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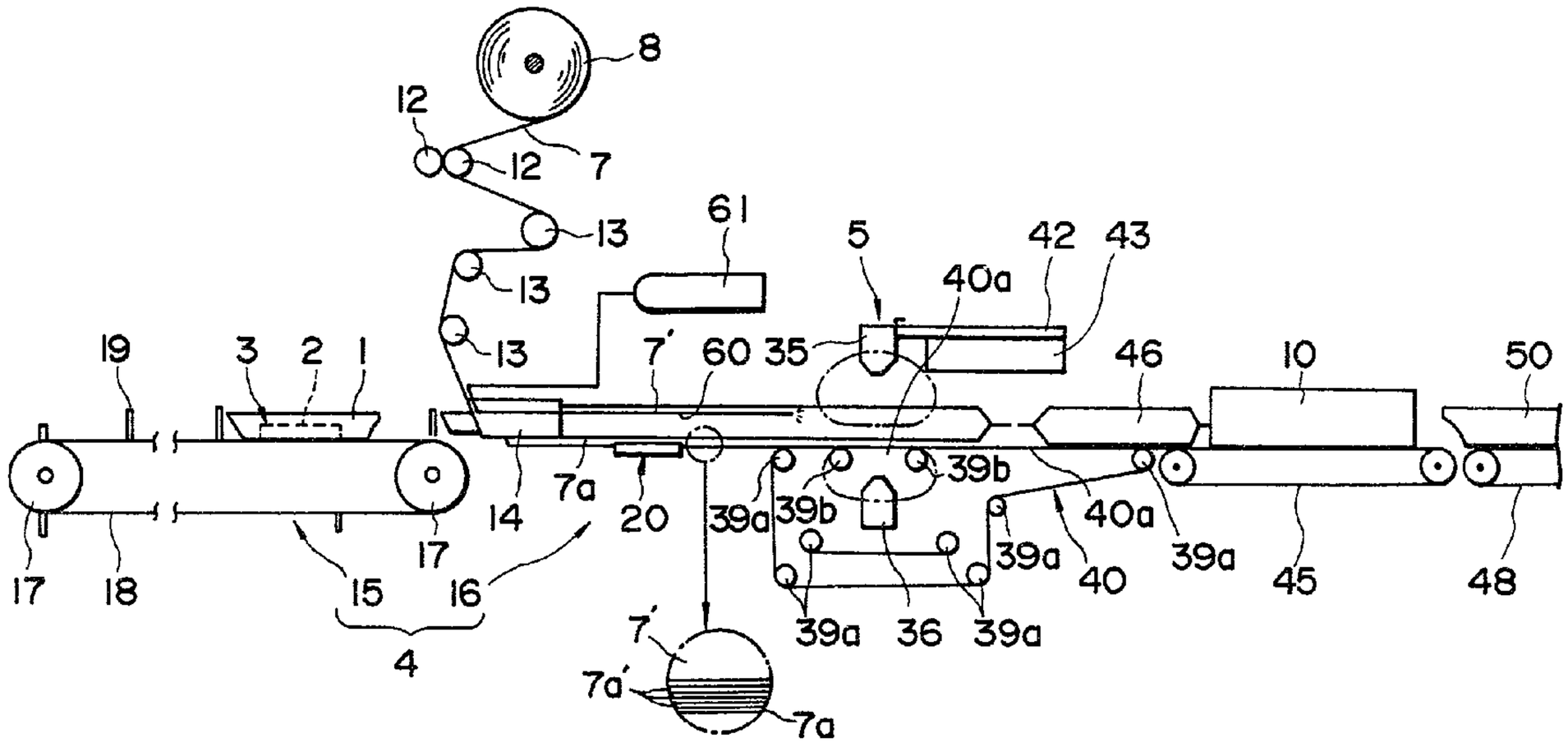
(54) **METHODE ET APPAREIL D'EMBALLAGE SOUS FILM RETRACTABLE**

(54) **SHRINK-WRAPPING METHOD AND APPARATUS**



(57) A thermal shrink film is continuously pulled out and is shaped into a tubular form. Individual items to be wrapped are fed into the tubular film sequentially and overlapping marginal portions of the tubular film extending lengthwise are sealed. The tubular film is sealed and cut along the transverse side of each of the items at the front end thereof and the tubular film is deformed inwardly by applying pressure thereto to decrease its content volume. Then the tubular film is sealed and cut along the transverse side of each item at its rear end to form an intermediate package. The film of the intermediate package is shrunk by heating to shrink-wrap the item.

ABSTRACT OF THE DISCLOSURE

A thermal shrink film is continuously pulled out and is shaped into a tubular form. Individual items to be wrapped are fed into the tubular film sequentially and overlapping marginal portions of the tubular film extending lengthwise are sealed. The tubular film is sealed and cut along the transverse side of each of the items at the front end thereof and the tubular film is deformed inwardly by applying pressure thereto to decrease its content volume. Then the tubular film is sealed and cut along the transverse side of each item at its rear end to form an intermediate package. The film of the intermediate package is shrunk by heating to shrink-wrap the item.

SHRINK-WRAPPING METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and apparatus for shrink-wrapping items by thermally shrinking a film wrapping the items.

2. Description of the Prior Art

According to a prior art, a web of wrapping film which is thermally shrinkable is continuously pulled out from a reel and is led to a bag making unit, by which it is rendered tubular, and individual items are fed into the tube of the wrapping film. Then, opposed sheets of the tube of the wrapping film are joined in longitudinal seals along opposite marginal edges of the film and in transverse seals along the transverse sides of each item lying in the tube, forming intermediate packages respectively containing the items within the thermal shrink film. The intermediate packages are fed through a shrinking tunnel, by which the film is heated and shrunk into close contact with the individual items contained therein. In the case where the film of each intermediate package is sealed completely airtight, however, the air in the package is thermally expanded by the heat applied for shrinking the film and the pressure of expanding air causes the film to swell against its shrinking force, making it impossible to shrink the film into a desired form in which the item is tightly wrapped.

A solution to this problem is to make very small deairing

perforations in the wrapping film at predetermined positions. When the intermediate package is heated, the air remaining therein is thermally expanded but does not swell the film, because the expanded air is discharged outside through the perforations. Accordingly, the film is thermally shrunk into close contact with the item and hence shrink-wrap it.

To make the deairing perforations in the wrapping film a perforator is provided in the path along which the web of film pulled out from the reel is fed to the bag making unit. The perforator is disposed adjacent a guide roller which guides the film to the bag making unit. The perforator comprises a rod extending widthwise of the film, a plurality of rotary members mounted on the rod and a plurality of needles attached to each rotary member. By this, the perforations are made in the wrapping film at predetermined positions while it is transferred in contact with the rotary members.

The number and positions of such perforations to be made in the wrapping film, that is, the number and positions of perforations to be made in each intermediate package are determined according to the size of the intermediate package and the ratio in volume between the article contained therein and the internal space of the package. Hence it is necessary to adjust the number of perforations and their positions in the wrapping film in accordance with the size and shape of each article to be wrapped. On this account, the conventional shrink-wrapping apparatus calls for time-consuming and cumbersome work such as selection or exchange of the above-mentioned rotary members and adjustment of the relative

angular positions of the perforating needles between the rotary members each time the size and shape of the article to be wrapped are changed.

Moreover, the shrink package itself obtained with the conventional shrink-wrapping apparatus has the following defect, because it has the deairing perforations and hence lacks sealing performance.

For example, when the item to be wrapped is a plant, perishable food, or the like, it is preferable, for preserving its freshness or preventing its discoloration, that nitrogen gas, carbon dioxide, or similar inert gas is filled in the package together with the item to be wrapped, but the conventional shrink package cannot be filled with such an inert gas. That is, the nitrogen gas or the like, even if filled in the shrink package will flow out therefrom through the perforations, lessening the effect of the gas.

Besides, thermal shrink films as of polyethylene, polypropylene, etc., used in the past, are not so low in gas permeability, thus nitrogen gas or similar inert gas filled in the shrink package leaks out therefrom little by little through the film, further lessening the above-mentioned effect.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and apparatus for forming a shrink package which does not call for making deairing perforations in the wrapping film and hence has high gas permeability.

Another object of the present invention is to provide a

method and apparatus for forming a shrink package which is so excellent in gas permeability that nitrogen gas or similar inert gas filled therein will not leak out therefrom.

Accordingly, the present invention relates to a shrink-wrapping method comprising the steps of: continuously pulling out a wrapping film made of a material having excellent thermal shrinkage and low gas permeability properties; shaping the film into a tubular form; feeding into the tubular film individual items to be wrapped; sealing overlapping marginal portions of the tubular film extending lengthwise thereof; sealing the tubular film transversely along a front end of each of the items and cutting the tubular film along the thus formed transverse seal; pressing the tubular film to deform the tubular film inwardly to decrease the internal volume thereof; sealing the tubular film transversely along a rear end of the each item and cutting the tubular film along the thus formed transverse seal to form an intermediate package while the internal volume of the tubular film is maintained decreased; and heating the film of the intermediate package to thermally shrink the film to shrink-wrap the each item.

Preferably, another step is included which introduces an inert gas into the tubular film after it is sealed and cut along the transverse side of the item at the front end thereof.

The shrink-wrapping apparatus according to the present invention includes: means for continuously supplying a wrapping film made of a material having excellent thermal shrinkage and low gas permeability properties; means for shaping the film into a tubular form; means for feeding into the tubular film individual items to be wrapped; center seal means, provided in a path of conveyance of the

tubular film, for sealing overlapping marginal portions of the tubular film extending lengthwise thereof; end seal means, disposed downstream of the center seal means, for sealing and cutting the tubular film transversely thereof at predetermined intervals; a shrinking tunnel, disposed downstream of the end seal means, for heating an intermediate package cut away from the tubular film by the end seal means; and film deforming means, disposed between the end seal means and the shrinking tunnel for deforming the tubular film inwardly to decrease an internal volume thereof.

Another aspect of the present invention relates to a wrapping apparatus comprising: means for continuously supplying a wrapping film made of a material having excellent thermal bonding properties; means for shaping the film into a tubular form; means for feeding into the tubular film individual items to be wrapped; center seal means, provided in a path of conveyance of the tubular film, for sealing overlapping marginal portions of the tubular film extending lengthwise thereof; and end seal means, disposed downstream of the center seal means, for sealing and cutting the tubular film transversely thereof at predetermined intervals. The end seal means includes a pair of upper and lower sealers conducting a box type movement. At least one of the upper and lower sealers has first urging means for generating an urging force relatively weakly pressing end faces of the upper and lower sealers into contact with each other with the film gripped therebetween when the upper and lower sealers are closest to each other, and second urging means for applying between the end faces of the upper and lower sealers an urging force larger than that by the first urging means when the

end faces are pressed against each other by the first urging means.

With such a construction, the wrapping film made of a material of excellent thermal shrinkage and low gas permeability is continuously pulled out of a reel and is provided in a tubular form, but while the film is pulled out, no deairing perforations are made in the film. On the other hand, individual items are fed into the tube of the wrapping film, which is conveyed with the items held therein and during the conveyance the overlapping ends of the film are sealed by the center seal means. While being further conveyed, the film tube is sealed transversely thereof at the front side of each item and then the film tube is deformed by pressuring it to reduce its content volume, after which the film tube is sealed and cut transversely thereof at the rear end of the item contained therein to form the intermediate package. The

intermediate package thus provided has its film depressed, and hence the amount of air (or gas) therein is small. Finally, the film of the intermediate package is heated, by which the film is thermally shrunk and becomes taut. At this time, the air in the intermediate package is thermally expanded but the expanded air flows into an upper space which is newly defined as the film, once depressed, rises until it becomes taut, and consequently, the film will not be swollen more than predetermined, owing to the expansion of the air. In this way, the individual items are shrink-wrapped.

Since the shrink package thus formed is a completely sealed package with no perforations made therein, an inert gas, which is filled therein for the purpose of preserving the quality of the item contained therein, will not ever leak out of the package and will serve the purpose for a long period of time.

Other objects, features and advantages of the present invention will become more apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view schematically illustrating the overall construction of the shrink-wrapping apparatus according to a preferred embodiment of the present invention;

Fig. 2 is a plan view illustrating a center seal unit and its vicinity in the embodiment, with an item to be wrapped being taken away;

Fig. 3 is a front view of the center seal unit with the

item to be wrapped being positioned thereon;

Fig. 4 is a side view showing an end seal unit composed of a pair of upper and lower end sealers and their vicinity in the embodiment;

Fig. 5 is a side view showing the state in which the upper and lower end sealers have approached each other from their positions in Fig. 4;

Fig. 6 is a side view showing the state in which the upper and lower end sealers have further approached each other to perform end-sealing;

Fig. 7 is a side view illustrating an intermediate package formed in the present invention;

Fig. 8 is a side view illustrating a shrink package of the present invention which is formed by passing the intermediate package of Fig. 7 through a shrinking tunnel;

Fig. 9 is a front view, partly in section, of a preferable end seal unit for use in the present invention;

Fig. 10 is a plan view of the end seal unit depicted in Fig. 9; and

Fig. 11 is a sectional view taken on the line XI-XI in Fig. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 schematically illustrates the overall structure of the shrink-wrapping apparatus according to a preferred embodiment of the present invention. As shown in Fig. 1, an end seal unit 5 is provided downstream of a conveyor unit 4 by which articles to be wrapped 3, each of which includes a tray 1 and an item 2 contained therein, are conveyed at

predetermined intervals. Disposed above the conveyor unit 4 is a reel 8 with a web of wrapping film 7 wound thereon, and disposed at the discharge end of the end seal unit 5 is a shrinking tunnel 10.

The wrapping film 7 is made of a film material which is low in gas permeability, that is, excellent in gas barrier property, and highly thermally shrinkable, such as BDP-2050 (made by W. G. Grace & Co., CRYOVAC Division). The wrapping film 7 travels between a pair of pull-out rollers 12 and over a plurality of tension rollers 13 to a bag making unit 14 disposed at the intermediate position on the conveyor unit 4, by which the film 7 is folded into a tube 7′ (hereinafter referred to as a tubular film 7′). The articles to be wrapped 3 are sequentially fed into the tubular film 7′ being conveyed.

The conveyor unit 4 is made up of a first conveyor 15 which conveys only the articles to be wrapped 3 and sequentially feeds them into the tubular film 7′, that is, serves both as a conveyor and as an infeed conveyor, and a second conveyor 16 which is disposed near the discharge end of the first conveyor 15 and conveys the articles to be wrapped 3 together with the tubular film 7′. The first conveyor 15 includes an endless chain 18 mounted on a pair of sprockets 17, and fingers 19 attached to the endless chain 18 at predetermined intervals.

The second conveyor 16 has on the underside thereof near its charging side a center seal unit 20 for sealing overlapping marginal portions 7a of the tubular film 7′.

The center seal unit 20 is means by which the overlapping

marginal portions 7a of the tubular film 7′ extending in its longitudinal direction are pressed together from both sides thereof and heated so that they are fused together. Figs. 2 and 3 show the construction of the center seal unit 20, which comprises a heating roller 21 of a relatively large diameter and a pair small-diametered rollers 22 disposed opposite the heating roller 21 with the overlapping marginal portions 7a of the tubular film 7′ gripped therebetween. The pair of rollers 22 are provided to ensure heat sealing of the overlapping marginal portions 7a. The heating roller 21 has three annular projections or flanges 23 formed around its peripheral surface. The overlapping marginal portions 7a of the tubular film 7′ are held and heated between the three flanges 23 and the rollers 22 each having a flat peripheral surface to prevent the heat from being transmitted to the entire areas of the overlapping marginal portions 7a, thereby reducing the amount of heat which is transmitted to the tubular film 7′. Since the thermal shrinkage factor of the film 7 is high (about 50 to 60%), the overlapping marginal portions 7a, if heated too much, will shrink excessively and the sealed portion becomes so thick that no complete hermetic end sealing can be achieved in the subsequent steps. By suppressing the amount of heat which is transmitted to the overlapping marginal portions 7a, as mentioned above, the sealed portion becomes flat, ensuring the end sealing.

As a result, the overlapping marginal portions 7a sealed by the center seal unit 20 become a substantially flat portion having three longitudinal sealed portions 7′a as shown, with

being scaled up, in the circle indicated by the one-dot-chain line in Fig. 1.

Moreover, in this embodiment, to prevent that portion of the tubular film 7′ lying on the underside of the tray 1 is thermally shrunk by the heat transmitted from the heating roller 21, a pair of right and left cooling plates 25 are disposed between the center seal unit 20 and the tubular film 7′. The cooling plates 25 each has a three-layer structure which includes flat top and bottom panels 26 and 27 and an intermediate plate 28 sandwiched therebetween and having a meandering window 28a, which forms a cooling water channel. The bottom panel 27 has at a predetermined position an inlet port 27a for supplying cooling water to the meandering window 28a as the cooling water channel and an outlet port 27b therefrom. A pump 30 and a tank 31 are connected via pipes 29 to the inlet port 27a and the outlet port 27b. Thus, cooling water circulates through closed loops each formed by the cooling water channel, the pipes 29, the pump 30 and the tank 31. Incidentally, this embodiment uses tap water as the cooling water.

The overlapping marginal portions 7a of the tubular film 7′ are received vertically in the gap between the both cooling plates 25 so that they are gripped between the rollers 21 and 22 lying under the cooling plates 25.

The end seal unit 5 in this embodiment is what is called a box motion type end seal unit, which has such a construction as shown in Figs. 4 through 6. The end seal unit 5 has a pair of upper and lower end sealers 35 and 36, and the sealing

surface of the upper end sealer 35 has built therein a cutting edge. The end sealers 35 and 36 are associated with grooved cams 37 and 37 so that the end sealers 35 and 36 turn along predetermined path along which they move forward while meshing with each other with the film 7 gripped therebetween and then move backward while coming apart from each other. Around the lower end sealer 36 there is provided an endless belt 40 which travels over many fixed and moving pulleys 39a and 39b. The tubular film 7′ is received and conveyed on the top surface 40a of the endless belt 40. The opening 40b of the endless belt 40, defined by the moving pulleys 39b around the lower end sealer 36a, moves back and forth with the lower end sealer 36 by moving the moving pulleys 39b back and forth in synchronism with the movement of the lower end sealer 36, by which the width of the opening 40b is reduced to facilitate smooth conveyance of the tubular film 7′.

In the present invention, there is provided downstream of the upper end sealer 35 of the end seal unit 5 a film press member 43 connected thereto via a coupling plate 42, for pressing and deforming the tubular film 7′. The film press member 43 is formed by sponge shaped in a rectangular parallelopipedic form and its plane area is made smaller than that of the upper opening portion of the tray 1. The thickness of the film press member 43 is selected such that its underside lies below the upper edge of the tray 1 when the both end sealers 35 and 36 mesh with each other, that is, when the upper end sealer 35 lies at the lowermost position as shown in Fig. 6.

While in this embodiment the end seal unit 5 and the film press member 43 are formed as a unitary structure as mentioned above, it is a matter of course that they may be provided separately.

Downstream of the film press member 43 is the shrinking tunnel 10, which is usually open at both ends and is inverted U-shaped in cross section. Provided immediately below the shrinking tunnel 10 is a conveyor belt 45, which conveys each intermediate package 46 cut away from the tubular film 7′ by the end seal unit 5. Near the discharge end of the conveyor belt 45 is provided a take-away conveyor 48, by which is taken away a shrink package 50 thermally shrunk by the passage through the shrinking tunnel 10.

Next, a description will be given of the operation of the embodiment described above. At first, the web of wrapping film 7 is continuously pulled out from the reel 8 and is guided to the bag making unit 14 without being perforated, wherein the film 7 if formed into the tubular film 7′. On the other hand, the trays 1 are pushed by the fingers 19 and sequentially fed into the tubular film 7′ at predetermined intervals.

The articles to be wrapped 3 lying in the tubular film 7′ are conveyed intact by the second conveyor 16, while at the same time the overlapping marginal portions 7a of the tubular film 7′ extending lengthwise thereof are heat sealed by the center seal unit 20 while being gripped between the heating roller 21 and the rollers 22.

Downstream of the center seal unit 20 the tubular film 7′

is heat sealed and cut by the end seal unit 5 along the transverse side of each article 3 at predetermined intervals to form the individual intermediate package 46. Prior to the end sealing of each article at the rear end thereof the tubular film 7′ is depressed inwardly thereof by the press member 43 as shown in Fig. 5. Then the end sealers 35 and 36 are turned into engagement with each other to perform the end sealing as shown in Fig. 6, providing the intermediate package 46 with the top of the tubular film 7′ depressed as depicted in Fig. 7. That is, the quantity of air in the intermediate package 46 is reduced and shrinkage allowance of the tubular film 7′ is provided taking into account its thermal shrinkage.

Since the film press member 43 is made of sponge, the item 2 in the tray 1, even if hit by its underside, will not be injured and the tubular film 7′ can be deformed downward. Hence, when the thickness of the sponge portion is made larger than the thickness as illustrated, the film press member 43 goes down while being partly urged against the item 2, by which the tubular film 7′ around the item 2 can be pressed down below the top surface of the item 2.

Then, the intermediate package 46 is fed into the shrinking tunnel 10 via the endless belt 40 and the conveyor 45. Since the temperature in the shrinking tunnel 10 is particularly higher at the upper side, the tubular film 7′ shrinks greatly at the upper side of the tray 1, and hence the tubular film 7′ lying in the opening of the tray 1 becomes taut as shown in Fig. 8. In this instance, the air in intermediate package 46 is thermally expanded but the tubular

film 7′ does not swell upwardly of the upper edge of the tray 1, because the air flows into the upper space 51 which is newly defined as the top surface of the tubular film 7′ rises.

As the result of this, the tubular film 7′ thermally shrinks into close contact with the tray 1 to form the shrink package 50. The shrink package 50 thus formed is a completely sealed bag with no perforations and gas permeability of the film material is low, accordingly the shrink-wrapped item 2 can be preserved in good conditions.

The preservation of the shrink-wrapped item 2 can be further ensured by sealing an inert gas in the package 50. It is preferable to employ such an arrangement as schematically shown in Fig. 1. That is, one end of a small-diametered pipe 60 is connected to an inert gas supply source 61 such as an inert gas cylinder and the other end portion of the pipe 60 is inserted into the tubular film 7′ through an open front end of the bag making unit 14 at the upper portion thereof in a manner not to hinder the conveyance of the individual articles to be wrapped and the tip of the inserted end portion of the pipe 60 is opened toward the direction of advance of the tubular film 7′ at a position where it will not interfere with the end seal unit 5. This permits sealing of nitrogen gas or like inert gas in the package while retaining the feature of the shrink package, and hence makes it possible to prevent the wrapped item from deterioration.

With the end seal unit 5 used in the above embodiment, a coiled spring (not shown) is provided in the upper sealer 35 to hold its film gripping portion lower than the normal film

holding position so that when the both sealers 35 and 36 mesh with each other to grip the tubular film 7′ therebetween, the lower sealer 36 pushes up the upper sealer 35 at the film gripping portion against the coiled spring to apply a predetermined pressure to the tubular film 7′ by the reaction force of the coiled spring. With this structure, the film holding force is obtained with the coiled spring alone, and hence its compressive force must be large. Accordingly, a motor of a large capacity is needed to drive the both sealers 35 and 36 against the large compressive force of the coiled spring, besides the sealers 35 and 36 make a noisy metallic sound each time their film gripping portions bump against each other.

Figs. 9 through 11 illustrate an end seal unit suitable for use in the present invention. This end seal unit is also the box motion type as in the above embodiment and has a construction in which the upper and lower sealers 35 and 36 disposed opposite across the tubular film 7′ turn along such paths as indicated by the one-dot-chain lines in Fig. 1 while always maintaining their end faces 35a and 36a in opposing positions to each other. That is, the sealers 35 and 36 move in parallel with the conveyance of the tubular film 7′ over a certain section while gripping a predetermined portion of the tubular film 7′ between their end faces 35a and 36a.

The mechanism for driving the sealers 35 and 36 is such as depicted in Figs. 9 to 11. At a predetermined position below the tubular film 7′ an elongated flat lower support bed 70 is disposed perpendicularly to the direction of travel of

the tubular film 7'. The lower support bed 70 is movable back and forth and up and down. On the top of the lower support bed 70 is fixedly mounted the lower end sealer 36. The lower support bed 70 has attached thereto at its both ends disc-shaped cam followers 71, which engage grooved cams (not shown) to control the movement of the lower support bed 70 so that the lower sealer 36 moves along the predetermined path.

On the lower support bed 70 there are planted upright near its both ends a pair of guide rods 72, which are adapted to move in synchronism with the movement of the lower support bed 70. An elongated flat upper support bed 73 is mounted on the guide rods 72 in a manner to be slidable along their axes. More specifically, the guide rods 72 are inserted through bearings 75 held in through holes 74 made in the upper support bed 73 at predetermined positions near its both ends. Further, a L-shaped bracket 76 is mounted on the top of the upper support bed 73 at one end thereof and two pairs of rollers 77 are disposed vertically on the outer side surface of the L-shaped bracket 76 in such a manner that each pair of rollers 77 hold therebetween the one of guide rods 72. That is, this example is designed so that the upper support bed 73 can be moved up and down stably by one bearing 75 and the four rollers 77 associated with the one guide rod 72. Besides, the upper support bed 73 has attached thereto at its both ends cam followers 78 so that the upper support bed 73 is turned along the predetermined path defined by grooved cams (not shown) as is the case with the lower support bed 70.

The upper support bed 73 has a rectangular window portion

79 vertically extending therethrough centrally thereof, and the upper sealer 35 is disposed in the window portion 79. The upper sealer 35 turns with the rotational movement of the upper support bed 73 and, at the same time, moves up and down with predetermined travel relative to the upper support bed 73. As shown in Fig. 11, flat coupling plates 80 are mounted on the upper sealer 35 at predetermined positions. The width of each coupling plate 80 is selected larger than the width of the window portion 79 of the upper support bed 73. Accordingly, the coupling plates 80 engage the window portion 79 to prevent the upper sealer 35 from falling off the upper support bed 73.

Two pairs of side walls 81 are planted along marginal edges of the upper support bed 73 lengthwise thereof and a top panel 82 is mounted on each pair of side walls 81. The top panel 82 has tapped holes 83 at its both ends, into which bolts 84 each having a through hole 84a are screwed. Each bolt 84 has put thereon a jam nut 85. Guide pins 86 planted on the coupling plates 80 are respectively inserted into the through holes 84a of the bolts 84, and by vertical movement of the guide pins 86 guided by the through holes 84a, the upper sealer 35 is also brought up and down relative to the upper support bed 73.

Around each guide pin 86 there is disposed a coiled spring 87 which serves as first urging means, and upper and lower end portions of the coiled spiring 87 abut against the lower end of the bolt 84 and the coupling plate 80, respectively. The upper sealer 35 is urged downward by the

elastic restoring force of the coiled springs 87. In this example, the urging force of the coiled spring 87 can be controlled by moving up and down the bolts 84. Incidentally, in this example the urging force (i.e., the elastic restoring force) by the coiled springs 87 is set to a minimum value with a view to reducing the force which is applied to the both sealers 35 and 36 when their end faces 35a and 36a bump against each other.

On the top panel 82 there are planted support plates 88 in alignment with the side walls 81, for supporting air cylinders 89 which are used as second urging means. A cylinder rod 90 of each air cylinder 89 is received in the through hole 84a of the bolt 84 so that when the cylinder rod 90 is extended, its tip end portion abuts against the guide pin 86 to push it down.

The top panel 82 has a centrally disposed hole 91, through which an actuating rod 92 inserted in a manner to be movable up and down. The actuating rod 92 is always urged upwardly by a spring 93 disposed around it. A cutter 94 is suspended from the lower end of the actuating rod 92 and is incorporated in the upper sealer 35. The lower end of the actuating rod 92 has connected thereto one end of a rocking lever 95, the other end portion of which is disposed on the lower support bed 70 in a manner to be movable up and down and has its extremity resting on a push-up pin 96 extending through the upper support bed 73. As the pin 96 goes up, the other end of the rocking lever 95 is urged upward, by which the rocking lever 95 is turned about a supporting point 97 and

its one end, and consequently the cutter 94, is lowered to protrude downward from the end face 35a of the upper sealer 35 as shown. On the other hand, when the push-up pin 96 goes down, the upward urging force acting on the other end of the rocking lever 95 is removed and the actuating rod 92, and consequently the cutter 94, is brought up by the elastic restoring force of the spring 93 and enters into the upper sealer 35.

Next, a description will be given of the operation of the end seal unit 5. When the end faces 35a and 36a of the both sealers 35 and 36, moving along a predetermined path, bump against each other with the tubular film 7′ gripped therebetween, the tubular film 7′ is pressed with a predetermined pressure and is heated at the same time. In this example, since the elastic restoring force of the coiled spring 87 is set small as referred to previously, the reaction force between the sealers 35 and 36 is small which is caused when their end faces bump against each other. Consequently, the both end faces 35a and 36a are smoothly brought by relatively small force into contact with each other with the tubular film 7′ gripped therebetween. However, the film gripping force between the sealers 35 and 36 by the coiled spring 87 cannot still provide the tubular film 7′ with sufficient sealing strength.

Thereafter, the sealers 35 and 36 move forward while holding the tubular film 7′ therebetween, and in this while the air cylinders 89 are activated to extend their cylinder rods 90, by which the guide pins 86 are pressed down. In

consequence, the upper sealer 35 connected to the guide pins 86 is also urged downward, by which the lower sealer 36 is urged down. By the reaction force which is caused by the lower sealer 36 at that time, a pressure for obtaining desired sealing strength of the tubular film 7′ is generated between the sealers 35 and 36. The urging force by the air cylinders 89 is applied to the both sealers 35 and 36 while they are abutted against each other. Hence, even if the urging force is large, the sealers 35 and 36 are scarcely damaged and no noise is made. In this way, the tubular film 7′ is heat sealed without fail. Simultaneously with the heat sealing, the cutter 94 is brought down, by which the tubular film 7′ is severed along the heat-sealed portion to form the intermediate package. The air cylinders 89 are activated when it is detected by a limit switch or similar sensors that the upper and lower sealers 35 and 36 engage each other.

Although in the above the article to be wrapped 3 is stored in the tray 1, the present invention is not limited specifically thereto and the tray 1 need not necessarily be used. Further, in the above embodiment the height of the tray 1 is larger than the height of the item to be wrapped 2, but this relation may also be reversed.

Needless to say, the film is not limited specifically to that used in the above embodiment, and its thermal shrinkage factor is determined taking into account the sizes and shapes of the item to be wrapped and the tray the relationship between the gas containing volume in the intermediate package and that in the ultimate shrink package.

Moreover, while in the above the end seal unit has been described to be the box motion type, it may also be of a rotary type in which the upper and lower sealers rotate about rotary shafts, and the other units and components are not limited specifically to those described above.

It will be apparent that many modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A shrink-wrapping method comprising the steps of:
continuously pulling out a wrapping film made of a material having excellent thermal shrinkage and low gas permeability properties;
shaping said film into a tubular form;
feeding into said tubular film individual items to be wrapped;
sealing overlapping marginal portions of said tubular film extending lengthwise thereof;
sealing said tubular film transversely along a front end of each of said items, and cutting said tubular film along the thus formed transverse seal;
pressing said tubular film to deform said tubular film inwardly to decrease the internal volume thereof;
sealing said tubular film transversely along a rear end of said each item and cutting said tubular film along the thus formed transverse seal to form an intermediate package while said internal volume of said tubular film is maintained decreased; and
heating said film of said intermediate package to thermally shrink said film to shrink-wrap said each item.

2. The shrink-wrapping method as claimed in claim 1, further comprising a step of:

introducing an inert gas into said tubular film after said tubular film is sealed and cut transversely of each item at said front end thereof.

3. The shrink-wrapping method as claimed in claim 1 or 2, wherein each of said items to be wrapped is an article stored in a tray and held therein lower than the upper edge of said tray, and said film deforming step comprises a step of pressing said tubular film from above to a position lower than said upper edge of said tray.

4. The shrink-wrapping method as claimed in claim 1, 2 or 3, wherein said transverse seals of said tubular film are formed by a pair of upper and lower sealers which conduct a box type movement, and said pressing is conducted in synchronism with movement of said upper and lower sealers approaching each other.

5. A shrink-wrapping apparatus comprising:

means for continuously supplying a wrapping film made of a material having excellent thermal shrinkage and low gas permeability properties;

means for shaping said film into a tubular form;

means for feeding into said tubular film individual items to be wrapped;

center seal means, provided in a path of conveyance of said tubular film, for sealing overlapping marginal portions of said tubular film extending lengthwise thereof;

end seal means, disposed downstream of said center seal means, for sealing and cutting said tubular film transversely thereof at predetermined intervals;

a shrinking tunnel, disposed downstream of said end seal means, for heating an intermediate package cut away from said tubular film by said end seal means; and

film deforming means, disposed between said end seal means and said shrinking tunnel for deforming said tubular film inwardly to decrease an internal volume thereof.

6. The shrink-wrapping apparatus as claimed in claim 5, wherein said tubular film shaping means is a bag making unit having an open front end, and further comprising a small-diametered tube inserted into the tubular film through said open front end of said bag making unit in such a manner as not to hinder the conveyance of the individual items to be wrapped, one end of said tube being terminated at a position where it does not interfere with said end seal means and the other end of said tube communicating with inert gas supply means.

7. The shrink-wrapping apparatus as claimed in claim 5 or 6, wherein each of said items to be wrapped is an article stored in a tray and held therein lower than the upper edge of said tray, and said film deforming means includes a member for pressing said tubular film from above to a position lower than said upper edge of said tray.

8. The shrink-wrapping apparatus as claimed in claim 5, 6 or 7, wherein said film deforming means comprises an elastic member driven in synchronism with said end seal means.

9. The shrink-wrapping apparatus as claimed in claim 5, 6 or 7, wherein said end seal means comprises a pair of upper and lower sealers conducting a box type movement, and said film deforming means is connected to said upper sealer so that said film deforming means is driven in synchronism therewith.

10. The shrink-wrapping apparatus as claimed in claim 5, 6 or 7, wherein said end seal means includes a pair of upper and lower sealers conducting a box type movement, at least one of said upper and lower sealers has first urging means for generating a relatively large urging force relatively weakly pressing end faces of said upper and lower sealers into contact with each other with the film gripped therebetween when said upper and lower sealers are closest to each other, and second urging means for applying between said end faces of said upper and lower sealers an urging force larger than that by said first urging means when said end faces are pressed against each other by said first urging means.

11. The shrink-wrapping apparatus as claimed in claim 10, wherein said first urging means is a coiled spring, and said second urging means is a fluid cylinder.

12. The shrink-wrapping apparatus as claimed in any one of claims 5 to 11, wherein said film deforming means is formed by a soft elastic member which has a plane area smaller than that of each tray.

13. The shrink-wrapping apparatus as claimed in any one of claims 5 to 12, wherein said center seal means comprises at least one disc having plural annular projections formed around a peripheral surface thereof.

14. A wrapping apparatus comprising:

means for continuously supplying a wrapping film made of a material having excellent thermal bonding properties;

means for shaping said film into a tubular form;

means for feeding into said tubular film individual items to be wrapped;

center seal means, provided in a path of conveyance of said tubular film, for sealing overlapping marginal portions of said tubular film extending lengthwise thereof; and

end seal means, disposed downstream of said center seal means, for sealing and cutting said tubular film transversely thereof at predetermined intervals;

wherein said end seal means includes a pair of upper and lower sealers conducting a box type movement; and

wherein at least one of said upper and lower sealers has first urging means for generating an urging force relatively weakly pressing end faces of said upper and lower sealers into contact with each other with the film gripped therebetween when said upper and lower sealers are closest to each other, and second urging means for applying between said end faces of said upper and lower sealers an urging force larger than that by said first urging means when said end faces are pressed against each other by said first urging means.

15. The wrapping apparatus as claimed in claim 14, wherein said first urging means is a coil spring, and said second urging means is a fluid cylinder.

16. The wrapping apparatus as claimed in claim 14 or 15, wherein said center seal means comprises at least one disc having plural annular projections formed around a peripheral surface thereof.

FIG. 1

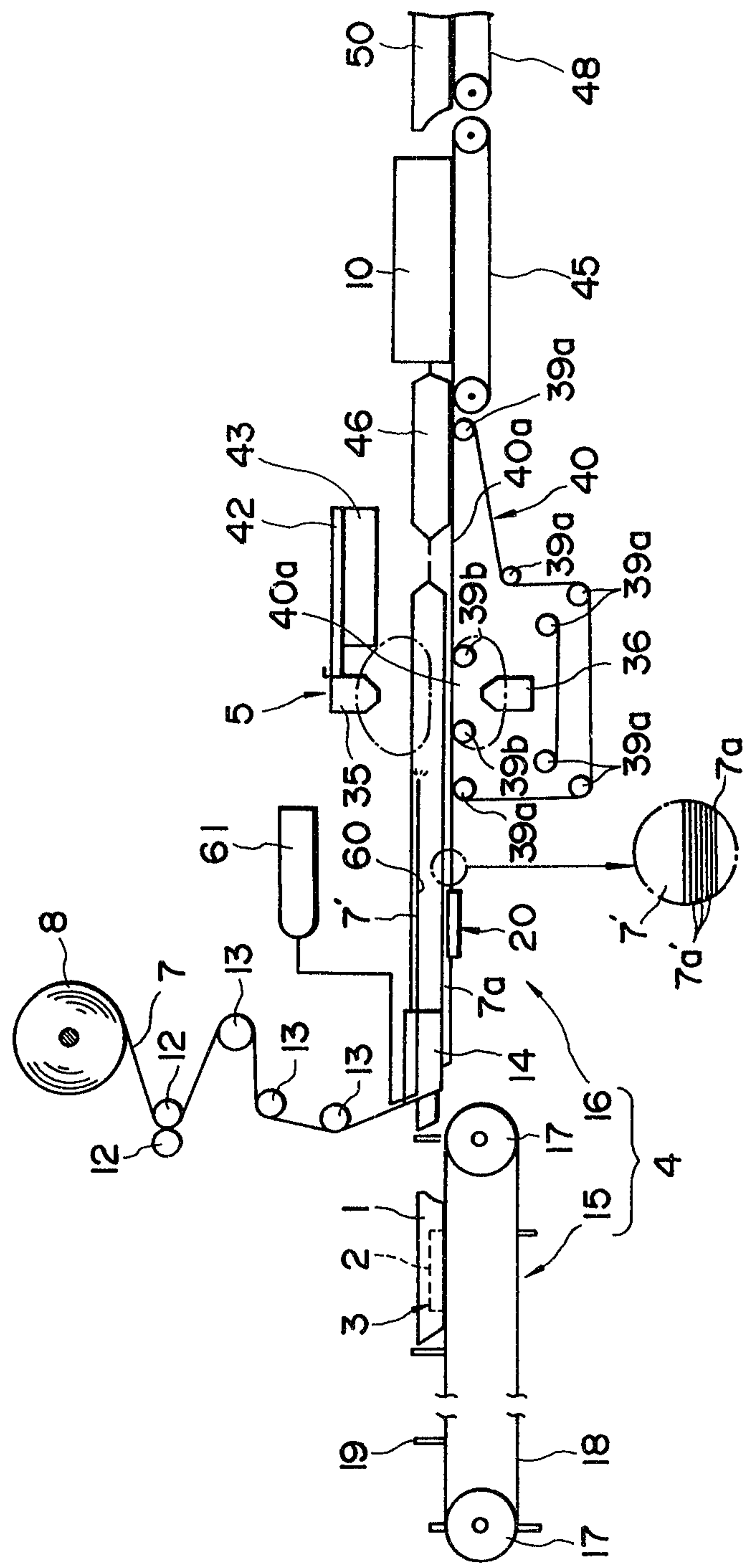


FIG. 2

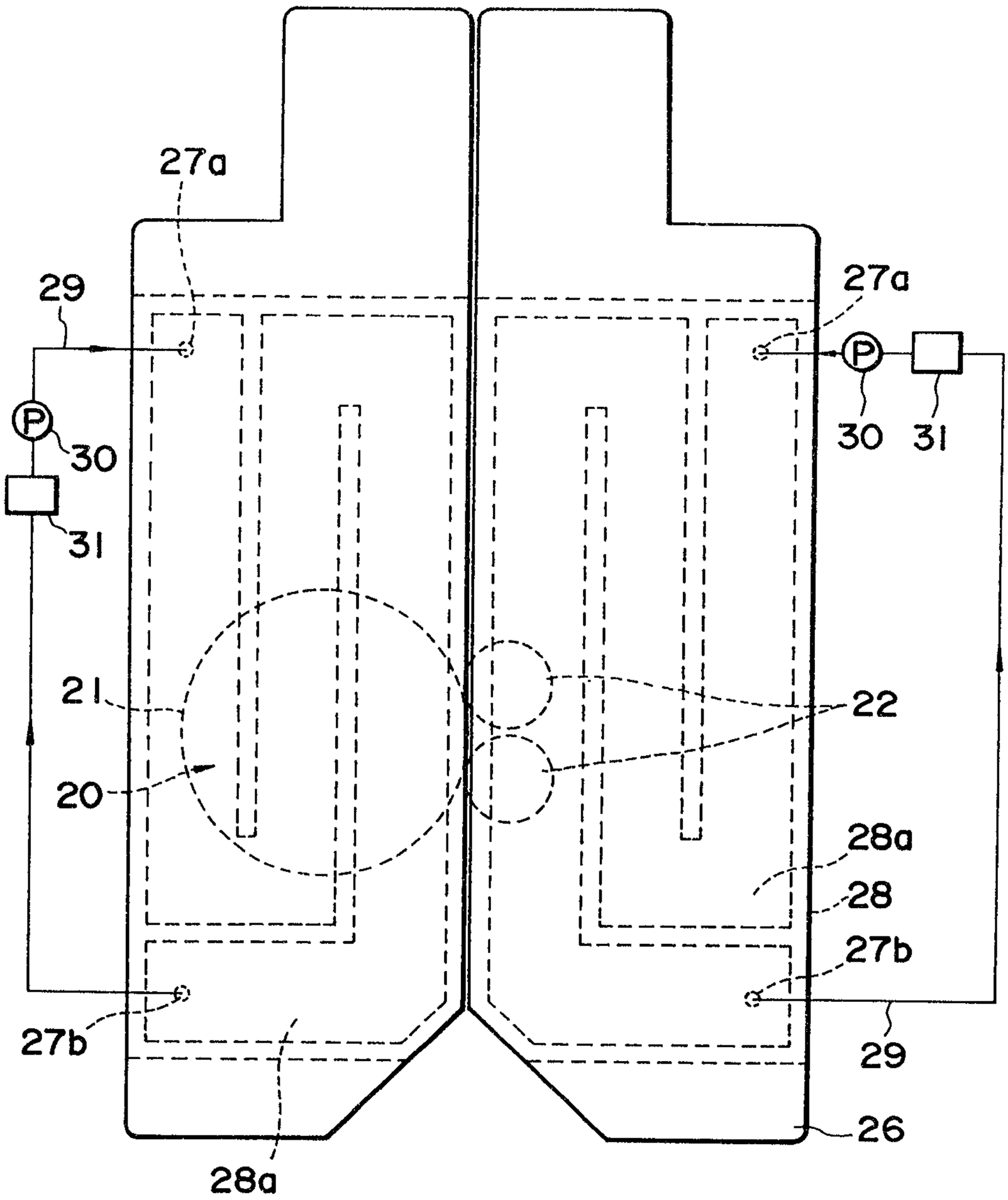

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FIG. 3

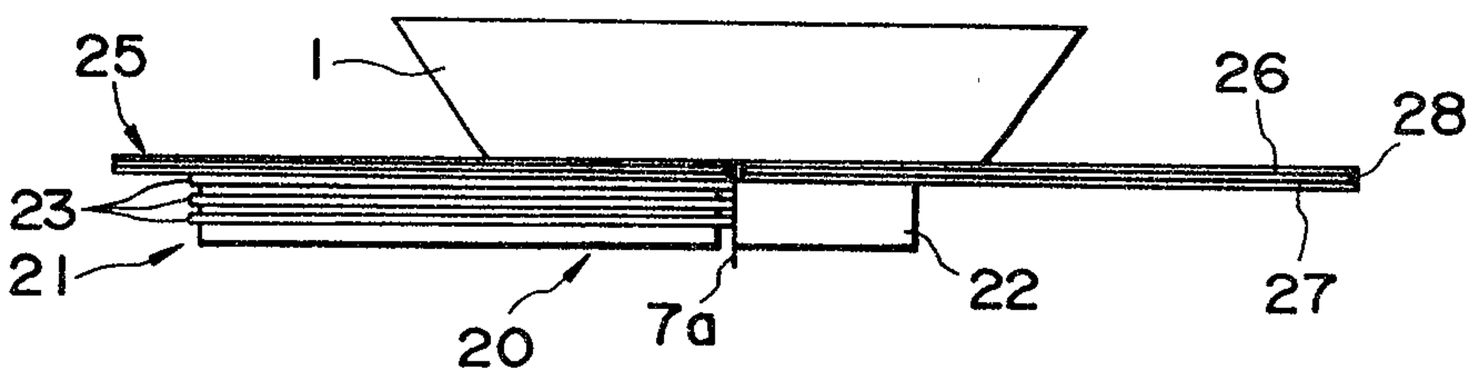
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FIG. 4

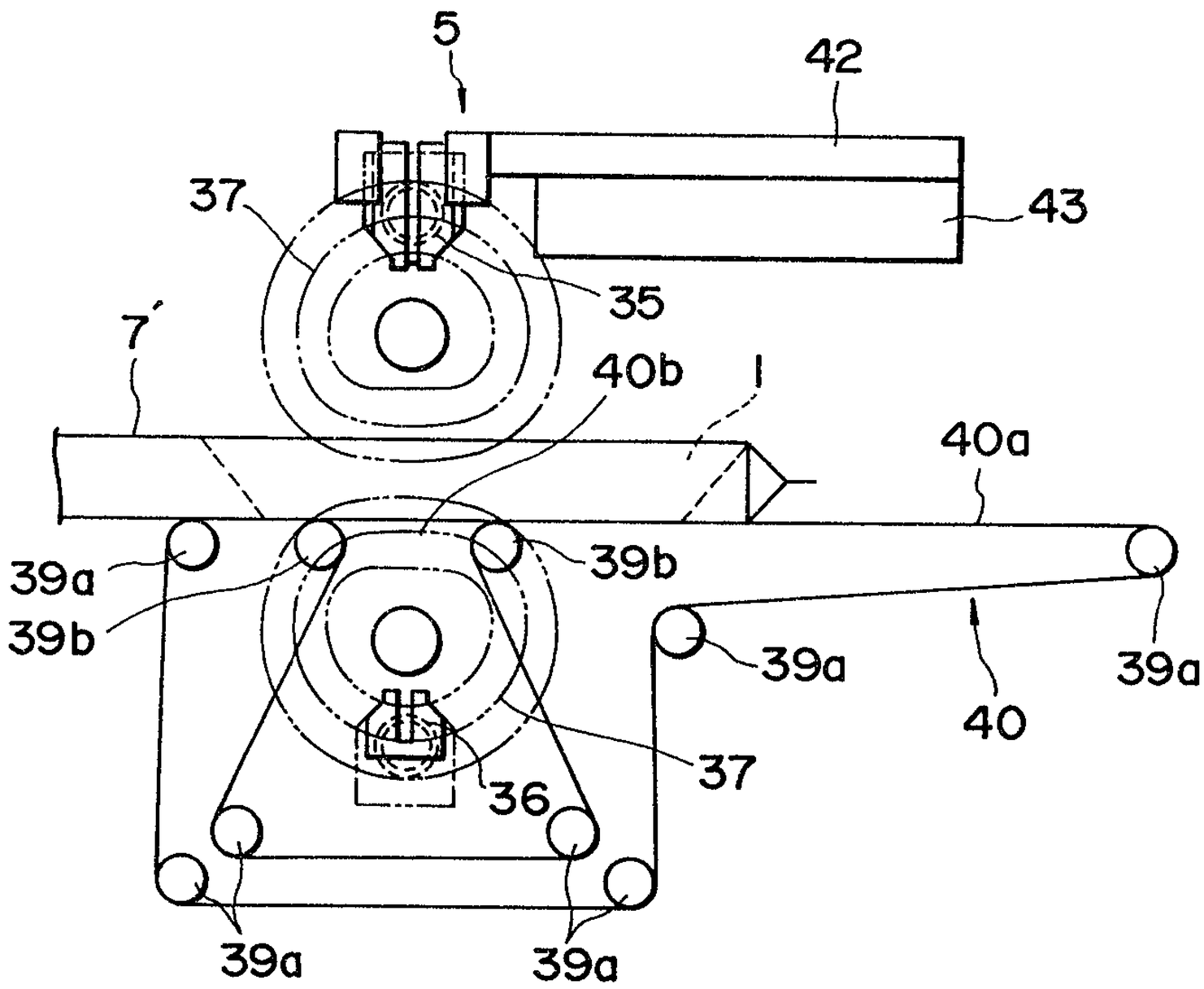
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FIG. 5

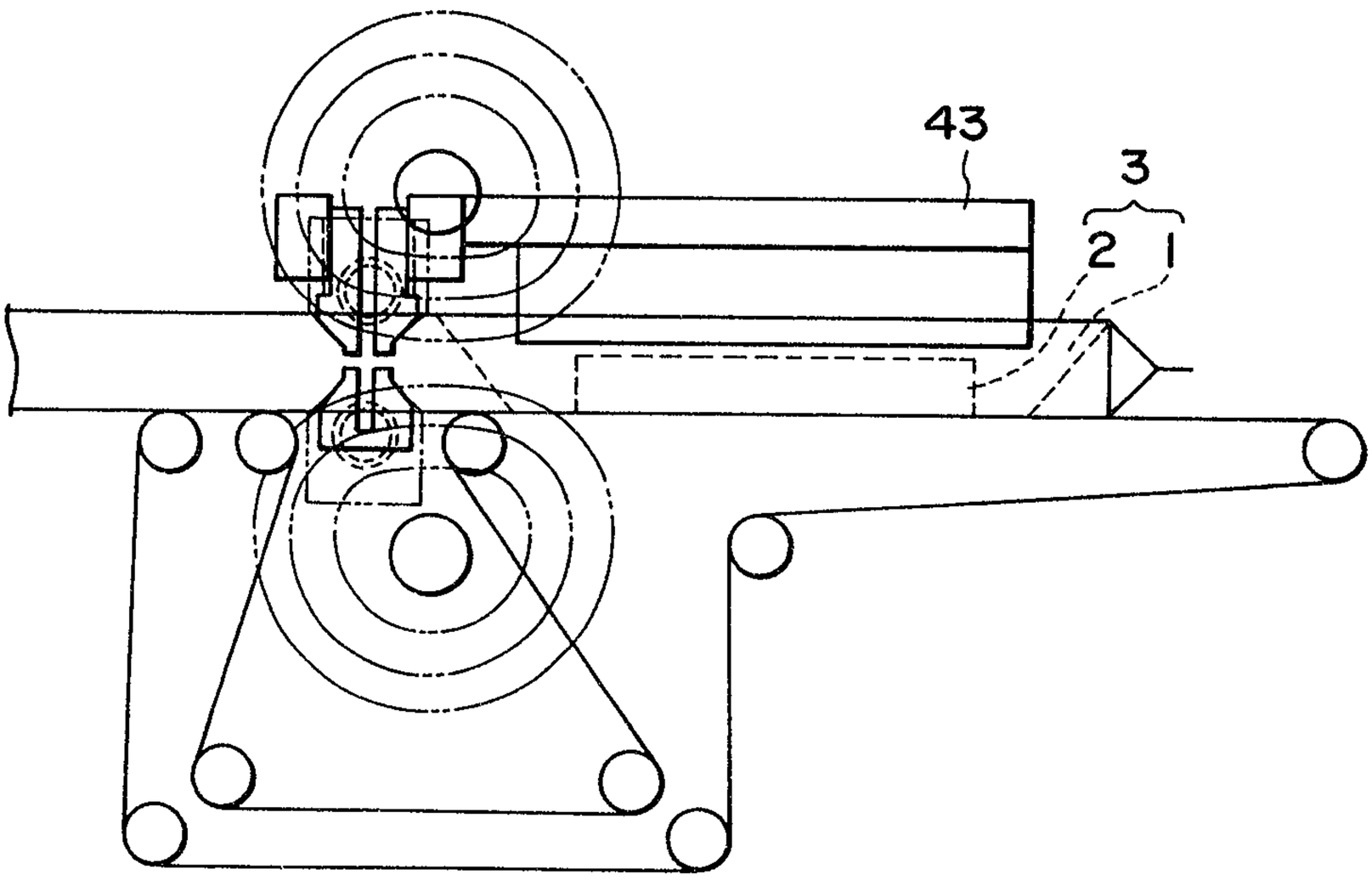
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FIG. 6

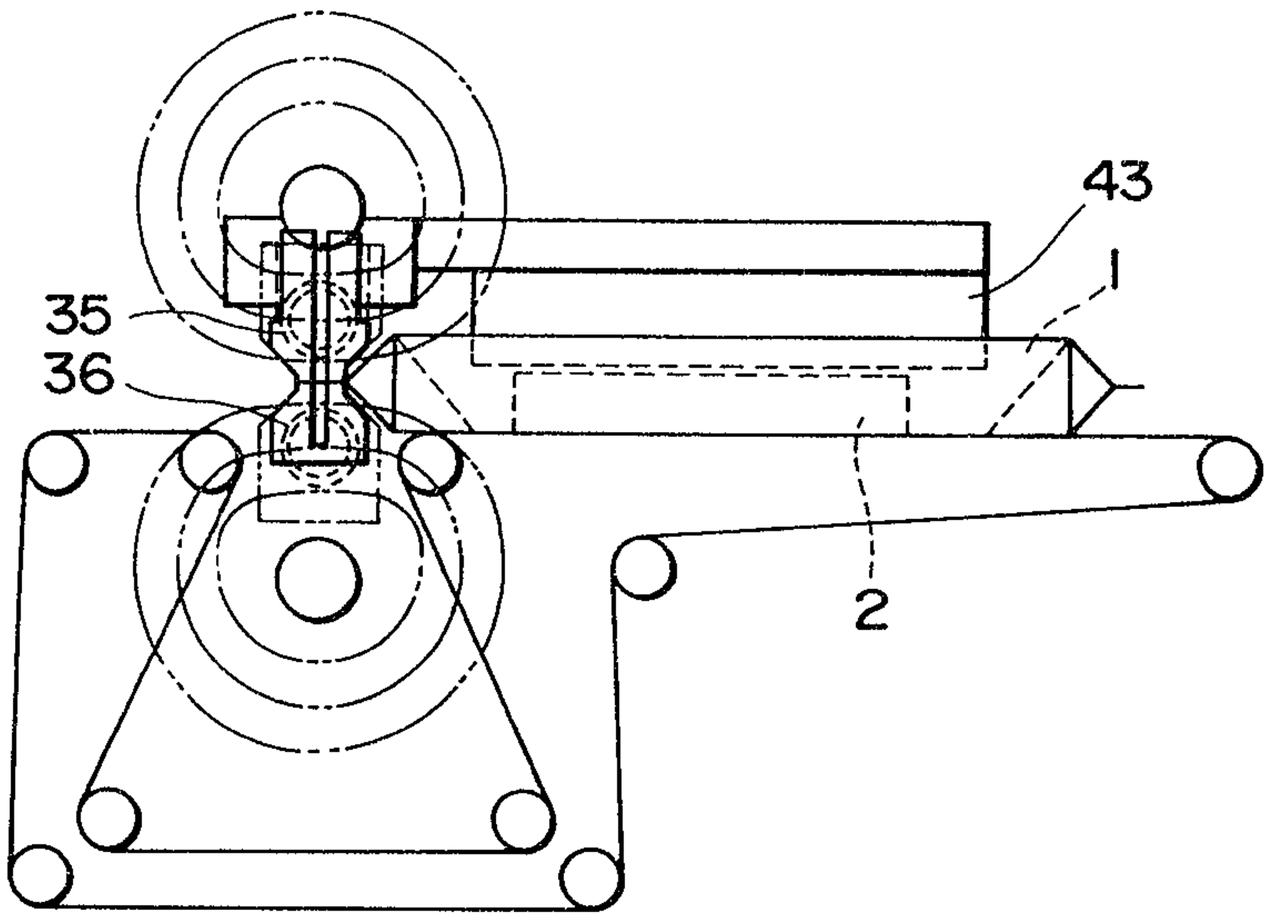

FIG. 7

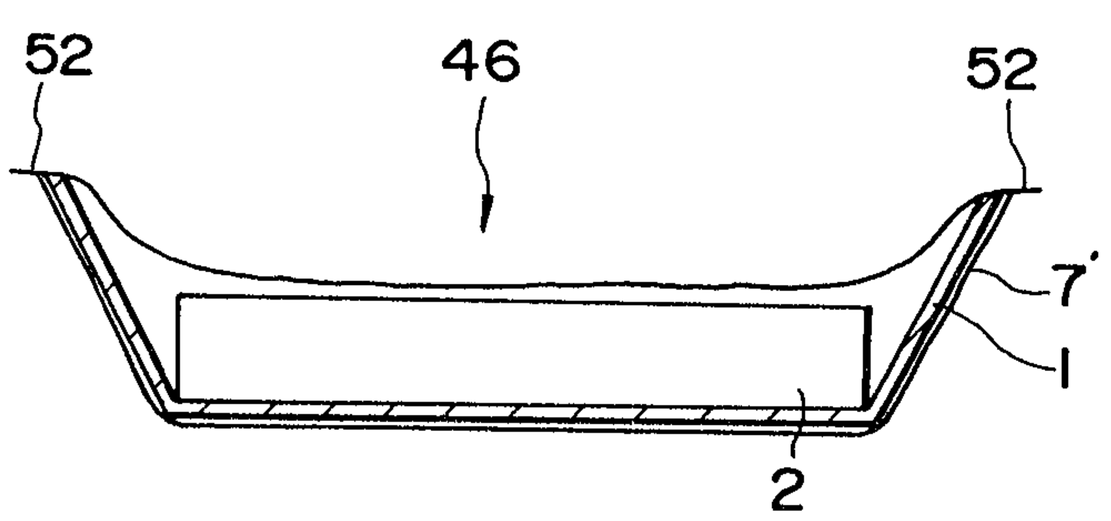

FIG. 8

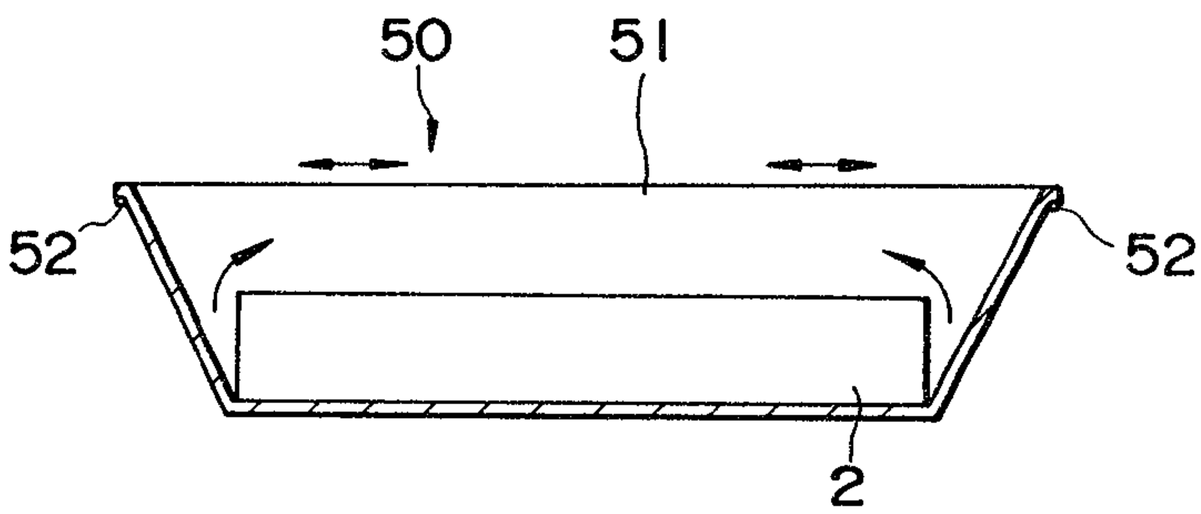

FIG. 9

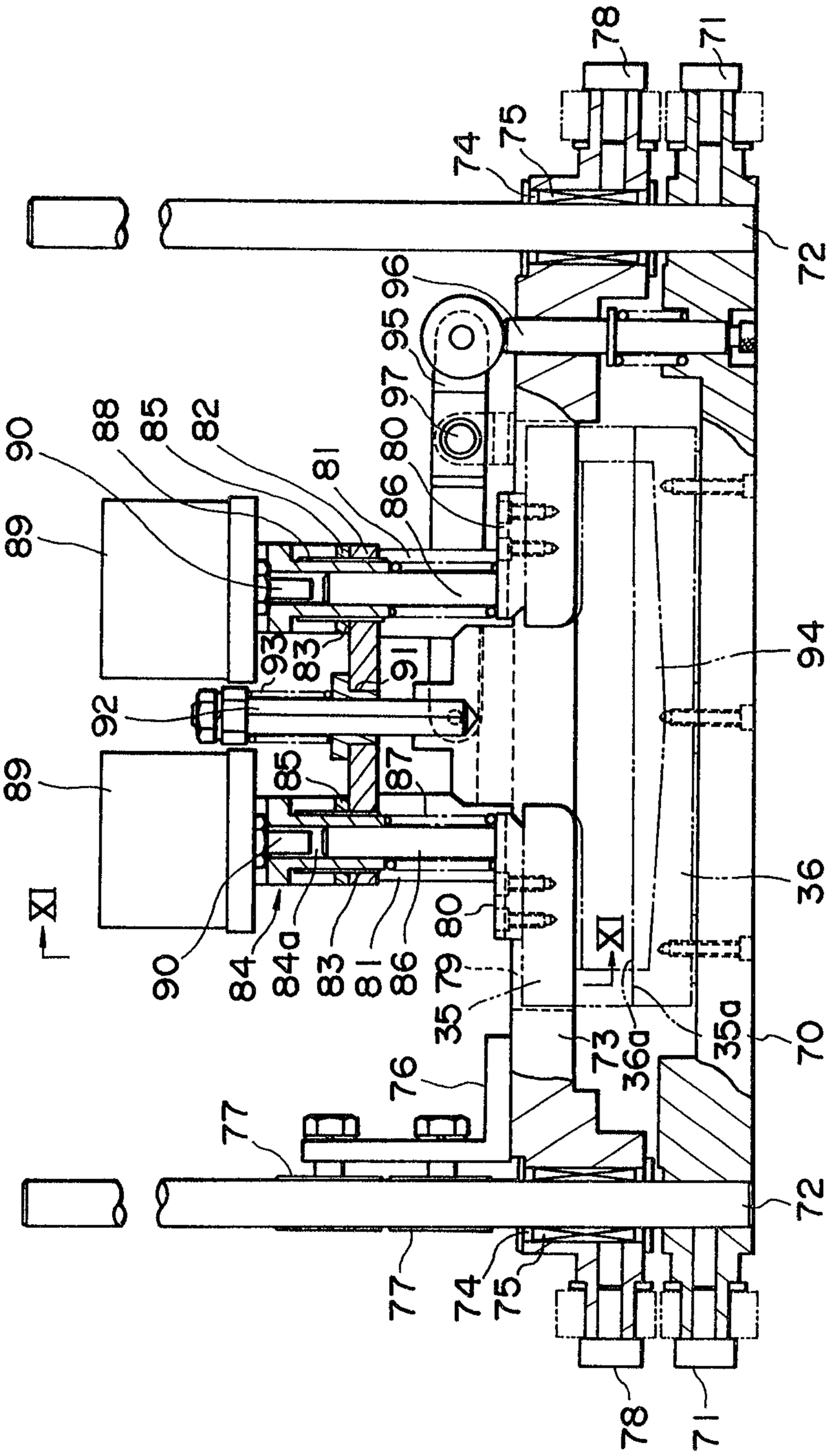
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FIG.10

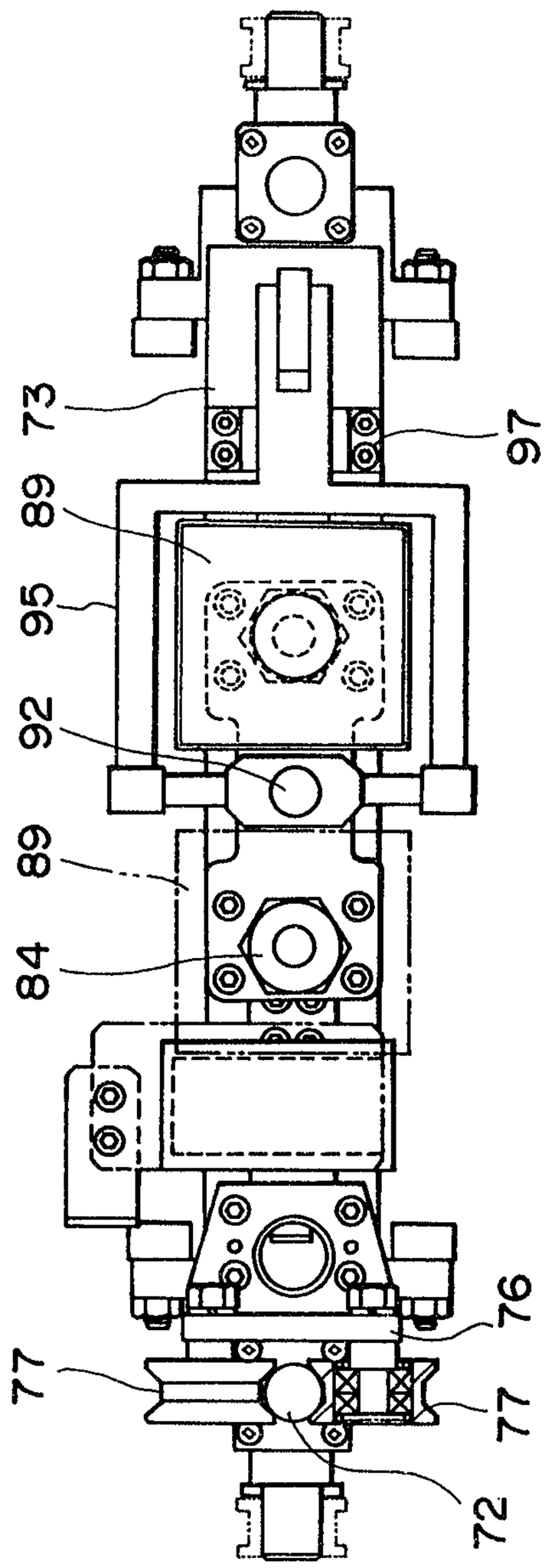
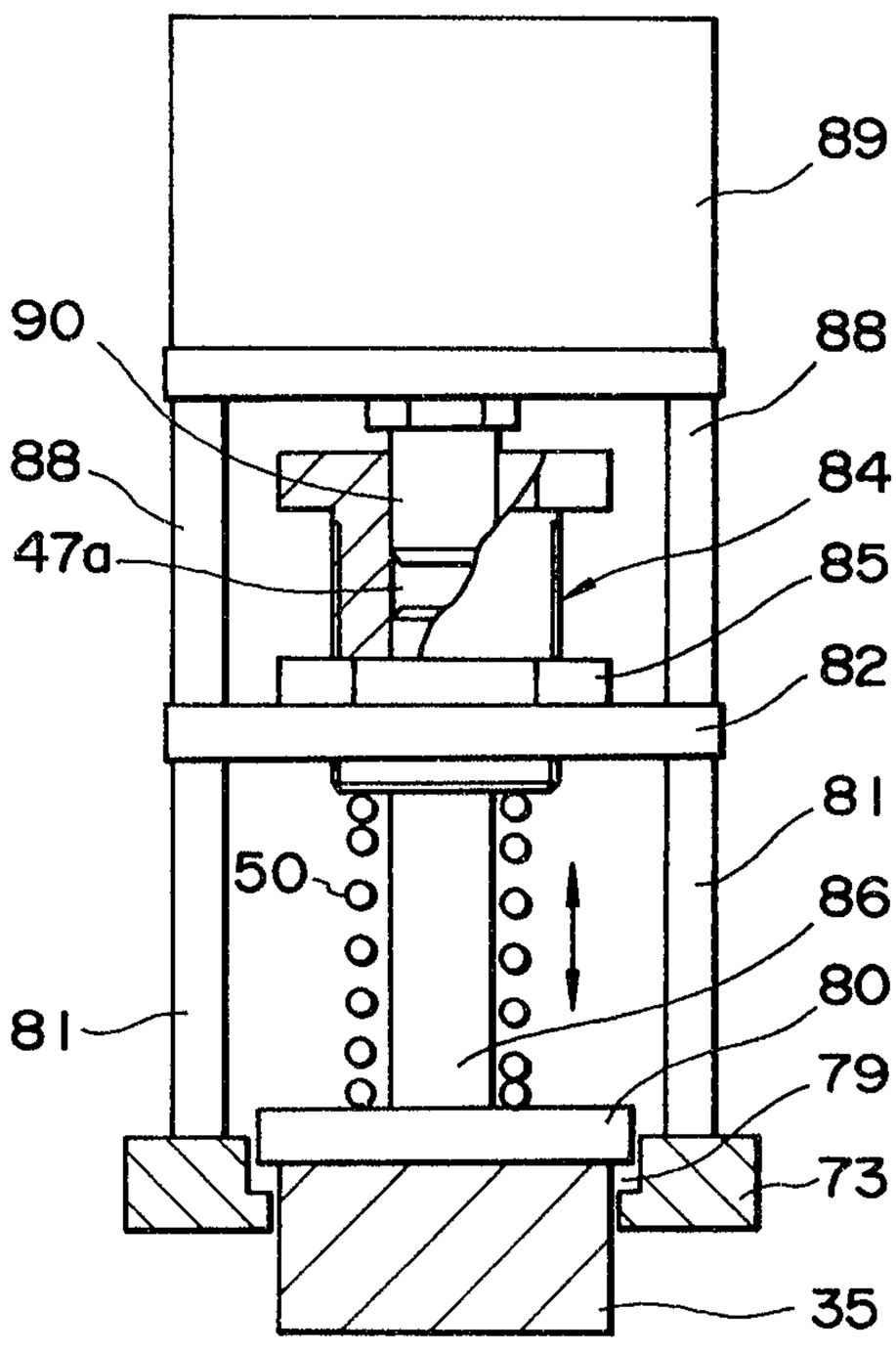
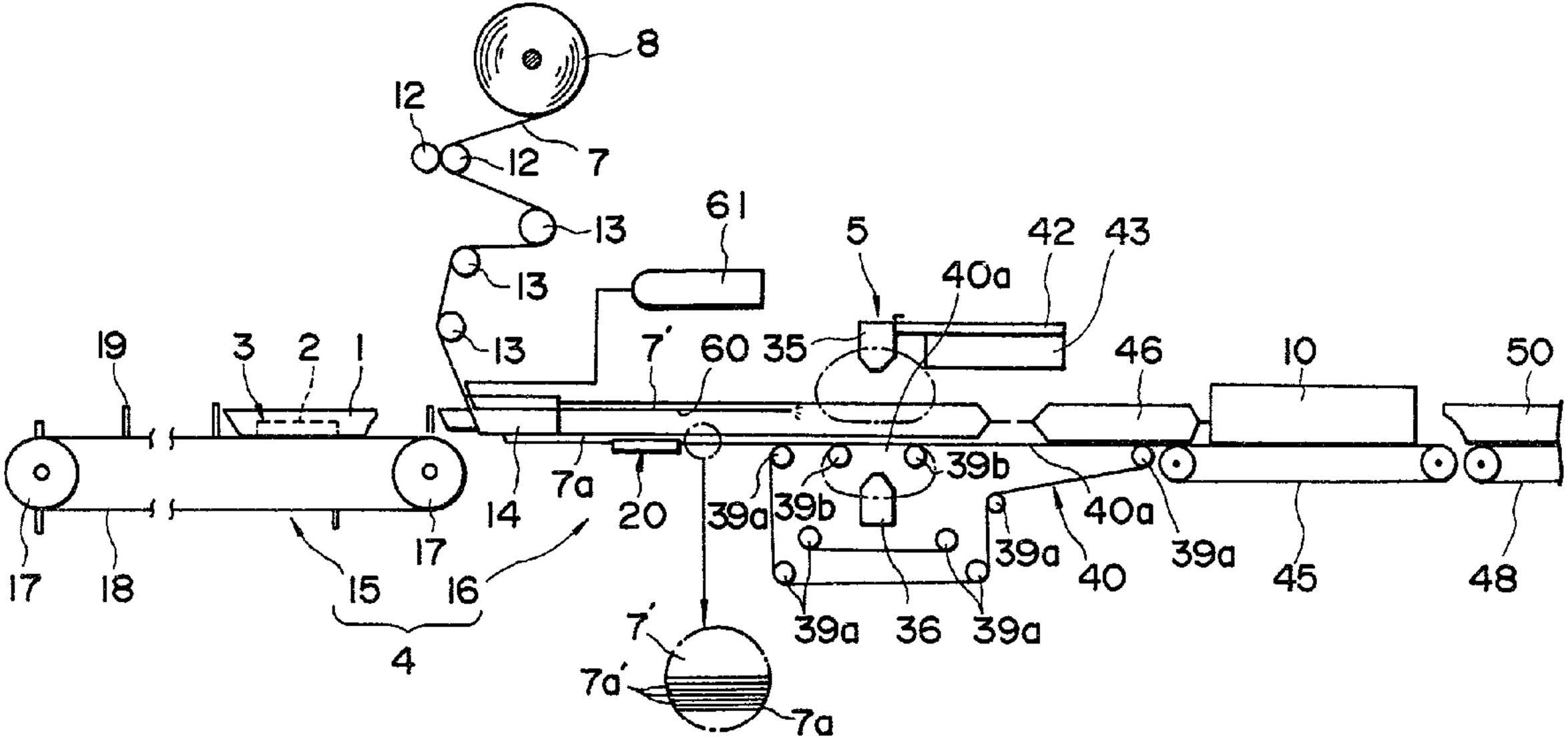


FIG. 11

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