June 2, 1964 W. A. KEENE ETAL 3,135,078

PACKAGE WRAPPING

Filed May 31, 1961 4 Sheets-Sheet 1

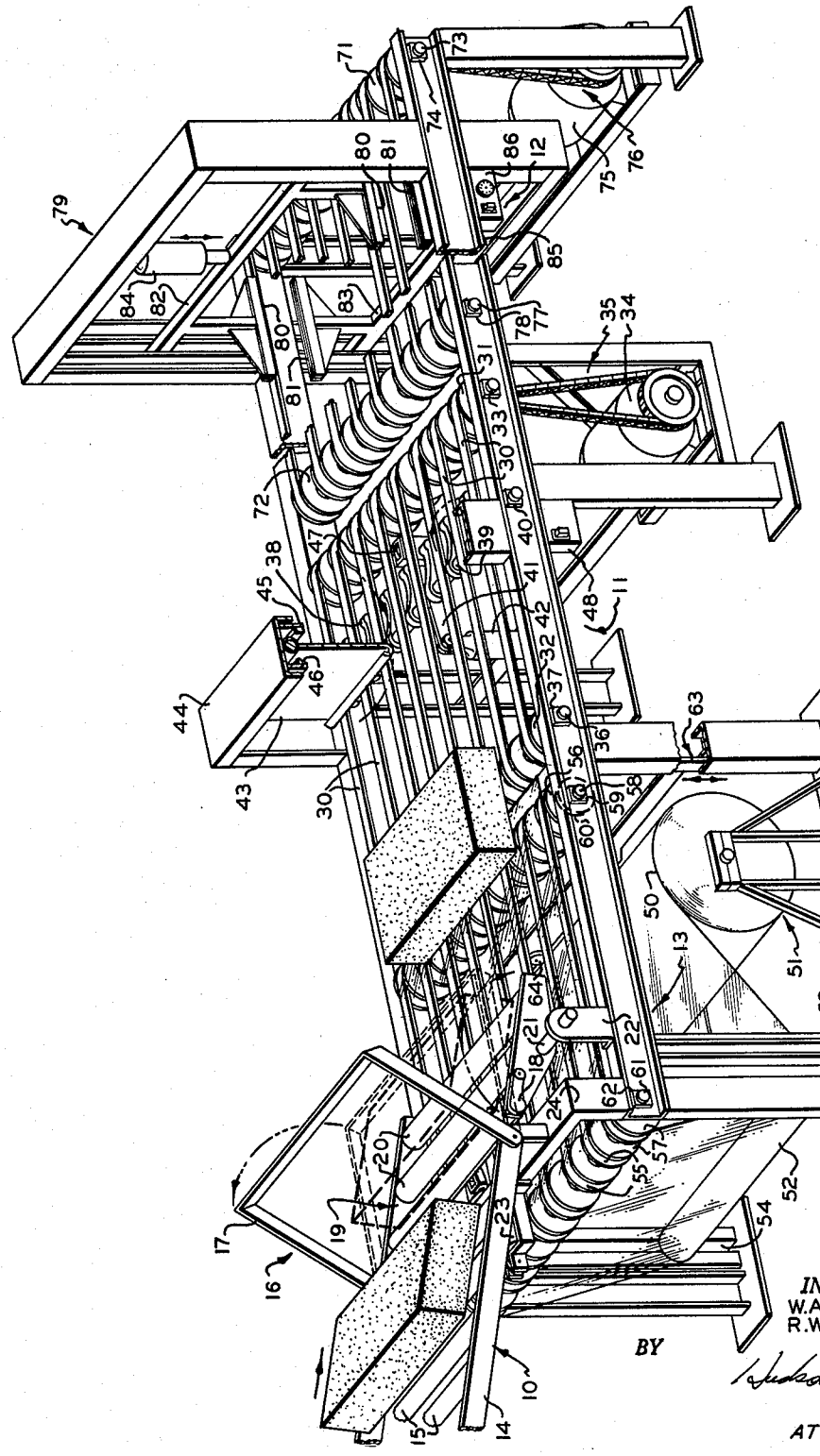


FIG. 1

INVENTORS
W.A. KEENE
R.W. MATTHEWS

BY

Hudson & Young

ATTORNEYS

June 2, 1964 W. A. KEENE ETAL 3,135,078

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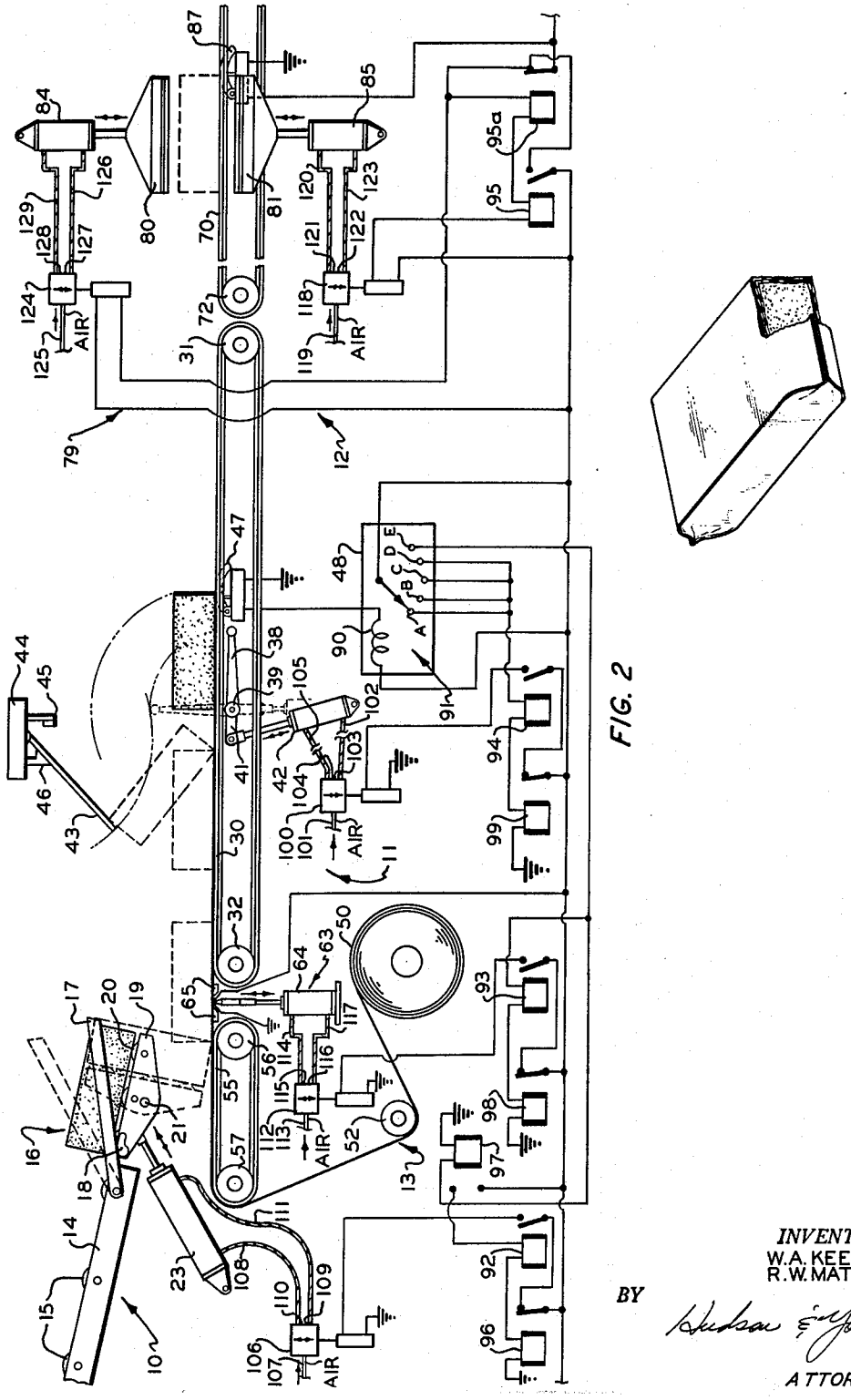


FIG. 2

FIG. 3

INVENTORS
W.A. KEENE
R.W. MATTHEWS

BY Hudson & Young

ATTORNEYS

June 2, 1964 W. A. KEENE ETAL 3,135,078

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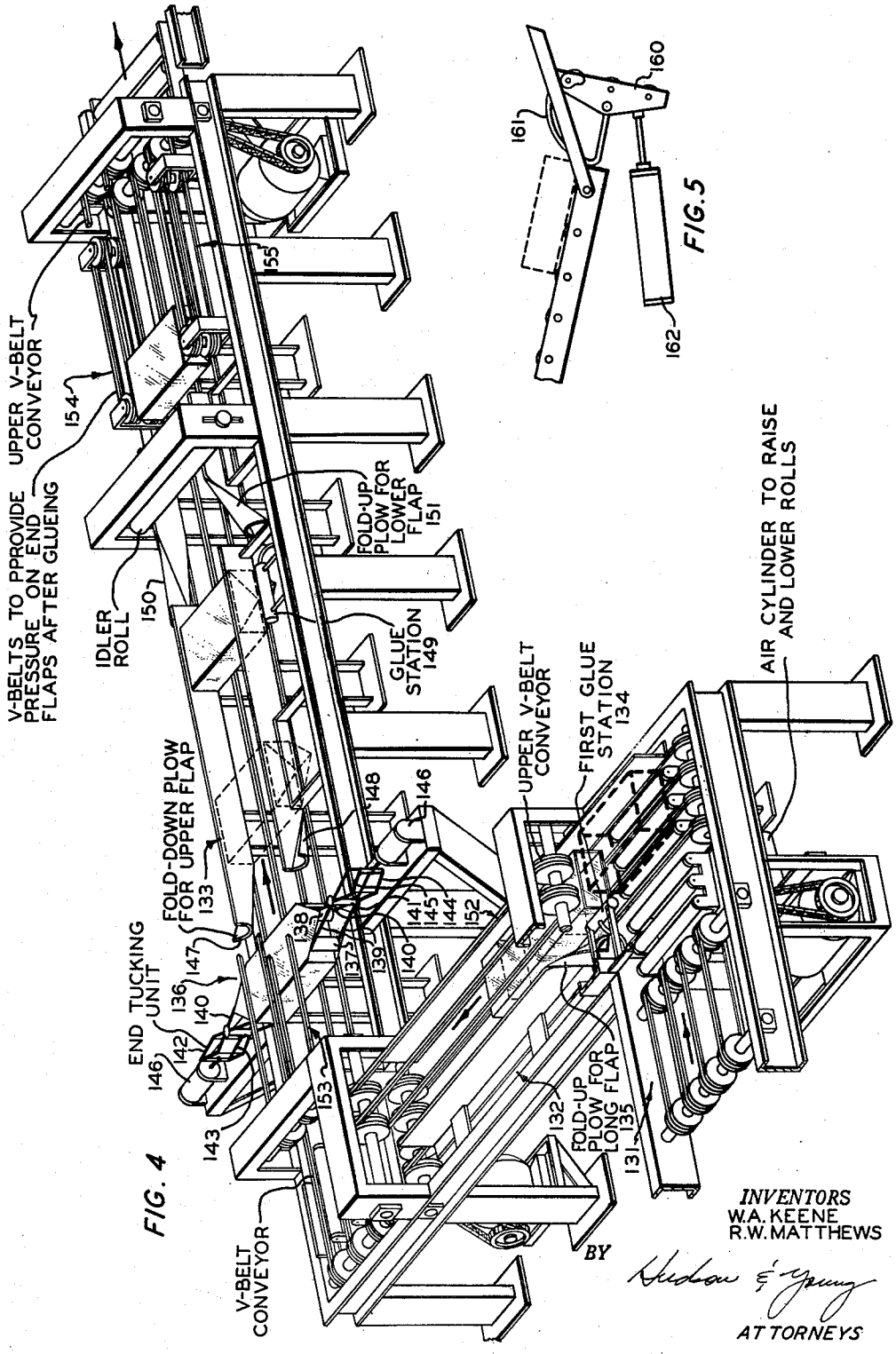


FIG. 4

FIG. 5

INVENTORS
W.A. KEENE
R.W. MATTHEWS

BY Hudson & Young

ATTORNEYS

June 2, 1964 W. A. KEENE ETAL 3,135,078

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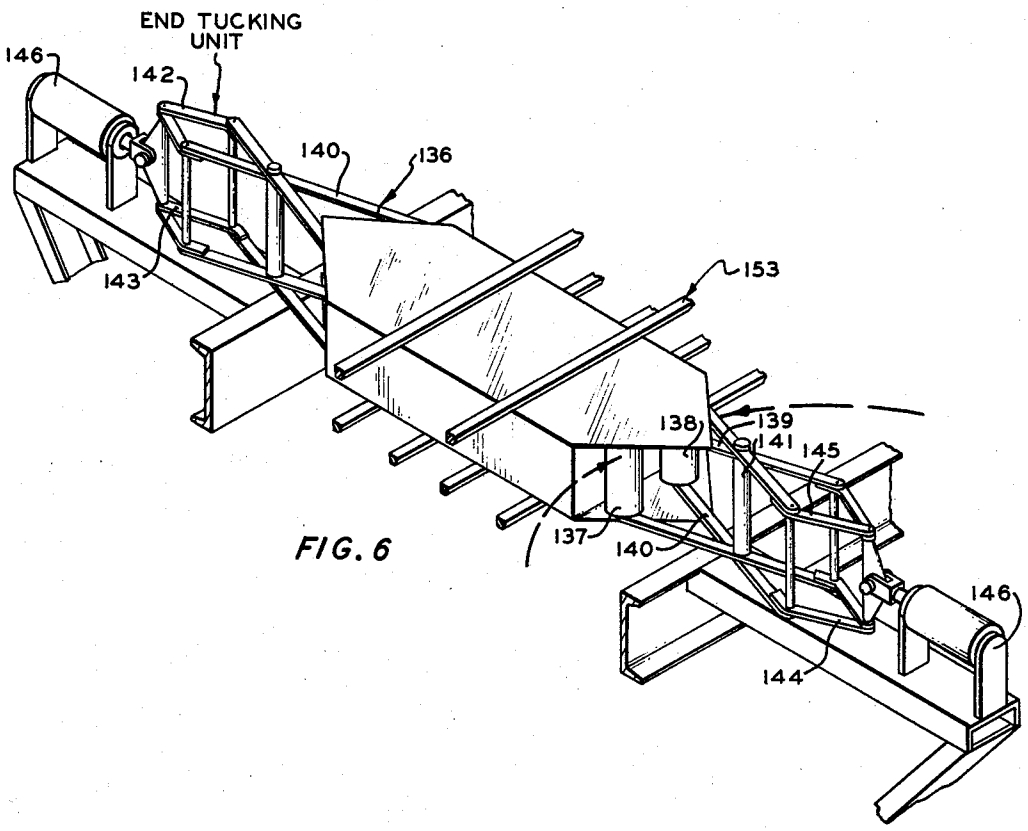


FIG. 6

INVENTORS
W. A. KEENE
R. W. MATTHEWS

BY Hudson & Young

ATTORNEYS

United States Patent Office 3,135,078 Patented June 2, 1964

3,135,078

PACKAGE WRAPPING

William A. Keene and Robert W. Matthews, both of Bartlesville, Okla., assignors to Phillips Petroleum Company, a corporation of Delaware

Filed May 31, 1961, Ser. No. 123,339
7 Claims. (Cl. 53—214)

This invention relates to package wrapping. In one aspect it relates to novel apparatus and method for forming a wrapping on an object by tumbling the object in contact with the wrapping sheet. In another aspect it relates to a novel package comprising an object having a multi-layer wrapper formed of a continuously wound sheet of wrapping material. In another aspect it relates to a novel end tucking device.

Certain types of raw synthetic rubber commonly are formed into bales and packaged in cardboard boxes for shipment to the consumer. To prevent sticking of the rubber to the box and/or to adjacent bales, it has been found that the bales can be wrapped with a polyethylene film. Although the film often sticks to the rubber bale, for most applications the rubber can be processed without removing the adhering polyethylene without adversely affecting the properties of the finished rubber product. However, since the rubber bales normally deform in shipment, when the polyethylene film is tightly adhered to the bale the film has a tendency to split, thus allowing the rubber to come in contact with the cardboard which, unless the cardboard is processed to prevent sticking, results in the rubber adhering tightly to the box and a resulting loss of product or increased handling cost. Bale to bale adhesion also increases handling costs because the bales must be cut or pried apart before processing. I have found that the above-described difficulties can be avoided by placing a continuously wrapped multilayer covering of the polyethylene film on the rubber bale. Such a wrapping can be produced through the use of the novel wrapping method and wrapping machine described herein.

It is an object of this invention to provide an improved package wrapping. Another object of this invention is to provide a novel package wrapping method. Another object of this invention is to provide improved wrapping apparatus.

Other aspects, objects and advantages are apparent from the study of this disclosure, the drawings and the appended claims.

According to my invention there is provided a novel method for wrapping an object by conveying the object and a wrapping sheet forward and tumbling the object backward on the sheet to provide a wrapping around the object. The tumbling step is repeated the number of times required to provide the desired number of layers of the wrapping on the object.

Also, according to my invention there is provided a novel wrapping machine which comprises means for conveying an object to be wrapped and a wrapping sheet therefor forward and means for tumbling the object backward to wrap the sheet around the object. Automatic means are provided to control the number of times the object is tumbled, thereby controlling the number of layers formed by the sheet in producing the wrapping. Means are provided to control the tumbling of the object to maintain it in the desired relationship with the conveying means and the wrapping sheet and to prevent bouncing of the object. An overhanging pivoted member which contacts the backwardly tumbling object prior to its next contact with the conveying means is suitable for controlling the tumbling motion. Sealing means are provided for securing the wrapping around the wrapped object.

Further, according to my invention there is provided a novel end tucking unit comprising rollers and supports therefor and means to move the rollers with a scissor-like motion, and package wrapping and sealing apparatus embodying this unit.

Further, according to my invention there is provided a novel article of manufacture comprising an object wrapped in a multilayer continuous sheet of wrapping material having a width greater than the width of the object.

In the drawing:

FIGURE 1 is an isometric view, partly in cross-section, of a package wrapping machine according to my invention.

FIGURE 2 is a schematic elevation of the apparatus of FIGURE 1.

FIGURE 3 is an isometric view, of a package according to my invention.

FIGURE 4 is an isometric view of a wrapper sealing apparatus.

FIGURE 5 illustrates the operation of a preferred form of dump platform.

FIGURE 6 is an enlargement of a portion of FIGURE 4.

Referring now to FIGURE 1 and FIGURE 2, the wrapping apparatus comprises a first conveyor section **10**, a wrapping section **11**, a second conveyor section **12**, and a film feeding section **13**. First conveyor section **10** includes an inclined frame **14**, a series of rollers **15**, and a feed stop and dump unit **16**. This unit includes a stop frame **17**, pivoted to frame **14** and resting against stops **18** on the frame of dump platform **19**. Platform **19** includes a plurality of rollers **20** and is pivoted around shaft **21** which is held by supports **22**. An air cylinder **23** is attached to a frame **24** and to dump platform **19**.

Wrapping section **11** comprises a plurality of V-belt type conveyor elements **30**, drive pulleys **31** and idler pulleys **32**. Drive pulleys **31** are attached to a shaft **33** which is driven by a motor **34** and a chain drive unit **35**. Idler pulleys **32** are supported on shaft **36** which is journaled in bearings **37**. A plurality of fingers **38** are mounted on a shaft **39** journaled in bearings **40** and connected by means of a crank **41** to an operating air cylinder **42**. A hold plate **43** is pivoted to an overhead frame **44** and is provided with limit stops **45** and **46**. A control actuating switch **47** is provided as shown and connected with control box **48**. Film feeding section **13** comprises a film roll **50** and a film roll support **51**, and a dancer roll **52** provided with cylindrical guide pins **53** which move within guide slots **54**. A plurality of V-belt type conveyor elements **55**, are carried by drive pulleys **56** and idler pulleys **57**. Drive pulleys **56** are attached to a shaft **58**, journaled in bearings **59** and can be driven by means of sprocket **60** by a motor and chain drive unit, not shown. Idler pulleys **57** are supported on a shaft **61** journaled in bearings **62**. A hot wire film cut-off unit **63** is provided for operation in the space between pulleys **32** and pulleys **56** and is actuated by an air cylinder **64**. In some instances it is necessary to provide support guides **65** to control the leading edge of the cut film.

Second conveyor section **12** comprises a plurality of V-belt type conveyor elements **70** supported on drive pulleys **71** and idler pulleys **72**. Drive pulleys **71** are attached to shaft **73** which is supported by bearings **74** and driven by motor **75** through chain drive unit **76**. Idler pulleys **72** are supported by shaft **77** which is journaled in bearings **78**. Sealing unit **79** comprises an upper pair of sealing elements **80** carried by frame **82** and a lower pair of sealing elements **81** carried by a frame **83**. Elements **80** and **81** are actuated by upper air cylinder **84** and lower air cylinder **85** respectively. Elements **80** and **81** are electrically heated and a heat control unit **86** is provided

to maintain a desired constant temperature of these elements.

As illustrated in FIGURE 2, control of the wrapping operation is maintained by means of switches, a stepping switch and relays as illustrated. Coil 90 of stepping switch 91 is energized when switch 47 is closed, switch 91 being the type which steps once upon being energized and cocks when deenergized. Relays 92, 93, 94 and 95 are quick closing and quick releasing while relays 96, 97, 98 and 99 have a time delayed actuation and release more slowly.

The control apparatus for each of the separate air cylinders comprises an air control valve operated by a relay actuated solenoid. For air cylinder 42 a valve 100 normally supplies air from inlet line 101 to conduit 102 which connects with the lower side of the piston cylinder 42 to maintain fingers 38 in the position shown. Upon actuation of solenoid 100 vent 103 is opened, vent 104 is closed and air is supplied through conduit 105 to the upper side of the piston to actuate fingers 38 to the dotted position thus flipping the package backward on the conveyor. Similarly air cylinder 23 is provided with valve 106, inlet line 107, conduits 108 and 111 and vents 109 and 110; air cylinder 64 is provided with valve 112, inlet line 113, conduits 114 and 117 and vents 115 and 116; air cylinder 85 is provided with valve 118 and inlet 119, conduits 120 and 123 and vents 121 and 122; and air cylinder 84 is provided with valve 124, inlet line 125, conduits 126 and 129 and vents 127 and 128.

The operation of the wrapping machine will be described in connection with the placing of a two layer polyethylene film wrap on a bale of raw synthetic rubber. As a bale is conveyed along first conveyor section 10 it is stopped by stop frame 17. With a bale in this position, automatic operation is initiated by manually actuating switch 47 a sufficient number of times to move stepping switch 91 to the E position. When the switch reaches this position, time delay relay 97 is actuated. At the end of the time delay period the normally open contact of this relay is closed thus energizing relays 92 and 96. Quick-closing relay 92 closes its contacts to complete a circuit to the solenoid of valve 106 thus opening vent 109, closing vent 110 and connecting conduit 108 with inlet line 107. This actuates air cylinder 23 to tilt dump platform 19. At platform 19 tilts, stops 18 riding against stop frame 17, lift this frame thus releasing the bale allowing it to be dumped onto the conveyor of wrapping section 11 as illustrated by the dotted lines. A short time later time-delay relay 96 opens its contacts thus deenergizing the solenoid of valve 106, permitting it to return to its normal position in which inlet line 107 is connected with conduit 111, vent 109 is closed and vent 110 opened, thus permitting air cylinder 23 to be actuated to its retracted position, returning dump platform 19 to its normal position in which the next bale will be retained. The wrapping film is not by itself conveyed forward by the conveyor belts of the various conveyor sections, the film being light and the belts merely slipping on the lower face of the film. However, when a bale of rubber is placed on top of the film, sufficient frictional force is applied between the belts and the film to convey both the bale and the film. Thus, the bale proceeds forward, riding on top of the film from film roll 50, and the bale depresses the actuating lever of switch 47 to close the switch. Stepping switch 91 is stepped from position E to position A. In this position relays 94 and 99 are energized. Since relay 94 is quick closing while relay 99 has a time delay, a circuit is completed through the solenoid of valve 100. This opens conduit 105 and closes vent 104 while closing conduit 102 and opening vent 103. Fingers 38 are swung up and to the left in an arc as illustrated thus tumbling the bale backward against hold plate 43 which swings backward against limit stop 46. The bale is held in this position until the conveyor elements 30 have moved sufficiently to move the bale forward to permit it to drop down on these conveyor elements. Since the polyethylene film adheres to the raw rubber bale the film has now been wrapped around the bale until the end of the film is now on the upper portion of the bale and the leading edge and bottom of the bale are entirely covered. Meanwhile relay 99 has operated to open its contact thus deenergizing the solenoid valve 100 permitting it to return to its normal position and the fingers 38 to be returned to their normal, inoperative, position. Since relay 94 is quick opening the first action upon the stepping of switch 91 is to open its contact before the contact in relay 99 is closed thus preventing an actuation of fingers 38 as switch 91 steps.

As the bale progresses forward again, switch 47 is actuated to step switch 91 to position B. The operation of the apparatus at positions B, C and D is the same as for position A and therefore the bale is tumbled backward four times thus making a complete two layer wrap of polyethylene on the bale. However, when the switch 47 is actuated for a fifth time to step switch 91 to position E, fingers 38 are not actuated so the bale is permitted to travel forward to second conveyor section 12. As the switch 91 reaches position E the first result is the actuation of hot wire film cut-off unit 63. Quick acting relay 93 closes to energize the solenoid of valve 112 to close conduit 114, open vent 115, open conduit 117, and close vent 116. This actuates air cylinder 64 to move the hot wire cutter upward against the film thus severing it. At this time relay 98 opens its contacts thus permitting valve 112 to return to its normal position and the hot wire film cut-off to its inactive position. Relay 97 has a time-delay slightly longer than relay 98 and thus closes its contacts a short time after the hot wire cut-off is returned to its normal position. When these contacts are closed relay 92 is energized immediately to actuate dump platform 19 as described above. The time delay of relay 97 is sufficiently long to permit the previously wrapped bale to travel far enough forward that the tail of film which stretches behind is removed from the area in which the next bale to be wrapped is dumped, thus preventing adherence between the tail of the previous wrap and the new bale. As noted above, the film alone without a bale pressing it against the conveyor belts will not be pulled forward; and, therefore, when the next bale drops in position as illustrated in FIGURE 2, the film covers only the trailing portion of that face of the bale, from hot wire cutter 63 to the trailing edge. Thus, a complete cycle of operation has been completed and another bale is now in position on the conveyor of wrapping section 11.

To prevent the formation of a tail of film, the hot wire cutter can be and preferably is actuated prior to one or more of the final tumbling steps. For example, if the hot wire cutter is positioned so that its distance from the trailing edge of the bale when in position to trip switch 45 is less than the width of one side plus the width of one edge, actuating the cutter prior to the last tumbling step results in the side of the bale resting on the severed edge of the film rather than having a tail of film stretching behind the bale. This can be accomplished by interchanging the connections of contacts D and E in control box 48. To make certain the entire bale has at least two complete layers, the distance of hot wire cutter from the trailing edge of the bale as it trips switch 47 must be greater than the width of this edge. Other positions of the hot wire cutter can be utilized and the time of operation of the cutter varied to produce the desired result. For example, if hot wire cutter is sufficiently removed from the position of the bale at the point where it is tumbled, the cutter can be actuated prior to the last two tumbling steps.

The first bale which now has a two layer wrap of the film proceeds to the position of sealing unit 79. Here a switch 87 is closed, thus completing a circuit to relays 95 and 95*a*, the solenoid of valve 118 and the solenoid of valve 124. Air cylinders 85 and 84 are thus actuated

to move sealing elements **80** and **81** together to form a seal of the ends of the film around the bale. Although there is no longitudinal seal in this particular application, this is not undesirable since the film wrapped bale is placed in a box along with other bales. Of course, a sealing step for this end can be provided in those instances in which it is desirable to do so. Relay **95** actuates a pair of contacts in a circuit to an electrically actuated clutch and brake mechanism on the drive system for pulleys **71**, this clutch and brake mechanism not being illustrated. Such mechanisms are well known, and in this instance, the system serves to stop the movement of conveyor **20**, thus permitting the bale to stand at rest while the end sealing operation described above takes place. Relay **95** operates without delay and closes its contacts to complete the circuit to the clutch and brake as described above. Relay **95***a*, on the other hand, has a time delay on opening sufficient to permit actuation of air cylinders **84** and **85** to form the desired seal while the bale remains at rest, after which this relay opens its normally closed contacts which remain open long enough to permit air cylinders **84** and **85** to return to normal and the conveyor to restart even though switch **87** is still closed. Thus, the wrapped bale proceeds onward allowing switch **87** to reopen.

FIGURE 3 is an isometric view, of a completely wrapped bale. For the particular application described, that is, a polyethylene wrap on a raw synthetic rubber bale, it is desirable to have a fairly loose fitting wrapping as shown.

The dump platform **160** illustrated in FIGURE 5 is provided with curved rods **161** and thus acts as an escapement mechanism to control the dropping of the bales on the conveyor. Air cylinder **162**, when it is desired to place another bale on the conveyor, retracts thus rotating the platform clockwise, as illustrated in this figure, dumping the bale which is on the platform and, through the use of curved rods **161**, preventing the next bale from interfering with the operation of the platform.

My apparatus and method are also applicable to a completely sealed wrapping. As one example of an application for such a wrapping, is cited the placing of a two layer paper wrapping upon a bale of rubber which has previously been wrapped with polyethylene or which does not have a tendency to stick to the wrapping. Where the wrapping film does not adhere to the bale, it is necessary to provide some means for attachment. One way which this can be accomplished is to reverse the sequence of operation of the bale drop and film cut-off and to use an adhesive station. Where the wrapping is to be completely sealed, it may be desirable to vary the length of the trailing tail. This can be accomplished, for example, by an earlier actuation of the cut-off means or an additional cut-off means inserted into the system closer to the wrapping station. For this application, a sealing apparatus as illustrated schematically in FIGURE 4 is substituted for the sealing unit **79** and second conveyor section **12** as described above. This sealing apparatus comprises conveyors **131**, **132** and **133**. As the wrapped bale is fed from conveyor **131** to conveyor **132** it passes by a glue station **134** at which point the trailing flap of wrapping is provided with a glue strip and this flap is pressed into place and fastened as the bale passes plow **135**. The ends of the wrapping are folded by a novel end tucking unit **136**. This unit comprises a pair of rolls for each end of the package, each pair actuated by a scissors mechanism. As illustrated, rolls **137** and **138** are rotatively mounted between upper and lower legs of scissors elements **139** and **140**, respectively. Scissors elements **139** and **140** are pivoted at **141** and are attached at the outer ends to connecting arms **142**, **143**, **144** and **145**. These connecting arms are actuated by an air cylinder **146**. As air cylinder **146** is extended, rollers **137** and **138** are moved away from the package, and as the cylinder is retracted, these rollers move in arcs as shown by the dotted arrows to contact the ends of the package to form the end tucks. A similar set of rollers, scissors and air cylinder is provided for the opposite end of the package being wrapped. These units can be actuated by a switch, not shown, over which the bale rides prior to reaching them, and the actual operation can be by relay and solenoid valve actuation of air cylinders **146**.

As the package leaves the end tucking unit, fold-down plows **147** and **148** are contacted, thus folding down the upper flaps, after which the package passes a glue station **149**, and then by fold-up plows **150** and **151**, which press the lower flaps in place to seal the ends of the package. Upper conveyors **152** and **153** and side pressure applying sets of belts **154** and **155** are installed to provide better control for the movement of the package being sealed and to maintain the various portions of the wrapping in sealing position while the glue sets up.

Although the system has been described with air cylinder actuated components and with electrical control circuits, other combinations can be used. For example, hydraulic power cylinders can be substituted for the air cylinders and a pneumatic control system can be used in place of the electrical system described. For such a system the switches **47** and **87** are replaced by spring loaded valves and a pneumatic pulse actuated multiposition, multiport valving arrangement substituted for the stepping switch. Valves having corresponding functions to the relay shown can be used. That is, valves having some delay in their actuation, etc.

Some of the mechanism required for a complete operation has not been shown or described in detail since to do so would unnecessarily complicate and enlarge the application and such details can be added by one skilled in the art. For example, the sealing apparatus illustrated in FIGURE 4 includes air cylinders to raise and lower rolls to permit the package being wrapped to change direction, actuating devices for the glue stations are not illustrated, etc.

The principle of using a continuous double wrapping of a polyethylene film on a synthetic rubber bale allows the wrapping to move, stretch and give as the rubber bale changes its shape and dimensions due to cold flow. A single film wrapping may rupture since it becomes attached to the bale and any deformation of the bale results in deformation of the wrapping which must be accommodated with a very short length of film since it is attached to the surface of the bale. Tests have shown that the second layer, not being attached to the bale surface, is free to stretch over most of its length to permit cold flow of the rubber. When the bale is wrapped with a continuous double layer of polyethylene film there is an additional advantage in that the outer layer upon which any accumulated foreign material will rest can easily be removed just prior to further processing to prevent contamination of the finished product.

Although in most instances the polyethylene wrapped rubber bales are placed in a preformed cardboard box or paper bag for shipment, economic savings can be made by making the final cover by utilizing a wrapped paper cover rather than the preformed container. This can be accomplished by utilizing wrapping section **11** to form the two layer polyethylene cover followed by a similar section used to place the outer paper wrap which can be single or have as many layers as desired for proper protection. A sealing apparatus similar to that illustrated in FIGURE 4 can then be used to seal the paper cover.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention in which are set forth method and apparatus for wrapping an object by tumbling the object in a reverse direction to the direction of travel of the object and the wrapping sheet, a novel end tucking unit comprising scissors actuated rollers, and a novel article of manufacture comprising an object having a continuous multi-layer covering.

We claim:

1. A wrapping machine comprising means for conveying an object and wrapping sheet secured thereto forward and means for tumbling said object backward on said sheet while continuing to convey said sheet forward to wrap said sheet about said object.

2. A wrapping machine comprising means for conveying an object and wrapping sheet secured thereto forward, means for tumbling said object backward on said sheet while continuing to convey said sheet forward to wrap said sheet about said object and automatic means to control the number of times said object is tumbled thereby controlling the number of layers of said sheet around said object.

3. A wrapping machine comprising a conveyor, means for feeding an object to be wrapped to said conveyor, means for feeding a wrapping sheet to said conveyor, said conveyor moving said object and said wrapping sheet secured thereto forward to a wrapping station, means for tumbling said object backward on said conveyor to wrap said sheet about said object, means for restraining the movement of said object while being tumbled to prevent bouncing upon said conveyor, automatic means to control the number of times said object is tumbled, thereby controlling the number of layers of said sheet about said object, and means for sealing said wrapping sheet around said object.

4. A wrapping machine comprising a horizontal conveyor, said conveyor comprising a plurality of drive elements spaced across the width of said conveyor, a plurality of rotatable lifting fingers between said conveyor elements for supplying a lifting force to the forward edge of an object conveyed on said conveyor to tumble said object backward on said conveyor, means for feeding a wrapping sheet to said conveyor, means to feed an object to be wrapped to said conveyor in contact with said film and secured thereto, holding means for arresting the backward tumbling motion of said object to permit said object to contact said conveyor without bouncing, driving means for said conveyor, driving means for said fingers actuated by the movement of said object on said conveyor, automatic means to control the number of times said object is tumbled thereby controlling the number of layers of said sheet around said object.

5. A wrapping machine comprising a horizontal conveyor, said conveyor comprising a plurality of conveying elements spaced across the width of said conveyor, a plurality of rotatable fingers between said conveyor elements for imparting a lifting force to the leading edge of an object being conveyed along said conveyor to tumble said object backward on said conveyor, means for feeding a wrapping sheet to said conveyor, means to feed an object to be wrapped to said conveyor in contact with said film and secured thereto, a pivoted restraining member suspended above said conveyor to restrain the tumbling motion of said object and keep said object directionally positioned relative to said conveyor and to prevent bouncing of said object on said conveyor, driving means for said conveyor, driving means for said fingers, automatic means to control the number of times the object is tumbled thereby controlling the number of layers of said sheet around said object.

6. A wrapping machine comprising means for conveying an object and wrapping sheet secured thereto forward and means for tumbling said object backward on said sheet while continuing to convey said sheet forward to wrap said sheet about said object, end tucking means comprising a pair of vertical rollers at the extremities of a pair of supports having a common vertical pivot and means to rotate said supports about said pivot to move said rollers across one end of said object to fold said sheet across said end of said object.

7. A wrapping machine comprising a conveyor and an end tucking unit, said unit comprising a pair of rollers mounted on a pair of supports having a common vertical pivot, means to move said supports with a scissor-like motion to move said rollers across the end of a package positioned by said conveyor.

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