Sept. 6, 1960 H. G. PODLESAK ET AL 2,951,324

PACKAGING APPARATUS

Filed Dec. 3, 1956 3 Sheets-Sheet 1

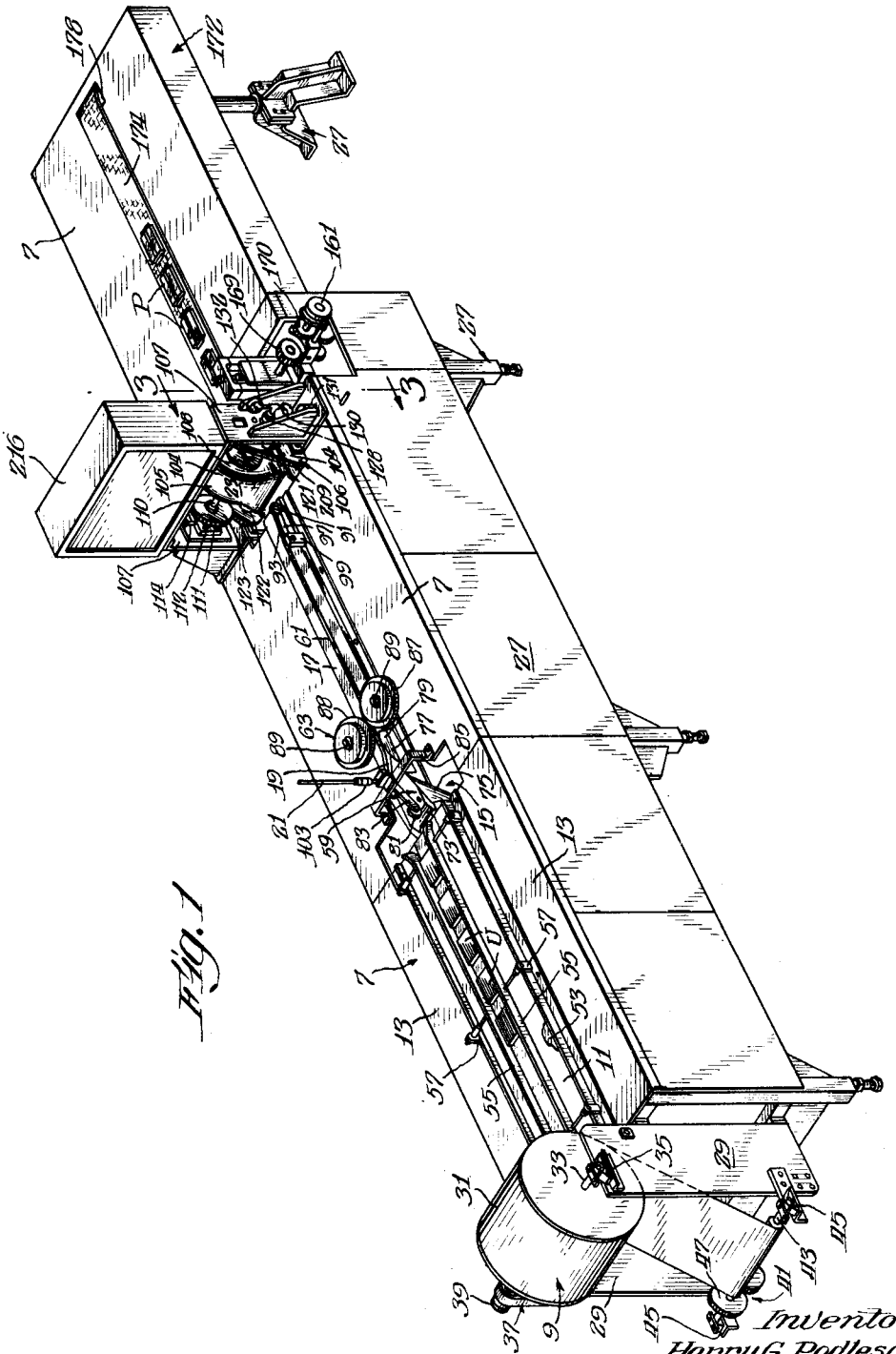


Fig. 1

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PACKAGING APPARATUS

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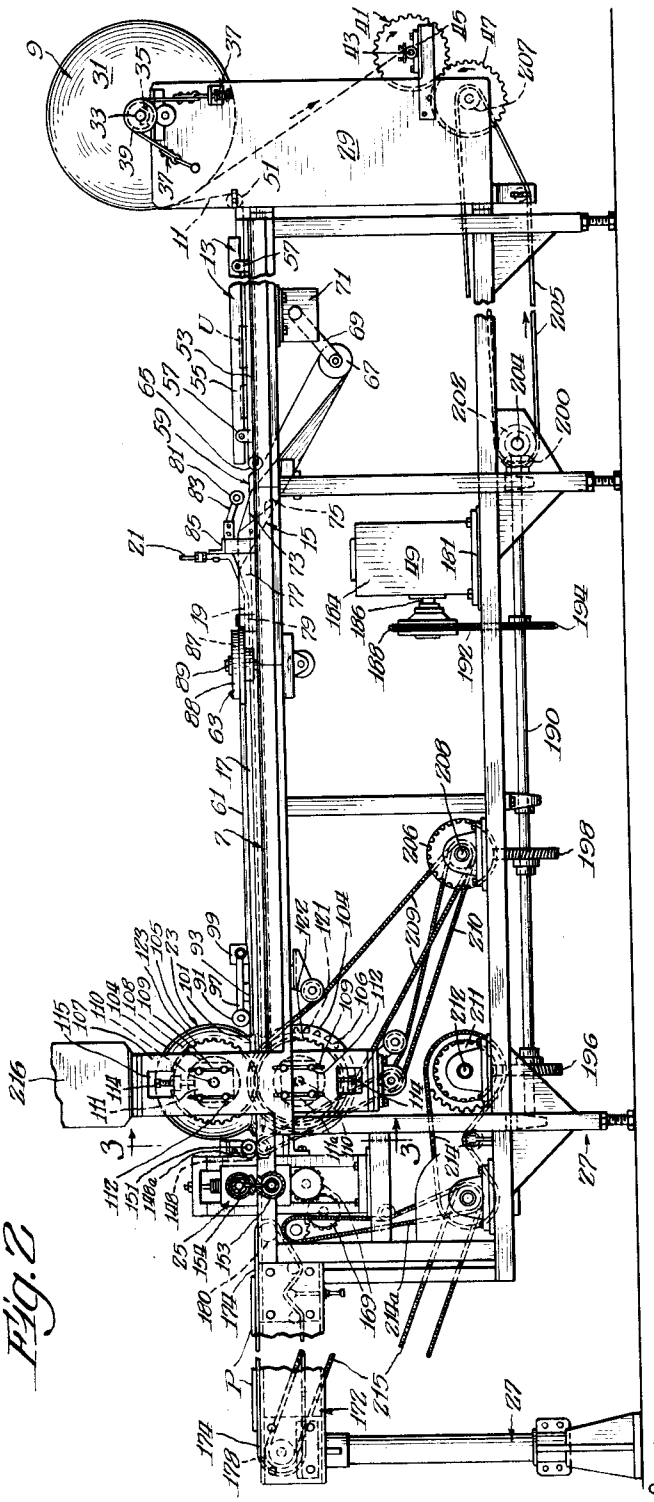


Fig. 2

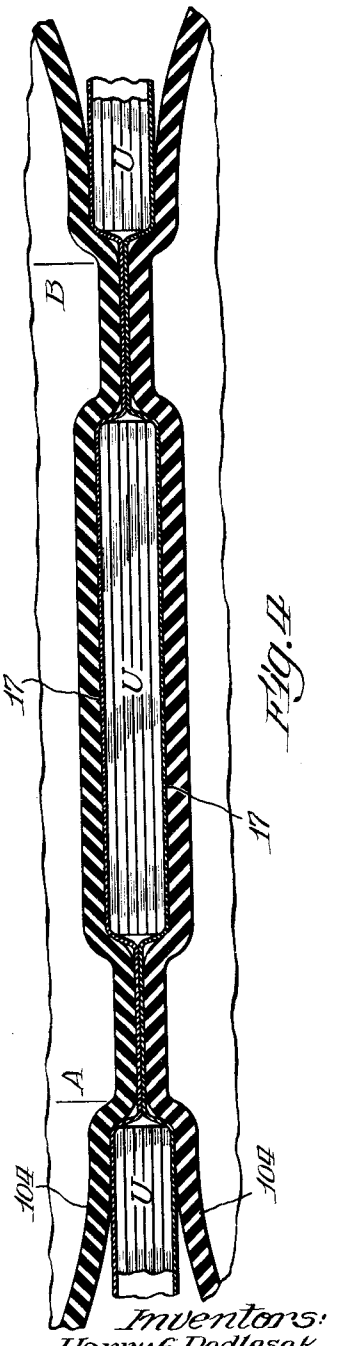


Fig. 4

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PACKAGING APPARATUS

Filed Dec. 3, 1956 3 Sheets-Sheet 3

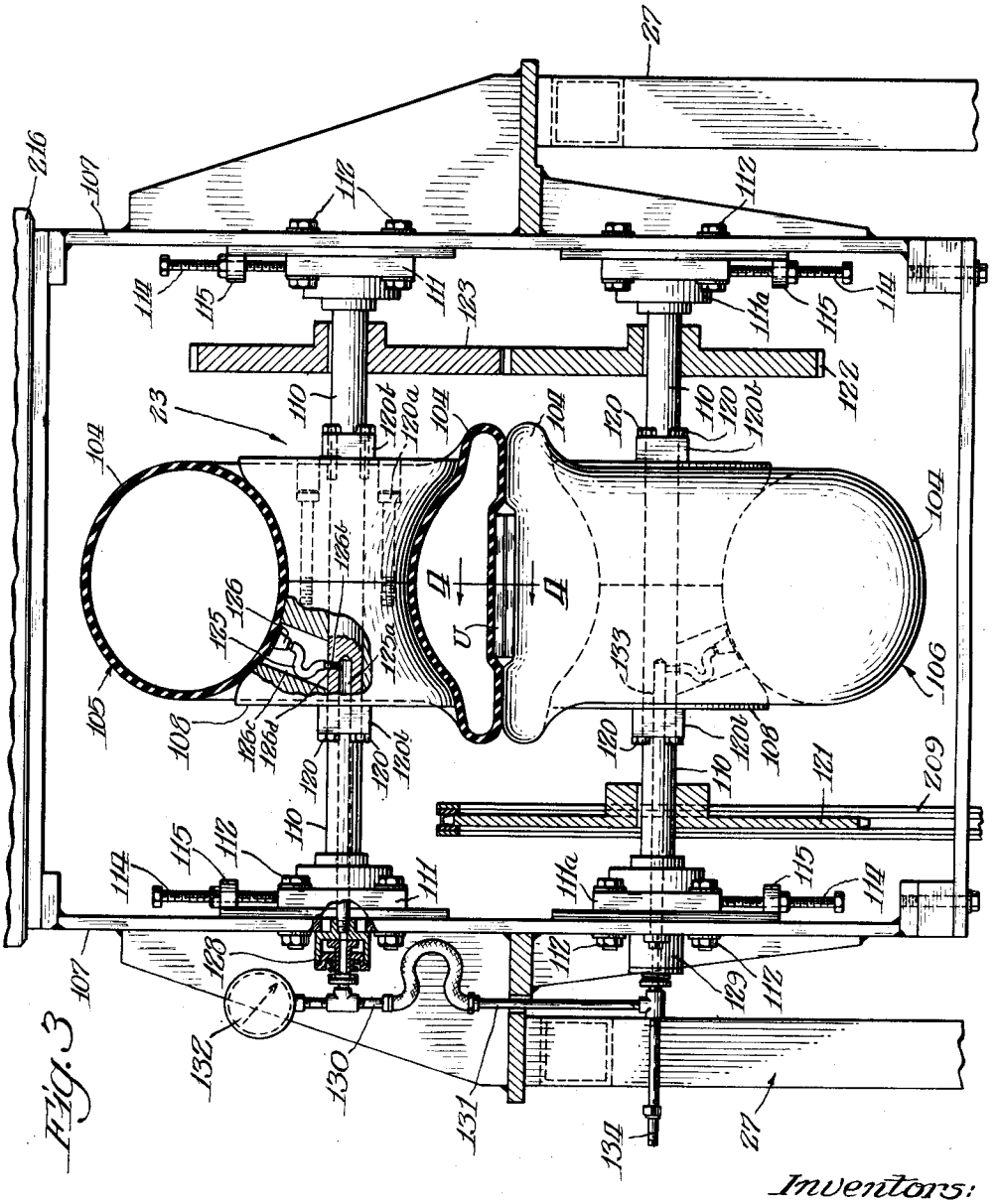


Fig. 3

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PACKAGING APPARATUS

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10 Claims. (Cl. 53—112)

The present invention relates generally to improvements in the art of packaging and more particularly to an improved apparatus for wrapping an article in sealable, flexible sheet material.

In the packaging of many products, for example food products such as cheese, in a wrapper of flexible sheet material, it has been possible to produce satisfactory packages on automatic or semi-automatic packaging equipment so long as the units to be packaged are of regular shape and size. The sheet material can easily be drawn taut about such uniformly shaped units, and when the sheet material is pressed into contact with each unit the sheet material remains smooth and wrinkle free. However, when the shape and/or size of the units is not regular, such as random cuts or slices, or irregular portions such as moon-shaped cheeses, it is difficult to wrap the units in flexible sheet material and press the sheet material into contact with each irregularly shaped unit in such a manner that the sheet material is not unduly wrinkled and creased.

Various means were previously used for pressing the sheet material into contact with the units to be packaged, such as a pair of resilient rolls made of sponge rubber or the like. The use of such rolls, however, has not been entirely satisfactory. One reason is that the rolls apply a non-uniform pressure to the units passing therebetween. The reason for this is that a unit wrap in the sheet material is subjected to increasing pressure by the rolls until the unit reaches the region in which the rolls are in contact, after which the pressure decreases. This non-uniform pressure often unduly wrinkles the wrapper, particularly in the seal area of a longitudinally sealed tubular wrapper, and makes it much more difficult to effect a gas tight seal for the wrapper. Further, with the known type of rolls for pressing a tubular wrapper into contact with the units to be packaged, the excess material overlying an air pocket in the package is generally collapsed into the area occupied by the air pocket and, therefore, into irregular contact with the unit being packaged.

Accordingly, the principal object of the present invention is the provision of apparatus for pressing flexible sheet wrapping material into contact with a unit to be packaged in such a manner that the flexible sheet material is maintained substantially smooth and wrinkle free. A further object is to provide improved apparatus for pressing a tubular wrapper into intimate contact with units contained therein, including means affording progressively greater contact laterally of each unit until the entire wrapper portion for the unit is conformed thereto. Other objects and advantages of the present invention will become apparent to those skilled in the packaging art as the description of the invention progresses.

We have discovered that the wrinkling of the sheet material, when it is pressed into contact with the unit to be packaged, can be minimized and the excess sheet material can be distributed over the surface of the unit

by employing a flexible, stretchable, resilient surface, for example a rubber sheet, as a pressing surface and by biasing that surface against the unit by fluid pressure. When this manner of pressing the sheet material wrapper into contact with the unit to be packaged is employed, the surface of the wrapper is smooth and substantially wrinkle free.

Apparently, the use of a flexible, stretchable, resilient surface to press the sheet material wrapper into intimate contact with the unit to be packaged produces a better package for several reasons. Principally, however, it appears that biasing such a surface against the unit with fluid pressure sets up forces in the resilient surface and in the wrapper which draw the sheet material wrapper into smooth conformation with the adjacent surfaces of the unit by distributing any excess material uniformly over the surface of the unit being packaged.

The flexible, stretchable, resilient pressing surface is preferably fabricated from a stretchable elastic material such as rubber, plastic etc. For best results and for producing a minimum of wrinkles in the finished package, the pressing sheet should be stretched at least to an extent such that when the pressing sheet is in use the area thereof used to conform the wrapper to the shape of the packaged item remains in a stretched condition at all times. That is to say that the pressing sheet preferably does not assume an unstretched or relaxed condition in which it tends to fold or wrinkle itself and thereby wrinkle the wrapping material with which it is in contact.

Operable conditions have been established wherein the pressing sheet was in an unstretched state but the establishment and maintaining of such conditions, particularly with variations in the size and shape of the packaged item, is quite difficult. Consequently, it is believed most practical to maintain the pressing sheet in a stretched state wherein the ordinary variations in the packages do not effect the quality of the wrap.

Obviously, the pressing surface which is to be biased against the unit to be packaged by fluid pressure must be fluid impervious. The amount of fluid pressure employed and the stretchability of the pressing surface should be correlated to meet existing conditions, preferably so that the pressing surface in use will substantially conform to the shape of the unit being packaged while retaining the stretched condition.

The pressing with the flexible, stretchable, resilient pressing surface can be accomplished in various manners. One convenient manner involves the use of an inflated circular rubber tube such as, for example, a pneumatic tire inner tube. The tube may be rolled over the wrapped units and this action will expel air or other gas from between the units and the wrapper material, press the wrapper against the unit being packaged, and efficiently distribute the wrapper over the packaged item to prevent the formation of wrinkles which otherwise tend to form in the excess wrapper material. Instead of being a tube with a continuous cross-section, the pressing surface may be provided by a flexible, elastic member which does not have a continuous cross-section, but which co-acts in combination with a rim on which it is mounted to retain the inflating fluid within the pressing member. Such an arrangement might generally resemble a tubeless pneumatic tire.

Any suitable fluid, liquid or gas, may be used to provide the fluid biasing of the pressing surface against the unit. Because of its ready availability and easy compressibility, air is a preferred fluid for use.

It is preferred that a pair of pressing surfaces arranged in opposed relation, one on each side of the unit, be used instead of only one of such surfaces, since a pair of such surfaces cooperate to more readily distrib-

ute any excess wrapping material over the surface of the unit being packaged.

Although the apparatus of the present invention has wide application in processes in which a sheet material is pressed into contact with a unit to be packaged, the apparatus has particular application in the process and apparatus disclosed in our co-pending application Serial No. 517,218, filed on June 22, 1955, and assigned to the assignee of this invention, now United States Patent 2,919,990, issued January 5, 1960. Accordingly, the present invention is described and shown in the drawings in combination with the apparatus of our prior co-pending application. The method and apparatus disclosed in this prior application for semi-automatically or automatically wrapping units of irregular shape and size in flexible sheet material has proved to be quite successful in use; however, on some packages it is desirable to pull the wrapper more tautly about the unit so as to provide a smoother unwrinkled appearance, and the present invention is particularly suited to accomplish this purpose.

In the drawings:

Figure 1 is a perspective view of a wrapping apparatus embodying various features of this invention;

Figure 2 is a side elevational view of the wrapping apparatus shown in Figure 1;

Figure 3 is an enlarged view of the compressing rolls of the wrapping apparatus taken along the line 3—3 of Figures 1 and 2, with a unit being wrapped shown between the rolls; and

Figure 4 is an enlarged sectional view taken on line 4—4 of Figure 3.

As will hereinafter become apparent, the packaging machine shown in the drawings includes, generally, an elongated platform **7** having means **9** at one end for supplying a strip **11** of flexible wrapping material which is adapted to be drawn across the platform by suitable means. The units to be wrapped, indicated as U in Figure 1, are placed in spaced-apart relationship on the sheet or strip **11** as it is drawn over an initial section **13** of the platform **7**. A forming station **15** is provided at which point the units U to be packaged are enclosed in a tube **17** that is made by the strip of material **11**.

A preservative gas is introduced into the tube **17** by means of a pipe or conduit **19** supported adjacent the forming station **15**. The pipe **19** extends longitudinally into the tube **17** of wrapping material **11** to conduct the preservative gas into the sealed portion of the tube **17**. The pipe **19** is connected by suitable means **21** to a source of preservative gas (not shown). The gas flows from the open end of the pipe **19** under a positive pressure and serves to dilute and sweep out the air in the wrapping material tube **17**. The entubed units U in the illustrated structure, are then acted upon by pressing means **23** which is operable to collapse the wrapping material tube **17** and presses it into close contact with the entubed units U. The tube **17** is then acted upon by sealing and severing means **25**, whereby it is severed and sealed transversely to form individual hermetically sealed packages, as shown at P in Figure 1.

Referring now more particularly to the drawings, the illustrated wrapping machine embodies various of the features of the invention and is particularly adapted to the packaging of cheese in irregular shapes. The illustrated machine includes a frame **27** of fabricated construction which at one end supports and in part constitutes the elongated platforms **7** upon which the various operations are carried out. As shown in Figures 1 and 2, the wrapper feed means **9** includes a pair of support members **29** which are attached to the frame **27** and which provide a support for a roll **31** of the wrapping material. The roll **31** is supported upon a shaft **33** which is keyed to the roll **31**, the shaft **33** being supported in a pair of suitable bearings **35** fastened to members **29**. Proper tension is maintained in the sheet **11** as it is drawn from the roll **31** by a friction brake assembly **37** which acts upon a pulley **39** attached to the shaft **33**.

Various types of wrapping materials can be used on the machine such as for example, a cellophane coated with a waxlike material, such as the material sold under the trade name Parakote, a rubber hydrochloride sheet, such as the material sold under the trade name Pliofilm, vinyl chlorideacetate sheets, such as the material sold under the trade name Vinylite, vinylidene-vinyl chloride sheets, such as the material sold under the trade name Saran, and various other pressure and/or heat sealable, flexible sheets, as well as various laminated sheets embodying such type of materials.

If the wrapping material being used is supplied in rolls having an interleaf sheet, as is common in the case of coated sheets to prevent the layers of sheet material from sticking together, a suitable means for rewinding the interleaf sheet is provided, such a rewind means being shown in the drawings at **41**.

The rewind means **41** illustrated includes a rewind shaft or core **43** which is supported on a pair of bearings **45** which in turn are attached to the lower ends of the members **29** in the illustrated manner. In order to provide a positive rewinding action, the shaft **43** is adapted to be power operated. In the illustrated structure, this is provided by connecting the shaft **43** to a suitable gear train **47**, which gear train is operatively connected to a suitable source of power **49** by suitable means as shown.

As was pointed out, the strip of wrapping material **11** initially moves onto an open initial section **13** of the platform **7** This is accomplished by drawing the sheet **11** from the feed roll **31** and under an idler roll **51** so that the strip or sheet **11** may be drawn tautly across the surface of the section **13**. The section **13**, as shown in the drawings, is arranged immediately adjacent the wrapper supply means **9** and comprises a generally flat, smooth-surfaced table-like area **53** which includes a pair of longitudinally extending guide rails **55**. The guide rails **55** are held in place by suitable supports and brackets **57** and are suitably spaced apart to maintain the cheese units U in alignment along the center of the strip of wrapping material **11**. The cheese units U in the illustrated machine are adapted to be spaced apart manually by an operator but the feed to the machine can readily be made automatic by employing known devices.

In the illustrated apparatus, the sheet **11** on which the units U are disposed is adapted to be wrapped around the units U to provide the tube **17**. This is accomplished by a forming station **15** which is positioned on the platform **7** closely adjacent the discharge end of the section **13**. The forming station **15** includes a forming shoe **59** which is adapted to wrap the strip **11** about the units U and to provide a seam **61** which can be sealed together by a sealing means **63** which also constitutes a part of the forming station **15**.

In order to insure that the strip **11** is held taut and flat over the section **13** and that the sheet does not wrinkle in its central section in the forming shoe **59**, the strip **11** is carried downwardly over an idler roll **65** (Fig. 2), mounted for rotation at the discharge end of the section **13**, from which point it passes around a roller **67**. The roller **67** is rotatably mounted on a pair of swingably mounted arms **69**. The arms **69** are pivotally supported on a pair of brackets **71** attached to the frame **27**. After passing around the roller **67**, the strip of wrapping material is guided upwardly and into the forming shoe **59**.

The roller **67** effects some tensioning of the strip **11** and is positioned so that the length of strip material **11** from the point that it leaves the top of the idler roller **65** to pass down and around the roller **67** and up again, to where a unit U is again contacted by the strip material in the forming shoe **59** is a multiple of the length of a unit U measured along the line of travel plus the distance between units. By having this length a multiple, as described, the sheet material on the initial sec-

tion 13 of the table may be indexed or labeled and the units placed thereon in proper position, and the units will thereby take a corresponding indexed position on the sheet material 11 in the forming shoe 59.

The forming shoe 59 includes a base member 73 which is of substantially the same width as the units U to be packaged. It also includes a pair of opposed, flared members 75 which are provided with stationary folding wings 77 which are adapted to cause the wrapper strip 11 to be folded upwardly around the units U into a tube incident to its movement through the shoe 59. The tube 17 at this point has vertically upstanding portions which are in face-to-face relationship and which provide a longitudinal seam in the tube 17. At the discharge end of the flared members 75, there is provided a narrow slit which is defined by a pair of closely spaced upstanding members 79 which hold the seam 61 in an upright position.

In order that the units being packaged are not displaced by the folding of the strips 11 about the units, there is provided a hold-down roller 81 which is rotatably supported on a bracket 83. This bracket is in turn attached to a bridge member 85 which extends over the forming shoe 59. The distance between the hold down roller 81 and the base member 73 is such that the units being packaged are prevented from moving upwardly incident to the folding of the strip 11 into a tube. The roller 81 is preferably fabricated from a material which will not stick to the materials being handled. The roller 81 which is shown is pivotally supported, and it can be readily provided with a spring biasing means, if desired. However, if the roller 81 is spring biased, it should be provided with a limiting stop so as to prevent it from moving down to a point where it would interfere with the passage of cheese units U thereunder.

The vertical opposing edges of the sheet 11, which form the seam 61, upon emerging from between the members 79 are immediately passed through the sealing means 63. The sealing means 63 includes a pair of opposed sealing rolls 87 and 88 which are rotatable and biased together to apply pressure to the seam 61. The sealing rolls 87 and 88 rotate in opposite directions on a pair of vertical shafts 89 and are arranged in a horizontal position on either side of the forming station 79, so that their peripheries coincide at the center line immediately forward and above the forming shoe 59. In the illustrated embodiment of the invention, the sealing rolls are heated, since the materials which are commonly used in the packaging of cheese are heat sealable. However, if an adhesive seal is to be employed, suitable means for that type of material should be used. The sealing means 63 in any event should be operable to provide an airtight, longitudinal seal along the seam 61.

After the strip 11 has been sealed in the form of the tube 17, it is moved along the platform 7 until the seam 61 which is in the vertical position is engaged by a folding guide 93 which is operable in cooperation with a folding roller 91 to fold the seam 61 into a horizontal position so that it lies flat on top of the tube 17. The folding roller 91 and the folding guide 93 are mounted on an arm 97 hingedly mounted on a bracket 99 supported on the platform 7.

As previously pointed out, a preservative gas is conducted into the body of the tube 17 through a pipe or conduit 19. The pipe 19 is supported at one end on the bracket 85 and the pipe 19 is positioned to extend downwardly to a point adjacent the forming shoe 59 and then longitudinally beneath the upstanding members 79 of forming shoe 59 and the sealing rolls 87 and 88 into the tube 17. The pipe 19 terminates at a point adjacent the folding roller 91 with an open end 101 which is adapted to release the gas into the body of the tube 17. The preservative gas is conducted from a source of pressurized gas (not shown) into the pipe 19 by means of suitable fittings and conduits indicated as 103 in the drawings.

In operation, the gas serves to dilute the air and to sweep it from the tube 17 rearwardly towards the forming shoe 59, the excess air and gas mixture flowing out of the tube at its open end at its point of formation. In this manner the oxygen content in the forward end of the tube 17, the end adjacent the folding roller 91, may be substantially reduced or minimized. Preferably, the pipe 19 is of flattened cross section so that it rides smoothly on the upper surface of the cheese or other units being packaged and so that it does not increase the open space in the package any more than is necessary. The pipe 19 illustrated extends into the tube 17 a distance equal to the length of at least several of the resulting packages P to a point adjacent the folding roller 91, so as to achieve maximum sweeping of air from the tube 17 rearwardly towards the forming shoe 59. While the pipe 19 may be of a shorter length than illustrated, it is preferred that the length of the pipe within the tube 17 be at least greater than the length of the wrapper tube 17 necessary to form one of the resulting packages P.

The pressing means 23 in the illustrated structure includes a pair of pressure rolls 105 and 106, which include pneumatic tubes 104. The pressing means 23 operates to press the walls of the wrapping material tube 17 into intimate contact with the units U and to collapse the wrapper tube 17 between the units U. The rolls 105 and 106 are positioned one above the other and are arranged with their axes at right angles to the line of travel of the wrapper tube 17. The rolls 105 and 106 are positioned adjacent to the folding roller 91, and the outer peripheries of the rolls 105 and 106 are in contact with each other to provide a nip which engages the wrapper tube 17 to effect its compression. In this connection, the rolls 105 and 106 are positioned so that the nip, created by the engagement of the rolls 105 and 106, one with the other, is disposed to receive the wrapper tube 17. The contact of the rolls 105 and 106 with each other provides an area of contact between the rolls 105 and 106 which is a generally flat area. The rolls 105 and 106 are close enough to each other so that the area of contact between the rolls is preferably wider than the unit U being packaged as is shown in Figure 3. By making the area longer than the unit in the direction of its movement, as is shown in Figure 4, the wrapper tube 17 is squeezed together forwardly of the unit, thereby preventing puffing of the already collapsed packages. While the length of the area of contact may be less than the length of the unit U, this relationship may not result in the expulsion of all gas pockets from the unit.

With respect to the utilization of annular pressure members, such as the rolls 105 and 106, it is an important feature of such members that they provide for initially engaging the tubular wrap at a position along the center line thereof. This is of particular advantage in connection with a tubular wrapper having marginal edge portions folded together along the center line of the formed tube, as in the case of the described seam 61. Since the forwardmost portion of the tube 104 on the rolls 105 and 106, that is, the surface portions adjacent the folding roller 91, are generally uncompressed and circular in cross-section, the first engagement with the tube 17 is generally linear and along the center line of the tube. Consequently, the seam 61 is pressed against the package and held in position while the tubular wrapped package proceeds into the nip of the rolls 105 and 106. As the package enters the nip of the rolls, the width of the area of engagement between the rolls and the tube 17 increases until the tube is completely surrounded by the rolls, as seen in Figures 3 and 4. This laterally progressive engagement of the tube 17 by the rolls 105 and 106 is particularly effective in pressing

the seam **61** against the package, while smoothing the wrapper toward each of the opposite side edges of the tubular wrapper to thereby prevent the formation of any wrinkles in the wrapper.

Each of the rollers **105** and **106** includes a supporting core **108** for the pneumatic tube **104**. In order that the tube **104** may be easily mounted on the core **108**, the latter is constructed of two half cores which are secured together by a pair of cap screws **120***a*. The outer periphery of the supporting core **108** is preferably concave so that the tube **104** may be mounted thereon in a manner such that it will not slip off of the supporting core. The upper supporting core and the lower supporting core are each mounted for rotation on shafts **110**. Flanges **120***b* on the shafts are secured to the associated supporting core **108** by screws **120**. The ends of the shafts **110** are journaled in bearings **111**.

The flexible and stretchable fluid retaining element or tube **104** that is mounted on each of the supporting cores **108** effects the pressing of the wrapper tube **17** about the units U incident to their passage therebetween. The pressing tube **104** is preferably a thin walled annular rubber tube resembling the inner tube of an automobile. In one commercial embodiment, the inner tube from an airplane tail wheel was used, wherein the tube had a diameter of 17 inches.

As hereinbefore mentioned, it is preferred that the thin walled annular rubber tubes **104** be stretched by inflating them, at least to an extent that they will remain in a stretched condition when in contact with each other and throughout the collapsing and pressing operation. For example, referring to Fig. 4, with the tubes **104** inflated and out of contact with each other (which condition is not shown), the distance from A to B on the upper tube **104**, measured along the outside of the tube, is an arc of a circle and is a measurement of a stretched length of the upper tube **104**. As shown in Fig. 4, when the tubes **104** are in contact with each other, however, the distance from A to B measured along the tube is substantially a straight line chord of a circle and, therefore, is shorter than the length of the arc between the same two points A to B when the tubes are out of contact with each other. If this shortening of the distance between arcuately spaced points on the tubes **104** occurs with the rubber in a relaxed or unstretched state, there is a great tendency for the tubes to wrinkle and fold upon themselves. However, this tendency is eliminated by pre-stretching the annular rubber tubes to a state where the described shortening is taken up within the walls of the tube by allowing the amount of stretch therein to diminish without completely relaxing the rubber or elastic material used for the tubes.

In order to inflate each of the tubes **104** with fluid, the upper tube **104** has a stem **126** leading therefrom which passes through a suitable opening **126***c* in the supporting core **108**. The upper shaft **110** has a hole **125***a* provided in the center thereof, and a threaded hole **126***b*, connecting with hole **125***a*, is provided in the shaft **110**. A threaded fitting **126***d* is provided in the threaded hole **126***b* and a flexible connection **125** connects the fitting **126***d* with the stem **126**, thereby providing communication of the hole **125***a* with the upper tube **104**. The lower tube **104** is similarly connected to a hole **133** provided in the lower shaft **110**. The air in each of the tubes **104** communicates with the air in the other tube through the pipes **130** and **131** and, therefore, the pressure within each of the tubes is maintained equal. It is preferred to have the pressure equal, since this appears to provide for the most efficient distribution of the wrapper material about the unit to be packaged. In order to increase the pressure within the tubes **104** or to decrease the pressure in the tubes a stem valve **134** is connected to line **131**. A pressure gauge **132** is provided to indicate the pressure in the tubes; however, a manometer or other pressure indicating device may be used. The air pressure within the tubes **104** and the stretchability of the pressing surface of tubes **104** should be so correlated that the pressing elements, which are the surfaces of the tubes **104**, will substantially conform to the shape of the unit being packaged. The pressure should also be great enough so that there is substantially no slippage between the tubes **104** and the wrapper tube. In this manner the sheet wrapper material will be efficiently distributed over the surface of the unit being packaged.

The tubes **104** are preferably rotated at a slow speed to allow for the escape of air between the unit and the sheet material. The wrapped unit is preferably passed through the center of the area over which the tubes are in contact. This provides for the above-mentioned progressive contact of the outermost portion of the tubes **104** with the unit along a line in the center of the unit which is parallel to the line of travel of the wrapper tube **17**, and the contact of the tube **104** with the wrapped unit spreads outwardly to the edges of the unit. Such contact is believed to set up forces in the tube **104** and the sheet material which tension the sheet material and press it into smooth conformity with the adjacent surfaces of the unit.

In the illustrated embodiment of the machine, the rolls **105** and **106** are supported by a pair of vertical members **107** which are attached to and which extend from the platform **7**. Each of the members **107** are provided with two pairs of parallel, vertically-disposed slots **109**, each of which pairs is adapted to receive a bearing bracket **111**. The pairs of slots **109** are vertically arranged and the upper of the pairs is adapted to receive a bearing bracket **111** for the upper roll **105**, while the lower of said pairs is adapted to support a bearing bracket **111***a* for the lower roll **106**. Each bearing bracket **111** and **111***a* supports a suitable bearing which is adapted to rotatably engage the roll shafts **110**. As illustrated in the drawings (Figs. 2 and 3) each of the bearing brackets **111** and **111***a* protrude into the slots **109** and are secured in vertical position in the slots **109** by four bolts **112**, which prevent rotational movement of the brackets **111** and **111***a*, but permit vertical adjustment of the brackets in their associated slots. This permits adjustment of the rolls **105** and **106** toward and away from each other and up and down, to permit a variation in the flat area over which the rolls **105** and **106** are in contact, and to change the location of the nip so that it is aligned to receive the unit U.

In addition to the slots **109** and the bolts **112**, positioning of each of the bearing brackets **111** and **111***a* and their associated rolls is facilitated by means of an adjusting screw **114** which is threadably engaged in an associated bracket **115** on the members **107**. These screws **114** bear on the bearing brackets **111** and **111***a* and are operable to effect their adjustment. The lower roll **106** has rotary motion imparted to it through a sprocket **121** which is keyed or otherwise secured to the lower shaft **110**. Sprocket **121** is driven through endless chain **209** which is suitably connected to the source of power **49**. Rotary motion is transmitted from the lower shaft **110** to the upper shaft **110** by a suitable means such as by the gears **122** and **123** which are keyed or otherwise suitably secured to their respective shafts **110**. As the rolls turn, the flexible, resilient surfaces of the tubes **104** move progressively along the tube **17**. The rolls are preferably rotated so that the peripheral speed is substantially the same speed at which the tube **17** is moving. The pressing surfaces of the tubes **104**, therefore, progressively move along the tube **17** at the same speed at which the tube **17** is moving and substantially no slippage occurs between said surfaces and the tube **17**.

After the excess gas has been removed from the tube **17**, the collapsed tube **17** containing the cheese units U is pulled forward from the rolls **105** and **106** and is contacted with two pairs of driven rollers positioned along

opposite edges of the path of the tube. One pair of the rollers **148** and **148***a* is illustrated. The rollers of each pair are in superposed relation of the tube. The lower rollers of each pair extend under the tube **17** and the upper rollers are shorter than the lower rollers but extend across a portion of the tube **17**. The two pairs of driven rollers provide nips which are adapted to receive the edges of the tube **17**. Each of the rollers is supported on the platform **7** by suitable brackets. The rollers **148** and **148***a*, as well as the similar pair which is not shown, are driven by a suitable gear train **151**, which is connected to the source of power **49**.

The sealing and severing means **25** are operable to seal the tube **17** at a position between each of the enclosed units U and to cut the individually sealed units U apart to form separate packages P. The sealing and severing means **25**, in the illustrated embodiment, comprises a pair of sealing and cutting rolls **153** and **154**, which are positioned one above the other with their axes at right angles to the line of travel of the collapsed tube **17** so that their nip is disposed on the same level as the advancing tube **17**. Each of the sealing and cutting rolls **153** and **154** is generally cylindrical in shape. One of the rolls or a portion of the surface area of the rolls may be heated by means of electrical heating elements (not shown) whose power requirements are supplied through a slip ring **161**.

In the operation of the sealing and severing means **25**, rolls **153** and **154** are rotated periodically in timed relation to the passage of the collapsed portion of the tube **17**. In this manner, certain raised portions of each roll **153** and **154** coincide with the collapsed portion of the tube **17** intermediate the units U, and the tube **17** is subjected to heat and pressure between the entubed units U to form longitudinally spaced, transversely extending seals. The severing means divides the tube **17** into a succession of individual, sealed packages P. After the passage of the collapsed portion of the tube **17** between the rolls **153** and **154**, the raised portions no longer coincide and there is adequate clearance for the passage of the next succeeding unit U to pass between the rolls **153** and **154** without pressure on the unit U.

The sealing and cutting rolls **154** are driven by a suitable gear train **169** which is operably connected to the source of power **49**. Of course, other methods of sealing and severing the tube **17** to form individual packages which are known to the art may be employed.

The wrapping machine is provided with a takeoff conveyor **172** for receiving the sealed and severed packages P from the sealing and cutting rolls **153** and **154**. The conveyor means **172** is of conventional design and comprises an endless conveyor belt **174** supported upon a pair of pulleys **178** and **180**.

All the operating parts of the machine are driven by a source of power **49** (Fig. 2) which is mounted on a platform **181** extending transversely between the lower, longitudinal supports of the frame **27**. The power source **49** includes a motor (not shown) which is connected to a speed reducer **184**. The speed reducer **184** is provided with a short stub shaft **186** having a sprocket **188** fixed thereto. The sprocket **188** is connected to a main drive shaft **190** by a drive chain **192** and a sprocket **194**. The main drive shaft **190** is suspended beneath the cross supports of the frame **27** and runs longitudinally of the machine. The shaft **190** carries a pair of helical gears **196** and **198** and a bevel gear **200**.

The bevel gear **200** supplies the interleaf rewind gear train **47** with necessary power through a connection with bevel gear **202** which is keyed to a cross shaft **204**. The cross shaft **204** carries a pulley (not shown) which drives a belt **205** connected to a pulley **207** operatively connected to the gear train **47**.

The helical gear **198** drives the roll **106** and the gear train **151**, which drives the driven rollers **148** and **148***a*, and the other pair (not illustrated). In this connection, the gear **198** meshes with a gear **206** on a cross shaft **208** which furnishes the necessary power to the roll **106** and gear train **151** through endless chain and sprocket arrangements **209** and **210**, respectively.

The helical gear **196** is connected with a gear **211** which turns a shaft **212**. The shaft **212** is connected by drive chains **214** and **214***a* to the gear train **169** which drives the sealing and severing means **25**. The chain **214** also drives the conveyor belt **174** by means of a chain and sprocket drive **215** which is operable to rotate the belt pulley **178**.

Timing of the machine and of the sealing and severing means **25** in particular may be readily accomplished by known mechanisms by causing the actuation of the sealing and severing means **25** in response to a given linear movement of the tube **17**, which is effected by the engagement of the rolls **105** and **106** with the tube **17**, thereby drawing the wrapping strip **11** and the tube **17** through the machine. Other suitable means might be provided for actuating the sealing and severing means **25**, such as a solenoid controlled member which is in turn actuated by a photoelectric cell. The cell may be responsive to the units U being packaged or to marks on the wrapping material strip **11**.

In order to provide a central point for installing switches, temperature gauges for the sealing means **63** and the sealing and severing means **25**, gas flow controls and the like, it is convenient to provide a control cabinet **216** which may be located, as illustrated, on the members **107**.

In one commercial embodiment of the apparatus which has been described, it has been possible to package a substantial number of units of cheese slices per minute. The resulting packages were very smooth and wrinkle-free and were very pleasing to the eye.

This application is a continuation-in-part of our prior application Serial No. 517,218, filed on June 22, 1955, and assigned to the assignee of this invention, now United States Patent 2,919,990, issued January 5, 1960.

We claim:

1. A wrapping machine which comprises means defining an elongated supporting platform, means for supplying at least one strip of flexible wrapping material to one end of said supporting platform, means for moving said one strip of wrapping material along said platform from said supplying means, said platform being arranged in such a manner that the units to be packaged may be placed in spaced-apart relationship upon said moving one strip, a wrapper tube-forming station on said platform advanced along the line of travel of said one strip from the point at which the units to be packaged are placed thereon, said wrapper tube-forming station including means for forming said wrapping material into a longitudinally sealed wrapper tube which encloses a series of the units to be packaged, a pair of flexible fluid-retaining annular pressing tubes having axes which extend transversely of the line of travel of said wrapper tube and being formed with peripheral generally convex surfaces, said tubes being disposed one above the other with their convex surfaces in contacting engagement to thereby define a nip which is aligned with the center line of the units being packaged in the same plane as the level of the platform, and which is positioned to receive said longitudinally sealed wrapper tube, said tubes being proportioned to collapse and press together the walls of said wrapper tube in the area between said entubed units and to press the walls of said wrapper tube into intimate contact with the surface of the entubed unit, the portion of each of said fluid-retaining annular pressing tubes which contacts the entubed units being of such flexibility that the pressure transmitted from the tubes to the entubed unit therebetween is substantially the pressure of the fluid within said tubes, the pressure of the fluid within each of the tubes being such that the passage of the entubed units therebetween does not distort said units,

means for substantially equalizing the pressure of the fluid within each of said fluid-containing tubes, means for rotating at least one of said tubes to thereby draw said strip and said wrapper tube across said platform and through said wrapper tube-forming station, and means for sealing and severing said wrapper tube between each unit.

2. A wrapping machine which comprises means defining an elongated supporting platform, means for supplying at least one strip of flexible wrapping material to one end of said supporting platform, means for moving said one strip of wrapping material along said platform from said supplying means, said platform being arranged in such a manner that the units to be packaged may be placed in spaced-apart relationship upon said moving one strip, a wrapper tube-forming station on said platform advanced along the line of travel of said one strip from the point at which the units to be packaged are placed thereon, said wrapper tube-forming station including means for forming said wrapping material into a wrapper tube which is sealed along its longitudinal center line and which encloses a series of the units to be packaged, a hollow pipe for conducting a preservative gas into the body of said tube, one end of said pipe being supported upon said platform at a point adjacent to said forming station, said pipe extending longitudinally into said tube a predetermined distance, means for conducting gas into the end of said tube adjacent said forming station, a pair of flexible fluid-retaining annular pressing tubes having axes which extend transversely of the line of travel of said wrapper tube and being formed with peripheral generally convex surfaces, said tubes being disposed one above the other with their convex surfaces in contacting engagement to thereby define a nip which is aligned in the center line of the units being packaged in the same plane as the level of the platform and which is positioned to receive said wrapper tube with the longitudinal seal thereof disposed along the longitudinal center line of said tubes, said pressing tubes being proportioned to collapse and press together the walls of said wrapper tube in the area between said entubed units and to press the walls of said wrapper tube into intimate contact with the surface of the entubed unit, the portion of each of said fluid-retaining annular pressing tubes which contacts the entubed units being of such flexibility that the pressure transmitted from the tubes to the entubed unit therebetween is substantially the pressure of the fluid within said tubes, the pressure of the fluid within each of the tubes being such that the passage of the entubed units therebetween does not distort said units, means for substantially equalizing the pressure of the fluid within each of said fluid-retaining tubes, means for rotating at least one of said tubes to thereby draw said strip and said wrapper tube across said platform and through said wrapper tube-forming station, and means for sealing and severing said wrapper tube between each unit.

3. In a packaging machine wherein a unit to be packaged is enclosed in a wrapper and wherein the wrapper is pressed into intimate contact with the unit being packaged, an improved means for pressing the wrapper into intimate contact with the unit, said means comprising a fluid retaining hollow element having flexible, stretchable and resilient walls providing an outwardly convex peripheral wrapper-engaging portion, said element containing pressure fluid and being mounted to locate the crown of said convex periphery in general alignment with the center line of the unit being packaged so that the fluid pressure acts to bias said convex wall portion against the wrapper enclosed unit to initially effect pressing engagement of the wrapper against the unit along the center line thereof and then to progressively engage and press the wrapper against the unit in the outward directions from the unit center line to complete intimate engagement of the wrapper with the unit being packaged.

4. In a wrapping machine of the class described wherein units to be packaged are enclosed in a tube of wrapping material which is moved longitudinally and then pressed into intimate contact with the units and collapsed between units, means for introducing a preservative gas into the tubular wrapper and releasing the gas at a point adjacent the point of tube collapse, and means for collapsing the tube and for pressing the wrapping material against the units, said latter means comprising a pair of fluid-filled annular pressing tubes arranged for passage of the wrapper enclosed units therebetween, said pressing tubes having flexible, stretchable, resilient, generally convex outer peripheries in contact with each other along an area in general alignment with the center line of the units being packaged to thereby initially engage and press the wrapper against the units being packaged along the unit center line and then to progressively expand the pressing engagement in both lateral directions to complete pressing of the wrapper against the units being packaged, and to thereby also collapse the wrapper between the units being packaged.

5. In a wrapping machine wherein units to be packaged are enclosed in a tube of wrapping material and wherein the tubular wrapper is pressed into intimate contact with the units and collapsed at positions between the units, means for pressing the tubular wrapper into intimate contact with the units and for collapsing the tubular wrapper between units, said means comprising a pair of flexible, stretchable, resilient elements, means for rotating at least one of said elements, and interconnected means affording the introduction of pressure fluid into each of said elements and the equalization between said elements of the fluid pressure therein, said elements being mounted in opposed relation with a portion of the unit-filled tubular wrapper disposed therebetween and containing pressure fluid at sufficient pressure to bias said elements against the tubular wrapper and enclosed units to thereby drive the tubular wrapper and enclosed units between said elements incident to rotation of said one element and to thereby engage the wrapper in intimate contact with the units being packaged and to collapse the wrapper between units.

6. In a packaging machine wherein a unit to be packaged is enclosed in a wrapper and wherein the wrapper is pressed into intimate contact with the unit being packaged, an improved means for pressing the wrapper into intimate contact with the unit, said means comprising a fluid retaining hollow element having flexible, stretchable and resilient walls containing pressure fluid and providing an outwardly convex peripheral wrapper-engaging portion, said element and the unit being movable relative to each other along a predetermined path, and said element being mounted to bias, incident to relative movement between said element and said unit along said path, said convex wall portion against the wrapper enclosed unit to define an area of contact therebetween having a convexly curved leading edge which advances along the element-engaged surface of the unit.

7. In a wrapping machine wherein units to be packaged are enclosed in a tube of wrapping material which is moved longitudinally and then pressed into intimate contact with the units and collapsed between units, means for pressing and collapsing the tube comprising a pair of opposed, annular pressing elements having flexible, stretchable, resilient, outer peripheries of generally convex formation, said elements containing pressure fluid and being mounted for passage therebetween of the tube and enclosed units and with portions of the peripheries of said elements in contacting engagement with the tube to define an area of contact between each element and the tube having a convexly curved leading edge disposed transversely of the direction of tube movement and having a maximum width, taken transversely of the direction of tube movement, greater than the width, also taken trans-

versely of the direction of tube movement, of the individual units being packaged.

8. In a packaging machine wherein a plurality of units to be packaged are successively enclosed in a moving tubular wrapper and wherein the wrapper is progressively pressed into intimate contact with the units being packaged, an improved means for pressing the wrapper into intimate contact with the units being packaged, said means comprising a pair of hollow toroidal elements having flexible, stretchable, and resilient fluid-retaining walls, said elements being rotatably mounted in a common plane, containing fluid at a pressure sufficient to maintain said walls in stretched condition, and being pressed into rolling engagement with the wrapper over a contact area having a convexly curved leading edge disposed transversely of the direction of wrapper movement, and having a maximum width, taken transversely of the direction of wrapper movement, greater than the dimension of said units taken transversely of the direction of wrapper movement, and means for progressively moving the wrapper and enclosed units into the nip between said engaged elements and generally along the center line of said contact area, whereby incident to movement of successive wrapper-enclosed units between said elements, the wrapper is engaged by said elements and initially pressed against the units along their center line and then progressively forwardly and sidewardly to engage the wrapper intimately with the units.

9. In a packaging machine wherein a unit to be packaged is enclosed in a wrapper and wherein the wrapper is pressed into intimate contact with the unit being packaged, an improved means for pressing the wrapper into intimate contact with the unit which comprises a fluid-retaining hollow element having flexible, stretchable, resilient walls, providing an outwardly convex peripheral wrapper engaging portion, said element containing fluid at a pressure sufficient to maintain said wrapper engaging wall portion in stretched condition and being mounted for movement relative to the unit being packaged such that the fluid pressure within said element acts to bias said wrapper engaging wall portion against the wrapper and enclosed unit to initially engage the wrapper at a localized area and then to simultaneously and progressively engage and press the wrapper against the enclosed unit in both lateral and forward directions to envelop the wrapper enclosed unit, thereby accomplishing smooth and intimate contacting engagement of the wrapper with the unit being packaged.

10. In a packaging machine wherein a unit to be packaged is enclosed in a moving wrapper and wherein the wrapper is pressed into intimate contact with the unit being packaged, an improved means for pressing the wrapper into intimate contact with the unit which comprises a pair of opposed fluid-retaining elements having flexible, stretchable, resilient walls with outwardly convex peripheral surfaces, said elements containing fluid at a pressure sufficient to maintain said peripheral surfaces in stretched condition and being rotatably mounted for passage of the wrapper and enclosed unit therebetween and with said stretched peripheral wall surfaces in rolling engagement with the wrapper to define an area of contact having a convexly curved leading edge disposed transversely of the direction of wrapper movement whereby incident to movement of the wrapper enclosed unit between said elements, the wrapper is progressively pressed from a localized area, in both the forward and lateral directions, into intimate contact with the unit.

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