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APPARATUS FOR LOADING TUBULAR PACKAGING MATERIAL ENDWISE ON SPOOLS

Filed July 29, 1966 3 Sheets-Sheet 1

Fig. 1.

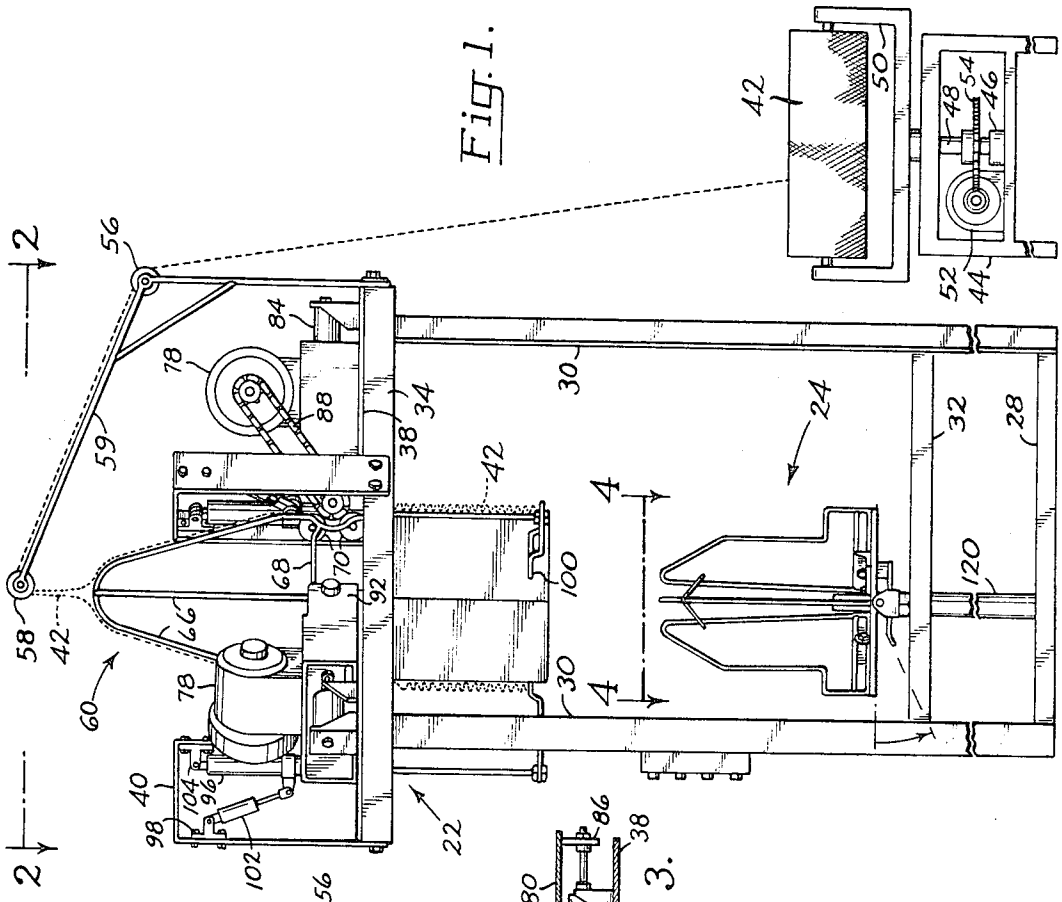


Fig. 2.

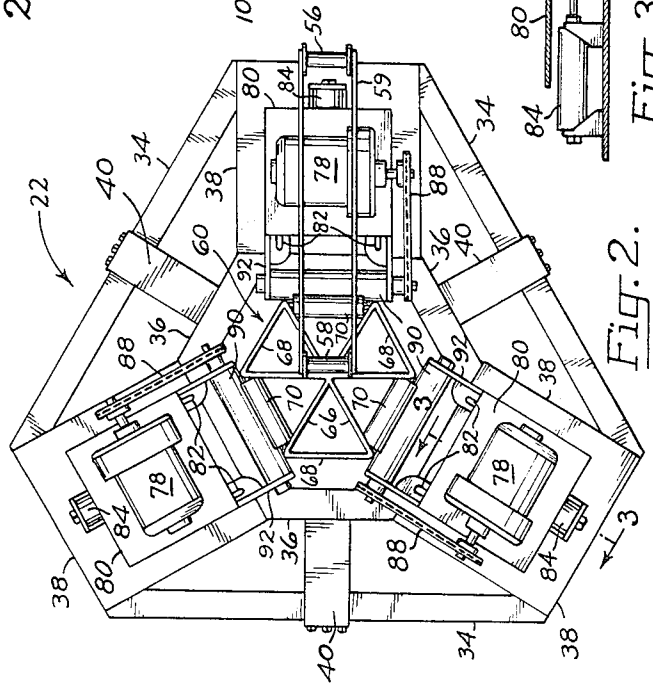
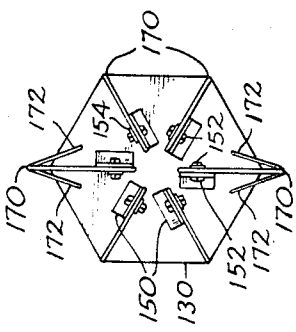


Fig. 3.

Fig. 4.



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APPARATUS FOR LOADING TUBULAR PACKAGING MATERIAL ENDWISE ON SPOOLS

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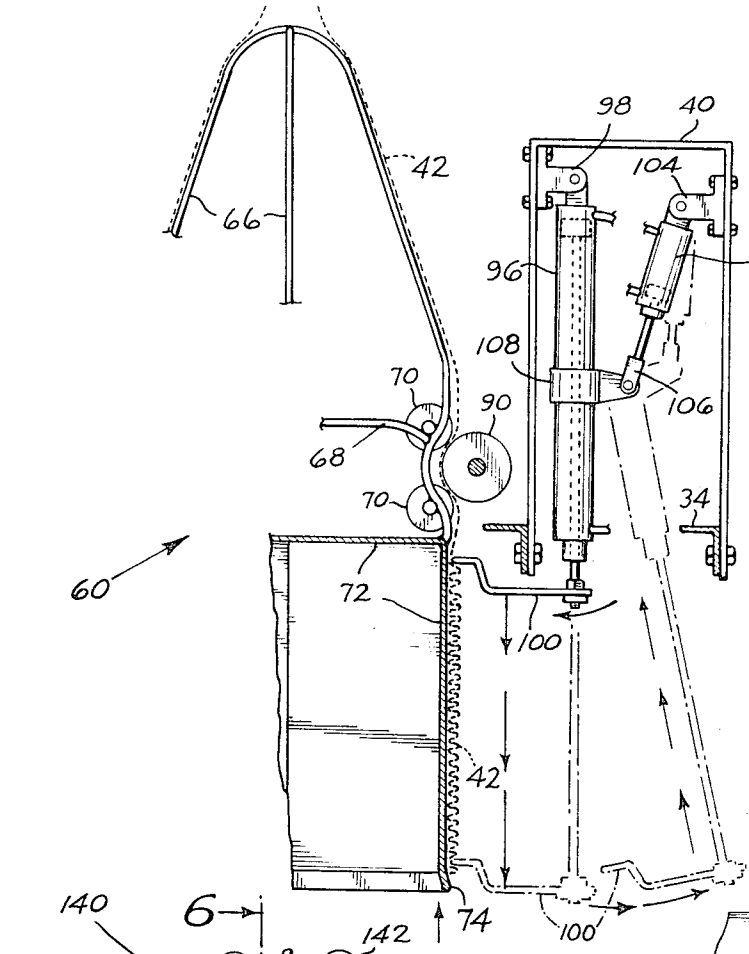
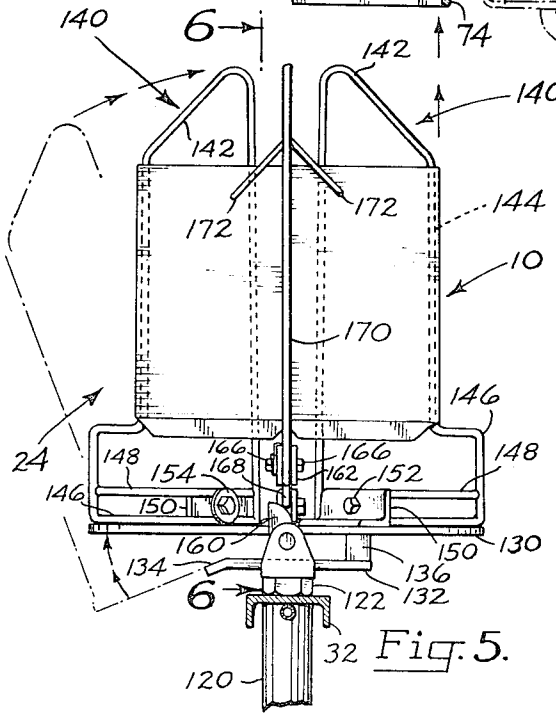


Fig. 5.



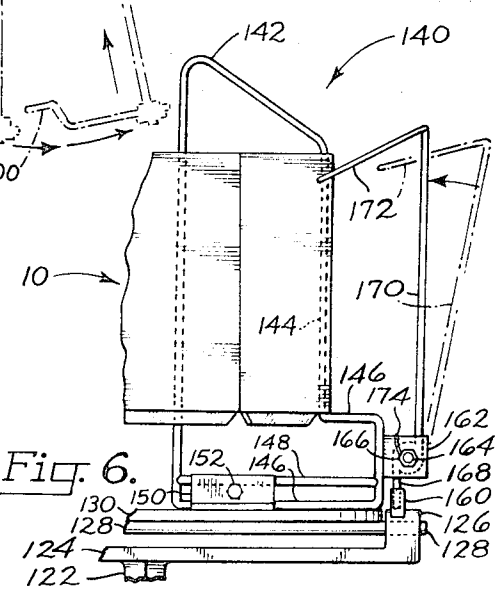


Fig. 6.

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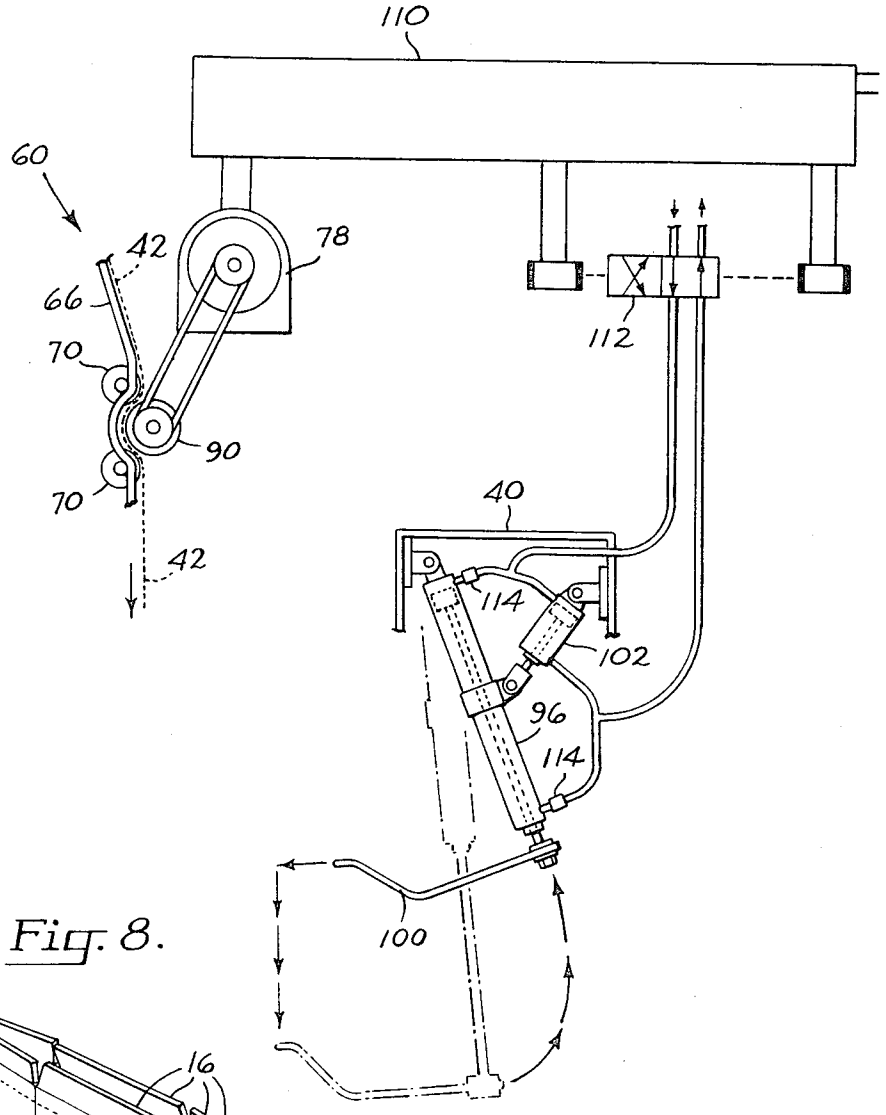


Fig. 8.

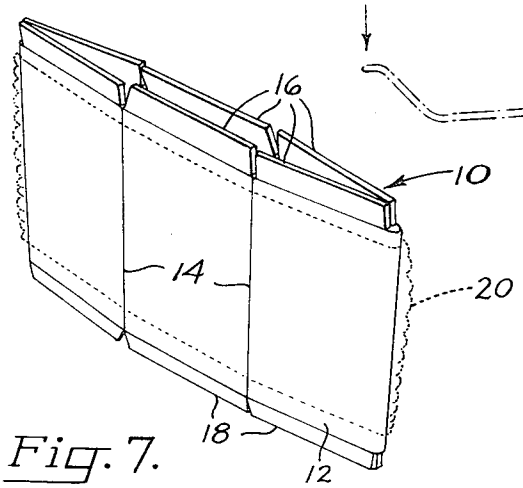


Fig. 7.

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United States Patent Office 3,412,523 Patented Nov. 26, 1968

3,412,523

APPARATUS FOR LOADING TUBULAR PACKAGING MATERIAL ENDWISE ON SPOOLS

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Filed July 29, 1966, Ser. No. 568,803
11 Claims. (Cl. 53—197)

This invention relates to apparatus for loading continuous lengths of tubular mesh plastic or other packaging material endwise on spools for holding and dispensing the same.

The presently described apparatus is particularly adapted for loading continuous lengths of stretchable tubular packaging material endwise on spools to form loaded spools or cartridges useful in the sheathing and packaging of Christmas trees and other commercial products by the method and apparatus set forth in the copending application of Gerald L. Raymond and Gary L. Raymond, Ser. No. 553,846, filed May 31, 1966 and entitled "Sheathing Apparatus and Method," although it is applicable as well to the preparation of loaded spools useful in charging other categories of packaging apparatus.

In accordance with the sheathing method set forth in the patent application aforesaid, the Christmas tree or other article is compressed laterally to relatively small diameter. The compacted tree then is passed through a sheath support which mounts a spool holding a continuous length of mesh plastic or other stretchable tubular sheath material. As the tree passes through the support and through the spool, it frictionally engages the sheath material, pulling it off the support and at the same time packaging the compacted tree. After the tree has left the sheathing station, the compacting pressure is released. This permits the tree to expand to a limited extent against the resilient containing pressure exerted by the sheath. The sheath then is cut and its open ends tied to complete the packaging operation.

It is the general object of the present invention to provide apparatus for loading continuous lengths of mesh plastic or other tubular packaging material endwise on spools to produce loaded spools useful in packaging Christmas trees, garden produce and other articles of commerce by the method described above.

It is a further object of the present invention to provide apparatus for loading continuous lengths of stretchable tubular packaging materials endwise on spools, rapidly, uniformly and in a stretched condition in which it advantageously may be discharged from the spool onto a succession of articles to be packaged.

Still a further object of the present invention is the provision of apparatus for loading continuous lengths of tubular packaging material endwise on spools which apparatus is simple and efficient in operation and inexpensive in its construction.

In its broadest aspect the presently described apparatus comprises a hollow mandrel dimensioned to receive a continuous length of tubular packaging material over one of its ends and to discharge it over the opposite one of its ends. Feed means feed the material continuously onto the mandrel while packing means pack it and compact it thereon in the form of uniform, reverse folds or pleats.

Spool holding means dimensioned for insertion inside the mandrel are mounted on a reciprocating drive which alternately inserts the spool holding means into the interior of the mandrel and withdraws it therefrom. Transfer means are associated with the spool holding means and are operative to transfer the material from the mandrel to the spool during the reciprocative movement of the holding means, thus completing the loading sequence. The loaded spool then may be removed from the holder, another spool mounted upon it and the sequence repeated on a rapid, continuous basis.

The manner in which the foregoing and other objects are accomplished will be apparent from the accompanying specification and claims considered together with the drawings, wherein:

FIG. 1 is a view in elevation of the herein described apparatus for loading continuous lengths of tubular packaging material endwise on a spool for holding and dispensing the same;

FIG. 2 is a plan view of the apparatus of FIG. 1;

FIG. 3 is a detail sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a detail plan view looking in the direction of the arrows of line 4—4 in FIG. 1 and illustrating the construction of the spool holding means;

FIG. 5 is an enlarged fragmentary detail view in elevation similar to FIG. 1 and further illustrating the construction of the apparatus;

FIG. 6 is a fragmentary detail view taken along line 6—6 of FIG. 5 and illustrating the manner of operation of the spool holding means employed in the apparatus;

FIG. 7 is a perspective view depicting the spool in its folded condition and loaded by the operation of the herein described apparatus with a charge of tubular plastic, ready for storage and/or transportation to its end use location; and

FIG. 8 is a schematic view of the drive employed in the operation of the apparatus.

The apparatus in general

The apparatus of the invention is adapted for loading spools having the construction indicated generally at 10 in FIG. 7 with continuous lengths of tubular packaging material. The spool preferably is hexagonal in cross section and is comprised of six segments each indicated at 12 and each connected to the others through hinged connecting sections 14.

Each of the spool segments additionally is provided with terminal flanges 16, 18 which also are hinged to the body of the segment so that they may be folded outwardly or inwardly as desired to provide packaging-material-retaining and guiding sections during use of the spool. A spool of the foregoing construction conveniently may be fabricated from a closed length of cardboard or container board suitably scored and cut to form the structural parts.

The spool thus provided mounts a quantity of tubular packaging material indicated at 20. As has been indicated previously, the packaging material preferably comprises wide meshed resilient plastic such as polyethylene or polypropylene arranged uniformly in reverse folds of pleats so that it may be discharged smoothly over the end of the spool.

It will be apparent that the spool thus constructed and charged with plastic packaging material may be folded to the position of FIG. 7, which is its flat, storage and transport condition, or expanded to an open position, hexagonal in cross section, this being its use position in which a Christmas tree or other product may be passed centrally through the spool and during its traverse encased in mesh plastic sheathing material pulled off the end of the spool by frictional engagement with the tree.

As will be seen from a consideration of FIG. 1, the herein described apparatus basically comprises a mandrel unit indicated generally at 22 with means for charging the same with tubular packaging material, and a transfer unit indiacted generally at 24 for holding an empty spool and transferring a charge of packaging material from the mandrel to the spool.

The mandrel unit

The construction of mandrel unit **22** is shown particularly in FIGS. 1, 2, 3 and 5.

The entire unit is mounted on a frame. The frame includes a base **28** which supports a plurality of posts **30**. The posts in turn support lower cross pieces **32**. They also support a horizontal sub-frame which comprises an outer hexagonal arrangement of angle irons **34** and an inner hexagonal arrangement of angle irons **36** interconnected and supported by inwardly directed platforms **38** and housings **40**.

Platforms **38** and housings **40** alternate with each other to provide six operating stations, three for charging the packaging material to the mandrel and three for packing it thereon, as will appear hereinafter.

The packaging material comprising a continuous roll **42** of mesh plastic is rotatably mounted on a reel which itself may be rotated as required to remove from the material the twists which have been placed in it as it is rolled at the factory.

To this end a base **44** mounts a thrust bearing **46** which supports the lower end of shaft **48**. The upper end of the shaft is fixed centrally to a yoke **50** in which are journaled the shafts of reel **42**.

A reversible motor **52** also is mounted on the frame. It engages a gear **54** keyed to shaft **48**. The entire reel thus may be rotated at a speed and in a direction calculated to remove any twists which may be present in the material.

The continuous length of material passes upwardly over a pair of guide pulleys **56**, **58** rotatably mounted on a standard **59**. It then is threaded over a floating mandrel **60** which serves the triple functions of stretching the material laterally; second, loading it uniformly in reversely folded condition; and third, packing it so that a substantial amount may be charged to the mandrel.

To accomplish these functions the mandrel is divided into two sections, an upstream guiding and stretching section, and a downstream loading and packing section.

The upstream stretching section comprises a cone-shaped framework of vertical bars **66**, there being six such bars for a hexagonal spool, laced together with horizontal bars **68**.

The lower portions of vertical bars **66** are bent inwardly arcuate and rotatably mount three pairs of vertically spaced idler rollers **70**. These are employed in conjunction with the drive for feeding the material onto the mandrel. One such pair of idler rollers is present directly opposite each of platforms **38**.

The downstream section of the mandrel comprises an inverted case or shell **72** in axial alignment with nose portion **62** and hexagonal in contour, where a hexagonal spool is to be loaded. The cross sectional dimension of the case is somewhat greater than the cross sectional dimension of the spool so that the latter may be inserted within the former. The lower portion of case **72** is provided with an outwardly directed flange **74** which serves a retaining function.

The drive means employed for driving the tubular packaging material over the mandrel is also employed to support the mandrel so that it floats centrally of the apparatus. The construction of the drive means is shown particularly in FIGS. 2, 3 and 5.

Each of platforms **38** supports a motor **78** mounted on an inverted, cupped plate **80**. The lower edges of plate **80** are bent inwardly to provide a pair of guideways **82** which receive studs extending upwardly from platform **38**. The plate which mounts the motor thus is adjustable radially with respect to mandrel **60**, as required to remove the mandrel entirely from the apparatus, as when threading the tubular material over the mandrel, and as required also to adjust the pressure applied to the tubular material for engaging it securely.

The motor mounting plate is adjusted by means of a fluid-operated cylinder **84**, FIG. 3, mounted on brackets

welded or otherwise fixed to plate **38**. The cylinder also works in a radial direction with respect to the mandrel. Its piston rod is bolted to a cross-head **86** which is fixed to the underside of motor mounting plate **80**, transversely thereof.

Motor **78** drives a chain **88** which in turn drives a roller **90**, the shaft of which is mounted in bearings supported on arms **92** extending inwardly from plate **80**. Drive roll **90** thus is placed in pressure frictional engagement with idler rolls **70**, with the result that tubular packaging material threaded between the rolls may be driven onto the downstream or holding portion of the mandrel at a rate commensurate with the rotational speed of the drive roller.

If desired, however, as to insure a more positive drive, this arrangement may be reversed and rolls **70** made the drive rolls and roll **90** the idler roll.

As the tubular sheet material is fed to the loading part of the mandrel, it is packed thereon by packing units, the construction of which is shown particularly in FIG. 5.

Each of housings **40**, mounted alternately between platforms **38** and drive rolls **90**, mounts a pair of cooperating fluid-operated cylinders. Both cylinders operate in a substantially vertical plane. The base of the first cylinder **96** is pivoted to a bracket **98** which is bolted to the upper part of one of the side walls of housing **40**.

The cylinder depends freely from the bracket. The piston rod mounts a horizontal arm **100** which may be contoured appropriately from a reversely bent length of bar material to provide a terminal contact section which contacts the tubular material **42** as it is loaded on the mandrel. The stroke of cylinder **96** is substantially equal to the length of the mandrel loading section.

The base of the second fluid-operated cylinder **102** is pivotally attached to and supported by a second bracket **104** bolted to the opposite side wall of housing **40**. It too is freely suspended. Its piston rod carries a yoke **106** which is pivoted to a plate extension of a collar **108** fixed about cylinder **96**, centrally thereof. The stroke of cylinder **102** is relatively short as compared with the stroke of cylinder **96**.

Cylinder **96** serves the function of packing the material on the loading section of the mandrel. Cylinder **102** serves the function of oscillating cylinder **96** through a short arc as required alternately to bring arm **100** to bear against the material during the downward packing stroke of cylinder **96**, and to swing it outwardly out of engagement with the material during the return stroke of cylinder **96**, as is indicated by the dotted line positions of the cylinders and the arrows of FIG. 5.

The operation of the packing unit is further explained schematically in FIG. 8.

At the start of the operation an electric timing circuit contained in unit **110** is energized. This circuit drives motors **78** for a length of time predetermined to load the desired amount of tubular material on the mandrel loading section. It also operates a solenoid-operated valve **112** which controls the operation of cylinders **96**, **102**.

It is to be noted that the fluid circuit includes, in addition to cylinders **96**, **102** and solenoid-operated valve **112**, a pair of constricting valves **114**. These are so arranged that when fluid under pressure is fed through a common line to both of cylinders **96**, **102**, cylinder **102** is energized first to swing cylinder **96**, and hence packing arm **100**, to the operative packing position, or the inoperative return position of the latter, as the case may be. Then after cylinder **96** has moved to such position, it is actuated and performs its indicated function.

The operation of mandrel unit **60** is continued until it has been charged with the desired quantity of tubular material. For example, when charging the mandrel with plastic mesh material to be used in packaging Christmas trees, a charge of 2½ pounds of packaging material may be put on the mandrel in a time span of about 4 minutes.

This charge then is transferred to polygonal spool **10** by the transfer unit indicated generally at **24**.

The transfer unit

The construction and mode of operation of the transfer unit are illustrated particularly in FIGS. 5 and 6.

Base **28** and frame cross piece **32** support a vertically-arranged, fluid-operated cylinder **120** of substantial length. A pad **122** is welded to the piston rod of the cylinder. A bar **124** is welded to the pad. The bar mounts at each end a bearing **126** in which is journaled a pivot rod **128**. A horizontal plate **130** is welded to the rod.

Plate **130** thus can pivot angularly between the full line and dotted line positions of FIG. 5. It is supported in each of these respective positions by means of a bar **132**, one end of which is bent angularly to form a stop section **134** for supporting plate **130** in its angled, dotted line position, and the other end of which mounts a pad **136** for supporting the plate in its upright, full line position.

Plate **130** mounts a framework for supporting spood **10**, as well as claw means for scraping tubular packaging material **42** accumulated on the loading section of the mandrel onto the spool.

As seen particularly in FIG. 5, the supporting framework comprises a plurality of metal rods bent to form closed loops, indicated generally at **140**. The upper portion **142** of each loop is tapered to provide a cone section adapted to guide the spool onto the framework. The intermediate section **144** is of substantial extent and is adapted to support the spool in its operative, loaded position. The base section **146** is of somewhat greater cross section than either the intermediate section or the cone section. It forms a support for the spool, locating it properly. It also provides a means for securing the frame section to plate **130**.

To this end a rod **148** is welded across the base section **146**. The rod is spaced from the lower segment of base section **146** a distance calculated to provide a guideway which makes it possible not only to mount the frame section, but also to adjust it radially to accommodate spools of different diameters.

For this purpose a plurality of radially extending angle irons **150**, one for each frame section, are welded to the upper surface of plate **130**. A locking bolt **152** extends transversely through each angle iron and through the guideway formed by rod **148**. A washer **154** is present on the other side of the rod. Thus frame section **140** may be located and maintained in any desired position of radial adjustment by a suitable manipulation of the assembly including bolt **152**.

The transferring function of the transfer assembly is performed by claw elements **172** particularly evident in FIG. 6. Two such elements are present on the opposite sides of the apparatus, diametrically opposite each other.

Each claw is operated by a cam **160** of appropriate contour welded to the outer surface of bearing **126** and extending upwardly therefrom into proximity with base section **146** of spool support frame **140**. A pair of laterally spaced plates **162** are welded to base section **146** and project outwardly therefrom substantially parallel to each other. A short shaft **164** provided on each end with lock nuts **166** is supported between plates **162**. A length of rod **170** is looped pivotally about shaft **164**. A cam follower **168** is welded to the loop of the rod, in engagement with the cam surface of cam **160**.

The central portion of rod **170** extends substantially vertically to an elevation slightly higher than that of spool **10**. Its upper end mounts a bifurcated claw **172** which reaches inwardly and is sloped somewhat downwardly.

Since rod **170** is looped freely about shaft **164**, it may be pivoted from the full line operative position of FIG. 6 to the dotted line inoperative position of that figure by the operation of cam follower **168**, which works when the entire unit is tilted from the full to the dotted line positions of FIG. 5.

In other words, when it is desired to load a spool on, or remove a spool from, the framework, it is tilted manually to the dotted line position of FIG. 5. Claw **172** thereupon retracts to its dotted line position of FIG. 6 enabling removal of the spool from the framework. The reverse occurs when the framework is tilted to its erect, full line position of FIG. 5, claw **172** being returned to the full line operative position by the operation of a spring **174** provided for that purpose.

Operation

The operation of the presently described apparatus for loading continuous lengths of tubular packaging material endwise on spools is as follows:

First, the reel of packaging material as it comes from the producer is mounted on motor driven revolving yoke **50**. The end of the reel is threaded over pulleys **56**, **58** and about mandrel **60**. This is made possible by retracting cylinders **84** which mount drive rolls **90**.

After the material has been threaded past the rolls, cylinders **84** are advanced until drive rolls **90** are in frictional engagement with idler rolls **70**. This establishes a driving relationship for the material. It also supports the mandrel in a floating condition so that the material passes freely about it.

Next, timer **110** is energized. This initiates a time cycle which loads the predetermined amount of material on the mandrel, packs it, and transfers it to the spools which are to carry it to its end use.

Thus the material is stretched laterally by traversing the cone section of the mandrel, passes between rolls **70** and **90**, and is loaded onto the loading section of the mandrel where it is maintained by flange **74**. By controlling the rate of drive speed and the pressure exerted by drive rolls **90**, it is possible to lay the material on the mandrel in uniform, reverse folds or pleats. These are consolidated by the action of packing arm **100** driven by cylinders **96**, **102** in the cyclic sequence illustrated in FIG. 5.

During this time the operator places an empty spool **10** over the supporting framework **140** of the transfer unit **24**. This is accomplished by tilting the framework to the dotted line position of FIG. 5, which retracts claws **172** to their dotted line position of FIG. 6 in the manner explained hereinabove. The spool is then slipped over the framework and the unit returned to its vertical full line position of FIG. 5. This returns the claws to their full line operative position of FIG. 6.

Since by this time the loading section of the mandrel has been fully loaded, cylinder **120** supporting the transfer mechanism is actuated, automatically or manually, to raise the transfer mechanism in the direction of the arrows of FIG. 5 until it is contained within the hollow, cupped interior of the mandrel. During this motion the downwardly inclined angle of claws **172** causes them to pass smoothly upwardly outside the mandrel and outside the packed charge loaded thereon.

Cylinder **120** then is reversed, withdrawing both supporting framework **140** and claws **172**. Claws **172** thereupon engage the folded material on the outside of the mandrel and scrape it off smoothly onto the outer surface of spool **10**.

When the downward movement of cylinder **120** is complete, the continuous length of packaging material is cut, the loaded spool removed from the supporting framework, a fresh spool placed thereon, and the sequence repeated.

It accordingly will be seen that there is provided an apparatus in which the several objects of this invention are achieved and which is well adapted for the conditions of practical use.

It is to be understood that the form of our invention herein shown and described is to be taken as a preferred example of the same and that various changes in the

shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention or the scope of the subjoined claims.

Having thus described our invention, we claim:

1. Apparatus for loading a continuous length of tubular packaging material endwise on a spool for holding and dispensing the same, the apparatus comprising

(a) mandrel means dimensioned for insertion within the tubular packaging material,

(b) feed means arranged for engaging the material and pulling it over the mandrel,

(c) spool holding means adapted to mount a spool and with the spool mounted thereon dimensioned for insertion inside the mandrel means and for withdrawal therefrom, and

(d) material transfer means associated with the spool holding means and operative to transfer the material from the mandrel to the spool as the spool holding means and spool are withdrawn from the mandrel.

2. The apparatus of claim 1 wherein the mandrel means includes an upstream tapered and guiding section and a downstream material-holding section, the upstream guiding and packaging section being dimensioned to stretch the material laterally and guide it onto the holding section.

3. The apparatus of claim 1 wherein the mandrel means is mounted vertically and includes centrally thereof first roller means, adapted to be traversed by the material, and wherein the feed means comprises cooperating roller means interengaging the first roller means outside the material, and drive means connected to one of the roller means for driving the same in the material feed direction, whereby to support the mandrel in floating condition and drive the material thereover.

4. The apparatus of claim 1 wherein the mandrel means is mounted veritcally and includes centrally thereof support roller means adapted to be traversed by the material, and wherein the feed means comprises cooperating drive roller means interengaging the support roller means outside the material, and drive means connected to the drive roller means for driving the same in the material feed direction, whereby to support the mandrel in floating condition and drive the material thereover, and including also mounting means for mounting the drive roller means adjustably radially with respect to the mandrel means for adjusting the position of the drive roller means with respect to the support roller means.

5. The apparatus of claim 1 wherein the mandrel means is mounted vertically and includes centrally thereof support roller means adapted to be traversed by the material, and wherein the feed means comprises cooperating drive roller means interengaging the support roller means on the opposite side of the material, and drive means connected to the drvie roller means for driving the same in the material feed direction, whereby to support the mandrel in floating condition and drive the material thereover, and including also mounting means for mounting the drive roller means adjustably radially with respect to the mandrel means for adjusting the position of the drive roller means with respect to the support roller means, the mounting means comprising a fixed support, a platform slidably mounted thereon, bearing means on the platform journaling the drive roller means and a fluid-operated cylinder mounted on the support with its piston rod coupled to the platform for adjusting the same and the roller means which it mounts.

6. The apparatus of claim 1 including packing means stationed adjacent the mandrel means and operative to pack the material on the same.

7. The apparatus of claim 1 including packing means stationed adjacent the mandrel means and operative to pack the material on the same, the packing means comprising a first fluid-operated cylinder, pivotal mounting means for pivotally attaching the base of the first cylinder to a support member, a packing arm connected to the piston rod of the first cylinder for reciprocation therewith alternately in packing and withdrawing strokes, a second fluid-operated cylinder, pivotal mounting means for pivotally mounting the base of the second cylinder to a support member, pivotal coupling means for coupling the piston rod of the second cylinder to the first cylinder, the second cylinder being positioned at an angle to the first cylinder and operative to locate the first cylinder in operative packing position with respect to the material on the mandrel during the packing stroke of the first cylinder, and to withdraw it from the mandrel during the withdrawing stroke of the first cylinder.

8. The apparatus of claim 1 including reciprocating drive means connected to the spool holding means for alternately inserting the spool holding means and spool into the mandrel means and withdrawing them therefrom.

9. The apparatus of claim 1 including reciprocating drive means connected to the spool holding means for alternately inserting the spool holding means and spool into the mandrel means and withdrawing them therefrom, the reciprocating drive means comprising a fluid-operated cylinder of predetermined stroke, and means for coupling the piston rod of the cylinder to the spool holding means.

10. The apparatus of claim 1 wherein the material tranfer means comprises claw means operative to scrape the material from the mandrel onto the spool mounted on the spool holding means as the spool holding means and spool are withdrawn from the mandrel.

11. The apparatus of claim 1 wherein the length of material is rolled on a core member in a twisted condition, and including a reel for mounting the core member, mounting means for mounting the reel rotatably in a plane normal to the axis of the reel, drive means for rotating the reel at a rate predetermined to untwist the material, and guide means for delivering the material to the mandrel means.

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