

EXTENSION AND POSITION-SENSING PROCESS
FOR BAG-TIE REGISTRATION PROCESS

ABSTRACT OF THE DISCLOSURE

The present invention features an apparatus and method for extending, position sensing and folding the ties of a tie bag into the body of the bag. The apparatus and method of the invention accomplish the position sensing and folding of the ties as the webbing of the bag is rapidly moving. The ties are first extended and then folded within the web on-the-fly. The ties of the flexible web are caused to pass between two extension plates, in which respective air nozzles are located. Air is transversely passed over the upper and lower webbing surfaces via the nozzles. In so doing, the flexible ties are caused to flatten, smooth and extend perpendicularly to the direction of travel of the web. The air under pressure also prevents the ties from contacting the walls of the plates. The extended ties are now oriented so as to be acceptable to both the sizing and folding operations.

**EXTENSION AND POSITION-SENSING PROCESS
FOR BAG-TIE REGISTRATION PROCESS**

FIELD OF THE INVENTION

The present invention pertains to tie bags used most commonly for the storage and disposal of debris and other ubiquitous waste materials, and, more particularly, to the manufacture and packaging of bags having ties that are folded "on-the-fly" within the body of the webbing, as the web of the bag is being continuously advanced and conveyed during the packaging operation.

BACKGROUND OF THE INVENTION

The manufacture and use of polyethylene storage and disposal bags is well known in the art. One of the bothersome problems with the use of plain storage bags is the inconvenience involved in trying to tie the bag. Several brands use separate metal wire ties which are packaged along with the bags. As a separate item, these metal wire ties can be unwieldy to use and often become lost.

A convenient user feature of the polyethylene bags of this invention is its ties that ARE integral with the body of the bag. These integral ties comprise a curved, cut-out portion of the bag web. Built in, the ties can be grasped and knotted to seal the bag; hence, they are referred to in the trade as "tie bags". The tie bags of this invention are

illustrated in United States Patent No. 4,890,736, issued to Greyvenstein on January 2, 1990.

In the manufacture and packaging of tie bags, it has been determined that folding the ties within the webbing of the bag provides several advantages. One advantage is that a neat and compact packaging can be accomplished. Another advantage is that the user of the bag can more easily separate the two web halves when the ties are tucked inside the body of the bag.

Although it has already been determined that several advantages are achieved by folding the ties within the bag body, it has been heretofore impossible, nevertheless, to accomplish the packaging of the tie bags with the desired configuration.

The invention incorporates a system for folding the ties within the body of the bag webbing while the web is being conveyed. In other words, the ties are folded while moving on-the-fly.

When presented with the task of folding the ties within the body of the moving web, experts in the art have previously stated that it could not be achieved. The reason for their belief resulted from the major difficulty of sizing, folding and stacking operations with on-the-fly folding of the flexible tie material within the body of the bag at high speed.

Providing proper registration for the bag ties posed a difficult problem. As the polyethylene webbing is being rapidly conveyed through the manufacturing facility, the ties tend to ripple. Being very thin and extremely

flexible, the webbing lends no support to the ties. This results in ties that are free to flap, roll, wrinkle and ripple as they move along the conveyor apparatus.

Recently, this particular problem has been exacerbated by the reduction of the webbing thickness. The webbing has been made thinner in order to provide greater compaction for landfill disposal of the bag. Thinner webs, therefore, lend even less support to the ties.

Before the ties can be folded, they must be extended properly to provide for sensing of the bag position, before sizing the web into individual bag units. Therefore, the present invention includes tie extension, tie position sensing and tie-folding apparatuses and methods, all of which are accomplished while the webbing is continuously moving (on-the-fly).

The second major breakthrough in resolving the problem was the folding of the tie itself as the webbing is rapidly moving. The inventive apparatus passes the webbing of the bag through a web-separating device and the two halves of the webbing are then separated and passed over a guide member. The guide member forces the tie of each web half to fold under and rejoins the two web halves thereafter. While the webbing is under tension, the ties are maintained in a smooth, folded-in registration until the webbing is sized, cut, folded and packaged.

Discussion of Related Art

In United States Patent No. 4,906,228, issued on March 6, 1990, to Reifenhauser et al, entitled METHOD AND

APPARATUS FOR THE MANUFACTURE OF PLASTIC BAGS IN PAIRS WITH SIDE SEAMS, an apparatus for folding the ties of the bags is illustrated. The wave crests and wave troughs that are characteristic of the tie patterns of this invention are cut through the center of the sheet body, thus forming two oppositely facing bags. The ties are then folded down, in whole or in part, along a continuous fold line. The fold can be toward either the inside or the outside of the bag. The ties are then welded to the bag body. Thereafter, holes are punched in the folded and welded portions, forming a handle.

The aforementioned bag manufacturing method differs from the current invention in that the registration of the bags is achieved by scanning the inner or outer edges of the wave crests and wave troughs to convey them synchronously. Although not clearly described in the reference, this scanning is, nonetheless, a process step which is completely alien to the present invention. The method described for the current invention uses a flow of air to align each wave crest to its fully extended position. The present invention provides ties that are substantially devoid of wrinkles, which may or may not be the case with the prior patented apparatus. It is not evident from the Reifenhauser description as to just what the folding device comprises. However, since the crests are subsequently welded, there is, most probably, no concern about wrinkling. Furthermore, there is probably a similar lack of concern as to whether the folds are inside or outside of the bag, since the weld will be accomplished in either case. This is a concern with the present invention, however, as the ties must be tucked only within the bag. In addition, since Reifenhauser tucks the ties toward the outside and even welds them, the concern about air entrapment when the halves are separated is never

raised. This concern, highly relevant to the present invention, is one that is neither contemplated nor addressed by Reifenhauser. Finally, the folding in Reifenhauser is intermittently accomplished along a continuous fold line, as compared with the present invention, in which the folding of individual ties is continuously accomplished along a discontinuous fold line.

SUMMARY OF THE INVENTION

The present invention features an apparatus and method for tie extending, tie position sensing and folding the ties of a tie bag into the body of the bag. The apparatus and method of the invention accomplish the position sensing and folding of the ties as the webbing of the bag is rapidly moving. The ties are first extended and then folded within the web on-the-fly. The ties of the flexible web are caused to pass between two extension plates, wherein respective air nozzles are located. Air is transversely passed over the upper and lower webbing surfaces via the nozzles. In so doing, the flexible ties are caused to flatten, smooth and extend perpendicularly to the direction of travel of the web. The air under pressure also prevents the ties from contacting the walls of the plates. The extended ties are now oriented so as to be acceptable to both the position-sensing and folding operations.

It is an object of the present invention to provide a system and method for assisting in the folding the ties of a tie bag into the body of the bag, while the webbing of the bag is being continuously conveyed through the manufacturing system.

It is a further object of the invention to provide, in a continuous process, an extension and, thereafter, a folding of the ties within a flexible plastic bag.

BRIEF DESCRIPTION OF THE DRAWINGS

A complete understanding of the present invention may be obtained by reference to the accompanying drawings, when considered in conjunction with the subsequent detailed description, in which:

FIGURE 1 illustrates a perspective, schematic view of the extension and folding system of this invention;

FIGURE 2 depicts a sectional view of the extension apparatus (transverse to the path of travel of the web) for the system of the invention shown in FIGURE 1;

FIGURE 3 illustrates an enlarged, partial view of the folding guide member of the folding apparatus of the invention depicted in FIGURE 1; and

FIGURE 4 depicts a schematic electromechanical diagram of the web speed control system, in accordance with the invention.

For the purposes of clarity and brevity, like elements and components will bear the same designation throughout the FIGURES.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Generally speaking, the invention features a system and method for achieving packaging of a plastic bag having its ties internally folded within the body of the bag. The bag is made by a continuous process in which the bags are

manufactured as a continuous double web of polyethylene. The end of the web is cut in a serpentine pattern to provide tie-shaped surfaces. The ties are extended as they move along the conveyor and then folded by the apparatus and method of the invention. Thereafter, the continuous webbing is sized, cut, folded and packaged.

The extension apparatus for extending the ties of the high-speed web of flexible, plastic material provides for the proper sensing of each bag center, so that the web can be cut into individual bag units. Owing to the extremely high speed and the flexibility of the web, the sizing relies upon a unique "floating point average" of the center line of a number of individual bags approaching a sizing and cutting station. The "floating" center line value is not the actual center line as it may exist for that portion of the web positioned between the cutting or sizing elements. Rather, it is a calculated center line for a number of bags, based on the sensed position of the leading and trailing edges of the sinusoidally-shaped ties of each bag unit. The ties, by definition, are each designed to be in the center of the bag unit as it is cut from the moving web. The average center line of the bags approaching the sizing station actually represents where the position of the center of the tie should be, based on the web speed. As such, the "floating" center line determination is a calculated position well in tolerance with the actual center line.

Now referring to FIGURE 1, the extension, position sensing and folding system 10 of this invention are shown. The system 10 illustrates a continuous, double-layered web 11 of polyethylene that is being fed over a feed roller 12 on the left-hand side of the figure. The double-layered web 11 is cut on one end thereof in a serpentine pattern, as

shown by arrow 14. The web 11 will be subsequently sized and cut in later processes in order to provide individual bag units having a single tie 15 on each layer of the webbing, so as to provide two ties per bag.

The webbing 11 is fed along a feed path, generally depicted by the arrows 16.

The ties 15 are free to roll, wrinkle, ripple and fold as they exit from the feed roller 12, due to the flexibility and thinness of the web 11. It becomes necessary to provide a means by which each unit tie 15 will be extended to its maximum length in a direction transverse (arrows 18) to the direction of the web movement along the feed path 16. The tie 15 units are provided with an extension with respect to the feed path 16. Each tie unit 15 must be extended to provide a smooth, wrinkle-free tie surface. This is required so that the subsequent position-sensing and folding of the ties 15 within the web 11 (by the folding apparatus 20) will be accomplished properly.

As the web 11 is continuously fed from roller 12 in order to achieve the extension of each tie 15, the system 10 provides an extension device 25, comprising a pair of extended plates 21 and 22, respectively. The web 11 is fed between the lower plate 22 and the upper plate 21 of the extension device 25.

Referring to the sectional FIGURE 2, a more detailed operation of the extension of the tie units 15 will be explained. Each of the respective plates 21 and 22 is provided with an internal nozzle 23. Each of the nozzles 23 is fed by a conduit 24 that supplies each nozzle with air under pressure. Each nozzle 23 passes the air into the

cavity 26 at its far end, as defined by the respective upper and lower plates 21 and 22. As the web 11 (comprising a double layer of polyethylene) is conveyed through the plates 21 and 22 of the extension device 25, the nozzles 23 blow the pressurized air over the respective upper and lower surfaces 27 and 28 of web 11. The pressure of the flowing air (arrows 18) causes the web to become smooth and extend to its maximum length in a plane transverse to the direction of the feed path 16. The ties of the web 11 are prevented from contacting the surfaces of the plates 21 and 22, respectively. This is necessary in order to prevent the ties from skewing or dragging upon the plates, which would cause inaccuracy in the sensing operation. Once extended, the tie position can be sensed for purposes of sizing the individual bag units, as will be hereinafter explained with reference to FIGURE 4. As aforementioned, the nozzles 23 are positioned at the far ends of the plates 21 and 22, respectively, in order to prevent them from touching the inner surfaces of the plates. It is important to note, however, that a vacuum will not work for this purpose, and only air under pressure will keep the ties from contacting the inner surfaces of the respective plates 21 and 22.

The web 11 with extended ties 15 is immediately fed from the extension device 25 to a folding apparatus, shown generally by arrow 20.

The folding apparatus 20 comprises a double pair of guide plates 40a and 40b, and 50a and 50b, respectively. The first pair of guide plates 40a and 40b are divergently positioned according to the upward direction of travel of web 11, so that the webbing 11 is caused to separate into its two respective layers 11a and 11b, as shown by arrows 16a and 16b. It is necessary to open the webbing 11, so

that each tie 15 passing through the folding apparatus 20 can be tucked, or folded into, the interior portion of the double-layered web.

It should be understood that, as the web feed is continuous, the inventive system 10 requires that the two respective layers 11a and 11b of the webbing 11 must each be divergently threaded through the folding apparatus 20 prior to the activation of feeding rollers 12, 30 and 31. This threading is usually accomplished manually, since it must be done only once per production run.

As the layers 11a and 11b diverge, they are respectively fed to guide plates 50a and 50b, which converge toward each other. These converging plates 50a and 50b have a dual purpose. They fold in the respective ties 15a and 15b into the webbing 11, and also close the layers 11a and 11b of the webbing 11 after the folding has been accomplished, as shown by arrows 16aa and 16bb.

Each plate 50a and 50b, respectively, is provided with respective folding plates 46a and 46b (not shown), each of which has a cam-like surface, 45a and 45b (not shown), respectively. The cam-like surfaces respectively engage the diverging web layers 11a and 11b. In order to describe the folding operation in sufficient detail, and since upper and lower guide plates function in like manner, reference will be made only to the upper guide plate 50a and its corresponding folding plate 46a, as illustrated in more detail in FIGURE 3.

Referring to FIGURE 3, the ties 15a of the upper web half 11a are fed seriatim under cam-like guide member 45 that is part of folding plate 46a, as shown. As the upper

web 11a exits over the top surface of plate 50a, the ties 15a fold under the web 11a.

As will be seen from FIGURE 3, the travelling web half 11a comprises serpentine tie units 15a, having convex prominences that are additionally defined by concave wells 47a disposed therebetween. The wells 47a travel into contact registration with the cam-like well surface 45a of folding plate 46a. As the web 11a is caused to move over the top of plate 50a, each of the convex prominences 15a is discretely caused to be folded seriatim under the web 11a on-the-fly, as the respective concave wells 47a are cammed (folded under) by surface 45a of folding plate 46a.

After being folded under the web 11a, the convergent shape of plate 50a guides the web 11a back into contact with the similarly converging web 11b. Both web portions 11a and 11b are more clearly shown in their converging relationship with reference to arrows 16aa and 16bb, as illustrated in FIGURE 1.

The folded-in ties 15 become permanently folded within the web 11 as the web is fed under tension to the subsequent sizing and cutting sections of the manufacture, not shown here. The web 11 may also be rolled upon a storage drum (not shown), when the manufacturing operation is performed on a partitioned or modular basis.

Referring now to FIGURE 4, the electromechanical apparatus 120 of the web speed control system of this invention is illustrated in schematic view. Block 122 represents the speed drive that drives the continuously moving web 11, shown in FIGURE 1. The speed drive 122 is a variable speed drive, driven by servo-motor 123 that is

connected to a drive roller (not shown) supporting web 11 for movement.

The speed of the web 11 is sensed through a drive gear 124 attached to the drive roller and motor 123. The gear speed is sensed through a speed mag pick-up that generates a signal fed to controller 25 via line 26. The controller 25 is an M-Track model, Fenner Digital Control Unit, manufactured by Fenner Industrial Controls Company of Maple Grove, Minnesota. The tie position sensed at station 113 is also fed to controller 125 via line 127.

The position of a hot knife at a sizing station (not shown) is sensed and fed to controller 125 via line 128. The speed of a lead drive motor is sensed, and a signal indicative thereof is sent to controller 125 via line 129. A motor 130 is used to rotatively drive the drive motor.

The controller 125 determines the "floating" center line from the average of the ties passing the sensing station 113, using this information to control the hot knife sequencing and the web speed. The controller keeps the speed of the web 11 in synchronization with the subsequent folding drum apparatus, so that there is a smooth transitional flow between folding and subsequent sizing operations.

The controller 125 determines changes in web speed and can readjust the speed of the drive roller via servo-motor 123 in order to provide proper bag unit continuity.

Since other modifications and changes varied to fit particular operating requirements and environments will be apparent to those skilled in the art, the invention is not

considered limited to the example chosen for purposes of disclosure, and covers all changes and modifications which do not constitute departures from the true spirit and scope of this invention.

Having thus described the invention, what is desired to be protected by Letters Patent is presented in the subsequently appended claims.

WHAT IS CLAIMED IS:

1. An extension apparatus for a flexible web having outer surfaces and prominent portions defining ties, with the extension of said web causing said prominent portions to be smoothed and extended while the web is moving on-the-fly, said extension apparatus comprising:

means defining a continuous feed path for conveying a flexible web having integral ties disposed thereon;

conveying means for continuously moving said flexible web along said feed path;

an extension device disposed in said feed path and comprising walls defining a cavity, said ties of said flexible web being fed through said cavity by said conveying means; and

air pressure means carried by said extension device for providing air under pressure to said cavity, said air being caused to flow in a direction transverse to said feed path and over outer surfaces of said ties of said web, thereby preventing said ties from contacting said walls of said cavity, and further extending said ties outwardly while said web is continuously moving through said extension device.

2. The extension apparatus of claim 1, wherein said cavity is defined by a pair of plates, and said web is caused to move between said plates.

3. The extension apparatus of claim 1, wherein said means for supplying air under pressure comprises a pair of nozzles, each nozzle projecting air over an outer surface of

said flexible web.

4. The extension apparatus of claim 1 in combination with a position-sensing device.

5. The extension apparatus of claim 1 in combination with a folding device.

6. An extension apparatus for a flexible web having outer surfaces and prominent portions, with the extension of said web causing said prominent portions to be smoothed and extended while the web is moving on-the-fly, said extension apparatus comprising:

means defining a continuous feed path for conveying a flexible web;

conveying means for continuously moving said flexible web along said feed path;

an extension device disposed in said feed path and comprising means defining a cavity, said flexible web being fed through said cavity by said conveying means; and

air pressure means carried by said extension device for providing air under pressure to said cavity, said air being caused to flow over the outer surfaces of said web, whereby said prominent portions of said web will be extended on-the-fly, under the influence of the flowing air rushing past said outer surfaces of said web as said web continuously moves along said feed path.

7. The extension apparatus of claim 6, wherein said cavity is defined by a pair of plates, and said web is caused to move between said plates.

8. The extension apparatus of claim 6, wherein said means for supplying air under pressure comprises a pair of nozzles, with each of said nozzles projecting air over an outer surface of said flexible web.

9. The extension apparatus of claim 6, in combination with a position-sensing device.

10. The extension apparatus of claim 6, in combination with a folding device.

11. A method of extending prominences disposed on a flexible, continuously moving web, comprising the steps of:

- a) moving a flexible web along a feed path; and
- b) causing air to flow over the outer surfaces of said web in a transverse direction to said feed path, whereby said prominences of said web will become extended on-the-fly, in preparation for a subsequent processing procedure.

12. The method of claim 11, wherein said subsequent processing procedure comprises a folding operation.

13. The method of claim 11, wherein said subsequent processing procedure comprises a position-sensing operation.

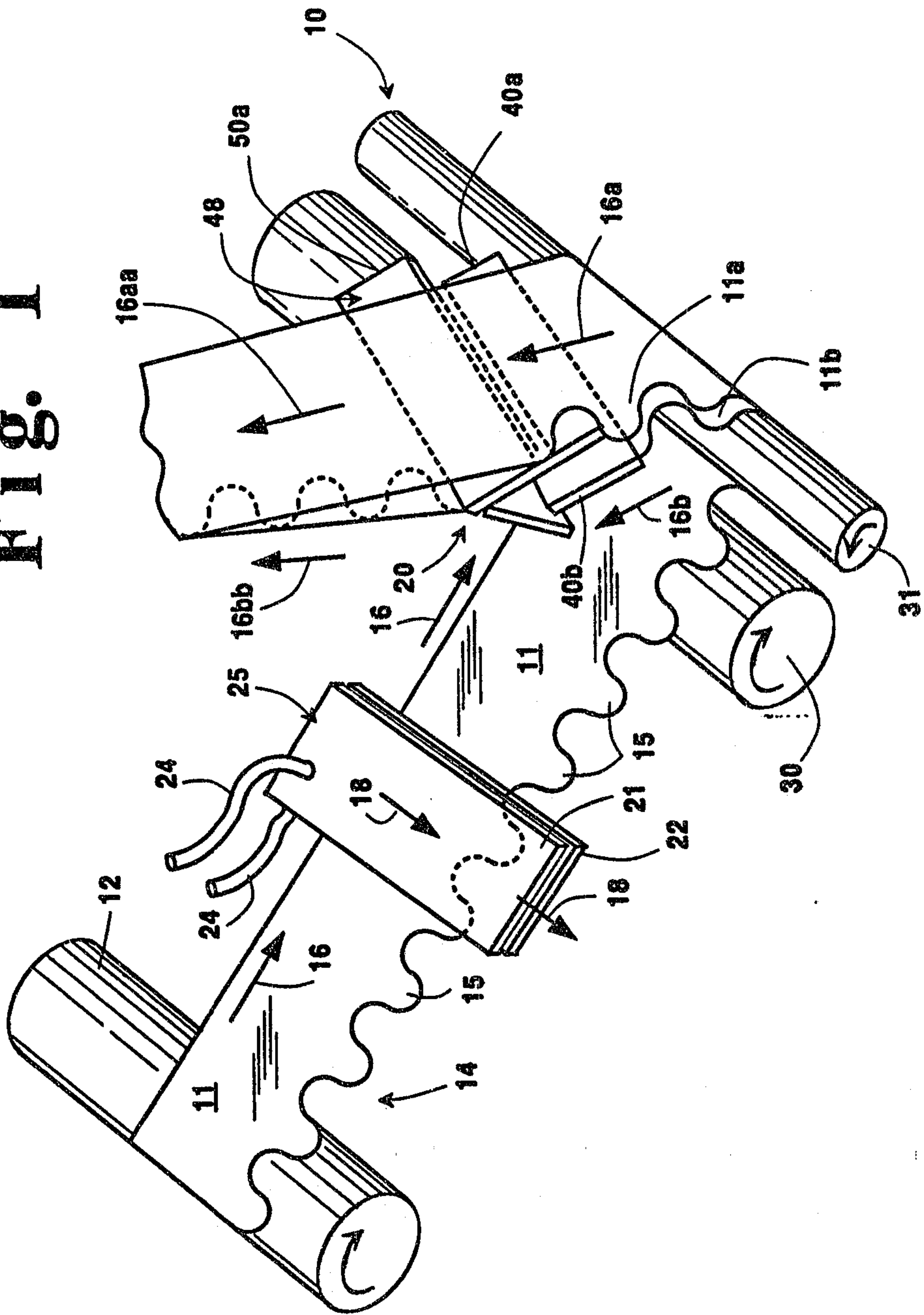
14. The method of claim 11, further comprising the steps of:

- c) feeding said flexible web to a cavity defined by a pair of plates; and
- d) blowing said air in accordance with step (b) through said cavity.

15. The method of claim 11, further comprising the further steps of:

- c) sensing leading and trailing edges of each prominence of said continuously moving web; and
- d) subsequently sizing said web into individual bag units.

Fig. 1



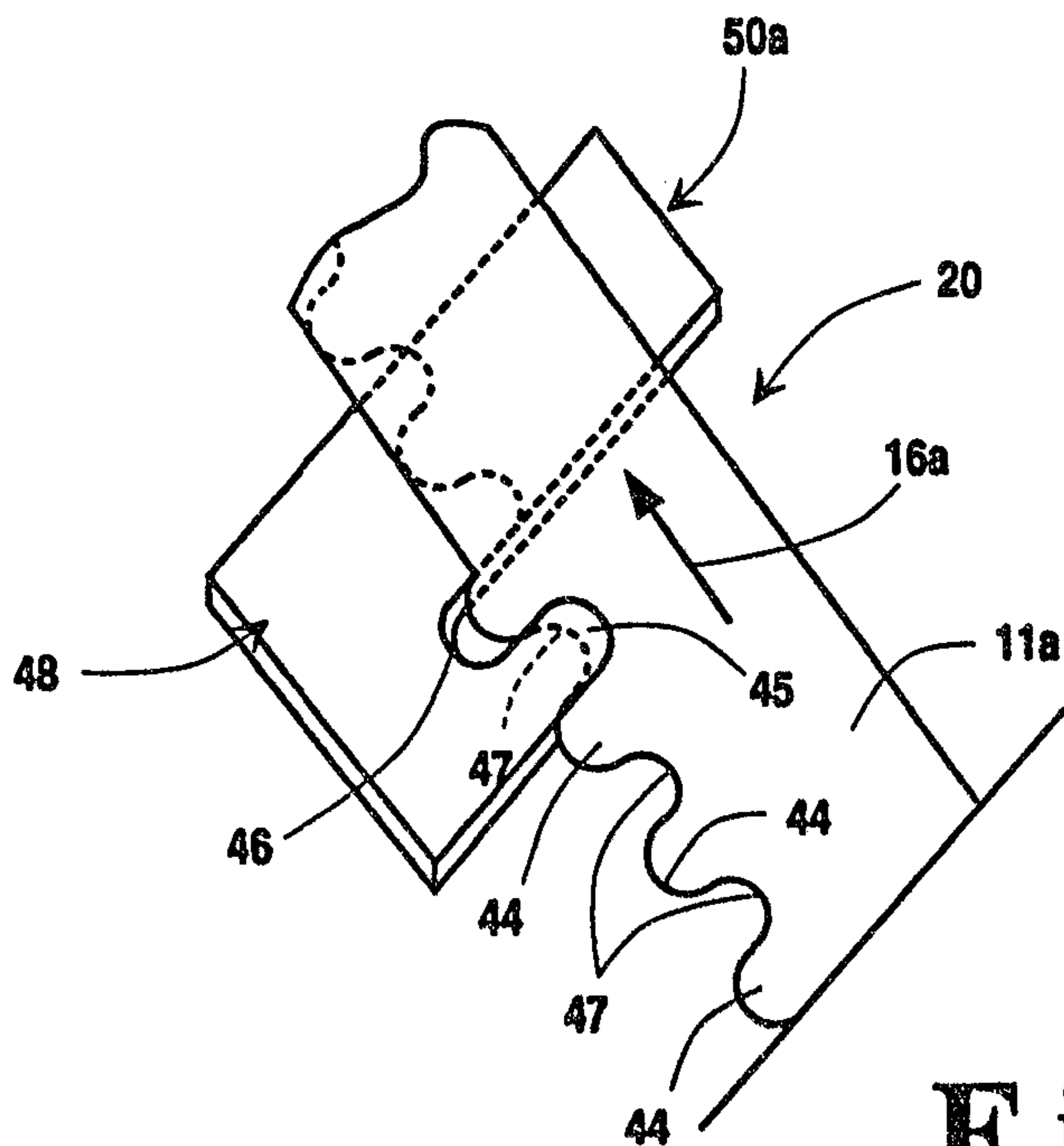


Fig. 3

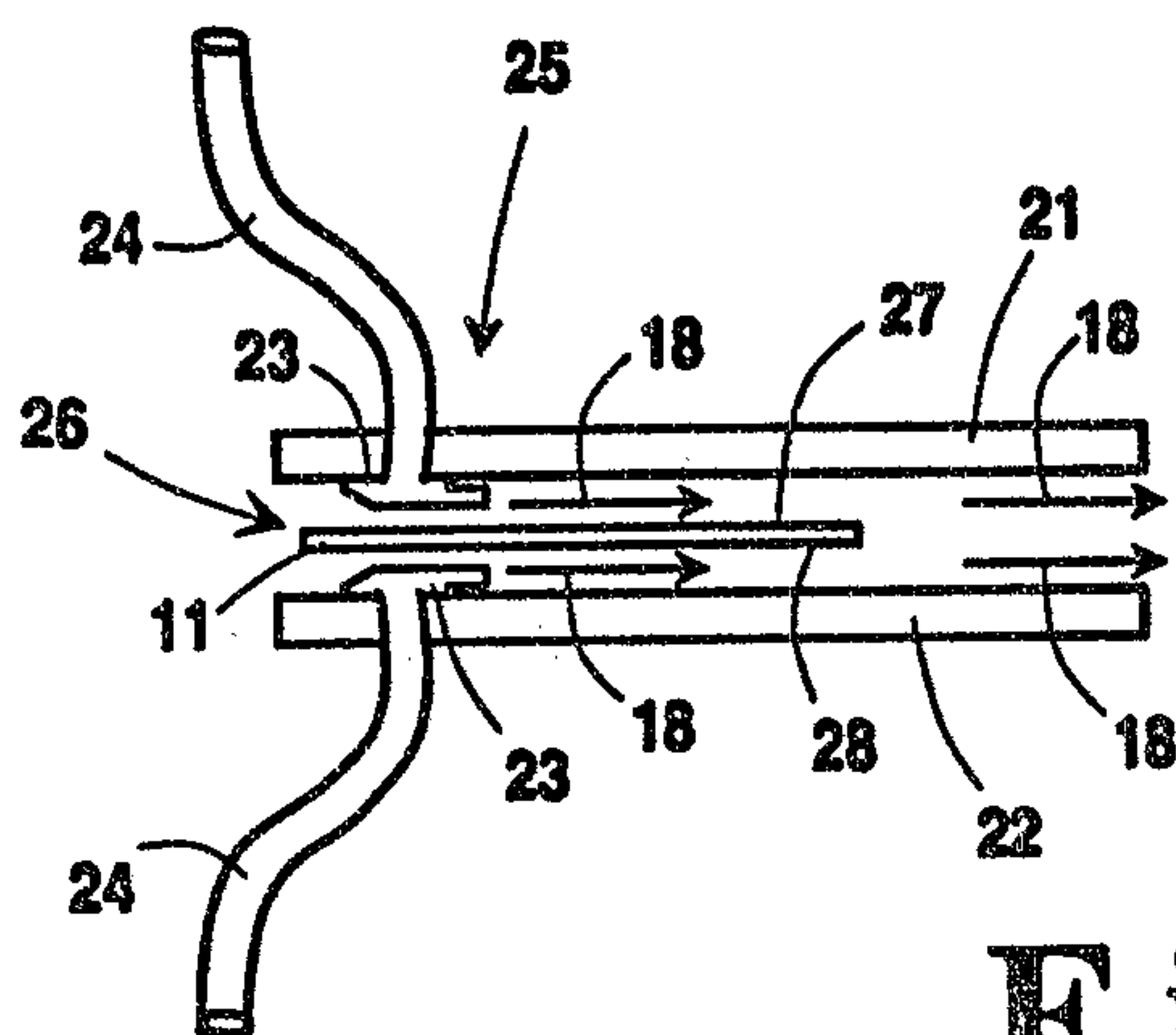


Fig. 2

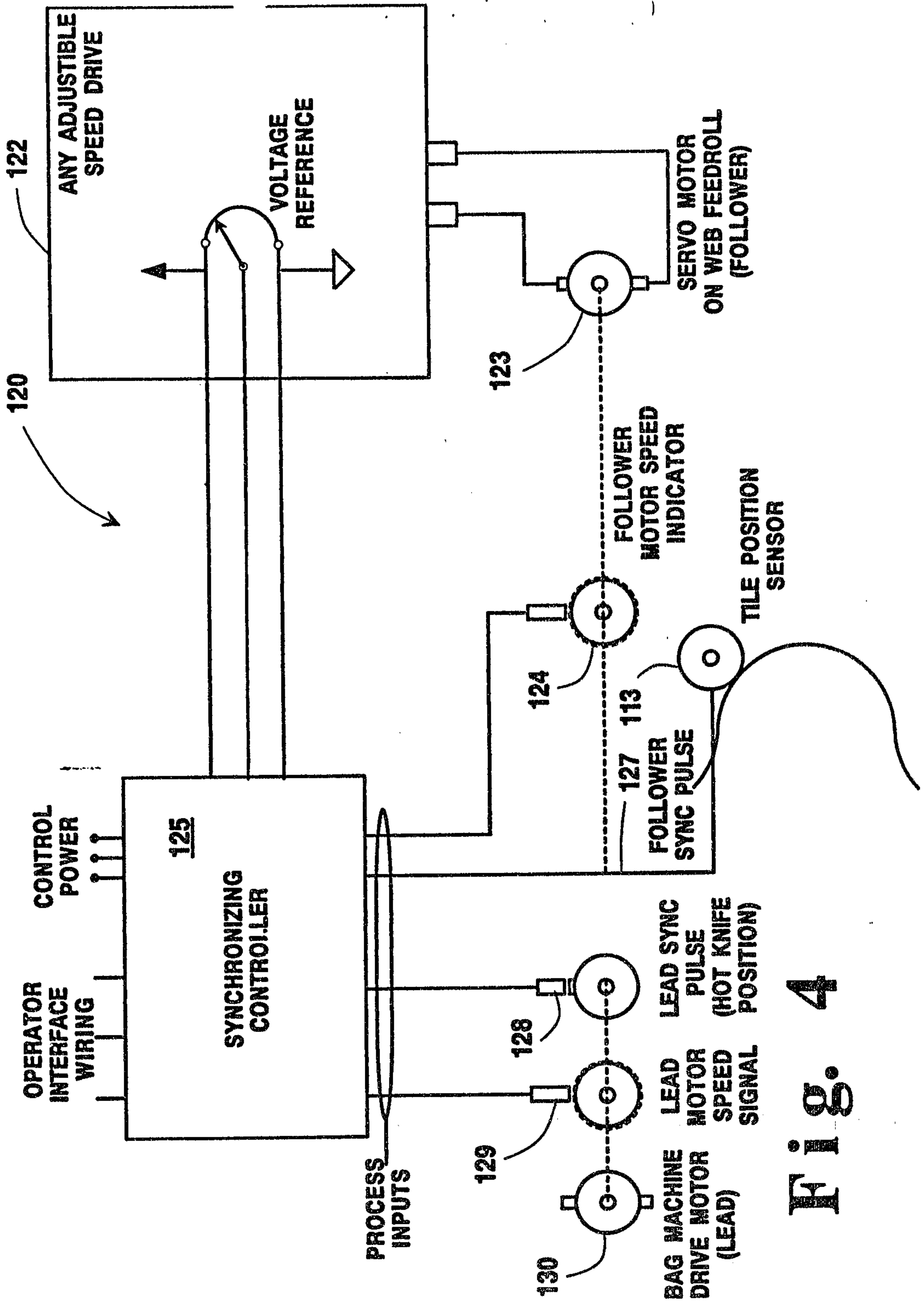


Fig. 4

