

March 18, 1969

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3,432,986

PACKAGING MACHINE OF THE FORM-AND-FILL TYPE

Filed Jan. 26, 1966

Sheet 1 of 7

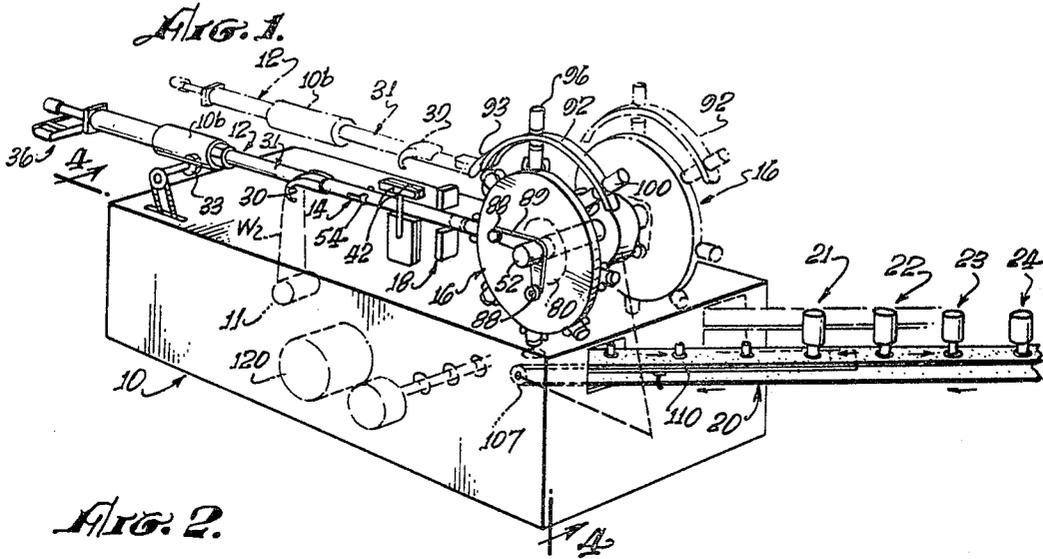


FIG. 2.

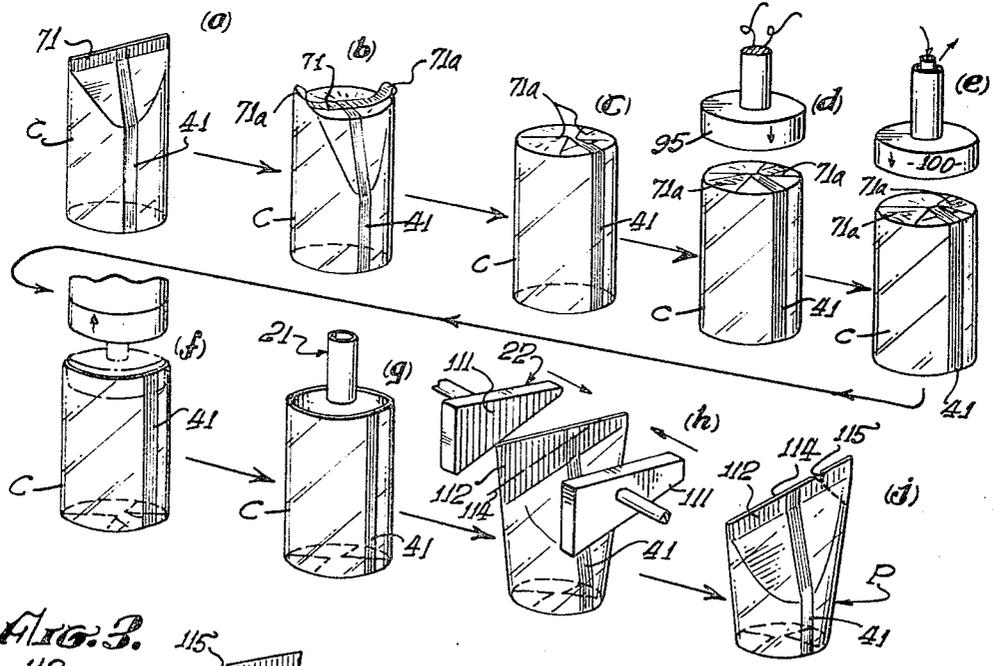
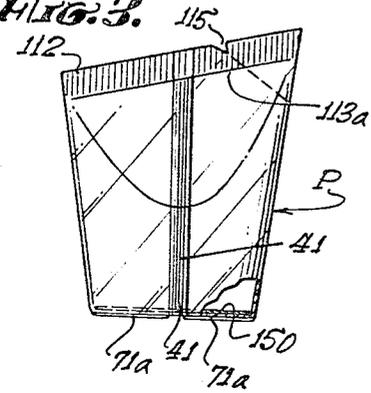


FIG. 3.



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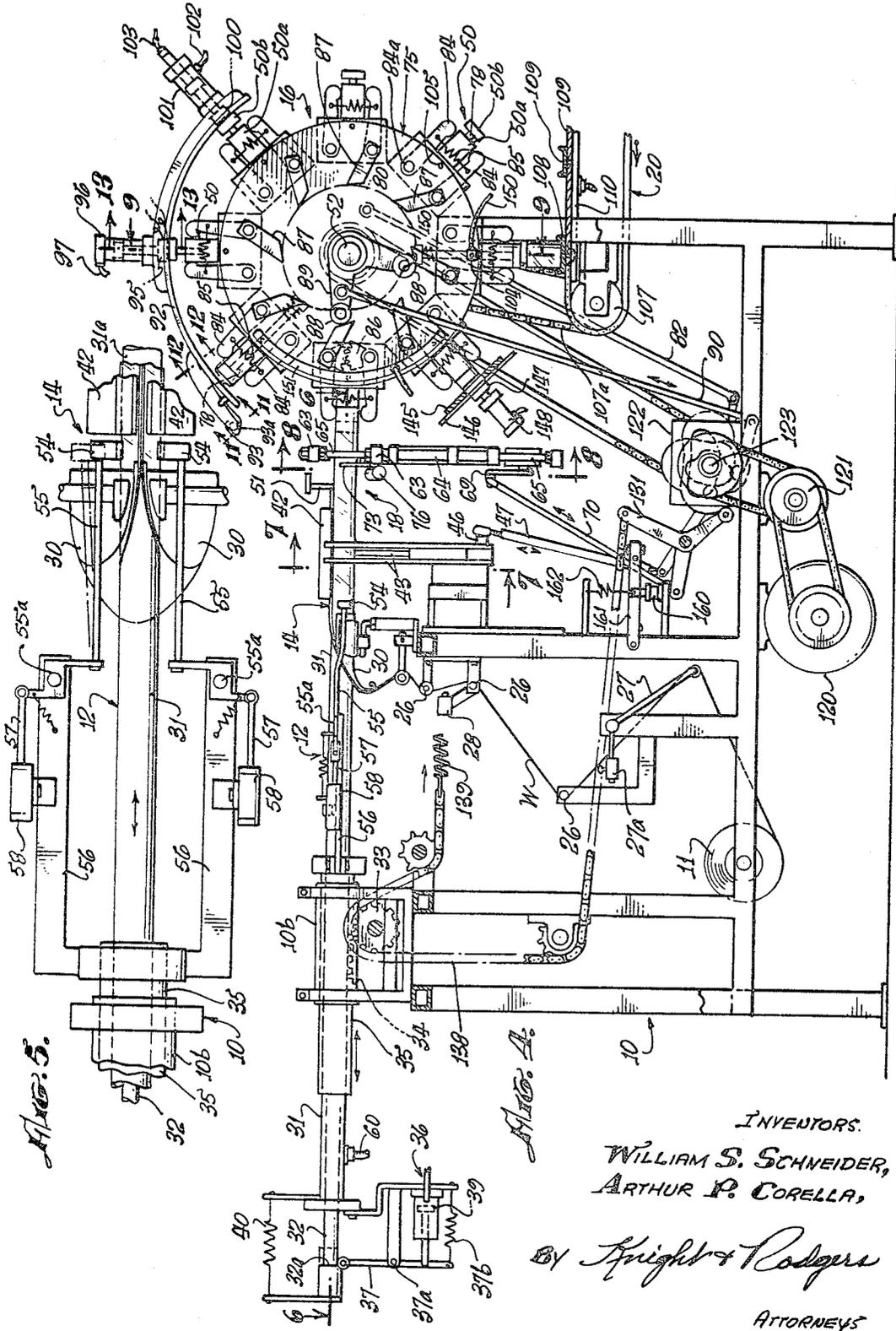


FIG. 5.

FIG. 1.

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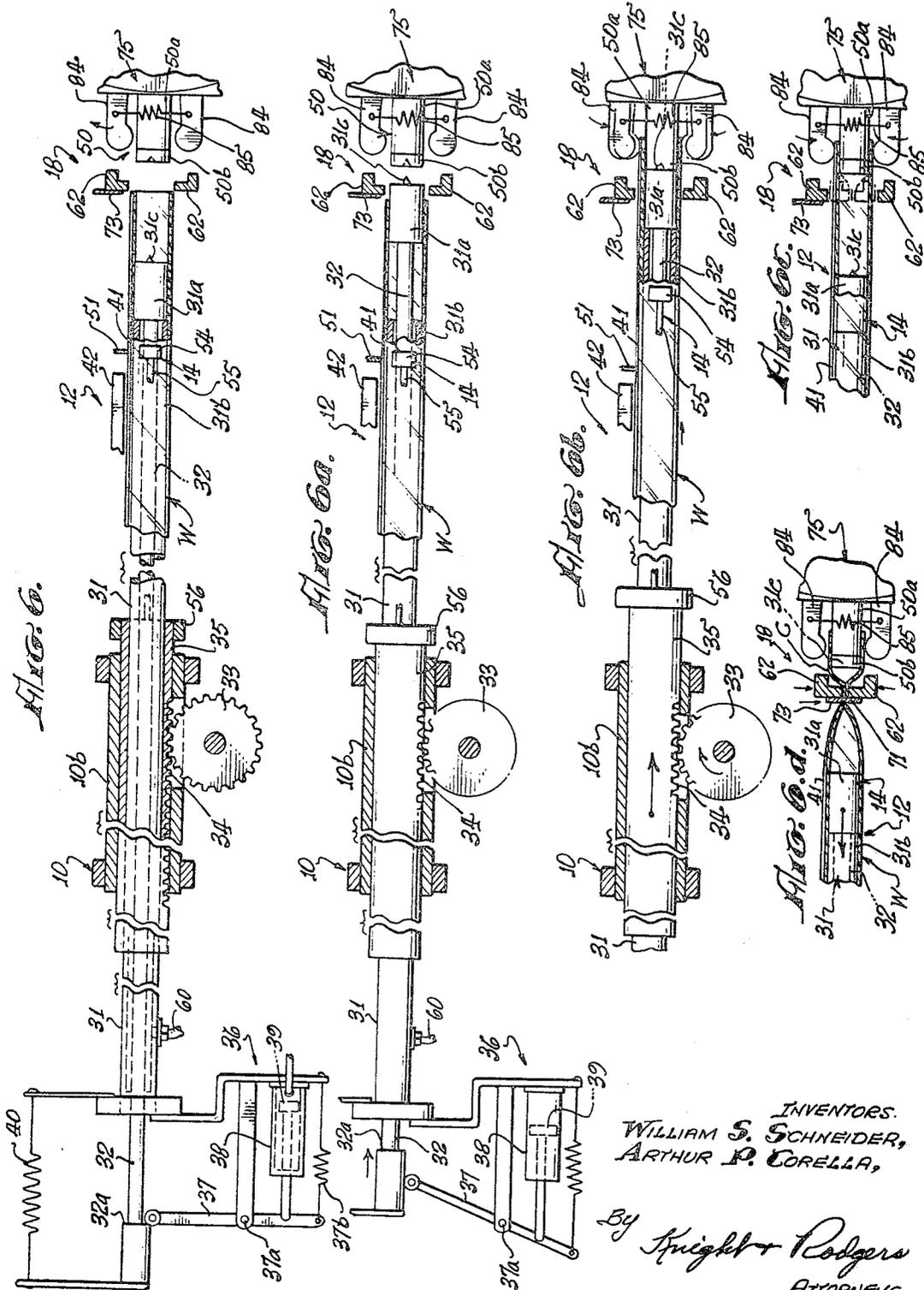
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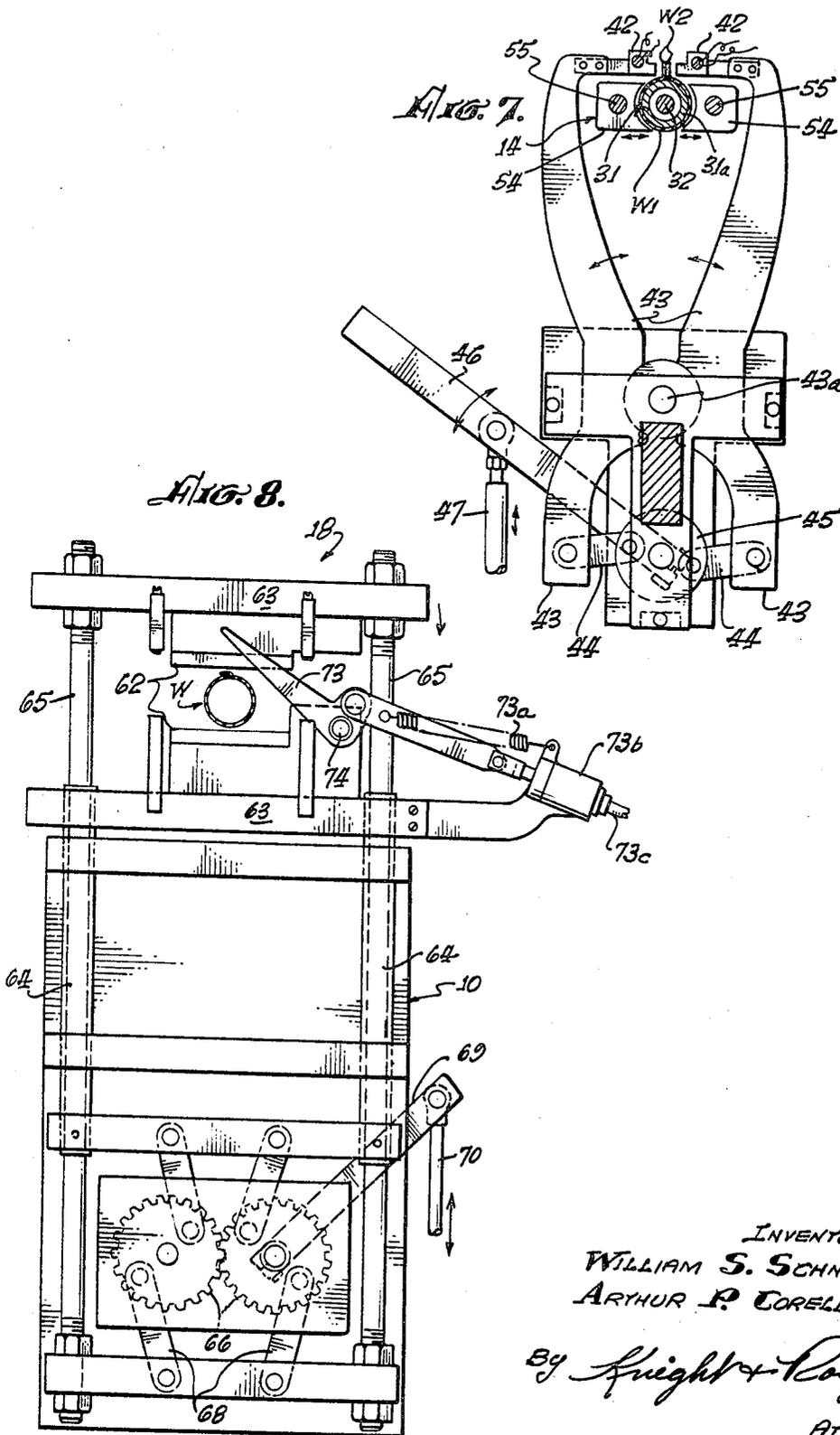
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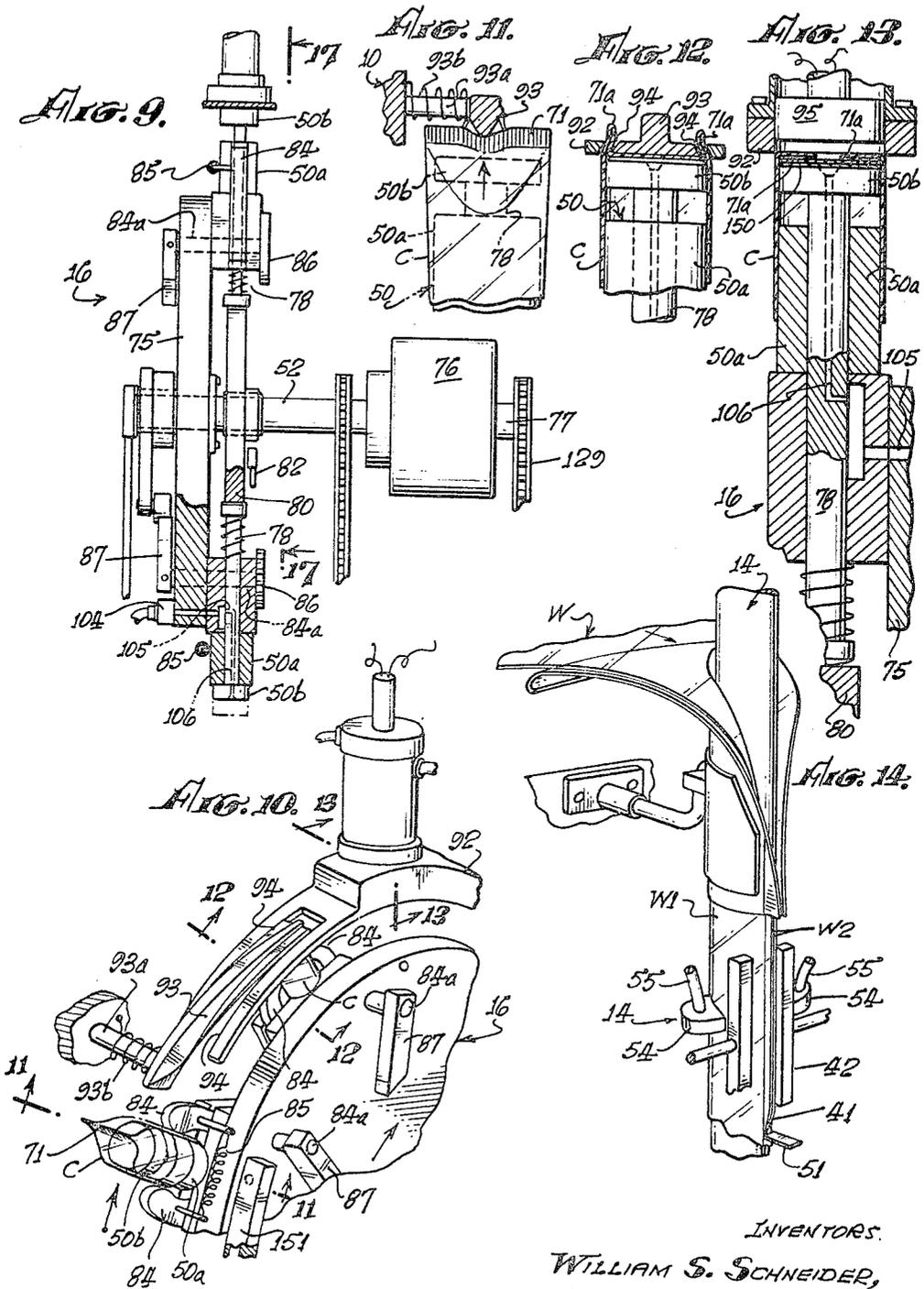
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FIG. 15.

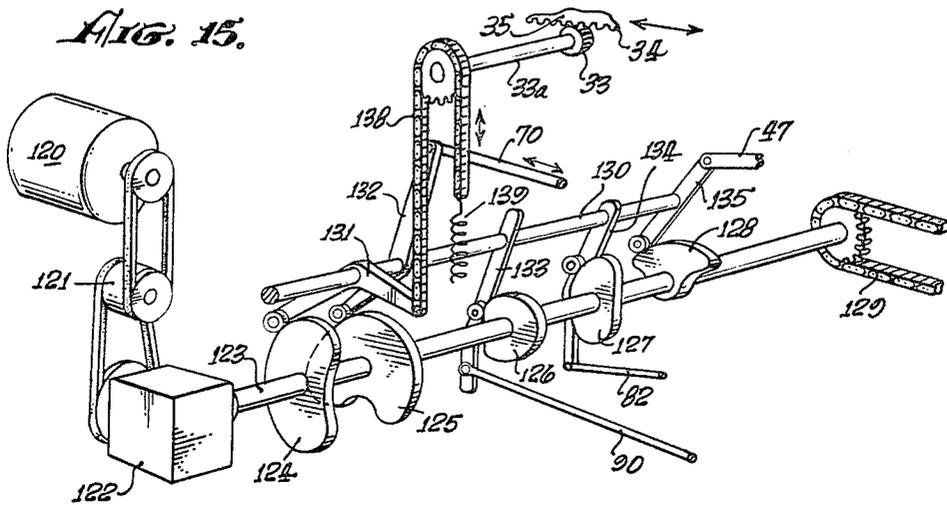
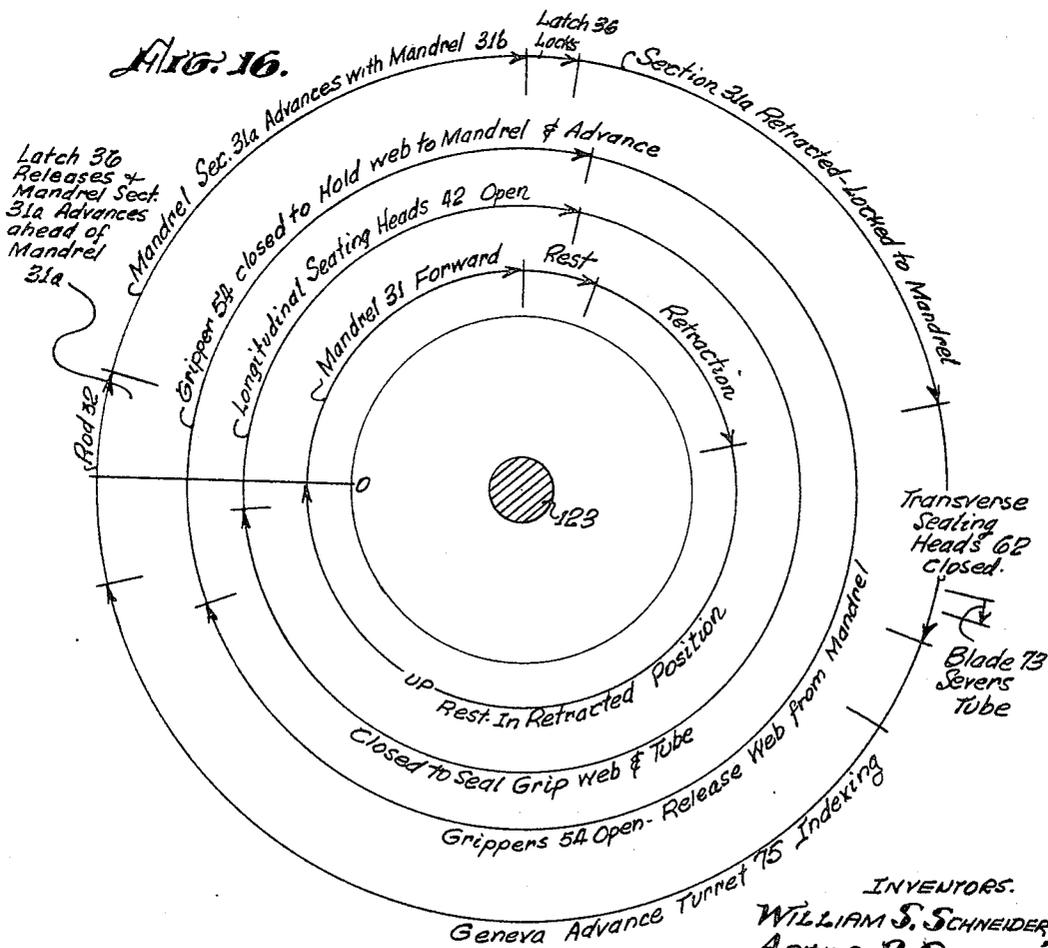


FIG. 16.



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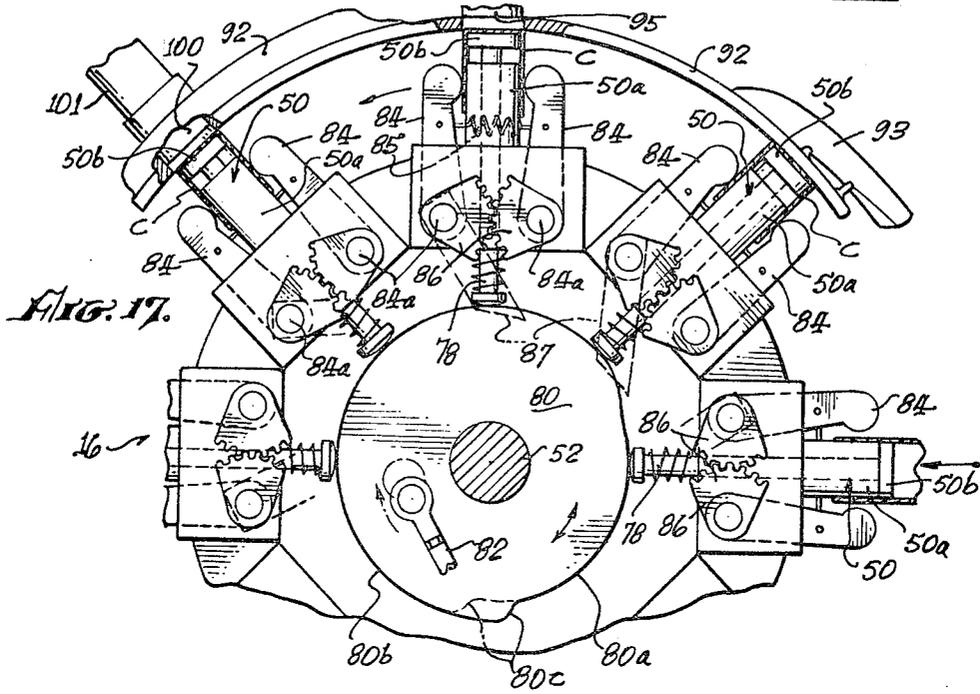


FIG. 17.

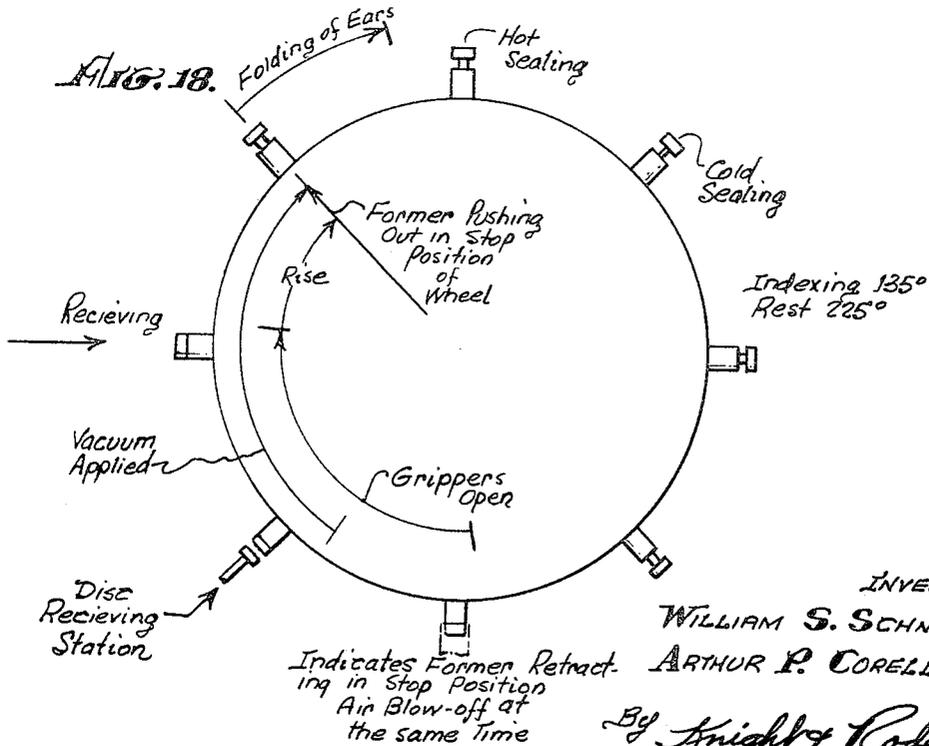


FIG. 18.

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PACKAGING MACHINE OF THE FORM-AND-FILL TYPE

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U.S. Cl. 53-179

47 Claims

Int. Cl. B65b 9/10, 51/26; B31b 1/10

ABSTRACT OF THE DISCLOSURE

Packages with a base on which each can stand are made from a flat web of thin, flexible, heat sealable film. The web is formed into a tube and transverse seals then are placed at intervals. At each seal, the web is severed forming a container closed at one end. The base is then formed and thermally set, after which the tubular container is filled and closed to provide a filled package standing on a base formed from the web material.

The present invention relates generally to packaging machines; and more particularly to a machine for producing from a continuous flat web of sheet material, filled packages of the stand-up type having a base upon which the package can rest.

Containers for liquids, powders, and other fluent materials are of many types, each having inherent advantages. For purposes of discussion here, containers may be classified according to the character of the materials from which they are made. For example, some containers have rigid walls, being made from glass, metal, or other relatively rigid materials. One of the particular characteristics and advantages of containers having rigid walls is that they normally have a well-defined base upon which the container can rest and stand upright. This characteristic permits the containers to hold more or less of their contents after once being opened, without the danger of the contents spilling or leaking out. This characteristic is most pronounced in bottles, cans, and the like.

Another type of container is that having stiff walls, such as those made of paperboard and the like. This material has some degree of flexibility so that it may not be considered as rigid; but at the same time, the walls are stiff enough for the container to stand upright and be supported in this position on a base surface by the inherent stiffness of the walls. This gives the advantages mentioned above in connection with containers having rigid walls. In addition, the containers made of paperboard or other combustible materials are generally less expensive and are more easily disposed of than those made of non-combustible materials.

Large numbers of containers are made of thin, flexible film, typically only a few mils in thickness, and which have generally been of the pouch or envelope type. These containers do not have a base surface on which the container can rest in an upright position.

However, containers of this character have many other advantages. They are made from a material having a low initial cost. They can be produced at a high rate on form-and-fill machines, thus making the filled packages easy and economical to produce. The materials used are easily disposed of by the ultimate consumer and lend themselves to a wide variety of printing, artwork, and the like, making the packages attractive from an advertising and sales viewpoint.

Furthermore, from the standpoint of the producer, a wide range of films are available. Some are laminates having particular advantages such as low permeability to

gases and moisture. Also these films are generally available with heat sealing materials on one side only. Machines which produce packages from thin, flexible films of this character are generally simplified in construction and operation by comparison with machines which are designed to handle stiffer stock which requires pre-cut blanks or other preliminary operations in making packages.

Thus it may be considered as a general object of the present invention to design a machine for producing filled packages having, as far as possible, all of the advantages mentioned above of the various types of packages.

More specifically, it is a general object of the present invention to provide a machine that produces from a flat continuous web of thin, flexible material a package with a firm, flat base upon which the package can rest in an upright position.

It is also an object of the present invention to make such packages on a machine of the form-and-fill type in which all of the economies of this type of machine may be combined for the production of a package which is adapted to stand up.

Many machines of the form-and-fill type have heretofore concentrated all, or substantially all, of the manufacturing operations at one location. This has resulted in congestion of parts and operations at one location in the machine with the result that the various operations have been slowed down and the output rate reduced. This is because, obviously, the slowest operation in the series becomes the bottleneck which controls the rate at which other operations can be produced.

Thus it is also an object of the present invention to design a machine of the form-and-fill type producing packages of the character described in which several operations are carried on at several separated positions or stations, whereby various operations can be carried on concurrently. In addition to enabling a higher production rate, such an arrangement has the advantages of making servicing the machine easier as well as more easily permitting modification of the machine to produce variations in the packages, such as packages of different shape or capacity.

It is also an object of the present invention to design a machine for producing packages from thin, flexible film that is heat sealing on one side only.

A further object of the present invention is to design a machine producing a stand-up package from thin, flexible film which is adapted to place a reinforcing liner inside the base of the package to add strength and rigidity to the base beyond that obtained with the web material.

It is also an object of the present invention to provide a machine designed to manufacture form-and-fill packages from a thin, flexible web which is capable of forming and thermally molding into stable shape a base surface on the package capable of supporting the package in an upright position.

These objects of the present invention are achieved, in general, by providing a machine for producing filled packages by forming, filling, and closing containers having thin, flexible walls that comprises means for forming a segment of a flat, continuous web into a tubular container that is closed at one end, an internal base forming member inside the container and supporting the container, container base forming means comprising an external forming member engaging and deforming a portion of the container to form a base presenting a surface disposed transversely of the container, container filling means spaced from said external member, and container closing means sealing the open end of the container.

The means forming the tubular container includes a mandrel in two sections which are mounted for independent axial movement and around which the web is

wrapped to give it a tubular configuration. The open ended tube is then completed by heat sealing together marginal portions of the web to form a tube.

Base forming means for the container comprises one or more internal formers or studs which are placed internally of the tube and which in a more specific preferred arrangement comprises a plurality of studs mounted on a rotating turret. Transfer means are provided for transferring the open ended tube from the mandrel to a stud, such means involving means reciprocating the sections of the mandrel in timed sequence to advance and engage the stud and then advance the tubular web onto the stud where the tube remains when the mandrel is retracted.

The tubular segment of the web is then severed from the following web and sealed at the trailing end by a transverse seal which seals together the inside heat sealing faces of the web. This results in a tubular container closed at one end and carried on a stud which subsequently assists in forming the container base.

The base forming means also includes a novel construction of the internal former or stud which distends the tube to shape the base and in so doing produces a pair of tabs from excess web stock, means being provided to fold over said tabs against an exterior surface, preferably the base surface of the tube. The base of the tube is then stabilized in shape, preferably by thermal molding means that includes means first heating the folded tabs and the base of the tube and then means chilling the tabs and tube in order while under pressure to set the base of the tube in the desired configuration.

The tube with the formed base is then ejected from the rotating turret onto transport means which carries the tube in sequence to container filling means, container closing means, and trimming means, which typically are respectively located at successive stations. The container is closed by means placing another transverse seal which seals together interior heat sealing faces of the container.

How the above objects and advantages of the present invention, as well as others not specifically referred to herein, are attained will be more readily understood by reference to the following description and to the annexed drawing, in which:

FIG. 1 is a diagrammatic perspective view of a complete packaging machine embodying the present invention and including two channels or package production lines.

FIG. 2 is a diagram showing in successive perspective views a sequence of operations in forming the base on the tubular container, filling and finally closing the package.

FIG. 3 is a side elevation of the completed package produced by the machine.

FIG. 4 is a side elevation of the packaging machine embodying a presently preferred form of the invention.

FIG. 5 is an enlarged fragmentary plan view of a portion of the mandrel and the contoured guide for wrapping the film around the mandrel.

FIG. 6 is a combined side elevation and longitudinal section of the mandrel and the means for forming a tube closed at one end and for transferring the closed-end tube to the turret of the base forming means.

FIGS. 6a, 6b, 6c and 6d are fragmentary views similar to FIG. 6 showing various operational positions of the parts therein.

FIG. 7 is an enlarged fragmentary side elevation and section of web-gripping means and longitudinal tube sealing means, taken on line 7—7 of FIG. 4.

FIG. 8 is an enlarged fragmentary elevation and section on line 8—8 of FIG. 4 showing transverse sealing means and severing means.

FIG. 9 is a fragmentary vertical section through the turret of the base forming means, taken on line 9—9 of FIG. 4.

FIG. 10 is a fragmentary perspective of a portion of the rotating turret and of the external base forming means.

FIG. 11 is a fragmentary side elevation of the tubular

container on a stud and the means for folding over the transverse seam, viewed on line 11—11 of FIG. 10.

FIGS. 12 and 13 are successive sections taken respectively on lines 12—12 and 13—13 of FIG. 10 showing successive positions of folding over the tabs of excess material while shaping the base of the package.

FIG. 14 is a fragmentary perspective of a section of the mandrel with the web-gripping means and longitudinal sealing means, the mandrel being rotated 90° from the position of FIGS. 4 and 5.

FIG. 15 is a diagrammatic perspective of the cam shaft and the cams thereon for driving various assemblies and for controlling the sequence of operations of the machine.

FIG. 16 is a chart showing the sequence of operations controlled by the cams illustrated in FIG. 15.

FIG. 17 is a fragmentary side elevation of the turret and cam thereof, viewed on line 17—17 of FIG. 9.

FIG. 18 is a chart illustrating the sequence of positions of the internal base former and the operations performed by the rotating turret of the container base forming means.

General operation

Referring now to the drawing, and particularly to FIGS. 1 and 4, the machine shown therein comprises several major assemblies which work in sequence upon the web W to produce a filled package P (FIG. 3) having a base upon which the package can stand up. FIG. 1 indicates diagrammatically how a single machine may contain two or more channels or production lines for packages, all driven from and controlled by a single driving mechanism. These two channels each comprise similar assemblies and accordingly only one set of such assemblies is shown and described hereafter.

There is generally indicated at 10 an open framework upon which the various components or assemblies of the machine are supported directly, or by means of suitable brackets, bearings, and the like. Frame 10 may be of any suitable construction and shape in order to provide a stationary support at various positions as may be required by and for the operating mechanisms later described. A supply roll 11 of sheet material provides the web W from which packages are formed. The web is unrolled from roll 11 in a flat form and passes to the mandrel or tube forming assembly indicated generally at 12 where the web is progressively formed into an open ended tube. The leading end of the tube is then transferred by the mandrel and gripping means indicated generally at 14 to base forming means indicated generally at 16. After this transfer is effected, a segment of the tube is severed from the following web and the trailing end of the segment is closed by a transverse seal, the severing and sealing operations being carried out by mechanism indicated generally at 18.

These operations produce a tubular container C (FIG. 2a) closed at one end and open at the other and supported internally on a stud or internal base former carried by the base forming means 16. This latter means shapes a base on the tubular container and then thermally molds and sets the base, after which the container is ejected from the base forming means onto transport means 20, such as an endless belt. This belt then carries the container successively to filling station 21, closing station 22, trimming station 23 and notching station 24, after which the completed package is delivered to any desired location for further handling, not disclosed herein since it constitutes no part of the present invention.

Mandrel assembly

Web W after leaving roll 11 is in the form of a flat, continuous sheet of material. It passes over various idler rollers 26 as required to obtain the proper direction of travel. At a suitable point between one of the rollers and the film roll is pivoted arm 27 which engages the web and

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maintains a desired tension in the web, pivoted arm 27 being provided with a weight 27a which can be adjusted to provide the desired tension. This arrangement permits intermittent advance of the web at the tube forming location, as will be further described, with more or less continuous rotation of roll 11.

Control of the web advance is preferably effected by an electric eye 28 which scans the web at a suitable point ahead of mandrel assembly 12. The purpose of this electric eye scanning mechanism will be more fully described.

Web W is a thin, flexible material, preferably of such a nature that the inside faces of the container can be sealed together by the application of heat and pressure, as is well known in the art. Typically, the web may be a material such as cellulose acetate film coated with a layer of polyethylene on one side to render the film heat sealable on that side. While a web that is heat sealable on one side is preferred for various reasons and the machine is particularly adapted to such material, it is within the scope of the invention to use webs that are heat sealable on two sides as well as those which require the addition of an adhesive to form the seals. The web may be either homogeneous film or laminated stock; and in the latter case may include a material such as a metal foil as one of the layers.

As shown best in FIG. 14, web W passes over a contoured guide 30 of mandrel assembly 12 which wraps the web around the outside of cylindrical mandrel 31. Mandrel 31 is shown in greater detail in FIG. 6 wherein it will be seen that the mandrel is in two parts divided transversely of the mandrel, the main or body portion 31b of mandrel 31 being hollow to provide a passage through which extends actuating rod 32 on which is mounted the lead section 31a of the mandrel. The main body 31b and the leading section 31a are of the same external diameter and when abutting each other, as in FIG. 6, provide a single continuous surface around which web W is wrapped progressively to form the web into a cylindrical tube. Mandrel 31 is mounted for reciprocation as a unit axially of the mandrel, by slidably mounting the mandrel in fixed sleeve 10b which is mounted on frame 10. Reciprocation of the mandrel is effected by pinion 33 engaging rack teeth at 34 which are cut in arbor 35 surrounding and supporting the mandrel. Teeth 34 are exposed to pinion 33 through a slot in the side of guide sleeve 10b.

Mandrel 31 extends beyond stationary guide sleeve 10b at both ends thereof, and at the left-hand end, as viewed in FIG. 6, carries a latch mechanism indicated generally at 36 by which rod 32 is locked with mandrel section 31a abutting the main body in the position of FIG. 6 so that the mandrel 31 and arbor 35 move as a unit.

This latch mechanism comprises lever 37 pivoted at 37a on a suitable bracket attached to the outer end of mandrel 31. Lever 37 extends to engage a shoulder 32a on rod 32 formed by an enlarged head at the end of the rod. Lever 37 is urged to the locked position shown in FIG. 6 by the pull of spring 37b and is rocked to the released position of FIG. 6a by air introduced into air cylinder 38, thereby driving piston 39 inside the cylinder to the far end. The spring 37b is connected to lever 37 to rock the lever counterclockwise in FIG. 6, thus pulling rod 32 outwardly of the mandrel until leading section 31a of the mandrel abuts the end of the main body 31b of the mandrel. Air under pressure in cylinder 38 moves piston 39 to the opposite end of the cylinder against the urging of tension spring 37b. When latch 36 is released, spring 40, which is connected between the outer end of mandrel rod 32 and mandrel 31, advances leading section 31a away from or forwardly of the main body of the mandrel, as shown in FIG. 6a.

As may be seen particularly from FIGS. 7 and 14, the contour web guide 30 wraps the web around mandrel 31 and brings into mutual contact longitudinal marginal portions of the web at one side of the tubular configuration W1 into which the web is shaped as it leaves guide

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30. These mutually contacting marginal portions at W2 of the web are in engagement inside-face-to-inside-face and extend radially outwardly from the tubular configuration of the web at the location W1 in FIG. 14. Since the inside face of the tube is the heat sealable side of web W, these mutually contacting faces of the web can be heat sealed together. This is accomplished by a pair of sealing heads 42 which are spaced from contour guide 30 in the direction of web travel and are designed to engage and press together the outwardly extending marginal portions of the web to form a longitudinally extending seam 41. Placement of this longitudinally extending seam by reciprocating heads 42 completes the formation of the web tube which is open at both ends.

Just beyond sealing heads 42 is a resilient finger 51 that presses against longitudinal seam 41 to lay it over against the side wall of the tubular configuration W1, as shown in FIG. 14, so that it does not extend radially away from the tube.

The two opposed sealing heads 42 of assembly 12 are mounted for reciprocation toward and away from each other by the mechanism shown in FIG. 7 which comprises a pair of scissor arms 43 on the outer end of which the sealing heads are mounted. The arms are pivotally mounted at 43a on an element of frame 10. The arms are connected at their ends remote from heads 42 by means of links 44 to a pivotally mounted disc 45 carrying a pair of pins pivotally connecting the disc to the links whereby, upon rotation, the disc acts as a double crank to spread apart or draw together the adjoining ends of arms 43. Crank disc 45 is rocked by lever 46 connected to operating rod 47, the motion of which will be described later.

Motion of sealing heads 42 toward each other to engage and effect the longitudinal seal 41 of the tube is timed in relation to web movement to take place when the web is stationary, thus enabling the heat sealing heads to additionally perform the function of holding the web against retrograde movement caused by reciprocation of the mandrel, as will be explained further.

After the web has been formed into an open-ended tube at W1, a segment of that tube is severed from the following web to become a container upon which the base is formed. This base is formed by container base forming means indicated generally at 16. Without at the present moment going into the detailed construction of that container base forming means, it is sufficient here to note that it comprises one or more internal base forming elements 50 mounted on rotating turret 75 to turn with shaft 52 having a horizontal axis. One of these internal base forming elements 50, hereinafter referred to as a stud, is shown in FIG. 6 in axial alignment with mandrel 31. In this position, the leading end of web tube W1 is transferred to the stud of the base forming means.

This advance of the web is effected with the assistance of a pair of web gripping elements 54 mounted externally of the mandrel at opposite sides thereof and carried on the forward end of arms 55 which are pivotally mounted at 55a on a yoke 56 which, in turn, is mounted on arbor 35 surrounding and moving with mandrel 31. Arms 55 are in the form of bell cranks of which the ends remote from grippers 54 are connected to piston rods 57 of air cylinders 58. By supplying compressed air to the cylinders, the pistons therein, not shown, are driven to the right in FIG. 5, causing grippers 54 to move toward each other and to engage the web tube, pressing it against mandrel 31. Grippers 54 and the mechanism for operating them just described move with mandrel 31 as the mandrel is advanced toward stud 50 by rotation of pinion 33.

However, in order to ensure accurate registration of stud 50 with the mandrel, leading section 31a of the mandrel is advanced ahead of the main section. This is accomplished by proper timing of the admission of air to cylinder 38, permitting spring 40 to urge rod 32 and

mandrel leading section 31a forwardly. The extent of the advance of section 31a is at least sufficient to extend the section beyond the leading end of web tube W1, as shown in FIG. 6a. In this position, it then advances with and at the same rate as the mandrel body 31b until contact is made with stud 50, after which section 31a stops and body 31b continues to advance to the position of FIG. 6b.

Mandrel section 31a preferably carries at the leading end a conically tapered registration pin 31c which enters a recess in the head of stud 50 to ensure accurate registration of the mandrel and the stud prior to advancing the web tube onto the stud. Mandrel section 31a bridges the gap between the leading end of web tube W1 and internal former 50 but does not leave the web tube. Consequently, as the main body of the mandrel moves toward the stud with grippers 54 pressing the web against the mandrel, the web tube is pushed over mandrel section 31a onto stud 50, thereby placing the internal base forming member in the leading end of the web tube.

The tubular end of the web has now been advanced onto stud 50 to the position shown in FIG. 6b. The length of the web advance may be conveniently controlled by controlling the linear movement imparted to the mandrel and side grippers 54. This advance then determines the length of the tubular container, formed as later described, which is mounted upon the stud 50 of the base forming means and accordingly determines the length of the ultimate filled package.

As part of this means of length control, there is provided electric eye 28 which scans the web as it advances to contour guide 30. Electric eye 28 is responsive to suitable indicia carried by the web, as, for example, opaque or reflective areas printed upon one surface of the web, and in response to the passage of these markings limits the web advance, as will be further explained.

The hollow portion of the mandrel may also serve as an air duct to which air under low pressure is supplied by line 60 (FIG. 6). Air from this low pressure source flows between the mandrel and the web tube to prevent collapse of the web tube between the mandrel sections as lead section 31a advances.

Following advance of the tubular configuration of the web onto stud 50, the mandrel is withdrawn as a unit. This is accomplished by exhausting air from cylinder 38, allowing spring 37b to return lever 37 to the position shown in FIG. 6. This locks mandrel section 31a to the main body 31b so that both move as a unit upon retraction of the mandrel by reversing the rotation of pinion 33. Upon retraction, the mandrel returns to the position of FIG. 6, leaving the leading end of the web tube W1 on stud 50 with the tube bridging the gap between the leading end of the mandrel and the end of stud 50, as shown in FIG. 6c.

Immediately prior to retraction of the mandrel, the two sealing heads 42 (FIG. 14) placing the longitudinal side seal 41 are brought together, not only for the purpose of gripping and sealing the edges of the web, as already explained, but also to hold the web against retrograde movement during the period of mandrel retraction.

After retraction of the mandrel, a transversely extending seal is placed across the tube by heated sealing heads 62, shown in FIG. 8. These two heads are mounted one on either side of the tube at a location between the end of the retracted mandrel and the base forming means 16. The heads are mounted to move toward and away from each other. While any suitable mechanism may be employed for this purpose, the sealing heads are shown in FIG. 8 as each being mounted upon a crossbar 63. One of the crossbars is mounted on a pair of hollow sleeves 64 while the other crossbar is mounted on a pair of rods 65 which are slidably mounted within sleeves 64.

A pair of intermeshing pinions 66 are each provided with two crank pins which are connected by two links 67 to a crossbar attached to sleeves 64 and by a second pair of links 68 to another crossbar secured on the ends of rods

65. When the two pinions 66 are simultaneously rotated by angular motion of lever 69, in response to linear movement of connecting rod 70, the two sealing heads are brought together to grip between them the web tube. The sealing heads are at two opposite sides of the tube which is sealed thereby inside-face-to-inside-face. This seal 71 extends transversely across the tube and closes it, as indicated in FIG. 2a.

In order to sever from the following web a terminal segment of the tube, there is provided severing means, also illustrated in FIG. 8. This severing means comprises a shear blade 73 pivotally mounted at 74 on a crosshead 63. The blade is normally pulled away from the path of tube W1 by helical spring 73a; but can be swung across the tube to sever a terminal segment of the tube by the action of air cylinder 73b which is supplied periodically with operating air through line 73c.

It will be noted that the shear blade is located closely adjacent sealing heads 62 but between them and the end of mandrel 31. This location is preferred since it enables the shearing operation to take place while the film is held firmly between the sealing heads. Severing the tube from the web at this point produces a tubular container C (FIG. 2a) mounted upon stud 50 as in FIG. 10, such tubular container being closed at its outer end while the tube web remaining on the forming mandrel is now open at its lower end.

Base forming means

The means for forming on the container a base on which the completed package can stand is indicated generally at 16 in FIG. 1 and is shown in greater detail in FIGS. 4, 9, 10 and 17. A plurality of studs 50 are mounted on turret 75 to rotate about a horizontal axis established by shaft 52. Shaft 52 is mounted in suitable bearings, not shown, mounted on frame 10. Shaft 52 is driven through Geneva movement 76, or any other suitable type of mechanism for obtaining intermittent rotary motion, from continuously rotating drive shaft 77. The Geneva movement indexes turret 75 from one station to the next, that is, each stud 50 is moved in succession from a given rest position to the position occupied by the next stud in the direction of movement. Although any given number of studs and stations may be mounted upon a turret, there are here shown eight such studs and stations; and accordingly each advance of turret 75 is $\frac{1}{8}$ of a complete revolution.

As may be seen particularly from FIGS. 9 and 13, each stud or internal base forming member 50 comprises two parts. A stationary section 50a is mounted on the turret to extend radially outwardly therefrom and is hollow to receive slidably a push rod 78 which carries on its outer end movable section 50b of the stud. Both the stationary section 50a and the movable section 50b are cylindrical in cross-section and each of the same cross-sectional shape and diameter as mandrel 31 in order that the web tube formed on the mandrel fits snugly over the stud. Movable section 50b is located at the outer end of the stud and is movable relative to section 50a in response to motion imparted to the inner end of push rod 78 by cam 80 which is mounted upon drive shaft 52 for rotational movement relative thereto. The desired periodic motion of cam 80 around the axis of drive shaft 52 is produced by connecting rod 82 fastened to the cam as shown in FIG. 9. Push rod 78 riding on the peripheral surface of cam disc 80 causes stud section 50b to move radially in and out with respect to the stationary section in timed relation to the rotational movement of the entire turret, for reasons which will become evident later.

Associated with each stud 50 is a pair of pivotally mounted gripping fingers 84 which are normally urged toward each other by a tension spring 85 in order to engage and hold on the stud a tubular container mounted thereon. This action is shown in FIG. 17.

As may be seen in FIG. 17, the two gripping fingers 84 of each pair are pivotally mounted at 84a on turret 75 and are connected by intermeshing gear segments 86. Control arm 87 (FIG. 10) is attached to the pivot shaft 84a of one of the pair of arms. Angular movement of the control arm causes both gripping fingers to swing apart about their pivots and disengage the film web, in opposition to the urging of tension spring 85, when arm 87 is moved in a clockwise direction, viewed in FIG. 10, by engagement with a cam roller 88. Two rollers 88 are mounted on the ends of the arms of crank 89 which, in turn, is rockably mounted on drive shaft 52 and can be shifted in angular position by movement imparted to the crank by control rod 90.

Above turret 75 is a stationary external base forming member which cooperates with studs 50 to form the base on a container C. This base forming member includes arcuate folding shoe 92 supported from frame 10 in any suitable manner and comprises several portions which operate on the container in sequence. Shoe 92 is slotted at one end and in this slot is a depressor 93 pivoted at 93a on frame 10, the depressor being urged clockwise by torsion spring 93b shown in FIG. 10. It will be remembered that the container so far produced has a transversely extending end seam 71, shown in position a of FIG. 2 as extending outwardly from the end of the container. The first contact with the external base former is at a centrally located depressor 93 which, as shown in FIG. 11, engages seal 71 near the central portion and, as the container is moved along shoe 92, lays down the seam, as indicated diagrammatically in FIG. 2 at b. The ends of the seam tend to stand up as at 71a.

Shoe 92 in combination with the depressor provides a pair of slots which converge in the direction of motion of the container. These slots 94, as shown in FIG. 12, each engage one of the more or less triangular tabs 71a formed on the base of the container at the ends of seam 71 by the process of forming the base. These tabs 71a are then folded over as shown at position c in FIG. 2. At the end of the slots 94, the two triangular tabs have been folded and are held in place by shoe 92.

At one of the stations after the tabs are folded, the base forming means includes a heated sealing plate 95 which is moved toward and away from a container C brought into registration with the plate by an air cylinder 96 to which air is supplied through line 97. When air is introduced into the cylinder, sealing plate 95 is pressed against the end of the container, as indicated in FIG. 2 at d and in FIG. 13, for the purpose of heating the web stock as the first step in thermally molding the base of the container. This heating operation not only softens tabs 71a but also softens the entire base area of the container so that it can assume the desired configuration. Plate 95 may be heated by a resistance heating element; but any other suitable source of heat may be employed.

For purposes of illustration in the application, only a single heating station is illustrated; but it will be realized that heating may also be applied at the next station if desired when the dwell at one station is not long enough to permit the desired penetration of the heat into the package material.

Beyond the heating station, the base is maintained in the desired configuration by a continuation of shoe 92 which presses lightly against the folded over base portion. This shoe also acts as a heat sink to absorb heat from the package material; and for this purpose may be continued on around more or less of turret 75 as desired. However, it is preferred to provide chilling means at a station subsequent to the heating station where a cold pressure plate 100 is pressed against the bottom of the container by the action of an air cylinder 101 supplied with air through line 102. According to the needs of the packaging material, plate 100 may be cooled in any suitable manner. For example, it may be air cooled but preferably it is cooled by water or other liquid coolant

through lines 103. Means for setting the base configuration by cooling after heating is preferred in order that the base may be firm and rigid to the extent that it does not yield or change shape when the package is later filled. This can also be accomplished by air cooling but requires more time and consequently tends to slow the production rate.

Filling and closing operations

The apparatus so far described produces a tubular container with a molded base upon which the container can stand upright. Advantage is taken of this stand-up characteristic to strip the container C from the stud on which it has been shaped when the stud is at the lowermost position of the turret. Stripping or ejecting the container from the stud in this position deposits it with its molded base downward and its open end upward, on conveyor belt 20. Removal of the tubular container from the former is accomplished by a combination of motions. While turret 75 is stationary, cam 80 is rocked by rod 82 clockwise viewed in FIG. 17 to retract end section 50b of the stud as at f in FIG. 2. Cam 80 has a small radius surface 80a and a larger radius surface 80b separated by inclines or shoulders 80c and 80d. The movement of cam 80 shifts shoulder 80c from the full line to the dotted line position of FIG. 17, allowing spring 78s to retract the push rod and stud section 50b. At the same station, communication is made with a source of air under pressure through shoe 104 riding against the outer face of turret 75 which connects with an air passage 105 where it vents to the side face of the turret. Each push rod 78 has a longitudinally extending air passage 106 (FIG. 13) which terminates at the outer end face of stud section 50b, preferably at the coaxial recess that receives the centering pin 31c. By the construction shown in FIG. 13, passage 106 is in communication with the lateral passage 105 at all positions of the push rod within its normal range of axial travel. If desired, and preferably, the supply of air under pressure by line 104 is regulated by a valve (not shown) to admit a short puff of air at the desired position of the stud and container. This introduces air under pressure into the tubular container which blows it off the former and onto belt 20.

Endless belt 20 is exemplary of transport means designed to carry the tubular container, now resting on its formed base, through the final stages of filling, closing, and trimming. Other transport means, such as a turret or rotary table, may likewise be used for this purpose.

Endless belt 20 is trained over a driven roller 107 which is driven by chain 107a from a sprocket on shaft 52 (FIG. 9) so that the belt advances a predetermined amount with each angular indexing movement of turret 75 and in so doing indexes beneath the bottom station of the turret a tray 108 which holds and positions the container C on the belt.

As may be seen especially in FIG. 4, belt 20 and each cup 108 have an air passage 109 through them and communicating with a vacuum shoe 110 beneath the upper run of the belt. This shoe extends from the container receiving station to at least the filling station 21. The suction applied to the base of the container causes external air pressure to seat the container firmly and accurately in a cup 108 and to hold it there until at least the time that the open ended container is charged at 21, though it may be preferred to extend vacuum shoe 110 to the sealing station 22.

The filling mechanism at 21 may be of any desired type and is not shown in detail here, being indicated only diagrammatically at 21 in FIG. 1 and in FIG. 2 at position g.

After filling at 21, the next movement of belt 20 moves the container to the sealing station 22. Here the container is closed by placing another face-to-face seal at the open end of the container. This is accomplished by a pair of heated sealing heads 111 at opposite sides of the container. The heads are mounted on any suitable means, such

means being evident from the foregoing description, by which the heads can be moved toward and away from each other periodically. When moved towards each other, the heads grip between them the walls of the tubular container, bringing the inside face of the container, which is heat sealable, into contact at opposite sides of container C to place an inside-face-to-inside-face seal 112 which extends transversely across the package P, as shown in FIG. 2h.

It is desired to produce a package having a distinctive appearance and advantageous pouring characteristics. For this reason, seal 112 closing the package has its lower edge at 112a inclined to the container base and to the axis of the package, rather than being parallel to the base and normal to the package axis. This raises one top corner of the package substantially higher than the other one and gives advantageous characteristics to the completed package. The appearance of the final package P can be improved by trimming the sealed area along the line 114 so that the sealed area is of generally uniform width across the package, such line being indicated in FIG. 2h. The result is a final package P as indicated in FIG. 3 and at FIG. 2j. This cutting or trimming operation takes place at 23 in FIG. 1 at a station subsequent to the closing station.

After trimming the package at 23, belt 20 may transport the package to other operations or may deliver it to a storage or boxing facility, as may be desired. As an example of a possible additional operation, there is indicated at 115 a small notch cut into the sealed area 112 from one edge, as may be seen in FIG. 3, to facilitate starting and locating the tear across the upper corner of the package to open it. This may be done at station 24 or at the time of trimming at station 23.

Drive and control mechanism

The machine elements so far described are those performing the various operations on the web to form the tubular container, thermally mold a base on it, fill it and close it to produce a completed package. These operations are necessarily coordinated and this is accomplished by driving the several operating assemblies in timed relation to each other. As an example of a suitable drive and control mechanism for this purpose, there is shown in FIG. 15 in a schematic perspective the primary drive mechanism.

The prime mover is electric motor 120 which drives an overload safety clutch 121, the output from which goes to a speed reducing gear box 122. Output shaft 123 of the gear box is a master cam and drive shaft on which are mounted cams 124, 125, 126, 127 and 128; and power is also taken off shaft 123 by chain 129 to drive the Geneva movement, chain 129 driving input shaft 77 of the Geneva drive as shown in FIG. 9.

Parallel to the master cam shaft is a rock shaft 130 on which are loosely mounted a plurality of rocker arms equal in number to the cams on the master cam shaft. Each of the rocker arms is independently movable and is provided at one end with a follower which engages the peripheral surface of one of the rotating cams. Thus rocker arms 131, 132, 133, 134 and 135 are each respectively associated with and rocked by engagement with cams 124, 125, 126, 127 and 128.

Cam 124 and rocker arm 131 control the motion of the mandrel and pinion 33 which reciprocates the mandrel by means of chain 138 passing over a sprocket on shaft 33a attached to pinion 33. One end of chain 138 is attached to helical spring 139 which pulls on the rocker arm to maintain contact with cam 124 and biases the mandrel toward one extreme position, the cam acting to return the mandrel to the other position against the pull of spring 139.

Rock shaft 132 operated by cam 125 is connected by rod 70 to the mechanism shown in FIG. 8 for reciprocating sealing heads 62 toward and away from each other.

Rocker arm 133 operated by cam 126 is connected by rod 90 to crank 89 and cam rollers 88 which engage arms 87 to control the operation of gripping fingers 84 associated with each of the internal base forming members 50.

Rocker arm 134 is operated by rotary cam 127 and is connected by rod 82 to disc cam 80 which controls the operation of push rods 78 and the several stud sections 50b. It will be recalled that the cam is stationary during the time the push rod 78 travels around its periphery with turret 75 and is rocked about shaft 52 by rod 82 to effect motion of push rod 78 when the turret 75 is stationary.

Rocker arm 135 is operated by engagement with cam 128 and is connected by means of rod 47 to the lever which operates the scissor arms 43 carrying sealing heads 42 that place the seal at the longitudinal edges of the web to form the tube.

While the exact timed relation of the operation of each of these subassemblies of the packaging machine can be varied at the will of the designer to accommodate changes in web material, package size, the number of studs on turret 75 and various other conditions, a typical timing chart is shown in FIG. 16 in which the sequence of operations in the active period of each of the subassemblies operated by cams 124, 125, 126, 127 and 128 is graphically illustrated based on the assumption that one revolution of master shaft 123 represents one complete cycle of operations and results in the production of one completely filled package. In addition to the cam controlled mechanisms, the period of actuation of mechanisms controlled by air cylinders is also included.

The various operations carried out in forming and molding the base by the base forming means are, to some extent, independent of the timing of the operations indicated in the chart of FIG. 16. These operations of the base forming means are shown in a separate chart in FIG. 18 which indicates the eight stations at which any former 50 stops during one complete revolution of turret 75, the turret indexing from one station to the next for one complete revolution of the master cam shaft; and the periods of movement and rest of the turret being shown on the chart of FIG. 16.

Base reinforcement

For any one or more of various reasons, but particularly when using light gauge material for the web or in larger sized packages, it may be desired to reinforce the base. For this purpose, means are provided for placing inside the base a reinforcing liner which becomes integrated with or sealed to the base in the process of thermally molding the base. Referring to FIG. 4, it will be seen that at the turret station ahead of the container receiving station, there is provided means for supplying liner blanks. Typical of such means is die plate 145 over which passes a strip or sheet of heat sealable material 146. Blanks of the proper size are cut in timed sequence to the operation of the turret by punch 147 operated at the proper time by air cylinder 148. Sheet 146 may typically be polyethylene a few mils thick, the punch cutting a circular disc conforming substantially to the size of the base of the finished container. Of course, a magazine filled with pre-cut blanks may be used instead.

Forward motion of punch 147 by air cylinder 148 cuts a liner disc 150 from strip 146 and places it on the outer end face of stud 50 where it is held by external air pressure, a vacuum being applied to the contacting face of the liner disc by a vacuum manifold 151 which at this position of the turret communicates with the outer end of air passage 105 in the turret and leading to passage 106 extending longitudinally of stud 50 and terminating at the outer face thereof. Vacuum is applied to a given stud 50 by this passage, starting with the disc receiving station and continuing past the container receiving station to a location at which the stud is under folding shoe 92, after which application of the vacuum can be discontinued since the liner disc is then held in place by the tubular container

over the end of the internal base forming member and the pressure of the shoe.

The liner 150 typically may be polyethylene since the film or web from which the container is made is assumed in the foregoing description to be coated on one side with polyethylene to render it heat sealable. Of course, any other material bondable with the web used may be employed for the liner. The liner disc is heated and welded to the inside surface of the container base by the heat and pressure applied externally to the container by heated sealing plate 95 at the heating station. In order to achieve the desired degree of heating of the base of the container, it is within the scope of the invention to provide a second heating station in addition to the one shown, such second heating station being at the location of the chilling station indicated in FIG. 4. In this event, the cooling station is moved around the turret one station; and it may likewise be desired to provide two cooling stations, the second one duplicating the cooling station described above, except for its position around the turret.

After the base is heated to soften the liner and the coating inside the container, it is hardened by cooling by the pressure plate 100. This sets the base and completes the heat sealing of the reinforcing liner to the interior surface of the container as a part of the thermal molding operation.

Operation summary

The structure of the package machine having been described, its operation will now be summarized. The timing chart of FIG. 16 shows the sequence and duration of the major operations conducted in the forming of a tubular container and the movement of the turret 75 as it indexes from one position to another. A complete cycle of operations takes place for one revolution of shaft 123; and the cycle may be assumed to start from the heavy horizontal line extending to the left in the chart from the shaft. Reference to the chart will aid in following the description below.

The web from supply roll 11 passes in a flat sheet over the tensioning means 27 and past electric eye 28 to contour former 30 which wraps the web around mandrel 31 into a tubular configuration with longitudinal marginal areas of the web brought into mutual contact. These marginal areas project radially outward from the tubular web and are sealed together, inside-face-to-inside-face, to produce the seal 41 along the tube, by the action of sealing heads 42 which grip between them the marginal areas to be sealed.

Mandrel 31 intermittently advances toward turret 75, carrying with it the end of the web which has already been shaped into a tubular configuration as indicated at W1. Side grippers 54 advance with the mandrel assembly and press the web into contact with the mandrel to effect web advance as the mandrel moves from the position of FIG. 6 to the position of FIG. 6b. During the web advance, sealing heads 42 are retracted or spread apart.

It is preferred to design the mandrel for a slight over-travel of the web for each container. Then the total web advance is corrected periodically by electric eye 28 scanning the web and responding to the accumulated over-travel. This response energizes solenoid 160 that pulls knee brace 161 down to a straight position. When straight, the brace engages rocker arm 131 to limit its motion and thereby limit the travel of mandrel 31 toward the turret. This shortens one package enough to correct the total web advance. When solenoid 160 is de-energized, spring 162 pulls knee brace 161 up as shown out of engagement with rocker arm 131.

Before mandrel 31 advances as a whole, latch 36 is released, allowing mandrel lead section 31a to advance under the pull of spring 40. If mandrel 31 is arranged with its axis vertical instead of horizontal as shown, the force of gravity may be substituted for spring 40 and the spring omitted. As a result, mandrel section 31a is advanced ahead of the tubular web configuration at the time that the

mandrel as a whole starts to advance. After the mandrel advances, side sealers 42 grip between them the outstanding marginal portions of the web to place another seal for the next succeeding container. The formation of this longitudinal seal 41 results in the production of an open-ended tube at the end of the web, which tube is to be transferred to the base forming means.

This transfer to the base forming means is effected by inserting into the open leading end of web tube W1 an internal base forming member 50 by the just-mentioned advance of the web and the mandrel. The mandrel advancing ahead of the web first engages the internal base forming member 50 and accurately aligns the member 50 with the mandrel by the action of centering pin 31c which refines the approximate registration of the stud and the mandrel effected by indexing movement of turret 75. This advanced position of the mandrel lead section is shown in FIGS. 6a and 6b. With the stud and the mandrel properly aligned, the web tube is pushed off the mandrel and onto the stud of the base forming means by the advance of the main section 31b of the mandrel.

Next, the mandrel is withdrawn from the end of the tube, as shown in FIG. 6c. This permits the tube to be closed at the trailing end by placing a transverse seal 71 with heated sealing heads 62, as shown in FIG. 6d. During retraction of the mandrel, grippers 54 release the web and side sealers 42 hold the web against following the mandrel so that there is no retrograde movement of the web, and especially of the tubular portion just formed. A tubular segment at the end of the web is now severed by blade 73 from the following web, severing taking place at a position adjacent these sealing heads while they are still holding the tube and placing transverse seal 71. As a result of the operations so far discussed, there is produced a tubular container C closed at one end by transverse seal 71 and which is now mounted on and supported by a stud 50 of the base forming means. This tubular container is shown in FIG. 2 at a and it is subsequently operated on to produce the changes in shape illustrated in the positions of FIG. 2 from b to j, these operations taking place upon the base forming means.

Turret 75 of the base forming means carries this container from the receiving station, at the left in FIG. 18 or at the right in FIG. 17, to a sealing station which is at the top position of the turret. Between these two stations, seal 71 on the end of the container is folded over (FIG. 11) and flattened against the end of the stud, producing at the ends of the seal two tabs 71a of excess material which are subsequently folded over flat against the end of the stud (FIG. 2c and FIG. 12) to become a portion of the base of the tube.

Shaping the base of the container during the base forming operation is accomplished by folding operations as mentioned and also by relative movement of the container and the internal forming member in the vicinity of the base. In this particular machine, this latter relative movement is achieved by advancing end section 50b of the stud relative to the container in order to distend fully the container at the base end. Thus the internal former 50 shapes not only the side walls of the tubular container but also provides a flat end surface against which the stationary forming shoe 92 can fold and press portions of the web material which become the base of the container and also the tabs 71a which are formed by portions of the web stock which become in effect excess material since they are surplussage created by the conversion of areas initially on the side walls of the tubular container into a transversely extending base. This base has an outer surface substantially normal to the container axis and upon which the finished package can stand up. Outward movement of section 50b of the stud is indicated in FIG. 18 as stud 50 moves from the container receiving station at the left of the chart clockwise to the heating station at the top of the chart. Turret 75 comes to rest at an intermediate station; and at this

intermediate station extension or expansion of the internal base former is accomplished by shifting cam 80. This shift is the clockwise motion of the cam indicated in FIG. 17 and results in push rod 78 moving from low portion 80a of the cam surface over rise 80d to the high or maximum radius surface 80b, as may be seen clearly by reference to FIG. 17. At the same time grippers 84 are closed by spring 85 to press the container wall against the stud and hold it in place in opposition to the movement of the internal member.

Alternatively, this same outward movement of the end section 50b of the former could be accomplished with cam 80 stationary but moving the turret to change the position of the push rod on the cam surface. However, this shift of cam 80 occurs in connection with ejection of the container from the turret and the same cam shift is utilized to control the outward motion of former section 50b.

At the heating station at the top of the chart of FIG. 18, heat and pressure are applied externally to the base of the container by heating head 95 which is a part of the thermal molding means forming the container base. After the dwell at this station, the package progresses to the next station where the base of the package, now in a plastic condition, is hardened or set by cooling plate 100 which also applies pressure to the folded end of the container. Plate 100 is a heat sink that cools the base of the container, thereby giving firmness and rigidity to the base so that the package can be filled immediately. At the same time, the cooling completes the bond between liner 150 and the inside face of the container wall.

Moving on around with the turret 75, the tubular container with the molded base is now carried to the bottom station where it is ejected or discharged from the turret onto transport means 20. This transport means is typically an endless belt and is preferably provided with a series of spaced sockets or trays 108 which are designed to position the containers, open end up, for filling or any other further processing. A vacuum is applied to the base of the container through an opening in the bottom of each tray 108, whereby air pressure causes the empty container to be positioned and held firmly upon the transport means. This vacuum may be maintained as long as desired and is preferably maintained at least past the point at which the container is charged with a product. Belt 20 is driven from Geneva movement 76 and consequently advances intermittently in timed relation to the turret movement.

While carried on belt 20, the open containers are filled at station 21 as shown in FIG. 2g and are then closed at station 22 by sealing heads 111 which place a transversely extending, face-to-face seal 112 while the packages are stationary at station 22. This last operation is indicated in FIG. 2h. It is preferred that the heat sealed area 112 have a particular shape as described. For this purpose, the heat sealed area is trimmed and notched subsequent to closing. Both of these operations may be carried out at station 23 or they may be carried out at separate stations, as desired. After trimming and notching, the filled and completed package P appears as in FIG. 3 and is delivered by belt 20 to any other suitable means, not shown, for storing or packing in cartons.

The above operations produce a package entirely of film and without the reinforcing liner 151. If a reinforcement is desired, a liner blank of suitable size and shape is delivered to each former 50 ahead of the container receiving station and is held in place initially by vacuum applied through passage 105-106 in the former. It is bonded to the container by the thermal molding operations.

From the foregoing description, it will be apparent that various changes may be made in the detailed shape, design, and arrangement of the elements of the present invention without departing from the spirit and scope thereof. Accordingly, it is to be understood that the foregoing

description is considered to be illustrative of, rather than limitative upon, the invention as defined by the appended claims.

We claim:

1. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises:
 - means forming a flat, continuous web into a tubular configuration open at the leading end;
 - an internal forming member movable into axial registration with and receivable inside the leading end of and supporting the tubular configuration;
 - means intermittently advancing the web with the tubular configuration onto the internal forming member when in registration therewith;
 - means placing a seal extending transversely across the tubular configuration to close the tubular configuration;
 - means severing the web at the vicinity of the transversely extending seal to form a tubular container closed at one end and supported on the forming member;
 - means including an external base forming member engaging and shaping a terminal section of the tubular container at the closed end thereof to form a base disposed transversely of the container as the internal forming member moves out of said registration;
 - container filling means spaced from said external member for placing a product in the container;
 - container closing means sealing the open end of the container; and
 - drive means for operating all said means in timed relation to each other.
2. A machine as in claim 1 in which the base forming means includes folding means engaging triangular tabs of excess web material at the base to fold the tabs against the base.
3. A machine as in claim 2 in which the external base forming means also includes thermal setting means for setting the tabs in folded position.
4. A machine as in claim 1 that also includes means placing inside the container a base reinforcing liner.
5. A machine as in claim 1 that also includes:
 - die means cutting a liner disc in timed relation to formation of the tubular container; and
 - means placing the liner disc inside the container secured to the base thereof.
6. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises:
 - tube forming means including a mandrel forming a portion of a flat, continuous web into a tubular configuration on the mandrel to produce a tube open at both ends;
 - container base forming means for shaping a portion of the tube into a base on one end of said tube;
 - means transferring said tube directly from the mandrel of the tube forming means to the base forming means to produce a container with a base;
 - sealing means flattening the tubular configuration and sealing together the inner opposed faces of the tubular configuration at a position between the tube forming means and the base forming means while the tubular configuration is supported thereon; and
 - means severing the tube from the following web after the tube is transferred to the base forming means.
7. A machine as in claim 6 in which the base forming means includes a former received in the leading end of the tube and the sealing means closes the trailing end of the tube.
8. A machine as in claim 6 in which the base forming means includes means producing relative motion of the tube and the base forming means after transfer of the tube thereto.
9. A machine as in claim 6 which also comprises:
 - filling means spaced from the base forming means to fill the tubular container; and

container closing means placing a transversely extending face-to-face heat seal across the open end of the filled container.

10. A machine as in claim 6 in which the base forming means includes folding means engaging tabs of excess web material at the base to fold the tabs against an exterior surface of the container. 5

11. A machine as in claim 10 in which the base forming means also includes thermal means for setting the tabs in folded position. 10

12. A machine as in claim 10 in which the base forming means includes a heated element engageable with the tabs in folded position and cooling means spaced from the heated element to cool and set the tabs in folded position. 15

13. A machine for forming, filling, and closing containers made from a single, flat, continuous web, that comprises:

a mandrel divided transversely into two sections;
means to reciprocate axially each section independently of the other section; 20

means to wrap the web around the mandrel into a tubular configuration to form a tube open at both ends;

means to seal together longitudinal marginal portions of the web; and 25

tube receiving means spaced from the mandrel;
said reciprocating means advancing one section of the mandrel into engagement with the tube receiving means with said one section extending ahead of the tube and subsequently advancing the other section of the mandrel and the tube to engage the tube with the tube receiving means and subsequently retracting the mandrel. 30

14. A machine as in claim 13 that also includes cutting means severing the tube from the following web at a position spaced from the end of the mandrel after retraction. 35

15. A machine as in claim 13 that includes a pair of opposed sealing heads placing a transverse face-to-face seal across the tube at a position spaced from and between the retracted mandrel and the tube receiving means. 40

16. A machine as in claim 15 that also includes cutting means between the retracted mandrel and the sealing heads severing the tube from the web following. 45

17. A machine as in claim 13 in which the tube receiving means includes a former congruent in cross-section with the mandrel; and means cooperating with the mandrel to register the former and the one section of the mandrel. 50

18. A machine as in claim 13 in which the tube receiving means includes:

an internal former similar in cross-section to the mandrel and divided transversely into two sections; and means reciprocating one section relative to the other section. 55

19. A machine as in claim 13 in which the tube receiving means includes
a rotatably mounted turret; and
a plurality of internal formers carried by said turret for movement about the axis thereof and, in succession, into axial alignment with the mandrel to receive a tube from the mandrel, and for movement subsequently to each of a plurality of base forming stations. 60

20. A machine as in claim 19 that also includes:
means placing on the end of each former a liner disc at a station ahead of said mandrel; and
means retaining said disc in place on the former as a tube is placed on the former. 65

21. A machine as in claim 13 in which the tube receiving means includes:
an internal former similar in cross-section to the mandrel; and
means producing relative movement of the former 70

and tube thereon to distend the tube at the sealed end.

22. A machine for forming, filling, and closing containers of heat sealable film, comprising:

means producing a tubular container of said stock closed at one end by a transverse heat seal and open at the other end; and

means for forming a base on the closed end of said container, said base forming means including:

an internal forming member inside the container;
means to move said internal forming member about an axis;

means producing relative motion of the internal forming member and the container thereon to distend the container walls to shape a base on the container; 15

external folding means folding portions of the stock against the base of the container; and

thermal molding means molding the base under heat and pressure.

23. A machine as in claim 22 in which the thermal molding means includes a cooling plate cooling the heated base under pressure.

24. A machine as in claim 22 in which the internal forming member is divided into two sections, one of which moves axially of the container to distend the container walls.

25. A machine as in claim 22 which also includes:
transport means carrying the container away from the base forming means; and

means discharging the container from the base forming means onto the transport means with the open end of the container up.

26. A machine as in claim 25 which also includes:
means applying vacuum to the underside of a container on the transport means to hold the container in place.

27. A machine as in claim 24 which also includes:
container closing means spaced from the base forming means and placing a transverse face-to-face seal at the open end of the container; and
container filling means spaced from and between the base forming means and the closing means.

28. A machine as in claim 22 which also includes:
a source of liner blanks; and
means placing a liner blank inside the tubular container at the base thereof.

29. A machine as in claim 22 which also includes:
means placing a liner blank on the end of the internal forming member prior to receiving the container; and
means applying vacuum to one face of the blank whereby air pressure holds the blank on the end of the internal forming member.

30. In a machine for forming, filling, and closing containers of heat sealable film, a mandrel assembly comprising:

a body section;
a lead section coaxial with the body section;

means for advancing the lead section relative to and independently of the body section; and

releasable latch means locking the two sections together for movement in unison.

31. In a machine for forming, filling, and closing containers of heat sealable film, base forming means comprising:

a rotatably mounted turret;
a plurality of container receiving studs mounted on said turret to rotate therewith about the turret axis;

each of said studs comprising a first section attached to the turret and a second section coaxial with the first section;

means moving the second section away from the first section and back in timed relation to rotational movement of the turret;

means intermittently angularly advancing the turret with dwell periods between each advance;
 cam means controlling the movement of the second sections of the studs;
 and means angularly shifting the cam means during each dwell period.

32. A machine according to claim 1 in which the means forming the web into a tubular configuration includes:

a mandrel mounted for longitudinal reciprocation toward and away from the internal forming member; and

gripping means cooperating with the mandrel to advance the web with the mandrel toward the internal forming member.

33. A machine according to claim 32 that also includes second gripping means holding the web stationary during retraction of the mandrel away from the internal forming member.

34. A machine according to claim 1 in which the means forming the web into a tubular configuration includes:

a mandrel mounted for longitudinal reciprocation toward and away from the internal forming member; and

gripping means gripping the web to hold the web stationary during retraction of the mandrel away from the internal forming member.

35. A machine according to claim 34 in which the gripping means places a longitudinal seal along the tubular configuration.

36. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises: means forming a flat, continuous web into a tubular container closed at one end;

an internal forming member inside the container and supporting the container, said forming member having a relatively movable end section expanding the forming member lengthwise to form the base of the container;

means including an external base forming member engaging and shaping a terminal section of the tubular container at the closed end thereof to form a base disposed transversely of the container;

container filling means spaced from said external member for placing a product in the container;

container closing means sealing the open end of the container; and

drive means for operating all said means in timed relation to each other.

37. A machine as in claim 36 in which the external base forming means includes tube gripping means holding the container on the internal forming member against movement in response to expansion of the internal forming member.

38. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises: means forming a flat, continuous web into a tubular container closed at one end, said means including a mandrel;

means reciprocating the mandrel longitudinally thereof;

means forming the web around the mandrel into a tubular configuration;

means severing the tubular configuration from the following web to produce a tubular container;

an internal forming member inside the container and supporting the container;

means including an external base forming member engaging and shaping a terminal section of the tubular container at the closed end thereof to form a base disposed transversely of the container;

container filling means spaced from said external member for placing a product in the container;

container closing means sealing the open end of the container; and

drive means for operating all said means in timed relation to each other.

39. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises:

tube forming means forming a portion of a flat, continuous web into a tubular configuration to produce a tube open at both ends;

container base forming means for shaping a portion of the tube to provide a base on one end of said tube, including a former received in the leading end of the tube and having a relatively movable section extensible axially of the tube thereon to shape the base end of the tube;

means transferring said tube from the tube forming means to the base forming means to produce a container with a base;

sealing means closing the trailing end of the tube with an inside-face-to-inside-face transverse seal; and

means severing the tube from the following web.

40. A machine as in claim 39 which also includes tube gripping means holding the tube on the former as the movable section moves outwardly thereof.

41. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises: tube forming means forming a portion of a flat, continuous web into a tubular configuration to produce a tube open at both ends;

container base forming means for shaping a base on one end of said tube, including a former movable into alignment with the tubular configuration;

means advancing the tubular configuration onto the former;

means transferring said tube from the tube forming means to the base forming means to produce a container with a base;

means severing the tube from the following web; and

means operating the severing means after said advance of the tubular configuration onto the former.

42. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises:

tube forming means forming a portion of a flat, continuous web into a tubular configuration to produce a tube open at both ends, said tube forming means including a two-section mandrel around which the web is wrapped, and sealing means placing a longitudinal seal;

container base forming means for shaping a base on one end of said tube;

means moving the mandrel sections axially and independently of each other toward and away from the tube receiving means on the base forming means;

means transferring said tube from the tube forming means to the base forming means to produce a container with a base; and

means severing the tube from the following web.

43. A machine as in claim 42 which also includes web gripping means cooperating with the mandrel to grip the tube and advance the web and tube with the mandrel.

44. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises:

tube forming means including a mandrel forming a portion of a flat, continuous web into a tube on the mandrel, said tube being open at the leading end thereof;

container base forming means adapted to receive a portion of said tube and to form the wall of said tube portion into a base at one end of said tube portion;

means for inserting the base forming means into the open leading end of the tube and transferring a terminal portion of said tube from the mandrel onto said base forming means; and

means severing said terminal portion of the tube from the following web.

45. A machine for forming, filling, and closing containers as in claim 44 which also includes sealing means

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placing a face-to-face seal at the trailing end of the tube portion to close the tube at the trailing end.

46. A machine for forming, filling, and closing containers made from a thin, flexible web, that comprises:

means forming a flat, continuous web into a tubular container closed at one end;

an internal forming member inside the container and supporting the container, said forming member including means moving the tubular container axially thereof relative to at least a portion of the forming member;

means including an external base forming member engaging and shaping a terminal section of the tubular container at the closed end thereof to form a base disposed transversely of the container;

container filling means spaced from said external member for placing a product in the container;

container closing means sealing the open end of the container; and

drive means for operating all said means in timed relation to each other.

47. A machine for forming, filling, and closing containers made from a thin, flexible web, heat sealable on the inner face, that comprises:

a mandrel;

means forming a flat, continuous web around the mandrel into a tubular configuration;

means severing a terminal portion of the tubular configuration from the following web;

means heat sealing together at one end the inner faces

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of opposed walls of the tubular configuration to produce a tubular container closed at one end;

an internal forming member inside the container and supporting the container;

means including an external base forming member engaging and shaping a section of the tubular container at the closed end thereof to form a base disposed transversely of the container;

container filling means spaced from said external member for placing a product in the container;

container closing means sealing the open end of the container; and

drive means for operating all said means in timed relation to each other.

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