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(71) Applicant(s)
Cryovac, Inc.

(72) Inventor(s)
Riccardo Evangelisti

(74) Agent/Attorney
DAVIES COLLISON CAVE,1 Little Collins Street,MELBOURNE VIC 3000

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(71) Applicant (for all designated States except US): ~~W.R. GRACE & CO. - CONN.~~ Cryovac, Inc [US/US]; 100 Rogers Bridge Road, Building A Duncan, SC 29334-0464 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): EVANGELISTI, Riccardo [IT/IT]; Via Quarenghi, 40, I-20151 Milano (IT).

(74) Agents: MARCHI, Massimo et al.; Marchi & Mittler S.r.l., Viale Lombardia, 20, I-20131 Milano (IT).

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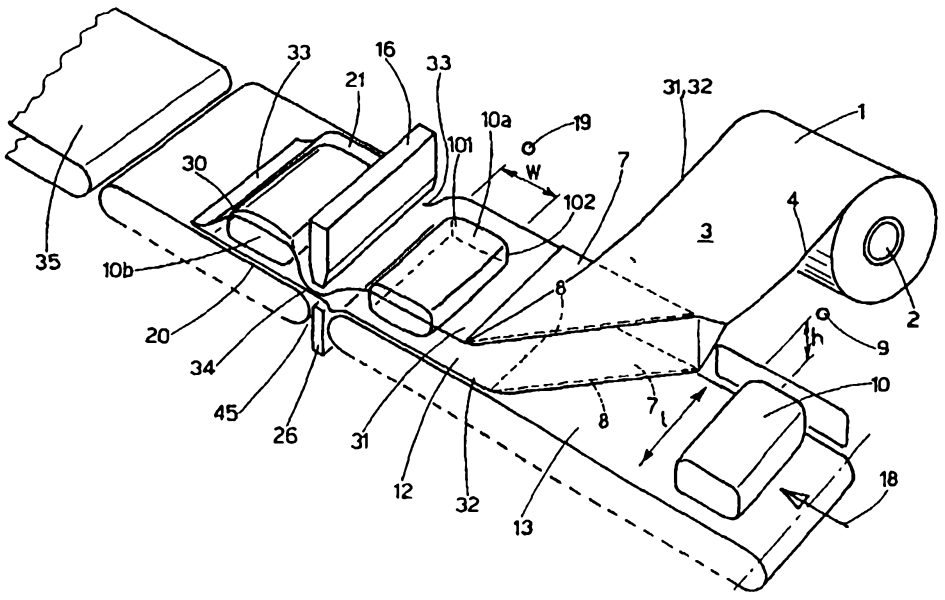

(57) Abstract

An apparatus for automatically packaging a product comprises a roll (1) of a center-folded film (3) of thermoplastic material, guides (7) suitable for straddling the two webs (31, 32) of the center-folded film (3) to form a recess (12) suitable for containing a product (10, 10a, 10b) to be packaged, conveyor belts (13, 20) suitable for moving the film (3) containing the product (10, 10a, 10b), a sealing bar (16) movable vertically and horizontally, capable of executing transversal welds (33, 34) along the two transverse sides of the product (10, 10a, 10b), while the film (3) is in motion, and a severing element (29) capable of separating the welds (33, 34), so as to form a bag (21) with an open mouth (30) containing the product (10, 10a, 10b).

"Method and apparatus for automatically packaging a food or non food product".

* * * * *

This invention relates to a method and an apparatus for automatically packaging a food or non food product by means of a mono- or multi-layer thermoplastic film.

A typical conventional method for producing an air-free package uses an either end-seal or transverse-seal preformed bag made of a thermoplastic material.

In both cases a product to be packaged is loaded into said preformed bag, the bag is evacuated in a vacuum chamber, and the open mouth of the vacuumized bag is then sealed or clipped.

Very often this method is used in conjunction with a preformed bag made of a heat-shrinkable thermoplastic material. After sealing or clipping of the vacuumized bag, the latter is heated while travelling through a shrinking tunnel to get the shrink of the thermoplastic material around the packaged product.

In case of a food product, the thus obtained air-free package increases the shelf-life of the packaged product.

This method, however, lacks in flexibility.

A first reason is that only some standard formats of bags are available that do not fit the size of every product to be packaged.

Secondly, the packaging machine has to be set on the format of the bag which is used. When a change in format is required, the packaging machine has to be shut-down, reset, and restarted.

Thirdly, a high packaging speed cannot be achieved even if the final steps of this packaging process (i.e. vacuumizing,

sealing, and shrinking) are performed in a revolving machine equipped with a plurality of vacuum and sealing chambers. As a matter of fact the first steps (i.e. opening of the bag mouth and loading of the product) cannot be sped up without risking an unacceptable increase in rejects.

Finally, the storage of preformed bags having many different formats is costly.

In order to overcome these drawbacks it has been proposed to form a bag in line from film webs which are continously shaped into a tubular form (US-A-3 237 371, US-A-4 141 196, US-A-4 537 016). Also this technique, however, lacks flexibility.

As a matter of fact, while the width of the package can be adjusted depending on the width of the product to be packaged by means of suitable sensors that provide a proper input to a microprocessor, the diameter of the tube (i.e. the length of the package) cannot be changed in accordance with the length of the product itself.

Advantageously, this invention may alleviate the above mentioned disadvantages of the known packaging machines and methods which form a package from a tubular film.

Advantageously, this invention may provide a method and apparatus capable of automatically forming packages from a continuous thermoplastic film wherein any single resulting package may have different length and/or width without requiring any resetting of the apparatus.

Advantageously, this invention may provide a method and apparatus capable of automatically forming air-free packages from a continuous thermoplastic film wherein any single resulting air-free package may have different length and/or width without requiring any resetting of the apparatus.

Advantageously, this invention may provide a method and apparatus capable of automatically forming packages from a continuous heat-shrinkable thermoplastic film wherein any resulting tight-skinned package may have different length and/or width without requiring any resetting of the apparatus.

Advantageously, this invention may provide a method and apparatus capable of automatically packaging products of varying sizes into a continuous thermoplastic heat-shrinkable film wherein any resulting air-free tight-skinned package may have different length and/or width without requiring any resetting of the apparatus.

According to a first aspect of the present invention there is provided an automatic packaging method comprising the steps of

(a) continuously unwinding a center-folded film from a roller;

(b) forming a recess between the film webs of the center-folded film by folding them around a pair of inverting heads having a substantially triangular shape;

(c) feeding spaced products into the formed recess;

(d) sealing and severing the continuously travelling film,

wherein the film webs of the continuously travelling film are sealed along the transverse sides of each product to form transversal welds between adjacent products, while the front side of the continuously travelling film remains open to the product, and wherein

the continuously travelling film is severed between the transversal welds formed between adjacent products so as to form a plurality of bags each having one open mouth on the front side and enclosing a product.

Preferably, the method comprises the step of sealing or clipping said open mouth of said bags, close to the front side of said product.

For the sake of clarity, it must be understood that the terms "rear side", "front side" and "transverse side" of the product to be packaged merely refer to the location of each single product with respect to the center-folding of the film. The side of each product close to said center-folding of the film

is referred to as "rear side"; the remaining sides are named accordingly. However, the products to be packaged may be fed randomly so that the side thereof which is referred to as the "rear side" may change randomly, product by product, even when the products are equal one another.

One skilled in the art will appreciate that in the known packaging machines which form a package from a tubular film, sealings and severings sequence is as follows (i) sealing of the front side, (ii) sealing of only one transverse side, (iii) severing of both the transverse sides, and (iv) sealing of one transverse side while the sequence of this invention is (I) sealing and severing of both the transverse sides, and (II) sealing of the front side.

A preferred embodiment of this invention also comprises the step of vacuumizing the bag before sealing or clipping its open mouth (i.e. before step e).

In an even preferred step of this invention a heat-shrinkable film is used and the method also comprises an additional step (f) of submitting the packaged to a heat-shrinking step to provide a tight-skinned package.

According to a second aspect of the present invention there is provided an automatic apparatus for packaging a food or non food product comprising guiding means for straddling two webs of a center-folded film and forming a recess capable of enclosing a product to be packaged; conveying means for advancing said film enclosing said product in a preselected travelling direction; I-shaped sealing means which is movable vertically and horizontally for sealing the film webs of the film together between adjacent products to form transversal welds along the transverse sides of each of said products and severing means for

severing the film between the transversal welds formed between adjacent products, said sealing means being operatively connected to an actuator means for bringing and keeping the sealing means in contact with said film in order to form said transversal welds while said film is in motion, whereby after severing of said film a plurality of bags are formed each having an open mouth and enclosing a product.

It is thus possible to get a high packaging speed because the center-folded film and the products are continuously advanced and the transverse sealings of the film is performed along the two transverse sides of each single product while both film and product are in motion.

Furthermore, the apparatus of this invention automatically fits the width of each single bag to that of each single product. In fact, the guiding means suitable for opening the two webs of center-folded film form a recess whose height is proportional to the height of the product and at least one sensor means detects the width of the product, allowing to automatically adjust the distance between the welds along the two transverse sides of the product and, thus, the width of each bag.

Moreover, the apparatus can perform packaging operations under favourable conditions due to the fact that the recess can be formed by folding the two webs of the center-folded film inward. In this way, it is possible to load the products to be packaged into the recess, avoiding any contact of the mouth of the bag with the product, so that no deposit of grease or liquids is formed capable of hindering the subsequent sealing of the mouth of the bag.

Features and advantages of the invention will now be

illustrated with reference to an embodiment represented as a non-limiting example in the enclosed figures, wherein:

Fig. 1 is a perspective view of an automatic packaging apparatus according to the invention, represented in a schematic manner;

Fig. 2 is a plan view from above on a reduced scale of the apparatus of Fig. 1;

Fig. 3 is a front view of the apparatus of Fig. 2;

Fig. 4 is a partial enlarged view of a sealing bar and of a counterbar shown in Fig. 3;

Fig. 5 is a partial plan view from above of welds of a film used in the apparatus of Fig. 1.

In Fig. 1 there is shown an automatic apparatus for packaging products by means of a film of thermoplastic material, according to the invention. The apparatus comprises a roller 1 provided with an axle 2 on which there is wound a center-folded film 3 of thermoplastic material; 4 is the longitudinal middle axis along which the film 3 is folded and 31 and 32 are the two superimposed webs of the film. The width of the folded film is greater than the maximum length l of the products to be packaged. As shown in Fig. 2, the center-folded film 3 is unwound from the roller 1 and is made to advance in a direction orthogonal to the axle 2 (arrow 5) by a pair of rollers 6. The roller 1 can be mounted idle on the axle 2 or it can be driven in rotation so as to unwind the film. The center-folded film 3 is guided by a pair of plates ("inverting heads") 7, substantially in the shape of triangles, whose respective edges 8 are inclined with respect to the direction 5 of forward motion of the film 3. The two triangular plates 7 are parallel and are placed at a vertical distance that can be adjusted

manually or automatically, in relation to the height h of products 10 to be packaged, by means of a mechanical actuator, diagrammatically shown as block 11. The height of the products 10 can be detected by at least one sensor means 9 such as one or more photocells.

The two plates 7, shown in Fig. 1 are shaped as right-angled triangles having respective hypotenuses that are inclined at an angle of 45° with respect to the direction 5. Said hypotenuses 8 open webs 31 and 32 of the center-folded film 3 and fold them over inward at 45°, causing the film to change its direction by 90° (arrow 18 of Fig. 2) to lay down over a conveyor belt 13. By using, as inverting heads, triangular plates 7 having a shape different from that of a right-angled triangle, a change of the direction of the film of less or more than 90° can be obtained. The webs 31 and 32 of the center-folded film 3, when they fold themselves around the plates 7, form a recess 12 capable of receiving one of the products 10. Products 10 are fed on the belt 13 by the belt 14 that keeps them at a uniform distance one from the other, thus acting as a synchronizer. Optionally, together with products 10 on the belt 13 there may be fed conventional items such as, for instance, absorbing pads (to be used for absorbing drips in case of packaging of e.g. meat), labels, oxygen absorbing sachets, and the like.

In the preferred embodiment of Fig. 1, the two webs 31 and 32 of the center-folded film 3 straddle on the outer surfaces of the plates 7 and then fold inward around the edges 8 to form a recess 12.

Alternatively, the two webs 31 and 32 of the center-folded film 3 are made to advance in-between the two plates 7 and then fold outward over the edges 8. In such a case, however, the

articles to be packaged should be loaded into the recess 12 from the opposite side and contamination of the inner sealing area might occur.

The conveyor belt 13 moves at a constant speed and causes the products 10 to move forward with a constant motion in the direction 18 along which there is at least one sensor means 19 that detects the width w of a product 10a. In this specific case the sensor means 19 is a photocell. The photocell 19 emits a first signal at the passage of a leading edge 101 of the product 10a and a second signal at the passage of a trailing edge 102 thereof. The signals of the photocell 19 are sent to an electronic control system, diagrammatically shown by a block 15 in Fig. 3, that commands the welding of the center-folded film 3 along the transverse sides of the product 10a in a manner that will be described below. The belt 13 feeds product 10a to an adjacent conveyor belt 20 while, in the space 45 between the two belts 13 and 20, a sealing bar 16 welds the center-folded film 3. Belts 13 and 20 are formed by two spaced branches of a single endless belt, indicated as a whole with 22. The belts 13 and 20 are moved by a driving pulley 40 and are guided by idle pulleys 41 and 43. The pulleys 40 and 43 are supported by a fixed base, not shown, while the pulleys 41 are supported by a movable carriage 24.

As shown in Fig. 3, the sealing bar 16 is slidably supported by a vertical slide 23 fastened to the movable carriage 24 and is operatively connected with actuators, diagrammatically shown by a block 27, that cause it to translate vertically along the slide 23 until it reaches the level of a fixed counterbar 26, integral with the carriage 24. For example, the actuators 27 may be formed by an electric motor and by a rack and pinion

mechanism located inside the carriage 24. In turn, the carriage 24 is operatively connected with actuators, diagrammatically shown by a block 28, that are capable of making it translate in a direction parallel to the belts 13 and 20, in a double direction of translation, as indicated by the double arrow 25. For example, the actuators 28 can also consist in an electric motor and in a rack and pinion mechanism. Both the actuators 27 and 28 are operatively connected to the control system 15 that operates them according to the signals emitted by the photocell 19.

As shown in Fig. 4, the sealing bar 16 is formed by two separate welding portions, 161 and 162, between which a shearing blade 29 is placed.

When the film 3, containing the product 10a in the recess 12, leaves the plates 7 and moves in the direction 18, the welding cycle of a bag 21 starts. The bar 16, which is in the initial raised position, is driven by its actuators 27 to move vertically downward to an operative position, in contact with the center-folded film 3 on the left hand side of the product 10a. The bar 16 presses the center-folded film 3 against the counterbar 26 and pulls it in the direction of translation 18, being caused to move by the carriage 24, while it performs two transversal welds 33 and 34, as shown in Fig. 5. The carriage 24 is driven by its actuators 28 to translate horizontally (arrow 25) at the speed of the belts 13 and 20, causing to move the bar 16, the counterbar 26 and the pulleys 41. In this operative condition, the bar 16 performs two transversal welds 33 and 34 by means of the two welding portions 161 and 162 (Figs. 4 and 5). The welds 33 and 34 close a bag 21 on the left hand side of the product 10a and a previous bag 21 on the right

hand side of a product 10b, respectively. The bar 16 remains in contact with the film 3 for the time needed to perform the welds 33 and 34 while accomplishing a forward stroke whose amplitude depends on the preset welding time and on the speed of translation of the carriage 24.

When welds 33 and 34 have been completed, it is caused to work the blade 29, associated with the bar 16, that severes the film 3 transversally along a line 39 intermediate between the two welds 33 and 34, separating them. At this point the bar 16 is driven by its actuators 27 to move away from the film 3 and to move vertically upward until it returns to the at rest position. Simultaneously, the carriage 24 is operated to translate backward, in a direction opposite to the movement of the belts 13 and 20, causing the bar 16 to perform a return stroke whose amplitude depends on the length of the product 10a detected by the photocell 19. In this way the carriage 24 takes the pulleys 41 and the bar 16 back to their original position, where the bar is ready to move downward again toward the film 3 to perform another two transversal welds 33 and 34 on the right hand side of the product 10a. The bar 16 moves downward after the arrival of the signal indicative of the edge 102 emitted by the photocell 19, coming into contact again with the film 3 and remaining in contact with it for another forward stroke. The bar 16 operates as described for the welds 33 and 34 on the left hand side of the product 10a, including the separation of the two welds 33 and 34. The actuators 27 and 28 of the bar 16 and of the carriage 24 are operated by the control system 15 depending on the signals coming from the photocell 19 so as to leave a constant distance between the edges 101 and 102 of the product 10a and the left and right transversal welds 33 and 34.

Once the welds 33 and 34 to the left and right of a product 10 have been completed and their shearing has been performed, the bag 21 is obtained with the mouth 30 open, that encloses the product 10. The bag 21 can be unloaded from the belt 20 to a conveyor belt 35 that, moving at a speed higher than that of belt 20, keeps the bags 21 spaced and conveys them toward a sealing apparatus. For example, the sealing apparatus may be a welding apparatus or a clipping apparatus capable of closing the open mouth 30 of the bag 21, after producing a vacuum, or in a normal or modified atmosphere.

Average welding times of the packaging apparatus described above can vary from about 0.5 seconds to about 3 seconds, depending on the material and the thickness of the film 3. In a typical welding cycle, the duration of the cycle is of 2.45 seconds and comprises the forward stroke of the bar 16 (1.75 seconds), the return stroke (0.55 seconds), inclusive of the time taken by the bar 16 to move down and up (0.5 seconds), and the waiting time (0.15 seconds). Hence, with this cycle, hourly production is of 1,500 bags.

In a still preferred embodiment of this invention the bag is vacuumized before sealing or clipping it. This step is typically performed by means of e.g. mono- or multi-product single vacuum/sealing chambers such as those manufactured by Transvac or by means of revolving vacuum/sealing chamber apparatuses such as those manufactured by Furukawa. Preferably these vacuum/sealing chambers will be provided with a system of conveyors capable of positioning the bag in such a way that sealing occurs as close as possible to the front side of the packaged product.

As used herein the term "vacuum" also includes partial vacuum

as it is well understood in the art and the term "vacuumizing" or "evacuating" refers to the removal of any undesired amount of gas (e.g., air) from the vacuum chamber and as a consequence thereof from the bag.

Typically, the amount of gas that is removed from the vacuum chamber during the vacuumization step is of at least 80%, preferably of at least 90% and even more preferably of at least 95% by volume.

In another preferred embodiment of this invention, the center-folded film is a heat-shrinkable film and the vacuumized bag, after sealing or clipping, undergoes a heat-shrinking treatment to provide a tight-skinned package. This can be easily accomplished by providing a conveyor that receives a packaged product from a vacuum/sealing chamber and discharges the same into a heated shrink tunnel.

As used herein the term "heat-shrinkable film" means any of those films of thermoplastic material that have been stretched and oriented at a temperature below the melting temperature of at least one of the resins used in the film so that when they are used in packaging, they shrink tightly around the package contents upon rewarming to a temperature close to the orientation temperature.

More specifically a "heat-shrinkable film" is a film having a free shrink of at least 5%, preferably at least 10%, in at least one direction at 90°C when evaluated according to ASTM method D-2732.

The films employed in this invention may be mono-layer or multi-layer.

Multi-layer films will be preferred whenever all of the required properties are not possessed by a single polymeric

component or by a blend of polymers in a single layer. For example, when gas barrier properties, sealability, abuse resistance, and the like are needed in a single film.

As described above, in a bag of this invention the sealing of the front side may be performed close to the front side of the packaged product so that there will result a surplus of film webs whenever the length l of the packaged product is shorter than the transverse length of the film webs. The above mentioned surplus may be severed. Alternatively, in the above mentioned surplus of film webs there will be made one or more holes or slits to be used for hanging or carrying the bag containing the packaged product.

The foregoing description of preferred embodiments of the invention has been presented for purposes of illustration and description only. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, and modifications and variations are possible in view of the above teachings or may be acquired from practice of the invention.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An automatic packaging method comprising the steps of

(a) continuously unwinding a center-folded film from a roller;

(b) forming a recess between the film webs of the center-folded film by folding them around a pair of inverting heads having a substantially triangular shape;

(c) feeding spaced products into the formed recess;

(d) sealing and severing the continuously travelling film,

wherein the film webs of the continuously travelling film are sealed along the transverse sides of each product to form transversal welds between adjacent products, while the front side of the continuously travelling film remains open to the product, and wherein

the continuously travelling film is severed between the transversal welds formed between adjacent products so as to form a plurality of bags each having one open mouth on the front side and enclosing a product.

2. A method according to claim 1, further comprising the step of sealing or clipping said open mouth of said bags close to the front side of said product.

3. A method according to claim 2, further comprising the step of applying a vacuum to each bag before sealing or clipping its open mouth.

4. A method according to claim 2, wherein said center-folded film is a heat-shrinkable film and each of said sealed or clipped bags is submitted to a heat-shrinking step to provide tight-skinned packages.

5. An automatic packaging method substantially as herein described with reference to the accompanying figures.

6. An automatic apparatus for packaging a food or non food product comprising guiding means for straddling two webs of a center-folded film and forming a recess capable of enclosing a product to be packaged; conveying means for advancing said film enclosing said product in a preselected travelling direction; I-shaped sealing means which is movable vertically and horizontally for sealing the film webs of the film together between adjacent products to form transversal welds along the transverse sides of each of said products and severing means for severing the film between the transversal welds formed between adjacent products, said sealing means being operatively connected to an actuator means for bringing and keeping the sealing means in contact with said film in order to form said transversal welds while said film is in motion, whereby after severing of said film a plurality of bags are formed each having an open mouth and enclosing a product.

7. An apparatus according to claim 6, wherein said sealing means comprises an I-shaped sealing bar which is driven by said actuator means to remain in contact with said film for a pre-determined forward stroke in order to perform a first transversal weld on one side of said product and, at the end of the stroke, is driven to move backward for a pre-determined return stroke to an initial position wherein it is ready to perform a second transversal weld of said film on another side of said product.

8. An apparatus according to claim 7, wherein said sealing bar contacts said center-folded film and presses it against a counterbar which pulls the film in said direction of translation while the sealing bar forms said welds.

9. An apparatus according to claim 7, wherein said sealing bar is slidably supported by a vertical slide integral with a carriage that is movable in said pre-selected direction parallel to said conveying means.

10. An apparatus according to claim 9, wherein said bar is operatively connected to first actuator mean that drives the sealing bar to translate vertically along said slide.

11. An apparatus according to claim 9, wherein said carriage is operatively connected to second actuator means capable of making it translate in a direction parallel to said conveying means in a double direction of translation.

12. An apparatus according to claim 11, wherein said conveying means are formed by a first belt and by a second belt that form two branches on an endless belt, idle pulleys for guiding said first and second branch being movably supported by said carriage.

13. An apparatus according to claim 6, further comprising at least one sensor means suitable for detecting the length of said product, capable of emitting a first signal at the passage of a leading edge of the product and a second signal at the passage of a trailing edge thereof, said sensor means being operatively connected to control means capable of operating said actuator means of said sealing means to leave a constant distance between said edges of said product and said transversal welds.

14. An apparatus according to claim 6, wherein said guiding means comprise two plates, substantially in the shape of a triangle, whose side is inclined with respect to the direction of forward motion of said center-folded film, said plates being capable of deflecting said center-folded film from said direction of forward motion to said direction of travel, while keeping the webs folded over inward, said two triangular plates being parallel and placed at a vertical distance that can be adjusted in relation to the height of said product.

15. An apparatus according to claim 14 wherein the two plates are in the shape of right-angled triangles having respective hypotenuses inclined at an angle of 45° with respect to the direction of forward motion, said two plates being capable of deflecting the center-folded film by 90° from the direction of forward motion to that of travel.

16. An apparatus according to claim 15, wherein said two plates are operatively connected to actuator means capable of adjusting their reciprocal distance.

17. An apparatus according to claim 12, wherein a third belt delivers to said first belt a plurality of products while keeping them at a uniform distance one from the other, thus acting as a synchronizer.

18. An apparatus according to any one of claims 6 to 17, further comprising means for sealing or clipping the open mouth of each bag formed.

19. An apparatus according to any one of claims 6 to 17, further comprising conveying means for moving formed bags to a vacuum/sealing chamber where each of the bags is evacuated and the open mouth thereof is sealed or clipped.

20. An apparatus according to claim 19, further comprising conveying means for transferring the evacuated and sealed or clipped bags to a heated shrink tunnel.

21. An automatic apparatus for packaging a food or non food product substantially as herein described with reference to the accompanying drawings.

22. A product when packaged by a method according to any one of claims 1 to 5.

23. A product when packaged by an apparatus according to any one of claims 6 to 21.

DATED this 2nd day of SEPTEMBER, 1999

Cryovac, Inc.

by DAVIES COLLISON CAVE
Patent Attorneys for the applicant

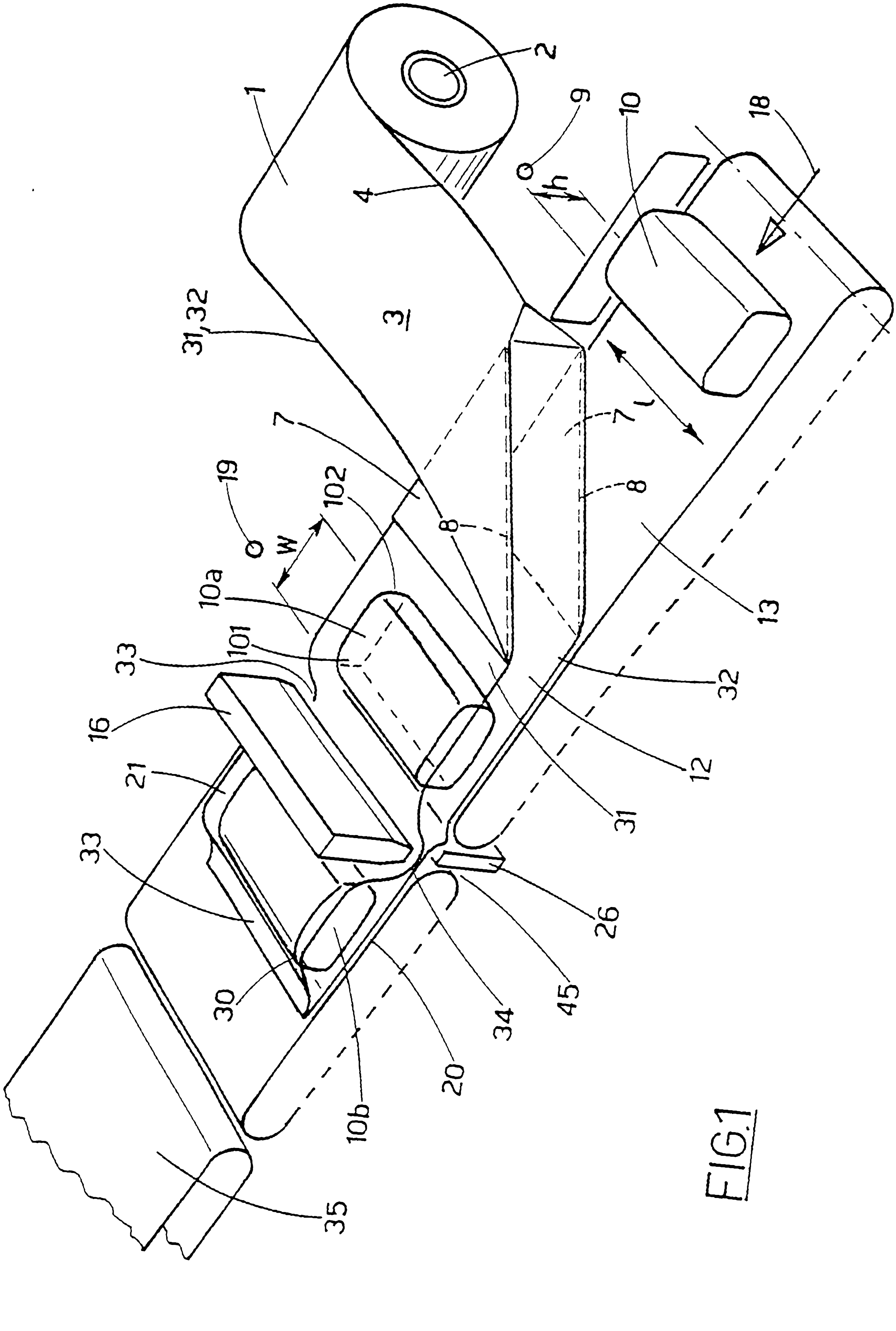
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FIG.1

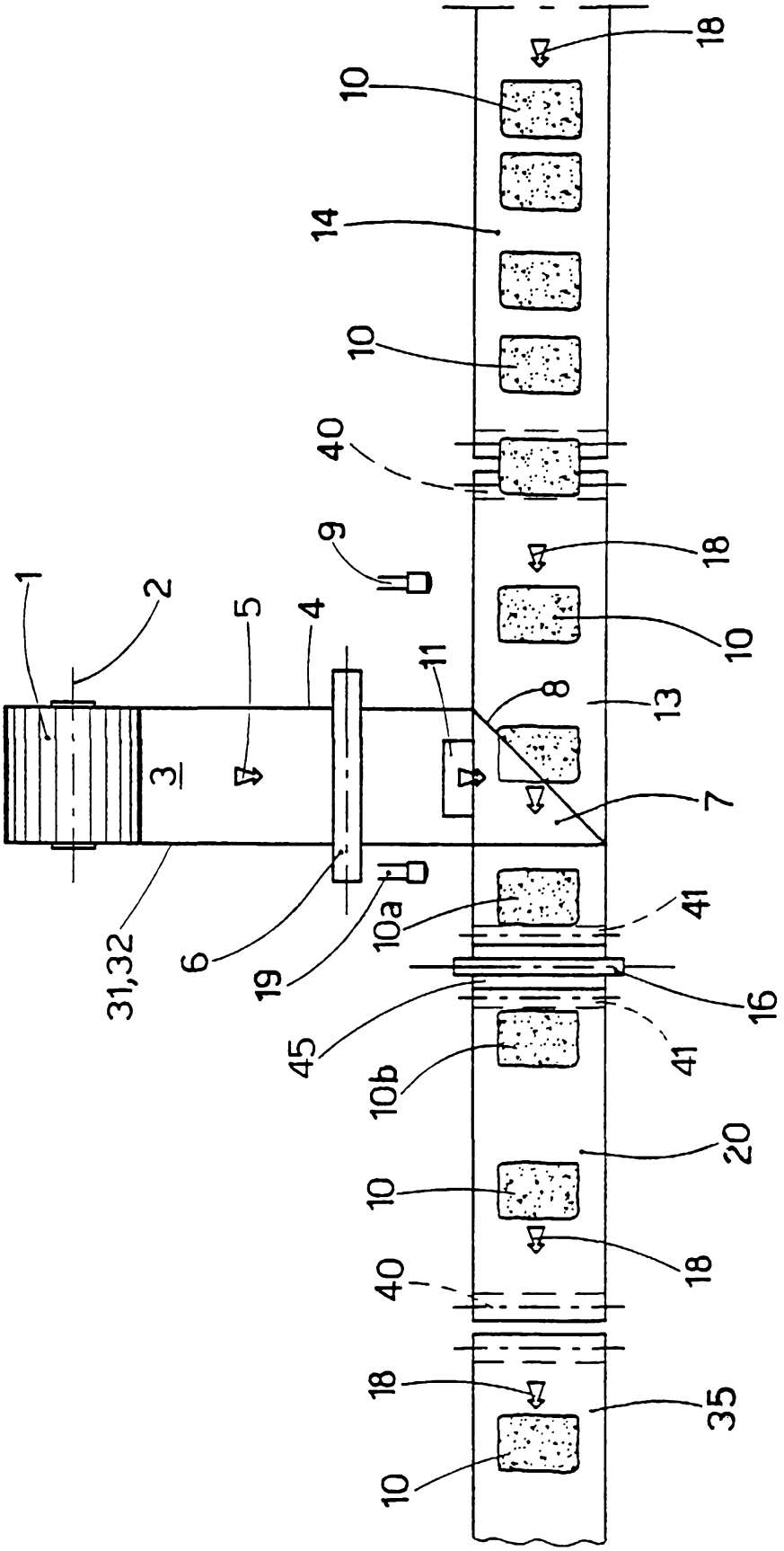

FIG.2

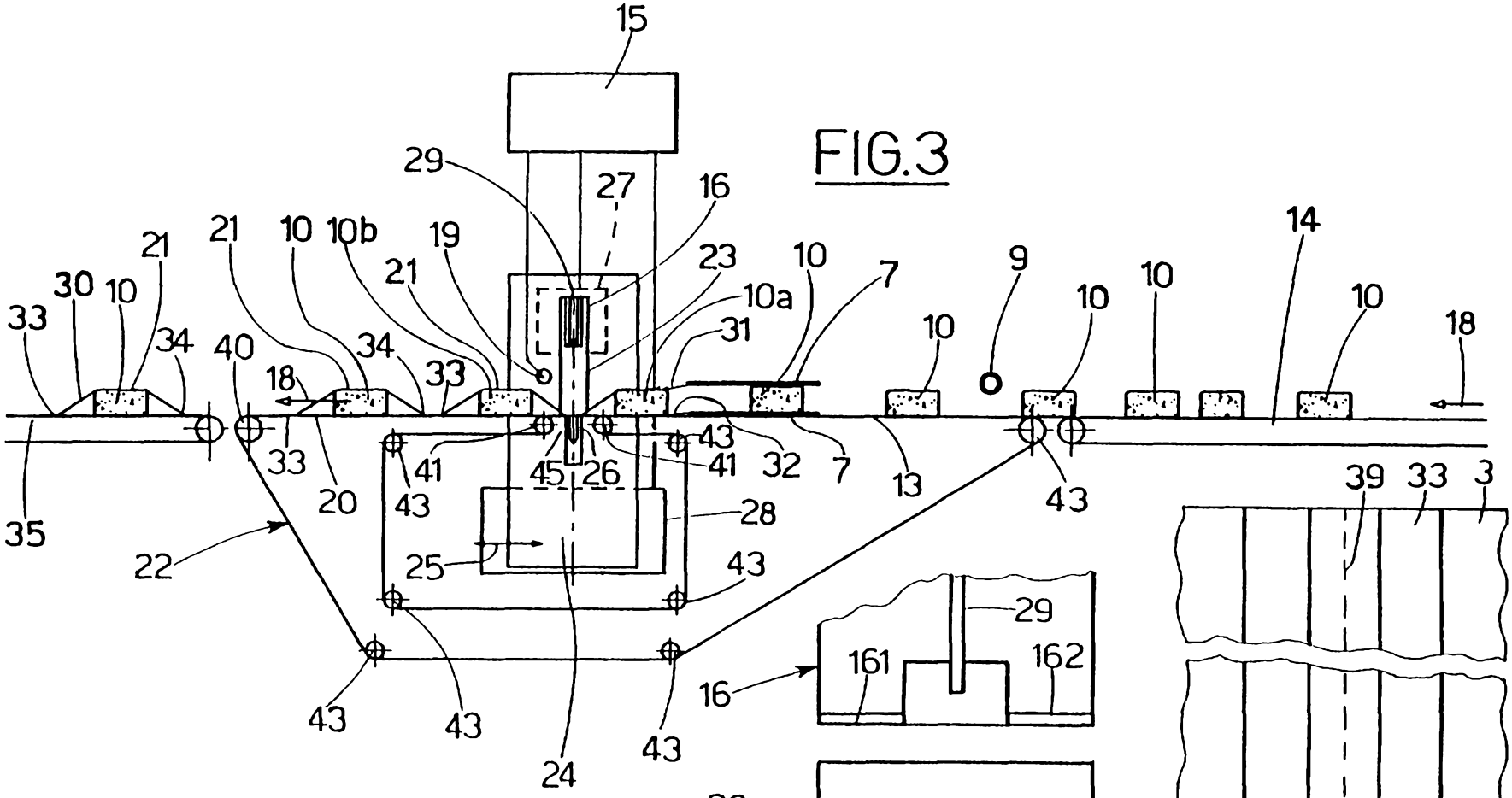

FIG.3

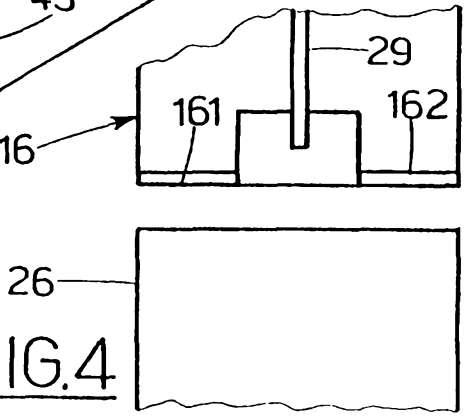

FIG.4

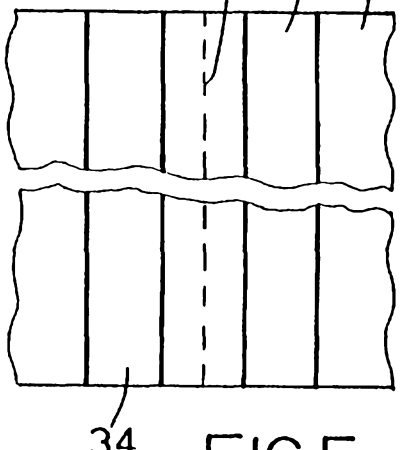

FIG.5