

[54] **METHODS OF AND DEVICES FOR
CONTINUOUSLY PACKAGING ARTICLES
IN THERMOSHRINKABLE PLASTICS FILM**

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217, 218, 225; 219/388

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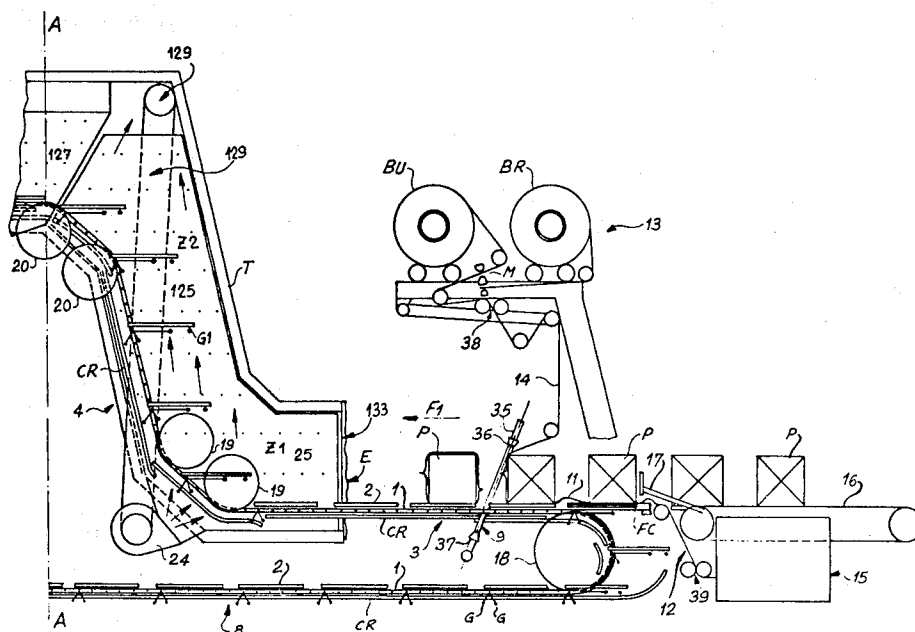
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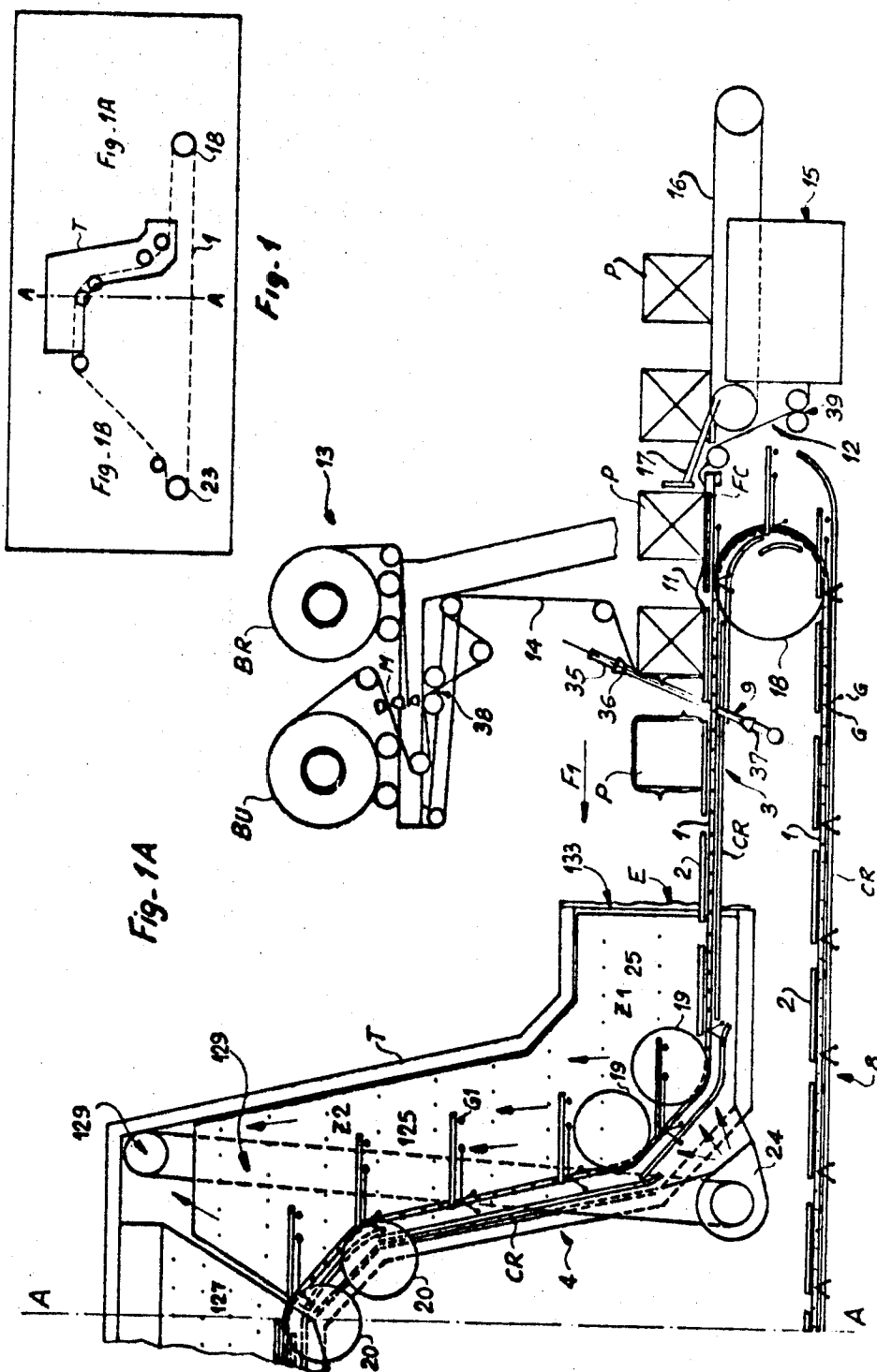
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[57] **ABSTRACT**

A method and device for continuously packaging articles in thermoshrinkable plastics film. Such a device comprises an endless chain conveyor driving equidistant trays articulated so as always to remain horizontal while following a roller path CR. This conveyor, between a feed station FC for the collections of articles to be wrapped and a discharge station for the collections closed and wrapped in their shrunk wrapping, comprises a device for loosely wrapping each collection, a thermoshrinkage zone, an upper finishing zone and a descending cooling zone at the exit from which the collections may be handled without risk, as soon as they arrive at the discharge station. This device comprises in addition a continuous reel handler for an upper film and a similar reel handler for a lower film, these films being intended for making up the wrappings of the collections of articles. The invention is applicable to the techniques of providing an outer wrapping to articles, of thermoshrinkable plastics film.

20 Claims, 12 Drawing Figures





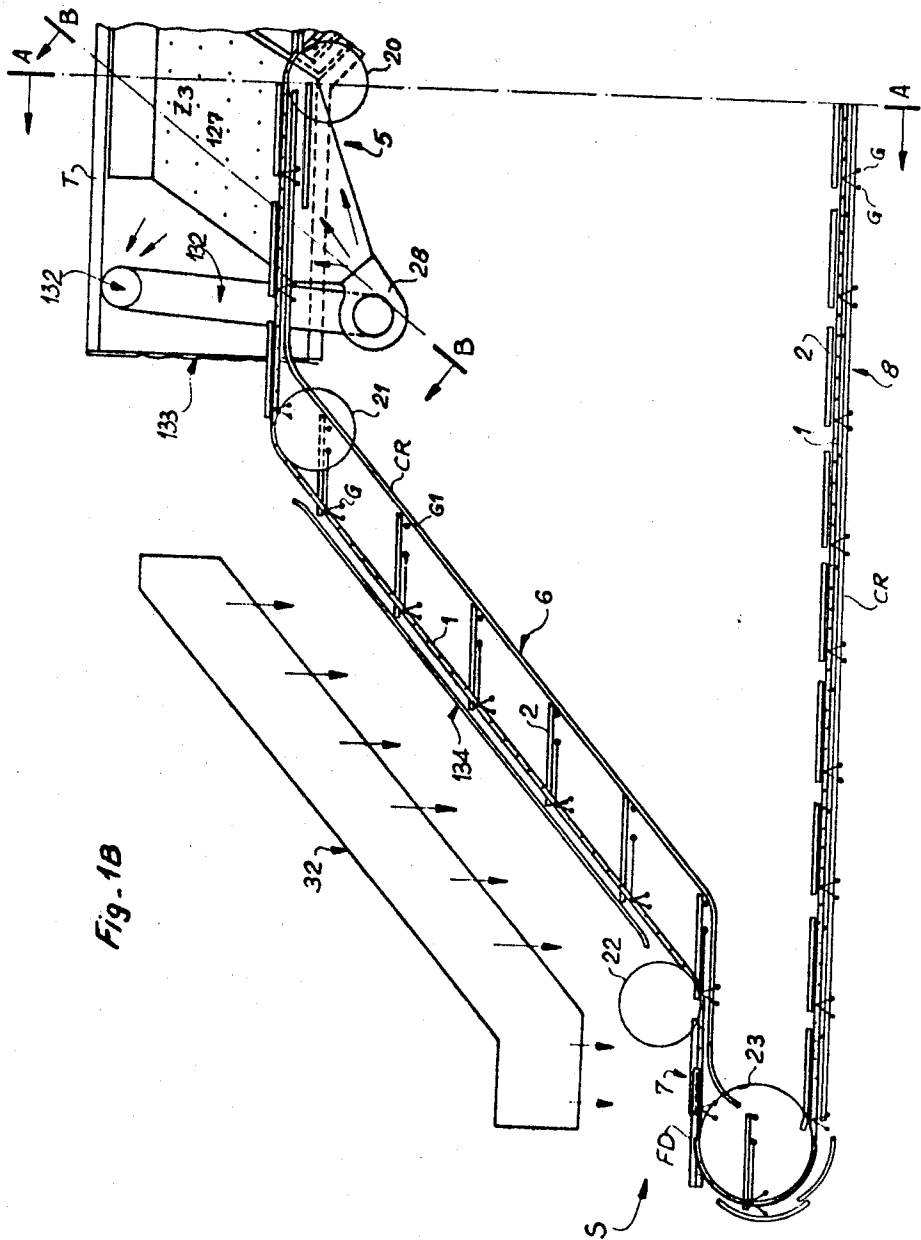
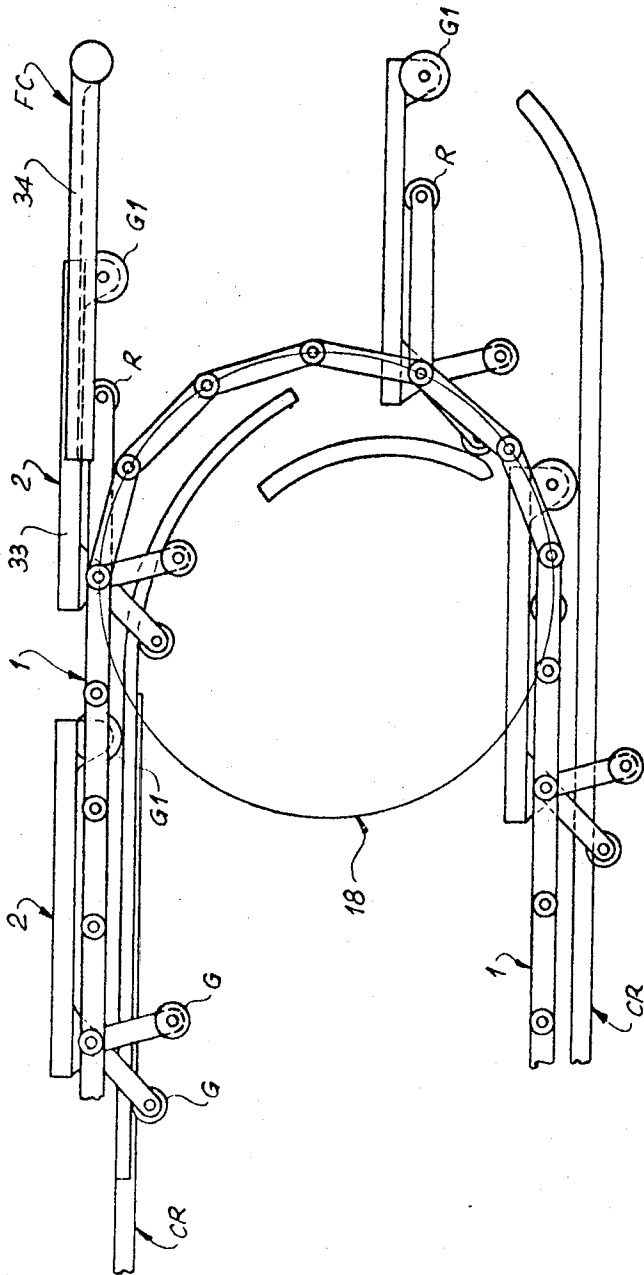


Fig-2



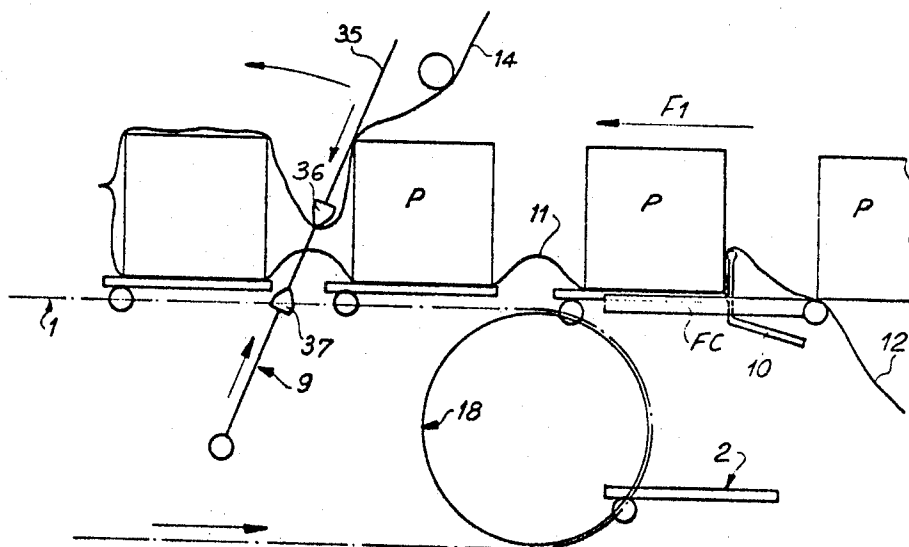


Fig. 4

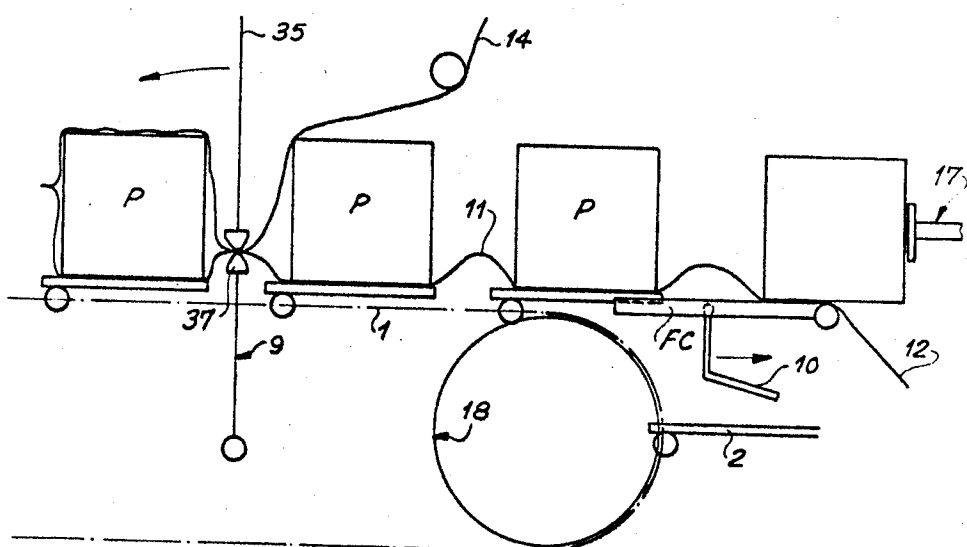


Fig. 5

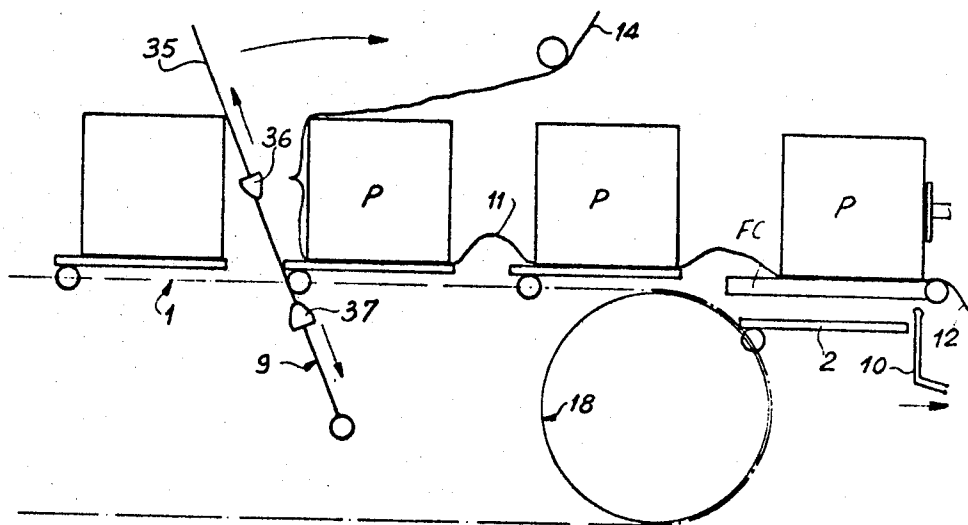


Fig-6

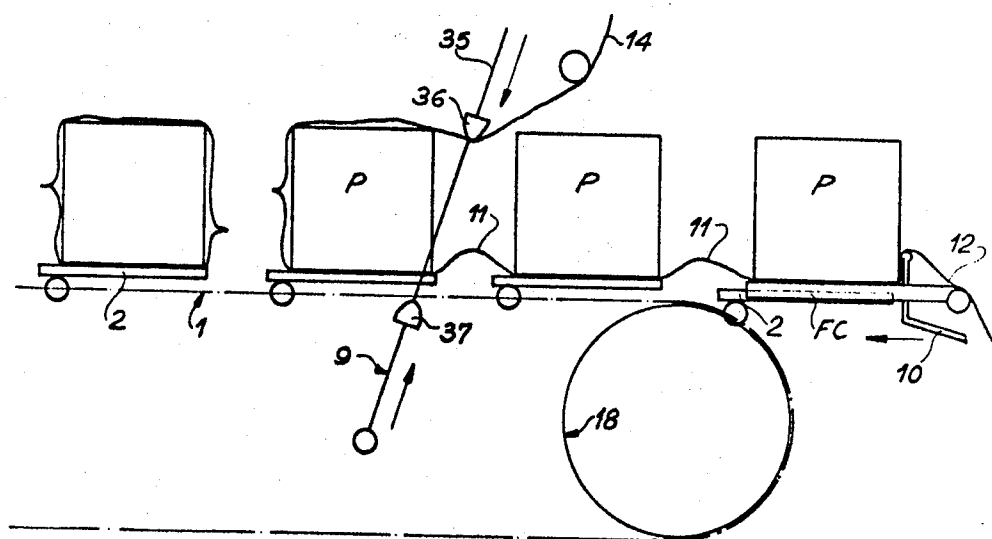
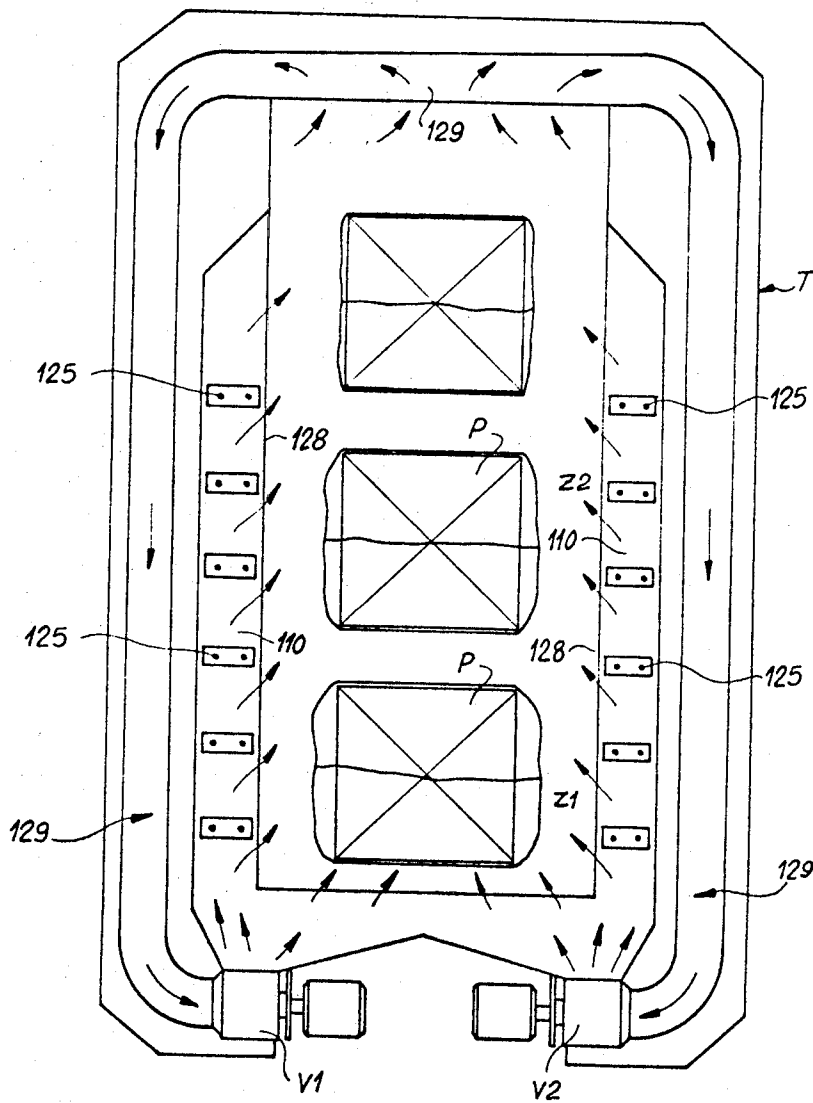


Fig-7

Fig. 8



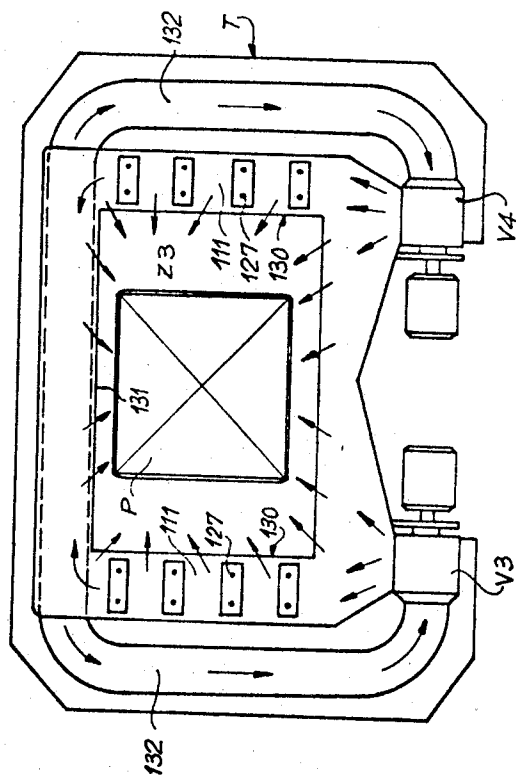


Fig-9

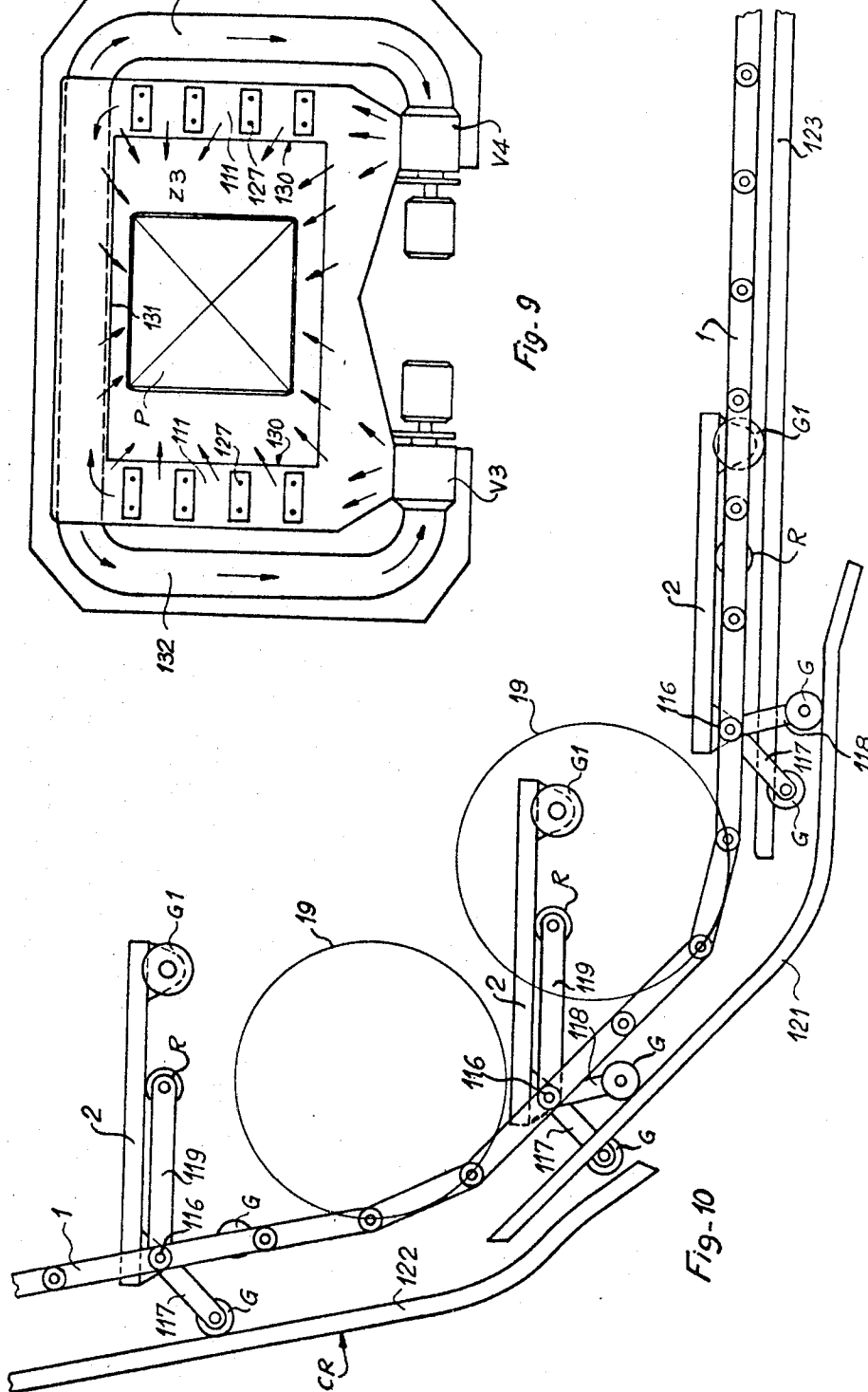


Fig-10

METHODS OF AND DEVICES FOR CONTINUOUSLY PACKAGING ARTICLES IN THERMOSHRINKABLE PLASTICS FILM

The present invention relates to methods and devices for continuously packaging articles in thermoshrinkable plastics film and, more especially, it deals with a method for continuously packaging articles or collections (bulkings) of articles in a wrapping of thermoshrinkable plastics film, such as PVC or polyethylene film; it also relates to a device for applying this method, in the form of a single machine fitted with a tray conveyor, which is so constructed as to move continuously; upon each tray of this conveyor there are carried out, without interruption, first the receiving of an article or collection of articles, then the placing and sealing of a loose wrapping of film around the article or collection, the wrapping extending laterally on either side of it, then the thermoshrinkage of this wrapping, followed by cooling sufficient to enable the package thus produced to be removed and handled without risk of deterioration, as soon as it leaves the conveyor; the conveyor meanwhile continues its return journey, empty, towards its entry point, where it takes over new collections of articles to be wrapped.

In the prior art of packaging using thermoshrinkable film, numerous types of device are known which are capable of effecting one of the aforementioned operations individually; these devices may be combined together to act in conjunction carrying out, consecutively but not continuously, these various operations for the production of packages of articles in shrunk wrappings. This lack of continuity in the succession of operations is due, in fact, to the excessively large dimensions, especially longitudinally, of these devices, which does not allow them to be placed in line in view of the restricted space available in the majority of cases, both for permitting them to be installed and for enabling them to operate correctly.

Also, in the current technique of packaging using thermoshrinkable plastics film, numerous types of shrinkage apparatus are known. The majority of these are in the form of long tunnels into which hot air is blown, followed by a long cooling zone, that is to say a zone where cold air or any other refrigerated fluid is projected upon the shrunk packages, these packages being considered sufficiently rigid to be handled when they leave this cooling zone. These known devices possess in general a disadvantage which is considered to be a serious one, in that they are too bulky, especially in their length; other disadvantages result from the fact that they do not always enable the thermoshrinkage operation to be carried out in a suitable manner, because of the unconsidered losses of hot air, nor do they enable the cooling operation to be satisfactorily effected since, in general, in spite of their very great length along the ground, the cooling zone of these devices is too short, with the result that the packages, still warm, cannot be handled immediately upon leaving this cooling zone, without risk of defects being produced.

It is moreover relatively uncommon, because of the different designs of these numerous devices, for it to be possible to combine them for the purpose of effective overall functioning; for this reason, an intermediate handling of the articles or collections of articles between each pair of operations is often required, thus still further increasing the number of disadvantages

which these devices of the prior art are recognized to possess. Moreover, in these known devices, the lower film which is to constitute the bottom and the sides, transversely to the conveyor, of the thermoshrinkable wrapping, is first placed upon said conveyor before each collection of articles is placed upon it, followed by the placing of an upper film over the articles to constitute the upper part of the wrapping; this upper film will later be joined to the transverse sides. This known method for placing the wrapping possesses certain disadvantages in that, in order to carry it out, each transporting element of the conveyor intended to receive a collection of articles must be in the form of a trough adapted substantially to the width and height of the collection, in order that the lower film shall follow the shape of its underside and of its sides, while it is waiting to be joined to the upper film which will follow the shape of the top of the collection of articles.

It is, therefore, one of the principal objectives of the present invention to provide a single device in the form of a machine which is short by comparison with the installations of known type constituted of a number of devices, and which is capable of carrying out a continuous process for the packaging of articles or collections of articles in wrapping of shrinkable film; this process also constitutes one of the objectives of the invention and overcomes the greater part of the disadvantages mentioned above.

Another objective is to provide such a machine, which operates continuously and does not require any handling of the collections of articles from the stage where they are taken over by the machine to that where they are removed in the condition of firmly closed packages, nor any surveillance at any time, but which requires only the replacing of the reels of empty film by other, full reels, so that the feed of thermoshrinkable film may be ensured without either stopping or cutting.

Another objective is to provide such a machine, so constructed as to possess an advantageous characteristic in the operation of placing loose wrapping material around each collection of articles, in that it takes over the collection while it is already resting upon the lower film, which in turn rests upon a fixed feeding fork.

Yet a further objective of the invention is to provide such a machine, designed in such a way that the portion of it corresponding to the thermoshrinkage and cooling station for the wrappings is of very short length along the ground, while still providing sufficient developed length to enable these operations to be effectively carried out and to permit the handling, without risk of deformation, of the closed and wrapped collections as soon as they leave this station; this result is achieved utilizing the ascending property of hot air in the shrinkage zone and, conversely, the property of cold air of falling in the cooling zone, the shrinking zone being a portion having a steep ascending slope, close to the vertical, while the cooling zone is, by contrast, a portion having a steeply descending slope, of sufficient length to ensure effective cooling of the shrunk collections, thus enabling them to be handled as soon as they leave that zone. In addition, this machine utilizes a chain conveyor having articulated trays and moving continuously, enabling the unwrapped articles or collections of articles to be received by the machine at the feed station, without interruption one after another, enabling them then to be passed continuously to the next station where they are fitted with their loose wrapping of ther-

moshrinkable plastics film, then to be conveyed, provided with their wrapping, first to the shrinkage zone and, after that, to the cooling zone, this being done without changing, anywhere along the path, the position in which they were originally fed and in which they will be discharged, tightly wrapped and ready to be handled, at the outlet from the cooling zone.

According to the invention, the method of continuously packaging articles and, notably, collections of articles in a wrapping of thermoshrinkable plastics film, based upon the use of a continuously moving tray conveyor, comprises the following operations:

1. The reception, by each tray, of an article or collection of articles placed thereon, resting upon a lower film, at the feed station;

2. The covering of the collection with an upper film, a free end of which is joined to that of the lower film at the front of the collection of articles;

3. Joining of the upper film to the lower film at the rear of said collection of articles and median cutting of the film providing at this stage, respectively, the closure edge for the loose wrapping of this collection and the starting joint for the wrapping of the next collection;

4. The transporting of each collection, loosely wrapped, into a preheating zone, followed by an ascending thermoshrinkage zone, then into a thermoshrinkage finishing zone and, finally, into a descending cooling zone, terminating in a discharging station, at which the collections, tightly wrapped and closed, may immediately be handled.

It should be noted that the last operation, constituting the thermoshrinkage and cooling operation for the film wrappings is, in accordance with the invention, carried out in a station constituted of a path substantially in the form of an open, inverted U, this path being followed by the conveyor with its articulated trays for transporting the articles or collections of articles, and one of the arms of this path being sleeved in a hot air tunnel constituting an ascending thermoshrinkage zone, while the other arm is open to the surrounding air but just beneath a cooling assembly which subjects it to a draught of cold air; this second arm constitutes a descending cooling zone, at the exit from which the collections are sufficiently rigid to be handled.

More specifically and in accordance with the invention, this method is based upon the use of an endless, straight-line conveyor, having articulated trays, spaced apart from one another and so designed as to remain horizontal along the totality of the path between the feed station and the discharge station; the successive operations which the method comprises are carried out uninterruptedly upon these trays, these operations being the following:

1. The reception, by each tray, of a collection of articles placed upon a lower film resting upon a fixed feeding fork and raised up behind the collection to provide a slack forming loop between that collection and the following collection;

2. The covering and enveloping of the upper part of the collection of articles with an upper film a free end of which is joined to that of the lower film at the leading end of this collection;

3. The joining together and cutting, by heat sealing and cutting, of the upper film and the loop of slack of lower film behind the collection, so as to close its wrapping in the loose state and to separate it from the starting edge of the wrapping of the following collection;

4. The transporting of the loosely wrapped collection into a thermoshrinkage preheating zone, then into an ascending thermoshrinkage zone, then subsequently into a horizontal thermoshrinkage finishing zone and, finally, into a descending cooling zone, at the exit from which each collection with its wrapping of film, now tightly closed, may be discharged and may be immediately handled.

Still more specifically, and according to the invention, it should be noted that, in this method, with regard to operations (1) to (3), the lower and upper films are continuously fed without cutting and are of a width greater than the dimensions of the collection as measured perpendicularly to the longitudinal axis of the conveyor, so that they project laterally, with respect to this axis, from these collections of articles. Moreover, during the operation of loading on its tray each collection, the loop of slack in the lower film is made while one collection starts to be moved forward by a tray of the conveyor and while the front edge of the succeeding collection arrives at the rear of the fixed feeding fork, these two collections being separated by the same distance as is maintained between them throughout the whole of their passage through the operational path of the conveyor, so that the front side of the loop is jammed between the rear edge of the collection on a tray and the rear of the same tray, and that the rear side of the loop is jammed between the front edge of the succeeding collection and the rear edge of the feeding fork. In addition, each collection is moved forward over the feeding fork at the same speed as the advance speed of the conveyor, thus entraining the lower film jammed beneath it. Moreover, the height of each convex loop of slack in the lower film between two collections is determined in such a way that the development of this loop is always less than the height of each collection so that, during the jointing operation, the joint line at the start of wrapping in front of this collection and also the joint line at the closure of this wrapping behind this collection are situated, respectively, in a region of the front and rear faces of the collection, and not above it.

The device for applying this method is, according to the invention, constituted of:

a. A tray conveyor, moving continuously along a straight-line roller path passing from a fixed feeding fork for the collections to a fixed, similar, discharging fork, via a station for receiving and loosely wrapping the collections, a preheating and thermoshrinkage station with an ascending path, a thermoshrinkage finishing station with a horizontal path, and a station having a descending path for cooling the shrunk wrappings, this station leading into the discharge fork, the conveyor then continuing its return path empty towards the feeding fork;

b. An oscillating device, having heat sealing and cutting jaws, situated in front of the feed fork, designed to join together and to cut the lower and upper films for forming a loose wrapping around each collection;

c. A device for forming a slack loop of lower film between two consecutive collections;

d. A film reel handler supplying the upper film continuously and a similar reel handler supplying the lower film continuously.

More specifically, this device for practicing the method according to the invention is constituted of:

a. An endless conveyor entraining equally spaced trays and moving continuously, at uniform speed, following a straight-line roller path comprising, from a fixed feed fork for the collections to a similar fixed discharging fork for these collections when they have each been firmly closed and wrapped in a wrapping of shrunk plastics film, a first horizontal portion where the operations of receiving and loosely wrapping the collections are carried out, an ascending portion having a slope close to the vertical where the preheating and thermoshrinkage operations are carried out, a second horizontal portion where the thermoshrinkage finishing operation is carried out, and a descending portion where the cooling is carried out, and which leads into a third horizontal portion, in the same plane as the first and co-operating with the fixed discharging fork, this roller path then continuing, in a plane below the first and third horizontal portions but parallel to these planes, into a return portion connecting the discharging station to the feed station;

b. A device with heat sealing and cutting jaws, mounted in the first horizontal portion, so as to enable jointing and cutting to be effected across the width of the upper and lower films for forming a loose wrapping and able to oscillate longitudinally relative to the conveyor in the forward and reverse direction through an angle encompassing the distance between the axes of two consecutive gaps in front of and behind a collection of articles, and capable of separating its wrapping from the start of the wrapping of the following collection;

c. A device for forming a loop of slack in the lower film between two consecutive collections, situated behind the fixed feed fork in the extension of the roller path and constructed in the form of a balance arm, the free end of which can move upwards and downwards in order to raise the lower film both ahead and behind along a path exceeding the gap between two collections of articles;

d. A film reel handler supplying the upper film continuously and situated substantially vertically above the heat sealing and cutting device above the first horizontal portion of the roller path, and a similar reel handler, supplying the lower film continuously, situated behind and below the plane of the fixed feed fork, preferably laterally to the rear extension of that feed fork, this extension being occupied by a second conveyor for assembling the collections, comprising at the front and close to the fork, a feed loader designed to push each of the collections onto the fork before they are placed on a tray of the first conveyor, at the same speed as that of this first conveyor.

The conveyor is constituted of two lateral chains, guided around return pinions so as to follow a path substantially close to that of the roller path and supporting, transversely between them, trays articulated at their front portion by means of crank arms with guide rollers attached to each of them, these crank arms being so designed that, when their rollers run along the roller path, they maintain each of the trays at all times in a horizontal position in the ascending and descending portions; each tray comprises, in addition, rear rollers so positioned as to run along the horizontal portions of the roller path and to keep the tray in a horizontal position along these portions of the path.

It should be noted, in addition, that each tray of the conveyor is constituted of ribs for supporting the col-

lection resting upon it, these ribs extending parallel to the conveyor axis and parallel to one another, separated from one another by a gap larger than the width of each arm of each of the fixed forks and slightly higher than the height of these forks, so that their upper plane is slightly above that of a fork when they are brought by their respective tray to the horizontal level of the feed and discharge stations so that, at the feed fork, they raise and entrain the lower film with a collection upon it and, at the discharge fork, they lower and deposit the collection with its shrunk wrapping upon that fork, without ever completely passing beyond the arms of these forks.

In addition, the jaw device for heat sealing and cutting is constituted of a balance arm supporting reciprocating upper and lower jaws having their heat sealing and cutting blades respectively facing each other, these jaws being so constructed that, when their balance arm is inclined in the direction opposite to the direction of movement of the conveyor, they grip between them the upper and lower films between two successive collections of articles, seal them and cut them apart during the oscillation of the balance arm in the direction of motion of the conveyor while the balance arm is substantially in a position close to its vertical median position, they open and move apart from each other while the balance arm continues its oscillation in this same direction, until the lower jaw is in a lower position close to the axis of pivot of the balance arm and the upper jaw is at a position above the collections of articles, this upper jaw then lowering the upper film onto the collection to be wrapped while the balance arm makes its return oscillation to come back to its initial position; at this instant the lower jaw bears up underneath the loop of slack lower film and the upper jaw bears down on the upper film until it presses it onto the upper part of this loop; the operation of gripping the films then takes place and the succeeding operations listed above are again carried out.

In addition, each of the reel handlers for the upper and lower films is constituted of a roller cradle designed to support a reel of film which is being used and a reserve reel, of a jaw device for heat sealing cutting comprising a central reversible jaw carrying the free end of the reserve film and two fixed jaws situated on either side of this reversible jaw, outside but close to the path of the film in use and the path which will be followed by the reserve film when it is being used, and (is constituted of) a film tensioning assembly for tensioning the film in use, directing this film via a roller direction changing assembly towards the corresponding film feeder of the packaging device, the construction of this reel handler being such that, when the film in use comes to an end, the reversible jaw, assisted by the corresponding fixed jaw, joins the free end of the reserve film to this tail end of the used film, the tensioning device releasing film during this operation, so that there is no cessation of feed of film by the film feeder.

In addition, in this device according to the invention, in order effectively to carry out the fourth operation of the method, the ascending portion in which the preheating and thermoshrinkage operation is carried out, and also the second horizontal portion of the roller path in which the thermoshrinkage finishing operation is carried out, are situated in a tunnel forming a sleeve along the roller path, and comprising in its lower part an air ventilation assembly opening into the curved

start of the ascending portion close to the preheating zone, comprising in its ascending part lateral groups of resistance heaters distributed in the thermoshrinkage zone and, in its upper part, a similar air ventilation system opening into the finishing zone and, within this zone, lateral groups of resistance heaters, these two ventilation assemblies being so designed as to remove respectively the hot air from the upper part beneath the ceiling of the tunnel and to recycle it.

The descending portion in which cooling is carried out is situated so as to be exposed to the surrounding air but has immediately above it a cooling assembly constituted of a ventilation assembly so constructed as to direct jets of cold air onto each of the shrink-wrapped collections of articles, in order to give them the best environment to accelerate their cooling as soon as they leave the top exit of the tunnel.

More specifically and according to the invention, these portions constitute, correctly speaking, the shrinkage device which comprises:

- a. A roller path followed by a chain conveyor with articulated trays for supporting collections of articles and having its entry and exit ends horizontally connected from the entry to the exit by an ascending portion of very steep slope, an upper horizontal portion and a descending portion of lesser slope than that of the ascending portion;
- b. A tunnel surrounding the entry end, the ascending portion and the upper portion of the roller path being of dimensions sufficient to permit the free passage through it of the chain conveyor with its trays carrying their loads, hot air being cycled through this tunnel;
- c. A cooling assembly above the descending portion and the exit end of the roller path which are open to the surrounding air, this cooling assembly being so constructed as to feed cold air onto the collections of articles which have been subjected to thermoshrinkage, from the time when they leave the upper part of the tunnel.

In this shrinkage device, the two lateral chains constituting the chain conveyor are guided around return pinions to have a path sensibly close to that of the roller path and they support, transversely between them, the trays articulated at their front part by means of cranks and guide rollers attached to each of them, these cranks being designed in such a way that, with their rollers running along the roller path, they maintain the trays in a horizontal position at all times in the ascending and descending portions, each tray comprising, in addition, rear rollers so positioned as to run along the horizontal portions of the roller path and to maintain the tray in a horizontal position along these portions of the path.

The tunnel constituting the ascending thermoshrinkage zone comprises three consecutive heating zones, a preheating zone corresponding to the horizontal inlet portion and to the curved commencement of the ascending portion of the roller path, a progressive thermoshrinkage zone proper, corresponding to the ascending portion and to the curved commencement of the upper horizontal portion of this roller path, and a thermoshrinkage finishing zone corresponding to said upper portion. This tunnel comprises, at its lower part, an air ventilation assembly opening into the curved commencement of the ascending portion close to the preheating zone, in its ascending portion lateral groups of heating resistors distributed in the progressive ther-

moshrinkage zone and, in its upper part, an air ventilation assembly opening into the finishing zone and, within this zone, lateral groups of resistance heaters. The ventilation assembly of the lower part is constituted of at least one blower of the suction and delivery type, arranged to direct air upwards over the groups of resistance heaters in order to surround the ascending collections of articles with progressively hotter air as they ascend and to draw this hot air out again at the ceiling of the ascending portion by means of a recycling duct running beneath that ceiling and descending to the blower along the internal walls of this ascending portion, the part of this duct beneath the ceiling being provided with numerous intake holes. The ventilation assembly for the upper portion is likewise constituted of at least one blower of the suction and delivery type, arranged to direct air upwards over the groups of resistance heaters in order to provide hot air around the collections of articles advancing through the finishing zone towards the exit from the tunnel and to remove this hot air from the ceiling of this zone by means of a recycling duct running beneath the ceiling of the upper part of the tunnel and descending to the blower along the internal walls of this upper part, the portion of this duct beneath the ceiling being provided with numerous intake holes.

It should be noted also that the resistance heaters, in the form of finned resistors, are arranged in tiers all along the lateral internal walls of the tunnel, both in its ascending portion and in its upper portion and are placed in front of the descending ducts for recycled hot air, towards the median plane of the tunnel, in order to ensure good heat distribution.

In addition, in a still more specific form of embodiment of this tunnel, each ventilation assembly delivers air into blowing ducts incorporating the heating resistors; these ducts, in the ascending portion of the tunnel, being placed in front of the recycling ducts towards the median plane of the tunnel and being perforated on the side towards this plane to constitute a hot air blowing chamber having perforated lateral and bottom walls, the ceiling of which is traversed by the perforated part of the recycling duct and, in the upper part of the tunnel, being placed in the same manner but to constitute a hot air blowing chamber completely surrounding the finishing zone and having lateral, upper and lower perforated walls, the perforated part of the recycling duct being placed beneath the ceiling of this upper part of the tunnel, in front of the chamber, close to the exit from the tunnel. It should be noted in addition, that in order to limit the losses of hot air from this tunnel, the tunnel is provided with a lock, at its entry and at its exit, in the form of slotted, hanging curtains, to permit the passage of the trays and their collections of articles.

The cooling assembly above the descending portion is constituted of a ventilation assembly constructed to direct jets of cold air onto each of the shrink-wrapped collections of articles in order to give them the best possible environment to accelerate their cooling.

Other characteristics and objectives of the present invention will become apparent from reading the description below, prepared in relation to the attached drawings, in which:

FIG. 1 is a diagram illustrating how FIGS. 1A and 1B should be joined together to provide a diagrammatic overall view of the packaging device for packaging collections of articles in thermoshrinkable plastics film wrapping, forming the subject of the present invention,

FIG. 2 is a diagrammatic view of the feed station for the collections of articles, before they are wrapped,

FIG. 3 is a diagrammatic view of the discharge station for the closed and wrapped collections of articles after the operation of thermoshrinkage and cooling of the thermoshrunk wrappings,

FIGS. 4, 5, 6 and 7 are diagrammatic representations of the successive stages of the operation of loosely wrapping the collections of articles, before the thermoshrinkage operation,

FIG. 8 is a section, along AA in FIG. 1B, of the ascending portion of the tunnel constituting the progressive thermoshrinkage zone, the roller path and the chains passing through this portion having been omitted for the sake of clarity,

FIG. 9 is a section, along BB of FIG. 1B, of the upper part of the tunnel constituting the finishing zone; here again, as in FIG. 8, the roller path and the chains have been omitted,

FIG. 10 is a detail of the curved portion of the roller path between the horizontal bottom portion at the tunnel entry and the commencement of the ascending portion of this tunnel showing, in addition, the chain conveyor and the articulation of the trays onto this conveyor.

As shown in the overall view, in FIGS. 1A and 1B (where the tunnel T is shown in section in order to assist understanding) the device according to the invention is constituted, generally speaking, of:

a. An endless chain conveyor 1, carrying trays 2 articulated at their front portion and equally spaced apart and moving continuously at a uniform speed following a straight-line roller path CR comprising, from a fixed feed fork FC for the collections of articles P to a fixed discharge fork FD for these articles, a horizontal portion 3 where the operations of loading and of loosely wrapping these collections are carried out, an ascending portion 4 having a slope close to the vertical in which the preheating and thermoshrinkage operation is carried out, a horizontal portion 5 in which the thermoshrinkage finishing operation is carried out, and a descending portion 6 in which the cooling operation is carried out and which leads into a horizontal portion 7 in the same plane as the horizontal feed portion 3 and cooperating with the discharge fork FD, and a return portion 8 in a plane below these horizontal portions;

b. A device 9 with heat sealing and cutting jaws, mounted along the horizontal portion 3 so as to be capable of oscillating in the direction of movement (indicated by arrow F1) of the conveyor and in the reverse direction, in order to effect the sealing and cutting of the loose wrappings of film;

c. A device 10 (see FIGS. 4 to 7) for forming a loop 11 of slack in the lower film 12 between two consecutive collections of articles, situated behind the feed fork FC and serving also to place each collection of articles in a correct position upon the tray on which it rides;

d. A film reel handler 13, feeding the upper film 14 continuously and mounted above the device 9;

e. A similar reel handler 15, feeding the lower film 12 continuously and situated behind and below the plane of the feed fork FC and to the side of the axis of the conveyor;

f. A collection-forming conveyor 16, comprising at the front, close to the fork FC, a feed loader 17 designed to push each of the collections P onto this fork, before they are engaged by a tray 2, this feed loader

being assisted by the device 10 in positioning this collection of articles upon this tray.

As can be seen in FIGS. 1A and 1B, the thermoshrinkage device proper is constituted, generally speaking, of the roller path CR, substantially in the form of an inverted, open U, followed by the conveyor 1 having articulated trays 2 for transporting the collections P, the right hand arm of this U (in FIG. 1A) being sleeved in a hot air tunnel T constituting an ascending thermoshrinkage zone, the other arm situated to the left (in FIG. 1B) and open to the surrounding air having above it a cooling assembly 32 which subjects it to cold air ventilation; this constitutes a descending cooling zone, at the exit S of which the collections P are sufficiently rigid to be handled.

The roller path CR has its entry end E and exit end S connected together, starting from the entry, by an ascending portion 4 having a very steep slope which nevertheless is less than the vertical, an upper horizontal portion 5, and a descending portion 6, having a lesser slope than that of the ascending portion.

The tunnel surrounding the entry end E, the ascending portion 4 and the upper portion 5 of the roller path, is of sufficient dimensions to permit the free passage through it, as seen in FIGS. 9 and 10, within its heating assemblies 110, 111, of the conveyor chain 1, with its trays 2 carrying the collections P of articles.

The cooling assembly 32 above the descending portion 6 and the exit end S of the roller path CR, open to the surrounding air, is constructed so as to feed cold air onto the collections P which have been subjected to the shrinkage operation, after they leave the upper part 5 of the tunnel.

As can be seen in FIGS. 1A and 1B, and in FIGS. 2, 3 and 10, the conveyor 1 is constituted of two lateral chains guided on return pinnions 18, 19, 20, 21, 22, 23 so as to follow a path substantially close to that of the roller path CR. These chains support, transversely between them, the trays 2 by means of transverse shafts 116, arranged at equidistant spacing from one another and serving at each of their ends as a substitute for the articulation pin for the links of the corresponding chain. Each shaft 116 supports in a freely pivoting manner the front portion of its corresponding tray 2, and also two lateral crank assemblies situated at the sides and close to each of the chains respectively and between them. Each crank assembly comprises three cranks 117, 118, 119, rigidly connected together and having the form of a three-branched fork. The free ends of the cranks 119 are connected together by a roller R passing transversely beneath the tray and supporting it, while each of the cranks 117 and 118 carries, cantilevered at its end remote from the shaft 116, a guide roller G intended for cooperating with the roller track defining path CR, each roller being opposite to the other; that is to say, for example, the roller of crank 117 is on the chain side, while the roller of crank 118 is on the side towards the median part of the tray, so that they may cooperate with lengths of roller tracks respectively 121, 122, offset laterally relative to one another depending upon the slope of the track in such a way that the roller R, joining together the ends of the two cranks 119, always supports the tray 2 in a horizontal position in the ascending and/or descending portions of this roller path. Each tray 2 comprises in addition, at its rear portion, two lateral rollers G1 for cooperating with the horizontal lengths 123 of the roller

track in the horizontal and descending portions of the roller path and while the cranks 117 and 118 are not "working" to support the tray in a horizontal position, it being noted that when these cranks "work" the rollers G1 are unsupported.

As can be seen more particularly in the left hand portion of FIG. 1A and in the right hand portion of FIG. 1B, and also in FIGS. 8 and 9, the ascending portion 4 in which the preheating and thermoshrinkage operation is carried out, and also the horizontal portion 5 of the roller path in which the thermoshrinkage finishing operation is carried out, are situated in the sleeve-shaped tunnel T, following this roller path. This tunnel T constituting the ascending thermoshrinkage zone comprises three consecutive heating zones, a preheating zone Z1, corresponding substantially to the horizontal entry portion E and to the curved commencement of the ascending portion 4 of the roller path, a progressive thermoshrinkage zone Z2 corresponding to the ascending portion 4 and to the curved commencement of the upper portion 5 of the roller path, and a thermoshrinkage finishing zone Z3 corresponding to this upper portion 5.

This tunnel supports, at its lower portion, an air ventilation assembly 24, opening substantially into the preheating zone Z1, in its ascending portion lateral groups 125 of heating resistors distributed on either side of the progressive thermoshrinkage zone Z2 and, in its upper portion, an air ventilation assembly 28 opening into the finishing zone Z3, this zone comprising, at the sides, groups 127 of heating resistors.

The ventilation assembly 24 for the lower part is constituted of two blowers V1 and V2, of the suction and delivery type, which are constructed respectively on the one hand to supply air upwards onto the lateral groups 125 of resistance heaters contained in the ascending ducts 128 perforated by numerous blowing holes so as to direct jets of hot air (indicated by the arrows) onto the collections of articles P and, secondly, to re-extract the hot air collected by a recycling duct 129 situated beneath the ceiling of the tunnel (and perforated in this region) and redescending along the internal lateral walls of the tunnel to discharge at each of its bottom ends into the respective intake of each blower. The hot air is thus continuously recycled, thus tending to reduce the consumption of electricity by the resistance heaters.

The ventilation assembly 28 for the upper part or finishing zone Z3, is also constituted of two blowers V3 and V4, of the suction and delivery type, which are constructed respectively, on the one hand to feed air upwards onto the lateral groups 127 of resistance heaters contained in the ascending ducts 130 connected together across the top beneath the ceiling of the tunnel by a duct portion 131, these ducts 130 and 131 being perforated with numerous blowing holes to direct jets of hot air (indicated by the arrows in FIG. 9) all around the collections of articles undergoing finishing thermoshrinkage and, secondly, to re-extract the hot air collected by a recycling duct 132, situated beneath the ceiling of the tunnel close to the exit from the tunnel (and perforated in this portion) and redescending along the lateral internal walls of the tunnel to discharge at each of its bottom ends into the respective inlet of each blower. As in the case of the progressive thermoshrinkage zone Z2, the hot air is thus continuously recycled in this finishing zone Z3.

It should be noted that in addition, in order to limit the hot air losses, the tunnel T is provided, at its entry and at its exit, with a lock 133 in the form of a slit curtain, to permit the passage of trays with their collections of articles.

As can be seen more especially in FIG. 1B, the cooling assembly 32 mounted above the descending portion is constituted of a number of blowers (not shown) constructed to feed jets of cold air, indicated by the arrows, onto the collections P in order that these collections shall be well cooled, that is to a sufficiently low temperature for the shrunk plastics film to have readopted its initial properties and for it thus to be capable of being handled without risk of deforming, when it leaves the exit S of the roller path.

It should be noted, in addition, that the roller track in this descending portion 6 below the cooling assembly is constructed to support only the rear rollers G1 of the trays 2, a counter-rail 134 being nevertheless provided to prevent these trays from tending to tip over forwards as they descend and thus not to retain their horizontal position as far as the exit S.

As can be seen more especially in FIGS. 2 and 3, each tray 2 is constituted by ribs 33 for supporting the collecting P of articles which it bears, these ribs being arranged parallel to the axis of the conveyor and parallel to one another, and separated from one another by a gap wider than the width of each arm 34 of each of the forks FC and FD and slightly higher than the height of these, so that the upper plane through the ribs is slightly above the plane of a fork when they are brought by their tray 2 to the horizontal level at the feed and discharge station, so that, at the feed fork FC (FIGS. 4 and 5) they raise and entrain the lower film 12, upon which there rests a collection of articles, and that at the discharge fork FD (FIG. 3), they lower and deposit the collection of articles with its heat-shrunk wrapping upon the fork. It should be noted that these ribs never pass upwardly completely through the gaps between the branches of the forks, either when ascending at FC or when descending at FD.

As shown in more detail but nevertheless a diagrammatic manner in FIGS. 4 to 7, the sealing and cutting jaws device 9 is constituted of a balance arm 35 supporting an upper jaw 36 and a lower jaw 37 reciprocating with their welding and cutting blades facing one another. These jaws are so arranged that, when the balance arm 35 is inclined in the direction opposite to the direction of motion of the conveyor, as indicated by the arrow F1 and seen in FIGS. 4 and 7, they grip between them the upper film 14 and lower film 12 between two successive collections of articles, heat seal them together and cut their joint in two during the oscillation of the balance arm 35 in the direction of movement of the conveyor, while the balance arm is in the position shown in FIG. 5, that is to say sensibly in a position close to its vertical median position; at this stage, the balance arm continuing its oscillation in the same direction, the jaws open and separate from one another until the lower jaw 37 is at a lower position close to the axis of oscillation of the balance arm and the upper jaw 36 is at an upper position above the collections of articles, as shown in FIG. 6; at this stage, the balance arm 35 reversing its oscillation movement, that is to say moving in the direction opposite to that of the conveyor motion, the upper jaw lowers the upper film onto the collection to be wrapped, then the oscillation con-

tinuing and the collection continuing to be entrained by its tray 2 as shown in FIG. 7, this jaw presses the upper film 14 between this collection and the following one, while the lower jaw 37 bears on the underside of the loop 11 of slack lower film 12, as shown in FIG. 4; at this stage, the balance arm readopts its oscillation in the direction of motion of the conveyor and, also, of the collections of articles, and the upper jaw 36 continues to descend and the lower jaw 37 to ascend, until they press the films against each other, while the balance arm is in the position shown in FIG. 5, the sequence of operations then continuing in the same order as previously described. It should be noted however that, during these operations, as the collections are taken over in succession by the trays 2, the loop-forming device 10 for forming the bulge or wave in the lower film 12 between two successive collections, comes into play at the same time as the loading device 17 in the sequence of steps represented in FIGS. 4 to 7, the lower film being first raised as in FIG. 4 with its loop 11 jammed by its left side between the rear edge of the collection on the tray which is ahead thereof and, at its right side, between the front edge of the following collection of articles and the rear of the feed fork FC, then with the device 10 dropping and drawing back, the loop 11 remains formed as shown in FIGS. 5 to 7, because the collections on the trays remain at the same spacing and are loaded at the same speed.

In addition, it should be noted that each of the reel handlers for the upper film and the lower film is of the type described in French patent No. 2,198,476, filed on Sept. 1, 1972 in the name of the applicant, for "apparat for continuously feeding a strip from a reel to a machine"; a general description of this apparatus is therefore all that will be given here. Each of the reel handlers 13 and 15 is constituted of a roller cradle designed to support a reel of film BU which is being used, and a reserve reel of film BR, of heat sealing cutting jaws device M, comprising a central reversible jaw carrying the free end of the reserve film and two fixed jaws, situated on either side of this reversible jaw, outside but close to the path of the film in use and the path which will be that of the reserve film when it is in use, and of a film tensioning assembly for the film in use directing this film via a change direction roller device to the corresponding film feeder 38 for the upper film 14 and 39 for the lower film 12. It will be noted however that the construction of each reel handler is such that, when its film in use comes to its end, its reversible jaw assisted by the corresponding fixed jaw joins the free end of the reserve film to this tail end of the used film, the tensioning device releasing film during this operation, so that there is no cessation of feed of film by the film feeder.

I claim:

1. A method for continuously packaging collections of articles in a wrapping of thermoshrinkable plastics film, utilizing a conveyor moving continuously and carrying the unwrapped collections of articles uninterruptedly one after another and delivering them, wrapped and closed and ready to be handled, comprising the steps of:

depositing collections of articles in spaced succession upon a lower film of heat sealable material at a feed station;
covering of the collections with an upper film of said material;

heat sealing the upper film to the lower film between each adjacent pair of collections and cutting each heat sealed joint in half to provide a series of loosely wrapped collections of articles;

transporting said series of loosely wrapped collections of articles sequentially through a preheating zone, then through a thermoshrinkage zone along an upwardly directed path, then through a thermoshrinkage finishing zone and, finally, through a cooling zone along a downwardly directed path to a discharge station where the collections, wrapped tightly and closed, may be immediately handled.

2. A method according to claim 1, including the steps of:

forming an upwardly arched loop of said lower film material rearwardly of each collection of articles, at said feed station, prior to deposit of the next succeeding collection on said film; and wherein said heat sealing step is performed by heat sealing said upper film to the crest of said loop.

3. A method according to claim 1 wherein said lower and upper films are continuously fed to said feed station, without cutting, and are of a width exceeding the dimensions of the collections measured transversely of said path so that they project beyond these collections laterally of said path.

4. A method according to claim 2 wherein said arched loop of lower film is formed rearwardly of one collection of articles and the succeeding collection is placed and maintained on said lower film in position to hold said loop.

5. A method according to claim 2 wherein the arched loop of said lower film between two collections is formed so that its height is less than the height of each collection of articles so that, during the heat-sealing step the joint between said films is situated in a region at the front and rear sides of each collection between the top and bottom thereof.

6. A device for packaging articles in a wrapping of thermoshrinkable plastics film, comprising:

a conveyor continuously movable along a path extending from a feed station to a discharge station, means between said stations for loosely wrapping articles on said conveyor; means defining a preheating and thermoshrinkage station encompassing an upwardly directed portion of said path; means defining a thermoshrinkage finishing station at a horizontal portion of said path extending from the upper end of said upwardly directed portion, and a station along a portion of said path extending downwardly from said horizontal portion for cooling the shrunk wrappings;

an oscillating device at said feed station having means for heat sealing and cutting lower and upper films of material for forming a loose wrapping for each article;

means at said feed station for forming an upwardly arched loop of lower film between two successive articles; and

a film reel handler feeding an upper film continuously to overlie said articles and a similar reel handler for feeding a lower film beneath said articles.

7. A device according to claim 6 wherein said conveyor is an endless chain conveyor having equidistantly spaced pivotally mounted trays thereon on transverse axes, and means for holding said trays horizontally oriented throughout the length of said path.

8. A device according to claim 7, wherein said last-named means comprise crank arms fixed to said trays and having guide rollers fixed to their free ends, and track means adjacent said path and so configured to engage said rollers and maintain the trays in a horizontal position at all times in the upwardly directed and downwardly directed portions of said path, each tray having further rollers so positioned as to run along horizontal portions of said track means and to maintain each tray in the horizontal position along horizontal portions of said path.

9. A device according to claim 6, wherein said upwardly and downwardly directed portions of said path and said recited horizontal portion are generally in the form of an inverted open U, one of the arms of this U being sleeved by a hot air tunnel, constituting an ascending thermoshrinkage zone, while the other arm is open to the surrounding air but having above it a cooling assembly which subjects it to cold air ventilation and constitutes a descending cooling zone, at the exit from which the articles are sufficiently rigid to be capable of being handled.

10. A device according to claim 9 wherein:

said upwardly directed portion of each path is of very steep slope, and said downwardly directed portion is of a lesser slope.

11. A device according to claim 9 wherein said hot air tunnel, comprises means defining three consecutive heating zones, the first or preheating zone being at the entry portion thereof, the second or progressive thermoshrinkage zone proper extending along said upwardly directed portion of said path and commencement of the upper horizontal portion of said path, and the third or thermoshrinkage finishing zone extending along said upper portion.

12. A device according to claim 9 wherein said tunnel includes, at its lower part, an air ventilation assembly opening into the commencement of the ascending portion close to the preheating zone; said thermoshrinkage zones including lateral groups of resistance heaters distributed therein and, in its upper portion, an air ventilation assembly opening into the finishing zone and, within this finishing zone, lateral groups of resistance heaters.

13. A device according to claim 12 wherein said first-named ventilation assembly comprises at least one blower, of the suction and delivery type, arranged to feed air upwards onto the groups of resistance heaters to provide progressively hotter air to the collections as they ascend and to re-extract this hot air at the ceiling of the ascending portion, by means of a recycling duct extending beneath the ceiling and descending to the blower along the internal walls of the ascending portion, the portion of this duct beneath the ceiling being provided with numerous intake holes.

14. A device according to claim 12 wherein the last-named ventilation assembly comprises at least one blower, of the suction and delivery type, arranged to feed air upwards onto the groups of resistance heaters to provide hot air to the collections advancing through the finishing zone towards the exit from the tunnel, and to re-extract this hot air at the ceiling of this zone, by means of a recycling duct extending beneath the ceiling of the upper part of the tunnel and descending to the blower along the internal walls of the upper portion, the portion of this duct beneath the ceiling being provided with numerous intake holes.

15. A device according to claim 14 wherein the resistance heaters are in the form of finned resistance heaters and are arranged in tiers all along the internal lateral walls of the tunnel, both in its ascending portion and in its upper portion and are placed in front of the descending hot air recycling ducts, towards the median plane of the tunnel, in order to ensure good heat distribution.

16. A device according to claim 15 wherein each ventilation assembly is arranged to deliver air into ducts having resistance heaters therein; said ducts, in the ascending portion of the tunnel, being situated in front of the recycling ducts towards the median plane of the tunnel and being perforated, in the side towards this plane, to constitute a hot air blowing chamber having perforated lateral and lower walls, the ceiling of which is traversed by the perforated portion of the recycling duct and, in the upper part of the tunnel, being situated in the same manner but to constitute a hot air blowing chamber completely surrounding the finishing zone and having perforated lateral, upper and lower walls, the perforated portion of the recycling duct being situated beneath the ceiling of this upper part of the tunnel, in front of the chamber and close to the exit from the tunnel, this tunnel being, in addition, provided with a lock at its entry and at its exit, in the form of hanging, slotted curtains, to permit the passage of the trays and their collections of articles, in order to limit the hot air losses.

17. A device according to claim 16 wherein the descending portion of said path, in which cooling is carried out, is situated so as to be exposed to the surrounding air and having thereabove a cooling assembly constituted of a ventilation assembly arranged to direct jets of cold air onto each of the collections having shrunk wrappings to accelerate their cooling.

18. A device according to claim 17 wherein each tray of the conveyor is constituted of ribs for supporting the article resting upon it, said ribs extending parallel to the direction of travel of the conveyor and parallel to one another, separated from one another by a gap exceeding the width of each arm of each of fixed forks and slightly higher than the height of said arms, whereby the upper plane of said ribs are slightly above that of a fork when they are brought by their respective tray to the horizontal at the feed and discharging stations, so that at the feed fork they raise and entrain the lower film with an article resting upon it and that at the discharge fork they lower and deposit the article with its shrunk wrapping upon the fork, without ever completely passing through the arms of these forks.

19. A device according to claim 18 wherein said oscillating device comprises a balance arm supporting an upper jaw and a lower jaw reciprocating with their respective heat sealing and cutting blades opposite each other, means for actuating said jaws so that, when their balance arm is inclined in the direction opposite to the direction of motion of the conveyor, they grip between them the upper and lower films between two successive articles, heat seal them and cut their joint during the oscillation of the balance arm in the direction of motion of the conveyor, when it is substantially in a position close to its median vertical position, they open and move apart from each other when the balance arm continues its oscillation in the same direction until the lower jaw is at a lower position close to the axis of oscillation of the balance arm and the upper jaw is at a posi-

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tion above the collections, this upper jaw then lowering the upper film onto the collection of articles to be wrapped while the balance arm makes its reverse oscillation to return to its initial position, at which instant the lower jaw bears up against the underside of the loop of lower film and the upper jaw bears down on the upper film so as to place it onto the top of this loop, gripping the films, and repeating the described cycle of operations.

20. A device according to claim 19 wherein each film reel handler is constituted of a roller cradle arranged to support a reel of film in use and a reserve reel, of a heat sealing and cutting device comprising a central reversible jaw, carrying the free end of the reserve film and

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two fixed jaws, situated on either side of this reversible jaw outside but adjacent the path of the film in use and to the path which will be that of the reserve film when it is being used, and of a film tensioning device for the film in use, means for directing this film via a direction changing assembly towards the corresponding film feeder of the packaging device, the construction of this reel handler being such that, when the film in use comes to an end, the reversible jaw, assisted by the corresponding fixed jaw, joins the free end of the reserve film to the tail end of the used film, the tensioning device liberating film during this operation so that there is no cessation of feed of film by the film feeder.

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