each of said welding units (19, 20) comprises a first and a second welding bars (19A, 19B; 20A, 20B) relatively movable one in relation to the other, characterised in that said means for clamping the open front end (21') of the tubular film (21) comprises a movable clamping device (52) related to each welding bar (20A, 20B) of the second welding unit (20).

19. Apparatus according to claims 13 and 18, characterised in that said means for extending the tubular film (21) comprises said welding bars (20A, 20B) and said clamping device (52) related to the second welding unit (20).

20. Apparatus according to any one of the previous claims, characterised in that said first welding unit (19) is provided in a fixed position; in that the second welding unit (20) is tiltably supported around a rotational axis parallel to the first welding unit (19); and in that drive means (30) are provided to make said second welding unit (20) to rotate between a first working position aligned and below the first welding unit (19), and a second working position laterally arranged to the first welding unit (19) in which said open front end (21') of the tubular film (21) is turned upwards.

21. Apparatus according to claim 18, in which said second tiltable welding unit (20) comprises a first fixed welding bar (20A) and a second welding bar (20B) which is movable in relation to the previous one, characterised by comprising guide means (43) for guiding the movable welding bar (20B) and disengagable drive means to move said second welding bar (20B) towards the first fixed welding bar (20A) in each of the working positions mentioned above.

22. Apparatus according to claim 13, characterised in that said first and said second welding units (19, 20) are provided in adjacent and fixed positions one in respect of the other.

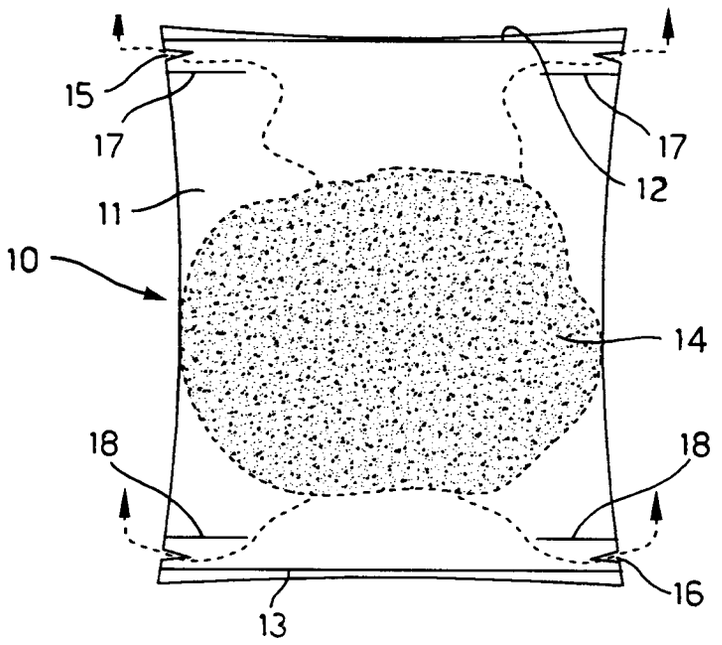
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FIG. 1

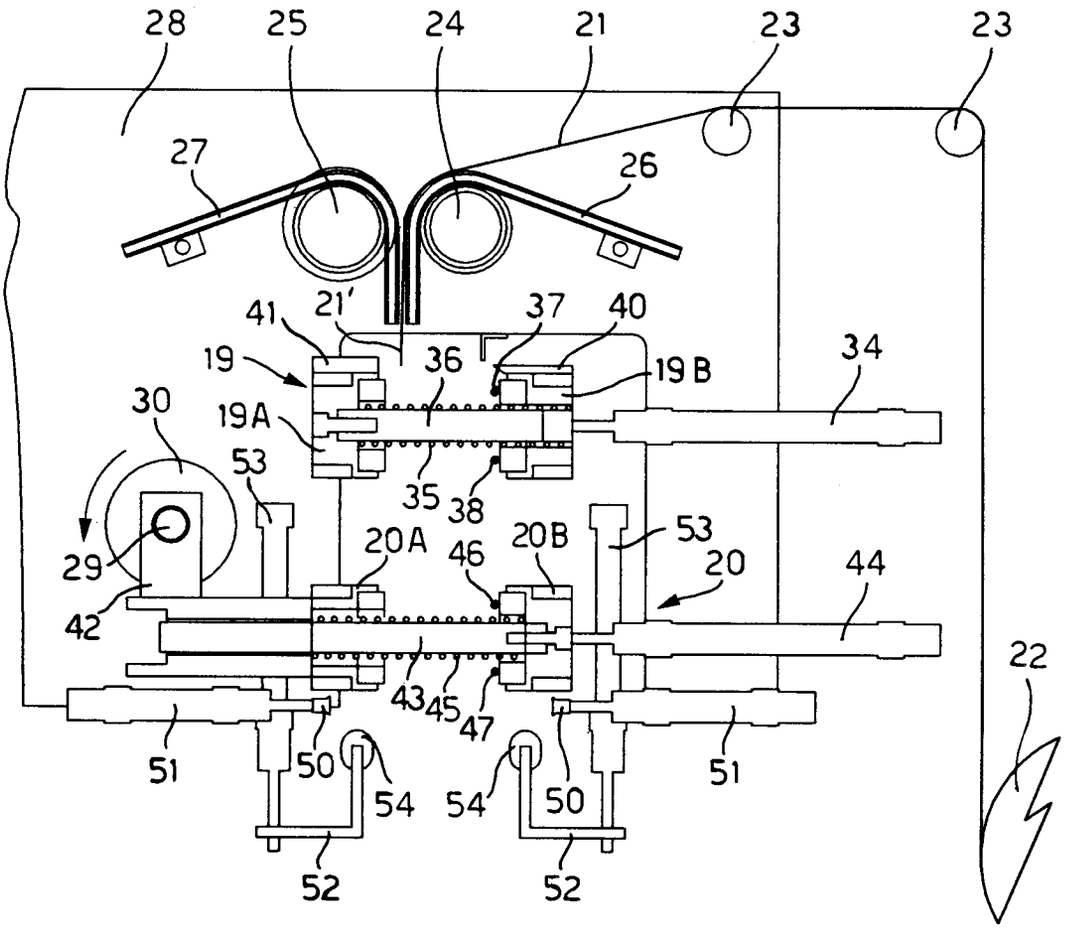
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FIG. 4

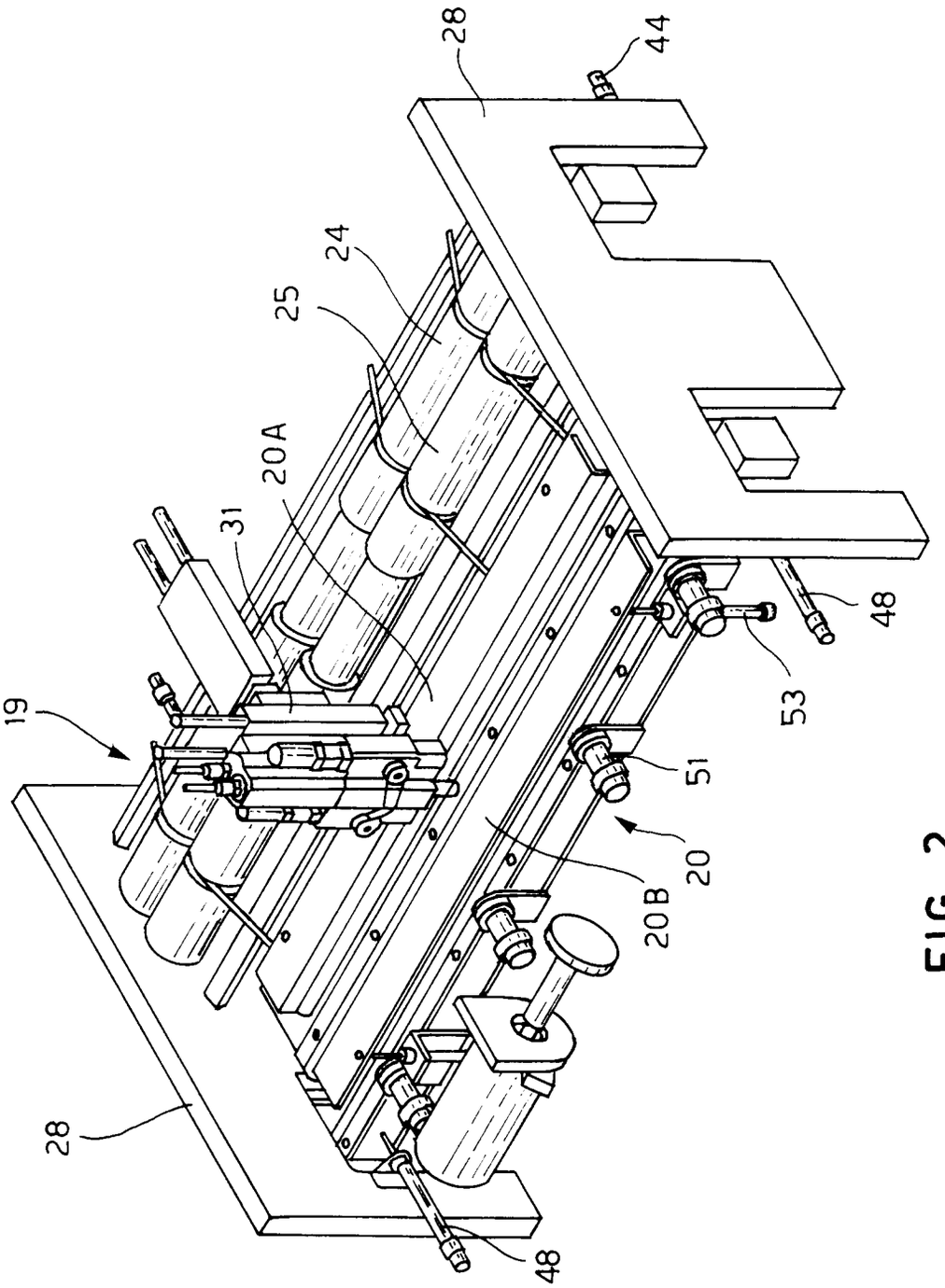

FIG. 2

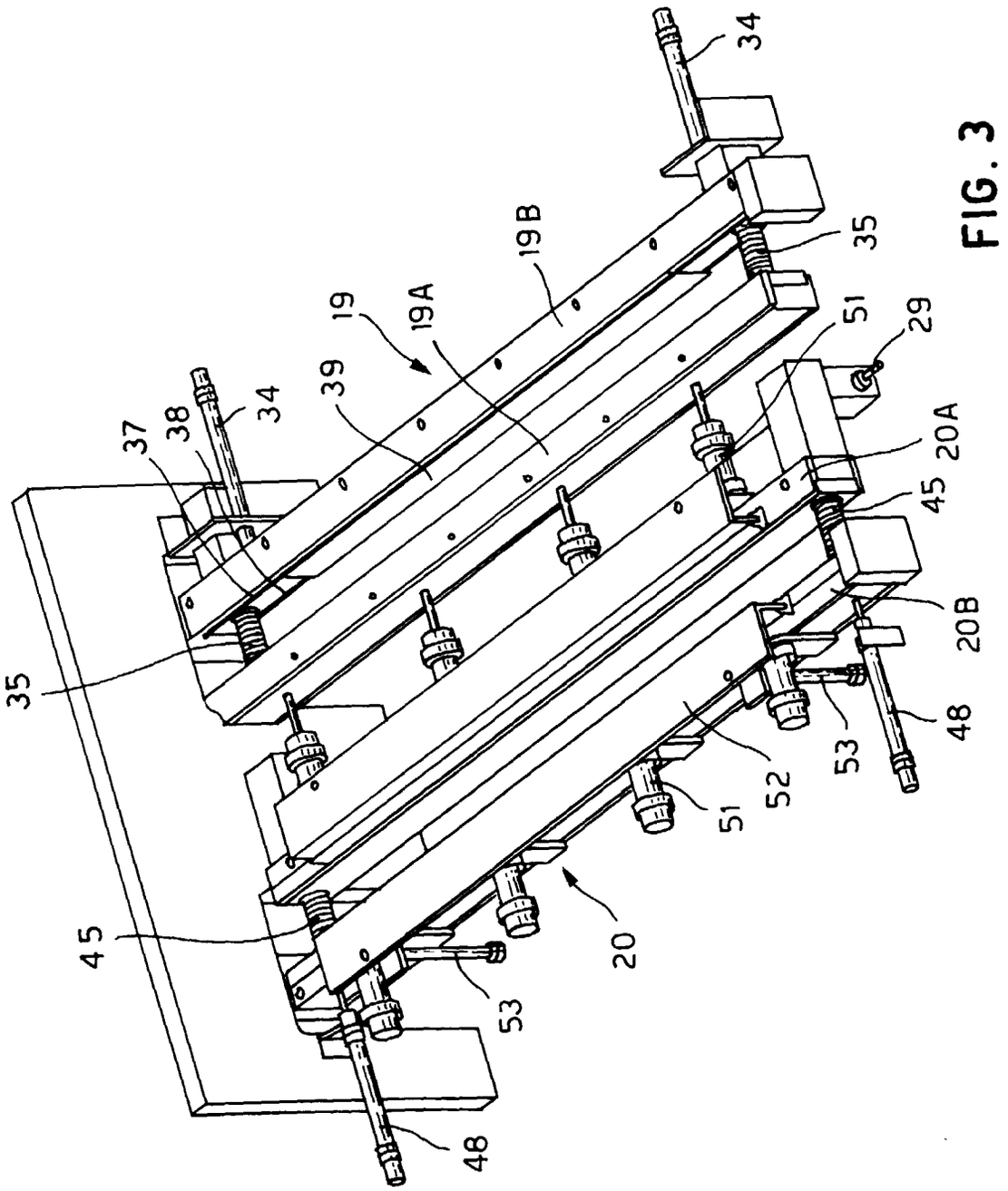

FIG. 3

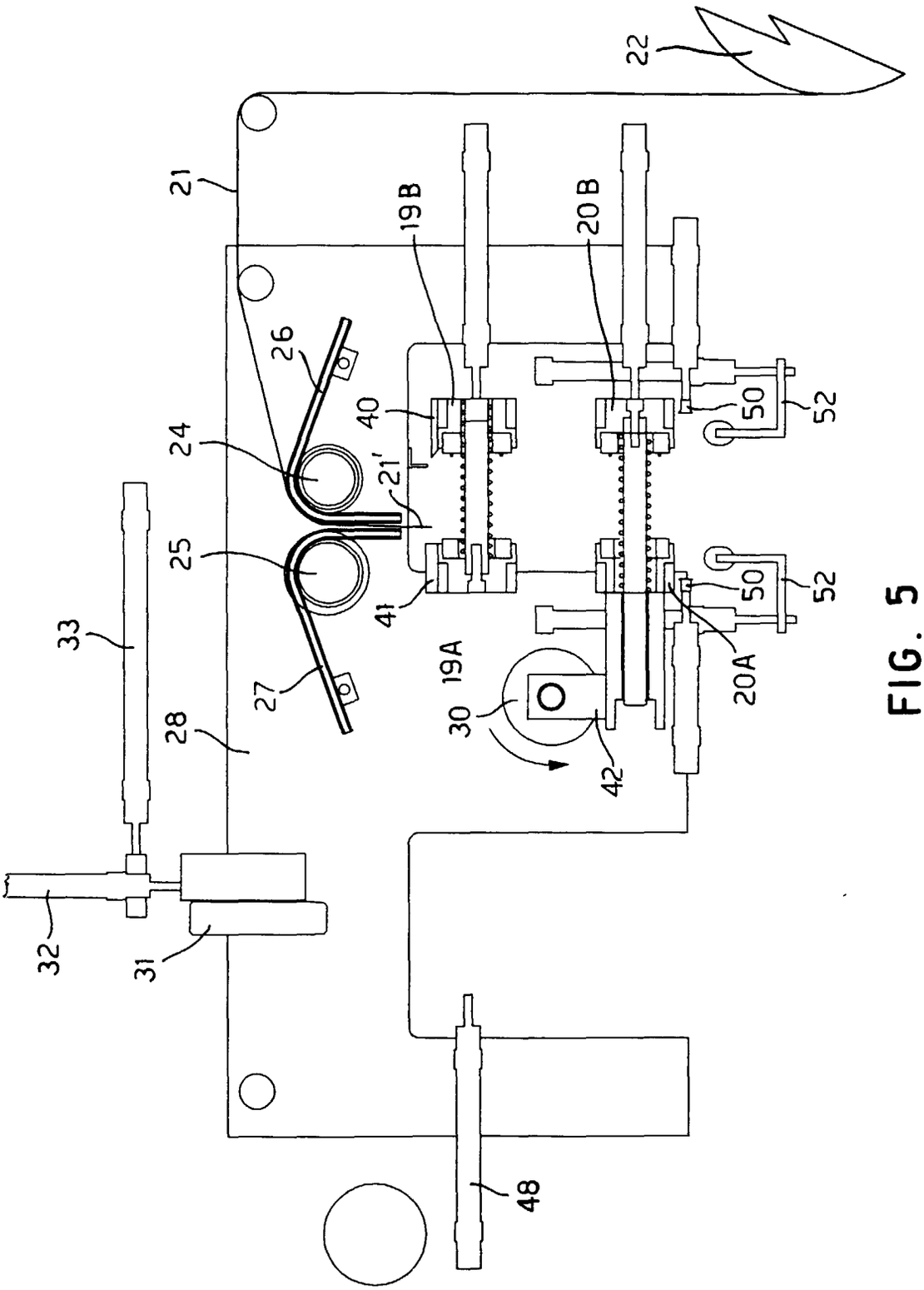

FIG. 5

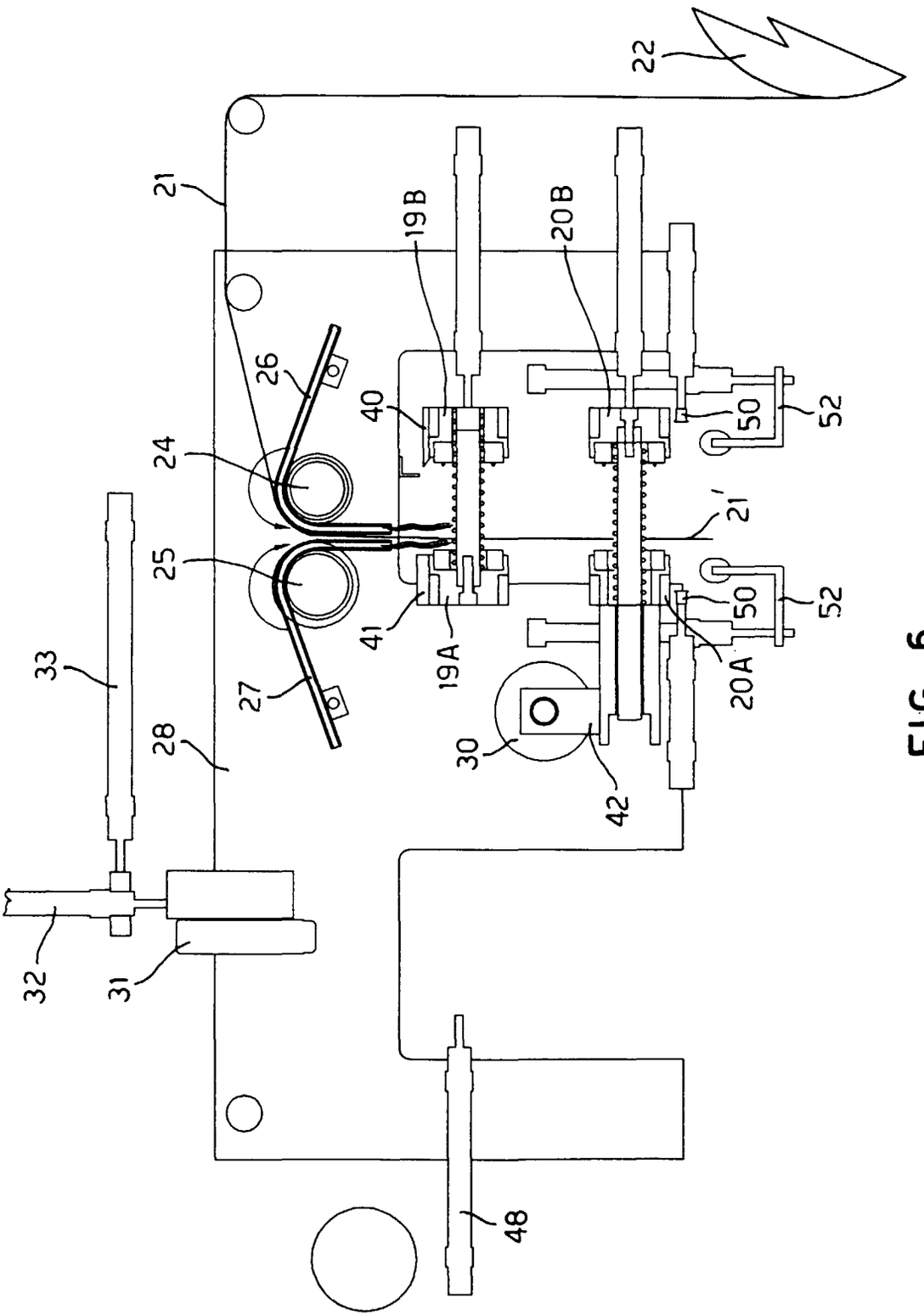

FIG. 6

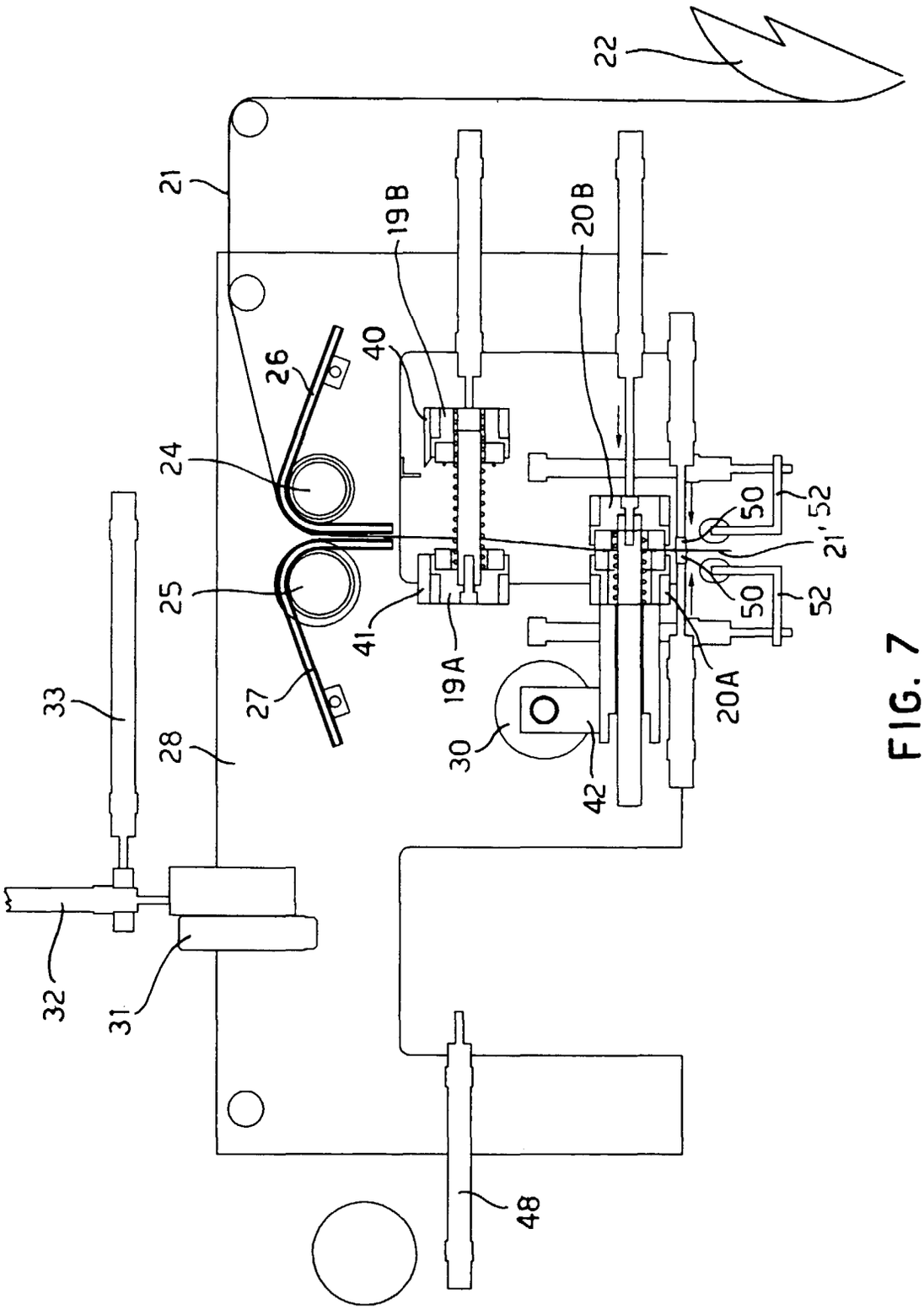

FIG. 7

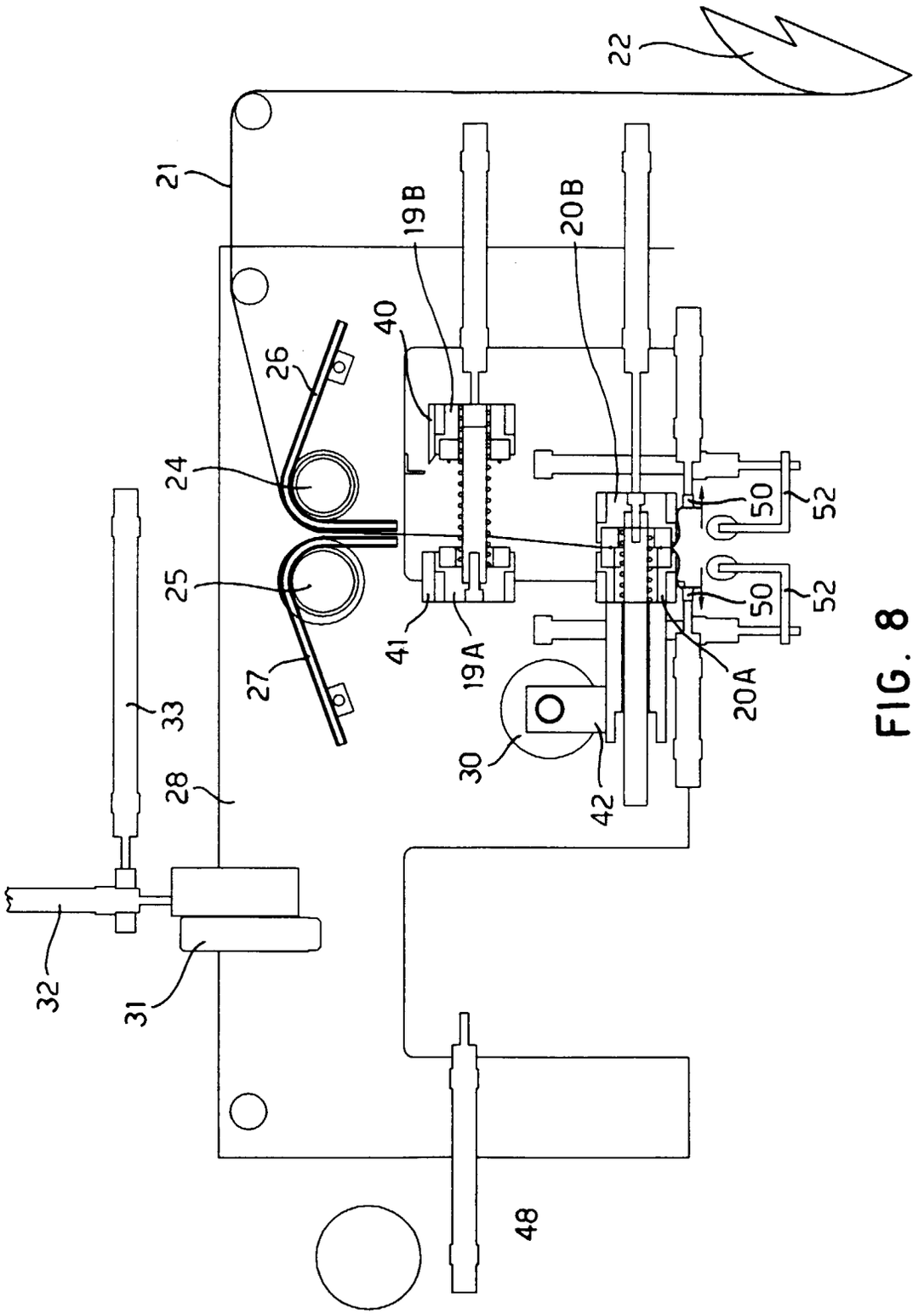
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FIG. 8

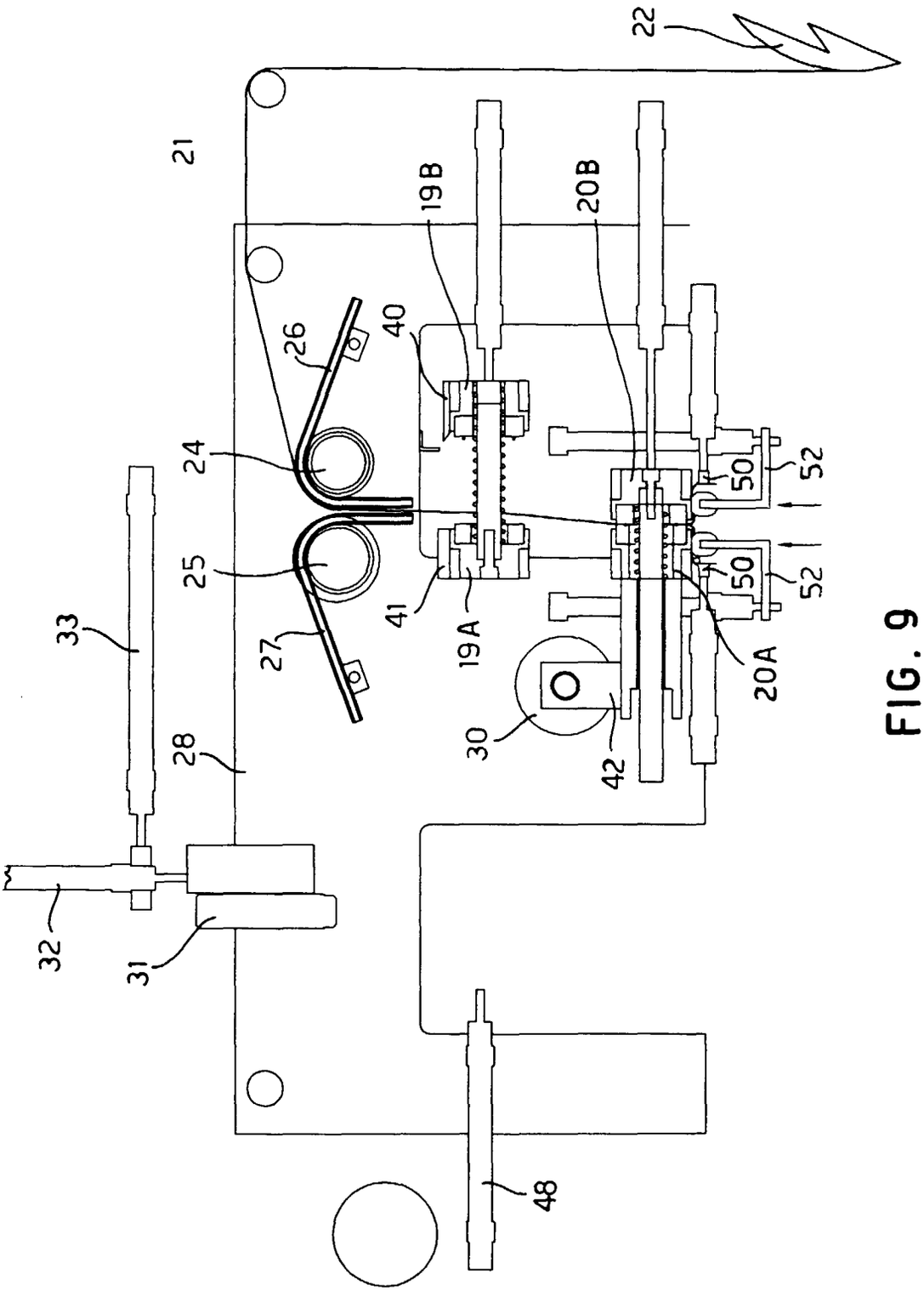
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FIG. 9

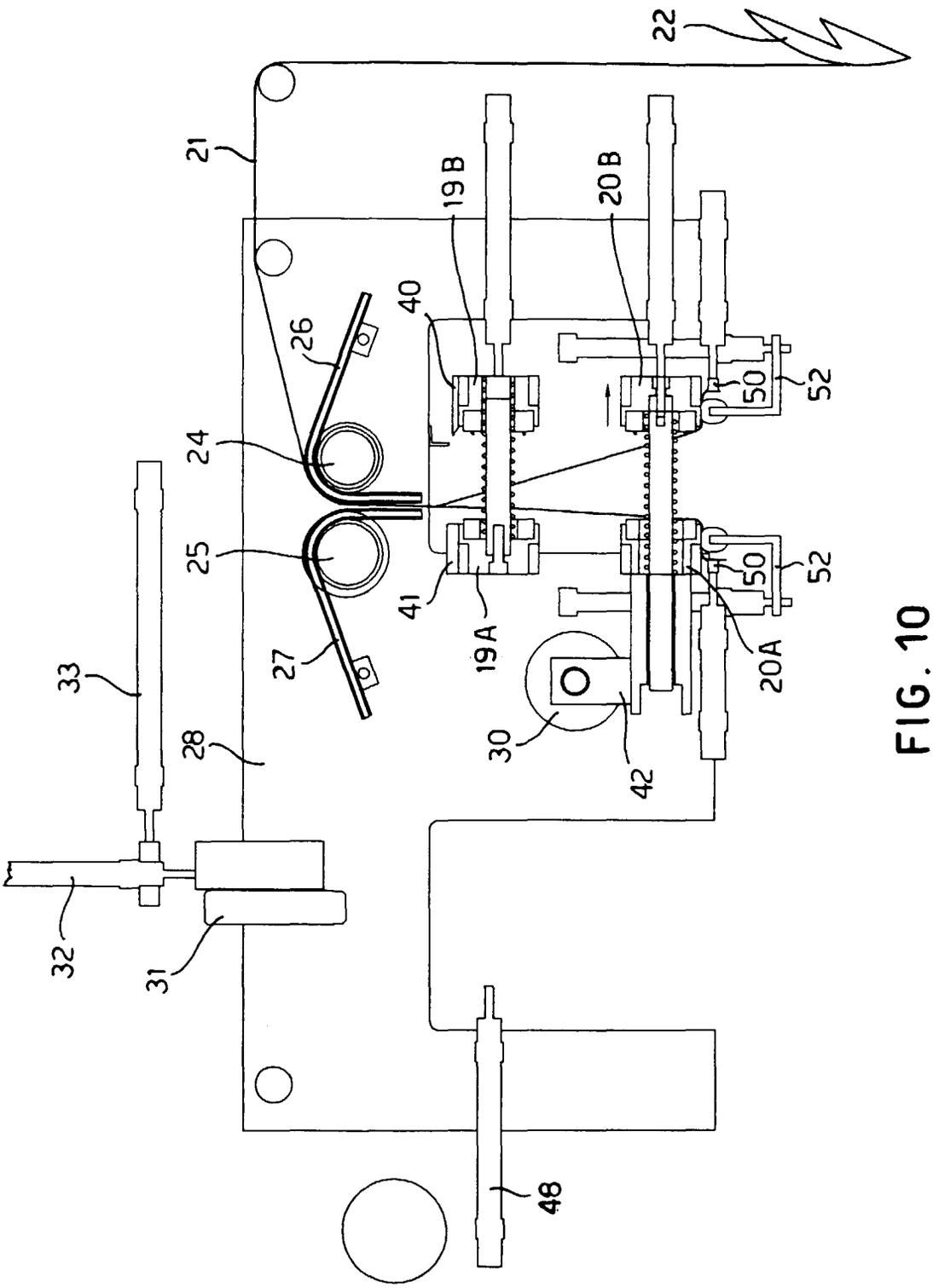

FIG. 10

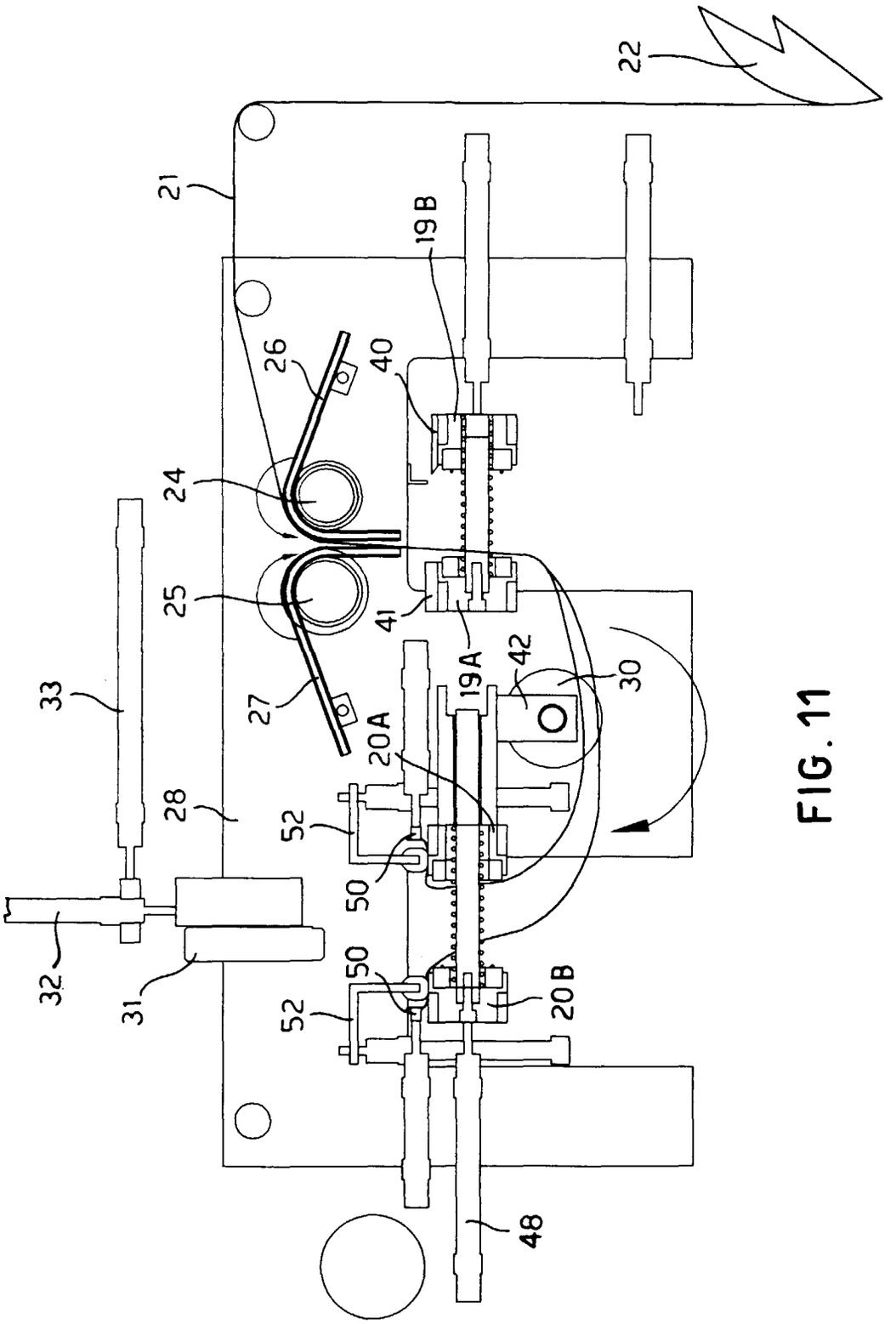
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FIG. 11

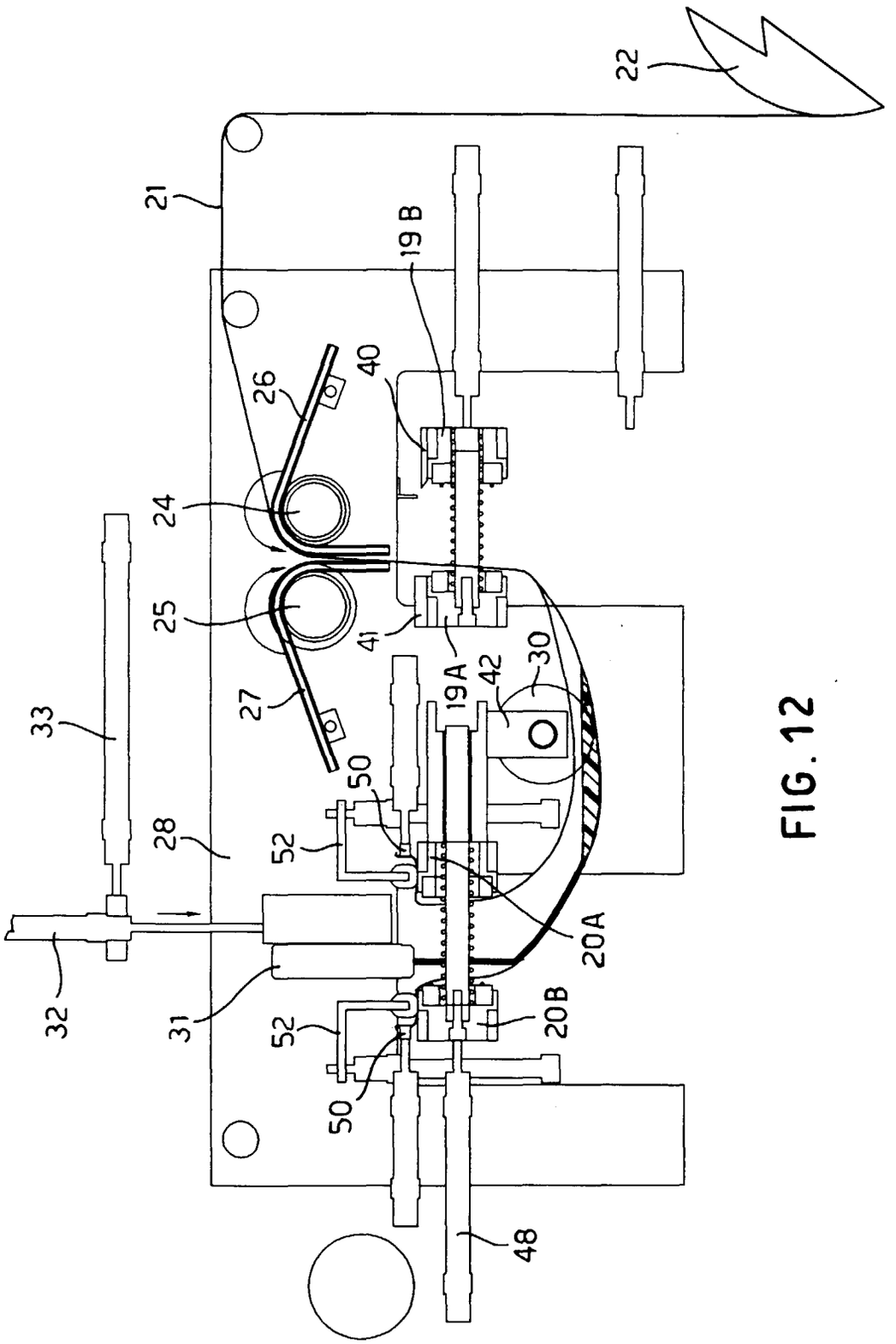
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FIG. 12

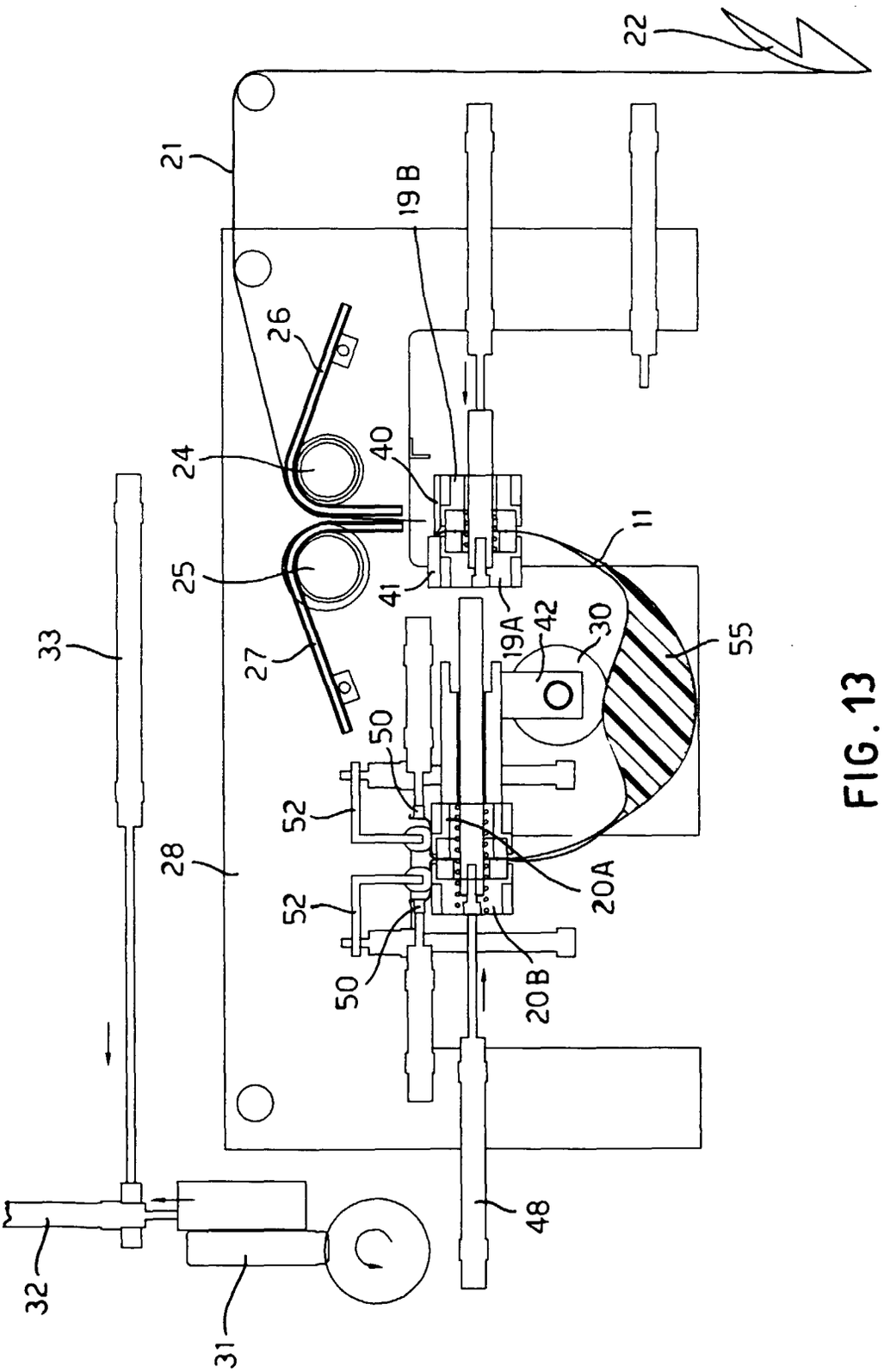
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FIG. 13

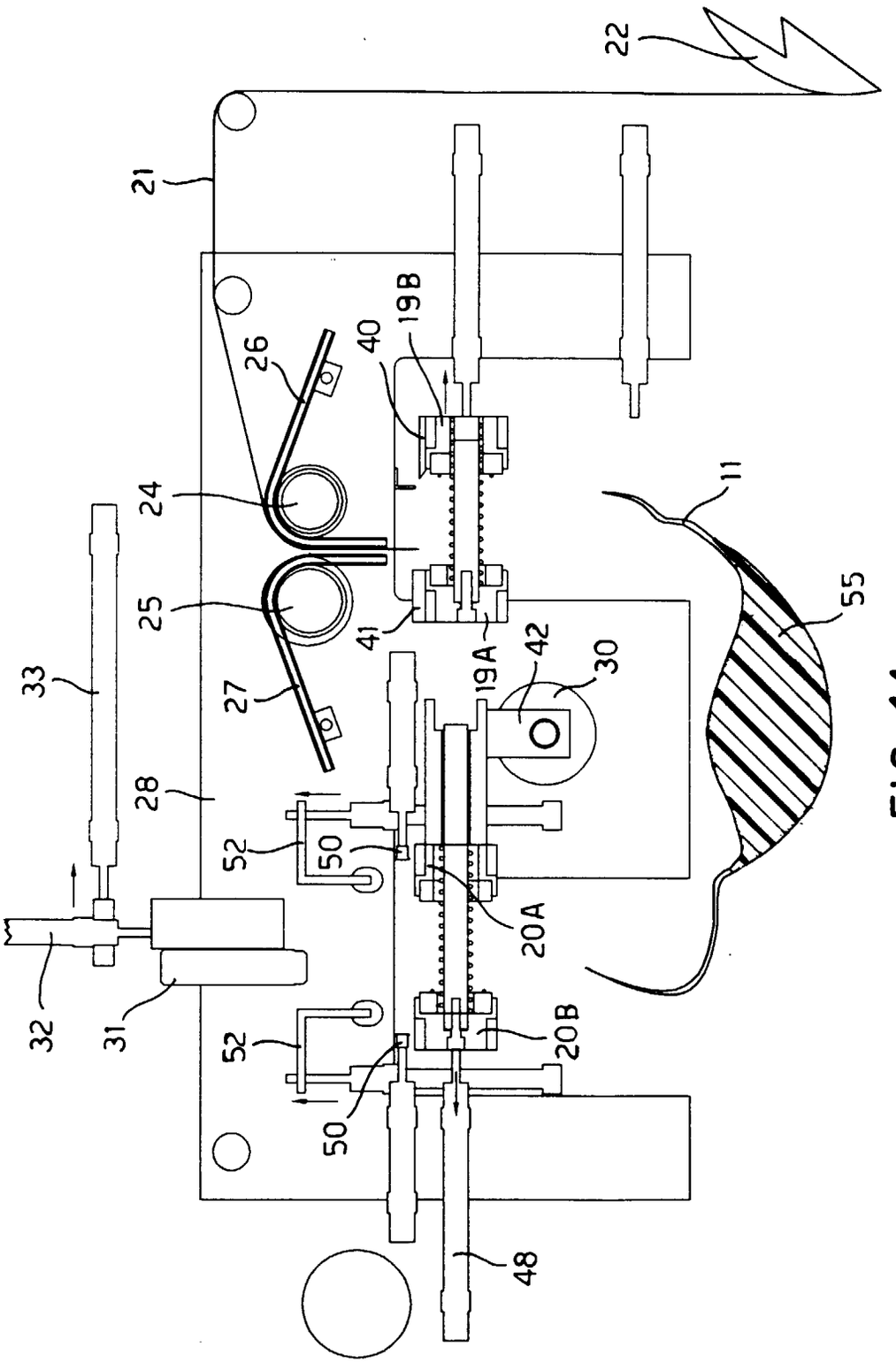
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FIG. 14

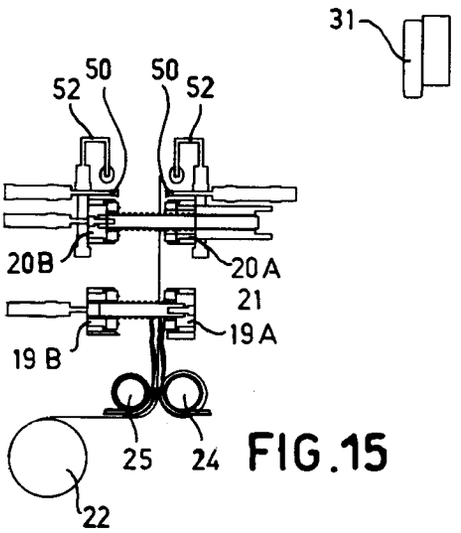

FIG.15

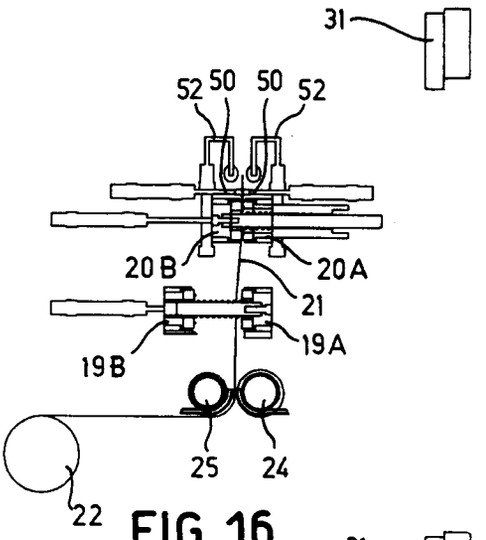

FIG.16

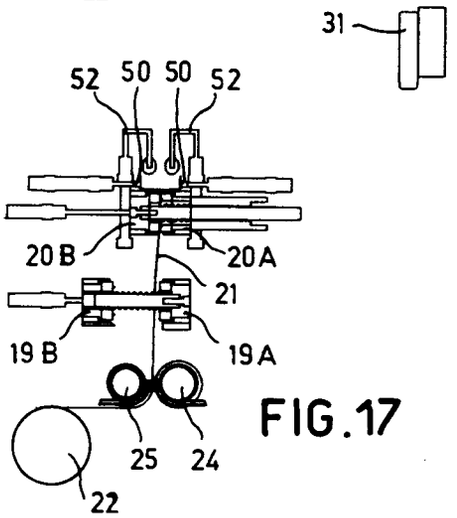

FIG.17

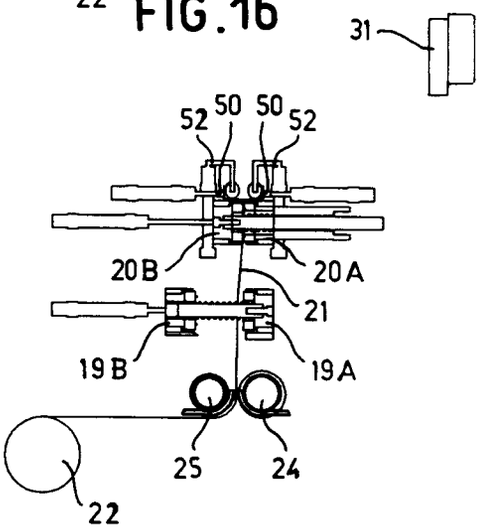

FIG.18

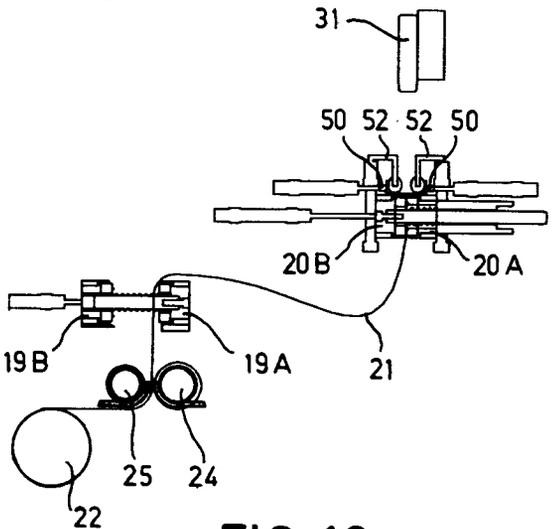

FIG.19

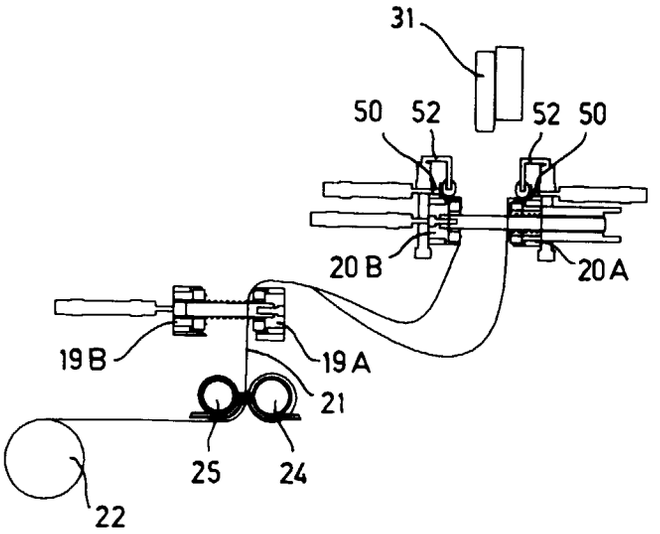

FIG. 20

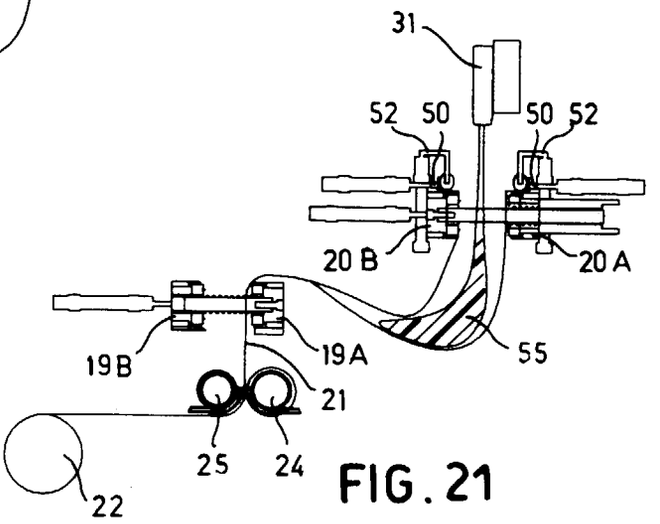

FIG. 21

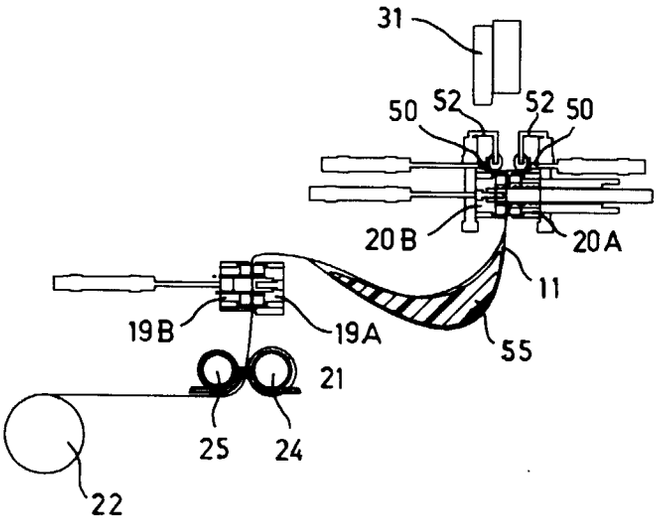

FIG. 22

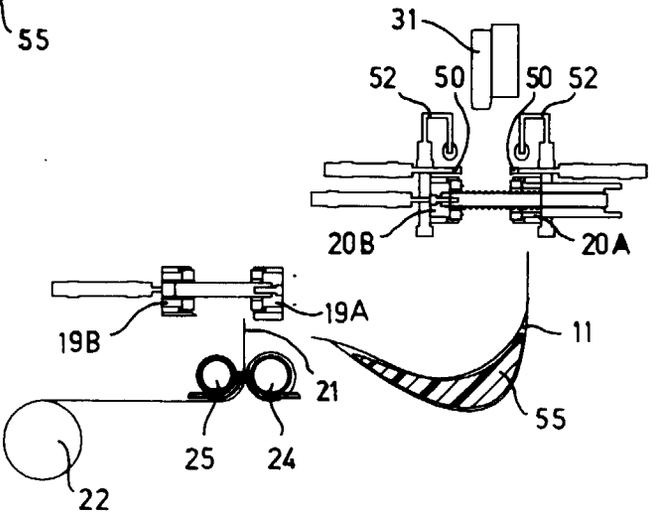

FIG. 23

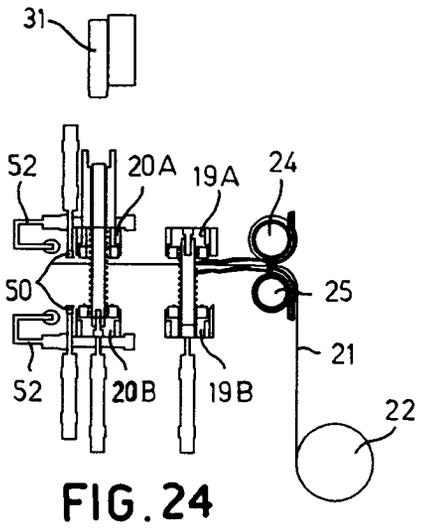

FIG. 24

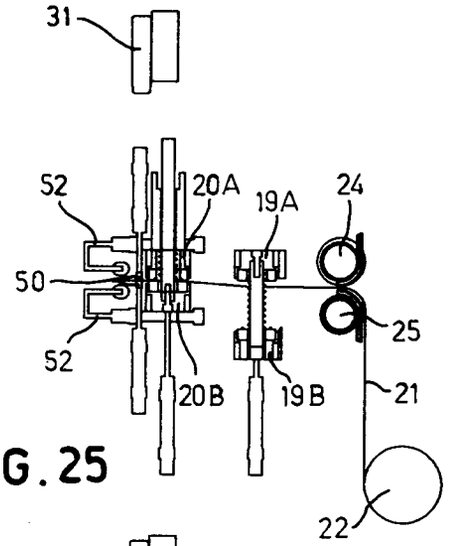

FIG. 25

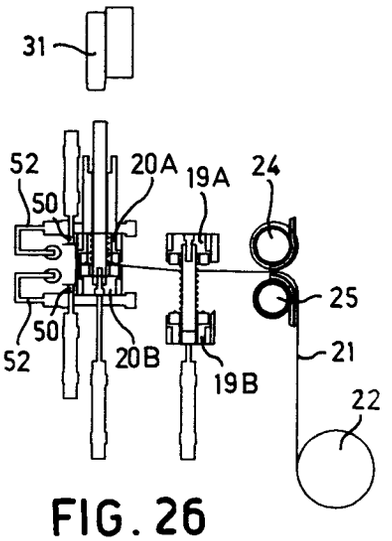

FIG. 26

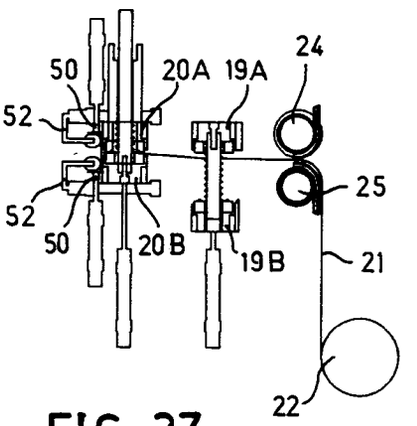

FIG. 27

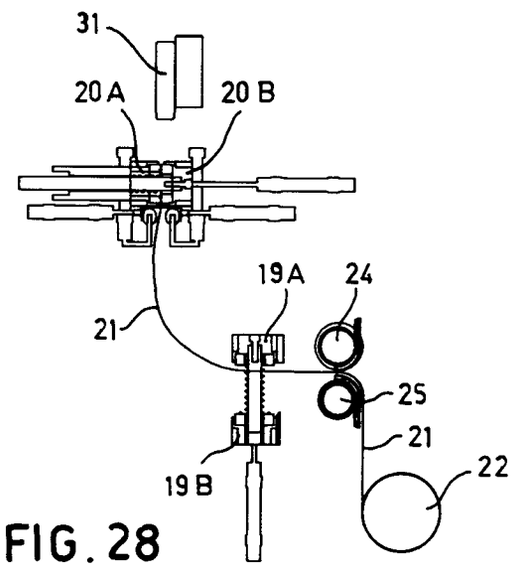

FIG. 28

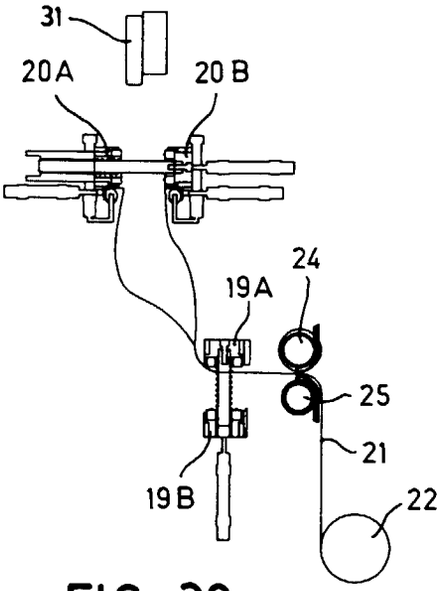

FIG. 29

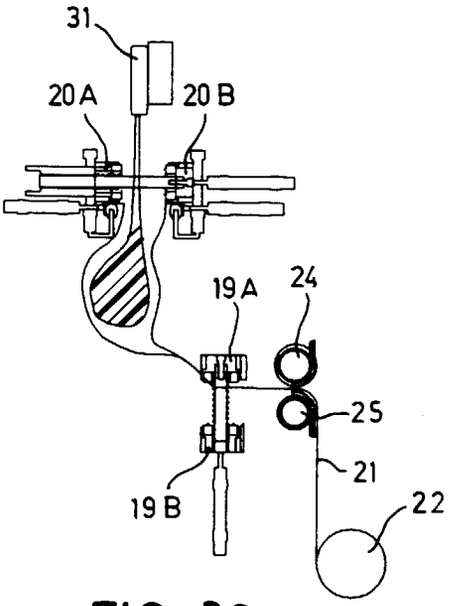

FIG. 30

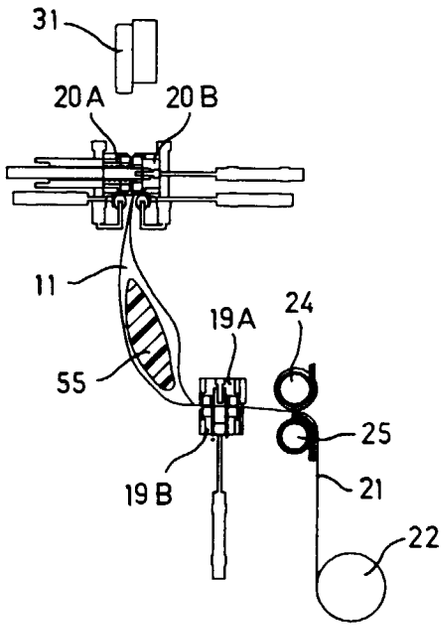

FIG. 31

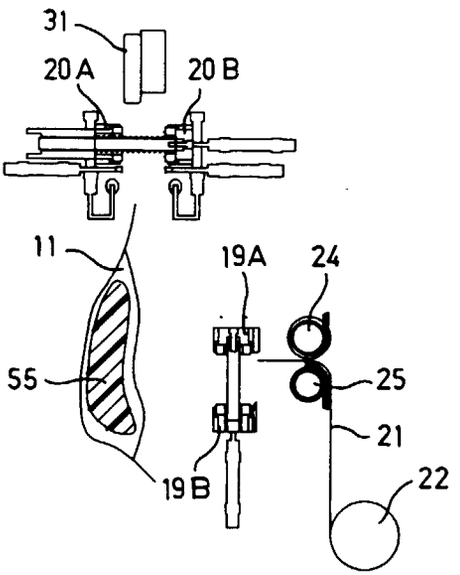

FIG. 32

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 3544

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR 2 158 898 A (S.F.V.N.K.I.K.M.) 15 June 1973	1,13,17	B65B9/13
A	* page 10, line 29 - page 12, line 11; figures *	4	
D,Y	EP 0 225 976 A (SEALED AIR CORP.) 24 June 1987	1,13,17	
A	* column 4, line 48 - column 10, line 4; figures *	3	
A	US 4 384 442 A (J. PENDLETON) 24 May 1983 * column 1, line 57 - column 3, line 32; figures *	1,13	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65B
B29C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 November 1998	Jagusiak, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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