

IMPROVED PACKAGING APPARATUS

The inventive concept relates to a packaging apparatus.

It is known to package liquid and other substances in
5 containers or vessels in the form of sachets made by
folding a film of flexible synthetic material and sealing
the folded film along suitable weldlines. One example of
such a container is that disclosed in the specification of
our co-pending British application No.8022216 (Serial
10 No.206797). Although in the following, the invention is
described in conjunction with the packaging of beverages,
it will be understood that the invention may be applied to
the packaging of other liquids and substances.

According to the present invention there is provided
15 packaging apparatus for forming a series of connected
containers from an elongate synthetic film and
sequentially filling and sealing the containers so formed,
comprising:

an assembly for supporting a supply of synthetic
20 film,

means for unwinding a supply of synthetic film and
for feeding the film to a forming station for forming the
film into connected containers having an open mouth
through which they can be filled, and a rotatable turret
25 which is located downstream of the forming station and
which includes means for indexing the turret between
stations for filling and sealing the containers while
interconnected in the form of a strip,

said turret carrying a plurality of gripper means,
30 each gripper means being mounted on a respective slide for
movement radially of the turret, the gripper means being
arranged to grip a container and convey it through the
filling and sealing stations, the position of the gripper
means on their slides being controlled during indexing
35 movement of the turret by a cam so that the gripper means
are guided in a generally inward spiral path whereby the

distance between neighbouring gripper means is reduced sufficiently to substantially compensate for increased tension in the film which would otherwise arise on filling the containers.

5 The inventive concept will now be described by way of example and with reference to the accompanying drawings, wherein:

Figure 1 is a side elevation of apparatus in accordance with the invention,

10 Figure 2 is a plan view of the apparatus shown in Figure 1,

Figure 3 is a view to a larger scale taken from the left hand end of Figure 1 and showing a device for unwinding the film,

15 Figure 3a is a section taken on the line A-A in Figure 3,

Figure 3b is a plan view of the device shown in Figure 3,

20 Figure 4 is a view to a larger scale looking in the same direction as Figure 1 and showing a device for folding the film,

Figure 4a is a plan view of the device shown in Figure 4,

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Figure 4b is a section taken on line B-B Figure 4,

Figure 4c is a section taken on the line A-A in Figure 4a,

Figure 4d is a section taken on the line C-C in Figure 4

Figure 5 is a view looking in the same direction as Figure 1 but to a larger scale and showing a film feed device,

Figure 5b is a plan view of the device shown in Figure 5,

Figure 6 is a partly sectioned elevation of a gripping device for holding the containers during the filling operation, showing the device in the gripping position,

Figure 6a is an unsectioned view looking in the same direction as Figure 6, but showing the device in its open position,

Figure 6b is a section taken on the line B-B in Figure 6,

Figure 6c is a partly sectioned view looking in the direction of arrow c in Figure 6,

Figure 6d is a section taken on the line D-D in Figure 6b,

Figure 6e is a section taken on line E-E in Figure 6c,

Figure 6f is a partly sectioned view of a gripper control member visible in figure 6 b, but showing additional detail,

Figure 7 is an elevation of an opening station for separating the walls of the container,

Figure 7a is a plan view of the device shown in Figure 7,

Figure 8 is an elevation of a sterilising station,

Figure 8a is a plan view of the station shown in Figure 8 and

Figure 9 is a section taken through the axis of a turret for leading the film through the final processing stations, showing the drive mechanism therefor and for the feeding device shown in Figure 5.

Referring to Figures 1 and 2, the packaging apparatus shown therein includes a number of workstations through which synthetic plastics film is drawn stepwise, and at which the film is folded into a channel, sealed transversely to

form individual interlinked containers in the form of sachets, the mouths of the containers are opened to permit a liquid product to be introduced, and the mouths closed and sealed. The stations are associated with a turret.

5 The apparatus may be arranged in a sterile pressurised atmosphere when packaging beverages or other edible liquids, for example.

Consider the apparatus in more detail, arranged in succession from the left-hand end of Figures 1

10 and 2 are: a support assembly 1 for a roll of synthetic film 2, from which the film is drawn by an unwinding device 3 and fed to a forming station 4 at which the film is formed into individual containers before being passed through a filling and packaging station to a

15 closing station. Movement of the film is brought about by mechanisms which act on the film in a linear sense. One such mechanism includes a roller for forming a loop of film and is incorporated in the unwinding device 3 and another

20 including a reciprocable jaw assembly, is located downstream of the forming station and is described with reference to Figure 5, under the head entitled "Film Feed Device". Finally

transport of the formed containers around the turret is effected by carriages provided with grippers for engagement with the initially open, upper edges of the containers.

~~The various elements of the apparatus will now be described in turn and the essential features of each of these elements forms an invention within the overall inventive concept.~~

Starting at the left-hand end of the apparatus as viewed in Figures 1 and 2:-

Support Assembly:

The support assembly 1 includes a horizontal shaft for supporting a roll 7 of plastics film of standard width and thickness, the shaft being journalled in bearings which support and centre the film axially and transversely. At least one of the bearings is associated with a braking system for preventing the film unwinding at a rate faster than that determined by the mechanisms for advancing the film through the apparatus. Continuity of operation may be ensured by providing supports for two rolls, so that a full roll may be put in place while film is being drawn from the other roll. When a roll is used up, the trailing end of the film leaving it may be connected to the leading end of the fresh roll of film by suitable welding

or bonding means, such device being brought into operation when symbols near the end of the length leaving the roll in use indicate that the roll is almost used. A device for printing symbols (or indicia) on the film may also be located at this end of the unit for printing the date of packaging on the film, this being a legal requirement in some countries for certain products. Advantageously, the unit is then provided with a system for detecting any discrepancy between the increments by which the film should be advanced through the machine by means later to be described and the actual increments so as to ensure synchronization and the location of the symbols centrally of the containers.

Unwinding Device

As shown in Figures 3, 3a and 3b, the device for unwinding film from roll 7 a fixed length at a time includes a pair of rollers 8 and 9 which make contact with the undersurface of the film drawn from the roll, a feed mechanism including a feed roller 12 for contact with the upper surface of the film between roller 8 and 9, a brake 10 for holding the film stationary downstream of the feed mechanism, and a guide device 11 for maintaining the film in a flat condition as it leaves the unwinding device.

As illustrated, the film passes through the unwinding device in a horizontal plane after leaving roller 8, so that the rollers rotate about a horizontal axis and the feed roller 12 is movable vertically by a piston and cylinder unit or other actuating device not shown in the drawings. However, the film may alternatively pass through the device in a vertical plane and the rollers and feed mechanism may be appropriately repositioned.

The brake 10 comprises a piston and cylinder unit 14 or other actuating device operable when the brake is activated to move a shoe 13 downwards to hold the film stationary in contact with the roller 9. Unwinding proceeds as follows:

- 1) The brake 10 is activated,
- 2) The feed roller 12 is driven downward to draw film from the roll,
- 3) The roller 12 is raised to leave a loop of film between rollers 8 and 9,
- 4) Brake 10 is de-activated,
- 5) The jaw assembly of the film feed device downstream of the forming station grips the film and advances in the longitudinal direction by one increment from its initial position, so advancing the film through the forming station

and drawing film out of the loop ,

6) The jaw assembly returns longitudinally of the film to its initial position or, more preferably, to a position somewhat upstream of the initial position, movement to the initial position taking place during step (1) above when the brake holds the film so as to tension the film extending between the brake and the film feed device.

It follows from the preferred sequence of the operations described above that the length of film unwound from the roll is somewhat shorter than the effective length of the step through which the film is advanced by the film feed device and an optimum degree of tension is exerted on the film.

The step of drawing the film from the roll into the unwinding device by downward movement of the roller 12 takes place at the same time as a container is being formed by a welding operation, a previously formed container is being filled, and a previously filled container is being closed, all of these operations taking place at respective workstations downstream of the unwinding device intermittently in a repetitive sequence in which, in step (a) work is carried out on the stationary film or other operations are performed, while in step (b) the film is advanced without work taking place. However, it

is within the scope of the invention for the film to move continuously through the apparatus and for the work to be carried out on the moving film by means of work stations which travel with the film, performing either a reciprocating movement whereby a work station advances linearly with the film and returns to its starting position, or by means of a work station mounted on a rotating support. It also falls within the scope of the invention for one or more of the work stations to move with the film and for the other or others to be stationary.

The guiding device 11 mentioned above for keeping the film flat as it leaves the unwinding device comprises a guide roller 15 across which the film passes and against which it is pressed by a roller 16 carried by levers 17 pivotable about an axis 18 parallel to the axes of rotation of the rollers 15 and 16. The roller 16 is pressed towards the roller 15 by a tension spring connected to each lever and to a point 20 on the frame of the apparatus.

From the unwinding device the film passes to a forming station shown in greater detail in Figures 4 and 4a to 4d and described below, with the interposition of a station for sterilizing the film bacteriologically if food products are to be packaged.

The sterilization station may, for example, consist of a bath of hydrogen peroxide located immediately downstream of the unwinding device and from which the film passes between two pressing rollers for squeezing liquid from the film and means for blowing sterilized hot air on to the film (and/or a microwave tunnel) for completing the drying operation. The results obtained depend on various parameters such as dissolution, concentration, soaking time of the film and drying time.

Forming Station

The forming station includes a folding device shown in Figure 4 and 4a to 4d, in which the film is progressively folded about longitudinally extending fold lines into a channel of W-shaped cross-section during each incremental movement of the film under the action of the film feed device. The folding operation is carried out in three stages, in the first of which the horizontal film is formed into a channel of U-shaped cross-section with creased edges between two vertical sides and a horizontal bottom. In a second stage the bottom is pressed upwards between the two sides of the channel and in a third stage the folded film is pressed to form permanent edges. To effect these operations, the folding device comprises a horizontal

folding roller 21 followed by a set of vertical re-centering rollers 22 and 23 engaging the outer surfaces of the sides of the channel and horizontal rollers 24 and 25 for engaging the under-side and inside respectively of the channel for forming the film into the channel of U-shaped cross-section, a ramp 26 for pressing up the bottom of the channel and vertical pressing rollers 30, 31 for pressing the folded film. The rollers 21 and 25 are supported on a cross piece at the lower end of a vertical beam extending downwards from a superstructure of the frame so that they lie within the interior of the U-shaped channel into which the film is formed. The rollers 22 and 23 extend between the superstructure and a base frame 27 in which the horizontal roller 24 is journaled, so that these rollers lie outside the channel in line with the roller 25 and co-operate therewith to form creased edges between the sides and bottom. As the film leaves this group of rollers, its bottom is pressed upwards by the ramp 26 which, when viewed in plan, has a V-shaped root joined to the base structure 27 and from which extends an upwardly directed finger 29 for producing the fold in the bottom wall. Thus, there is produced a generally W-cross-sectioned channel in the film before it is pressed flat as it passes through the nip between the vertical rollers 30 and 31 which are pressed

against the film by force provided by an adjustable spring 32. The film leaving the forming station therefore has two continuous vertical longer layers, the lower edges of which are interconnected by shorter layers interconnected along their upper edges.

Downstream of the folding device, the forming station includes a welding device by which the layers of the folded film are sealed along suitable weld lines by any known process, for example, induction welding, ultrasonic welding or high frequency welding, to form a series of compartments, the welding step taking place during the time in which the folded film is stationary. The compartments are then partially severed from one another by any suitable cutting means, for example a blade with a cutting edge which may be heated or by a cutter and counter-cutter. The film now forms, in effect, a string or strip of open-topped, partially interconnected sachets. Suitable devices for welding and partially severing the film are known and not shown in the drawings.

In the illustrated embodiment, the film is formed into a channel with vertical sides. However, it falls within the scope of the invention for the film to be formed into

a channel with horizontal or inclined sides without significant changes being made to the described apparatus.

Film Feed Device

As shown in Figures 5, 5a and 5b, the film feed device located downstream of the forming device comprises guides 35 and 36 extending longitudinally of the unit between posts bolted to the frame of the apparatus. A block is slidable along the guides and is reciprocated by a connecting rod 37 connected to the block. Carried by the block is a housing, one side of which is formed by a jaw 34 provided with guides to permit a jaw 33 to be moved relative to the jaw 34 in the direction transversely of the film under the control of a ram 38. The operation of the film feed device takes place as follows, in synchronism with the operation of the unwinding device

- 1) With the jaw 33 urged towards the jaw 34 so as to grip the strip of formed containers, the jaw assembly is advanced parallel to the strip towards the right hand end of the apparatus as viewed in Figure 1.
- 2) Jaw 33 is withdrawn from jaw 34 to release the strip of containers,

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3) The jaw assembly is retracted,

4) Jaw 33 is urged towards Jaw 34 to grip the strip of containers, and the assembly advanced slightly to tension the length of film extending back to the
5 unwinding device, as described above.

Downstream of the film feed device, each individual sachet-like container is opened, sterilised by the introduction of sterilised air, filled with liquid closed and sealed. These operations take place as the strip of
10 containers is stationary between each incremental advance and while the strip is guided around the turret.

The movements of the connecting rod 37 are imparted to it by the drive mechanism for intermittently rotating the turret, which will now be described together with the
15 stations and devices associated with it.

The Turret

The turret located at the right hand end of the apparatus as viewed in Figures 1 and 2 is shown together with the mechanism for driving it in greater detail in Figure 9.

The turret comprises a rotary plate 64 journalled on a hollow column surmounted by a stationary cover plate 64. A motor 66 operates intermittently or by way of intermittent gearing, to turn a pinion meshing with a ring gear fast with the turret so as to index it through a predetermined angle at preselected intervals of time. A further pinion meshing with the ring gear turns a gear 67 meshing with a pinion 68 for intermittently turning through one revolution with each index of the turret crank 69 to which is linked the connecting rod 37 for operating the film feed device described above. In this way it is ensured that the film feed device operates exactly in synchronism with the turret. The tensioning of the film as described above may be ensured by arranging for the crank 69 to come to rest immediately after it has returned the connecting rod 37 to the left and begun to move it to the right, as viewed.

The plate 64 carries a framework visible in Figure 1 and including a plurality of guides or slideways which radiate generally from the centre of the turret. Supported by the guides for movement radially of the turret under the control of cam tracks on plate 65 are container support carriages each provided with a pair of grippers. As each sachet-like container enters the turret, its open upper edge is clamped by the grippers of a respective carriage and the container is supported and guided thereby through the work stations associated with the turret. The ends of the grippers holding each container are also

pivotally moved towards one another to slacken and facilitate the spreading-apart of the two side walls of the container by suction nozzles located at an opening station, preparatory to the container being advanced into sterilising and filling stations. The shortening of the strip of containers which takes place as a result of this action of the grippers and emphasised by the bulging of the containers as they are filled, is compensated by moving the gripper carriages along their guides so as to cause the strip of containers to follow a somewhat spiral path converging on the axis of the turret as shown in Figure 2.

Considering in turn the various parts associated with the turret.

Container Support Carriages

Referring to Figures 6 and 6a, to 6e, each of the carriages is referenced 44 and the slides on which it is carried for movement relative to the turret are referenced 54 and 55. Positioning of the carriages relative to the centre of the turret is effected during indexing of the turret by cam tracks on fixed plate 65. Making contact with a roller 56 on the carriage.

Carried by each carriage is a pair of spaced grippers 39, 39'

comprising respectively jaws 40, 40' located on one side of the strip and jaws 41, 41' located on the other side of the strip. Each of the grippers 39 and 39' is mounted in the carriage 44 for pivotal movement about a pin 45 extending radially of the turret so that the separation between the working portions of the grippers may be varied. Each of the gripper jaws 40 and 40' is rigid with one of the pins 45, whereas each of the jaws 41, 41' is pivotal about an axis transversely of the respective pin 45 between the closed gripping position shown in Figure 6 and the open position shown in Figure 6a. Movement of the jaw 41 is effected by a mechanism 42 comprising a linkage connected to a roller 43 which runs against rails fixed to the cover plate 65 and serving as cam tracks with section 52 for holding the jaws 41, 41' in the closed position, and the section 53 for holding these jaws in the open position. The jaws 41, 41' moving simultaneously between their two positions.

The grippers of each carriage are applied near the ends of the upper edge of a respective container, the grippers initially being in the positions shown in broken lines in Figure 6c and of the left hand side of Figure 6b, wherein the grippers are inclined away from each other subsequently, the grippers pivot about the pins 45 into the position shown in solid lines in Figure 6c and at the right hand side of Figure 6b.

Pivotal movement of each gripper takes place under the action of the device 45 shown in Figure 6f and including a slider carrying symmetrical wheels 47, 48 for engagement during vertical travel with cam surfaces 49 of extensions 50 of the jaws 40 extending upwardly beyond the pins 45. Movement of the slider 46 takes place under the action of a further cam track on plate 65. The grippers are urged apart by a tension spring interconnecting the extensions 50, the force of which is overcome as the rollers 47 and 48 move down the cam surfaces 49. It will be appreciated from the foregoing that each container is taken over by the grippers of a carriage as the strip of containers is fed into the turret by the film feed device and the turret performs an index movement. The movements of the grippers relative to each other then take place during a subsequent indexing movement.

With the tension in the side walls of each container removed by the action of the grippers and movement of the strip nearer to the turret axes, the walls may be spread apart.

Opening Station

The opening station shown in Figures 7 and 7a includes a suction device mounted on the stationary frame at a position relative to the turret near where the grippers

of each carriage approach each other. The suction device comprises a pair of opposed suction nozzles 57,58, each carried by a carriage 59 movable radially of the turret by the piston of a cylinder mounted on a respective upstanding, fixed plate. As the container remains stationary following the indexing step during which its walls are spread apart, the suction nozzles are advanced towards the opposite side walls of the container midway between the grippers, suction is applied to the suction nozzles to pull the walls apart, the suction is removed and the suction nozzles retracted.

Sterilisation Station

Figures 8 and 8a show a sterilisation station which may be located immediately downstream of the opening station for the internal sterilisation of the containers.

Provided that the film is sterilised upstream of the forming station as described above, and the apparatus is located in a sterile atmosphere, this subsequent sterilising operation may be omitted.

The optional sterilisation station operates by discharging sterilized air into containers opened by the suction device two at a time. A pair of air discharge nozzles or insufflation cannula 60 and 61 extend from a support

block 62 mounted on the piston rod of a cylinder 63 mounted on the base frame of the apparatus and on the top plate 65. The cylinder is operable to lower the nozzles 60 and 61 into an adjacent pair of opened containers and to raise the nozzles after sterilized air has been discharged for a suitable length of time while the turret 64 remains stationary between two indexing steps. Although a single air discharge nozzle may be provided, it is preferred to make use of more than one such nozzle because of problems connected with achieving an adequate flow of filtered and sterile air.

Filling and Sealing

A subsequent indexing movement of the turret brings the containers, which are held open by the grippers, into the filling station in which a liquid product is metered into the containers individually, or several at a time.

As disclosed in the specification referred to above, each container may have a second cavity separate from that for receiving the liquid product. A liquid, gas or cold setting expansible material may be injected into this secondary cavity which remains sealed when the main cavity is eventually

opened, and provides the container with a degree of rigidity and forms a handle. The secondary cavity may be formed by an additional weld line applied in the forming station, and the carriages carried on the turret may each have two pairs of grippers and the opening station two pairs of nozzles for opening both cavities of each container simultaneously. The filling station may then incorporate auxiliary nozzles for discharging a quantity of the product or a neutral liquid or settable material, into the secondary cavity. The strip will be held during ^{the} filling operation by rollers in order to reduce traction in the region of the grippers. The strip of sealed containers is then severed to separate the individual filled containers or strings of several containers, a station for performing this operation also being known. As each container is moved during the next indexing step away from the filling station the grippers of the gripper assembly holding the container move apart so as to tension the upper edges of the container and hold them against each other, in which condition the container is brought into a known welding station.

~~Since the containers are individually supported as they follow their path, around the turret it follows that they may be severed from one another at any time after they have been taken over by the gripper carriages.~~



CLAIMS

1. Packaging apparatus for forming a series of connected containers from an elongate synthetic film and sequentially filling and sealing the containers so formed, comprising:

5 an assembly for supporting a supply of synthetic film,

means for unwinding a supply of synthetic film and for feeding the film to a forming station for forming the film into connected containers having an open mouth
10 through which they can be filled, and a rotatable turret which is located downstream of the forming station and which includes means for indexing the turret between stations for filling and sealing the containers while connected in the form of a strip,

15 said turret carrying a plurality of gripper means, each gripper means being mounted on a respective slide for movement radially of the turret, the gripper means being arranged to grip a container and convey it through the filling and sealing stations, the position of
20 the gripper means on their slides being controlled during indexing movement of the turret by a cam so that the gripper means are guided in a generally inward spiral path whereby the distance between neighbouring gripper means is reduced sufficiently to substantially compensate for
25 increased tension in the film which would otherwise arise on filling the containers.

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2. Apparatus according to claim 1 wherein each gripper means comprises two pairs of jaw members adapted to releasably close on said film, each pair of jaw members being arranged to grip one end of a container on rotation
5 of the turret and in response to engagement of a cam follower, linked to the gripper means, with a stationary cam.

3. Apparatus according to claim 2 wherein said
10 pairs of jaw members are mounted so as to be movable in the plane of the film relatively to each other and to permit the walls of the mouth of the container to be opened for filling.

15 4. Apparatus according to claim 3 which also includes a pair of suction nozzles disposed on opposite sides of the container for separating the side walls of the container prior to filling the container.

20 5. Apparatus according to claim 4 wherein the suction nozzles are arranged to operate following relative movement towards each other of said pairs of jaw members.

6. Apparatus according to any one of the
25 preceding claims wherein the gripper means are arranged to grip the strip in synchronism with the rotation of the turret and advance it intermittently from station to



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station around the turret.

7. Apparatus according to any one of the preceding claims in which the rotation of the turret is controlled in synchronism with operation of a device for feeding the strip of connected containers to the turret.

8. Apparatus for forming a series of connected containers from an elongate synthetic film and filling and sealing the containers so formed, substantially as hereinafore described with reference to the accompanying drawings.
