

Oct. 21, 1969

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3,473,291

SHEATHING APPARATUS

Filed May 18, 1967

5 Sheets-Sheet 1

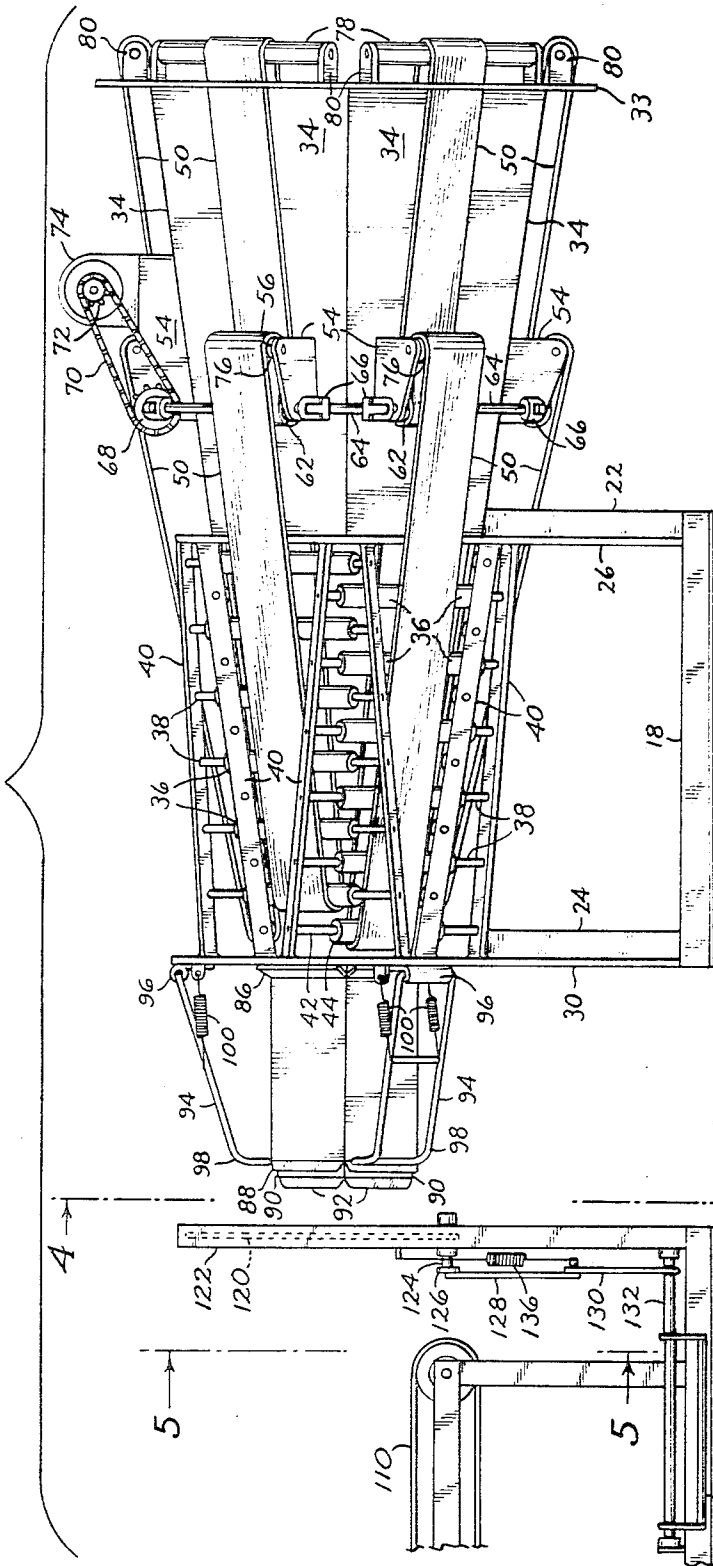
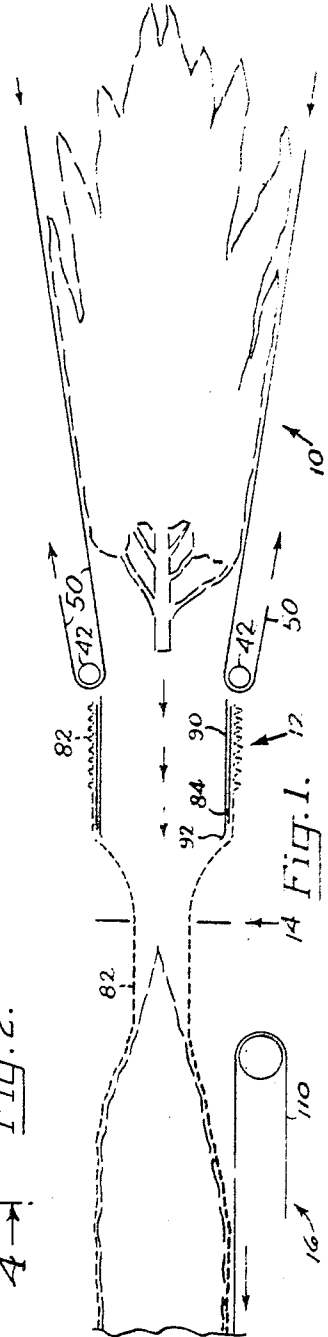


Fig. 2.



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5 Sheets-Sheet 2

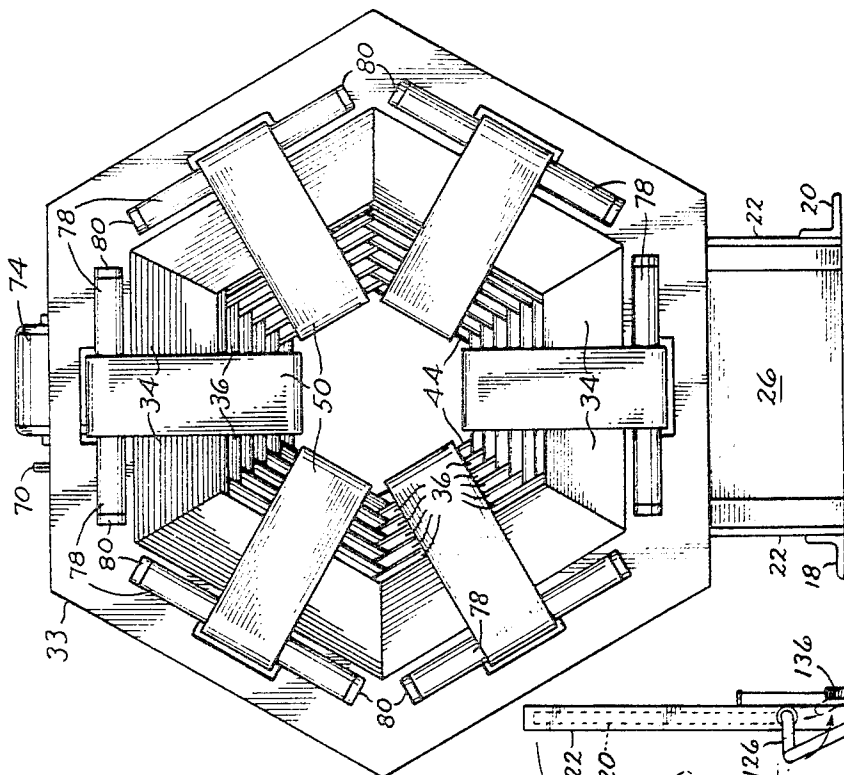


Fig. 3.

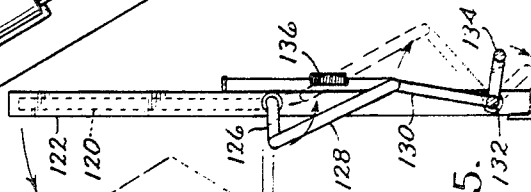


Fig. 5.

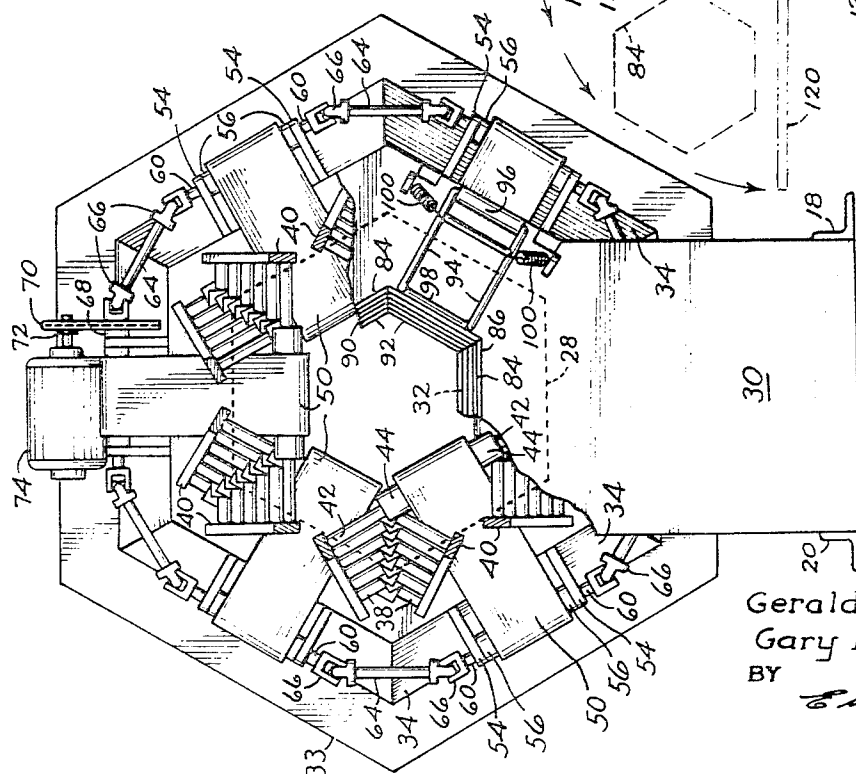


Fig. 4.

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5 Sheets-Sheet 4

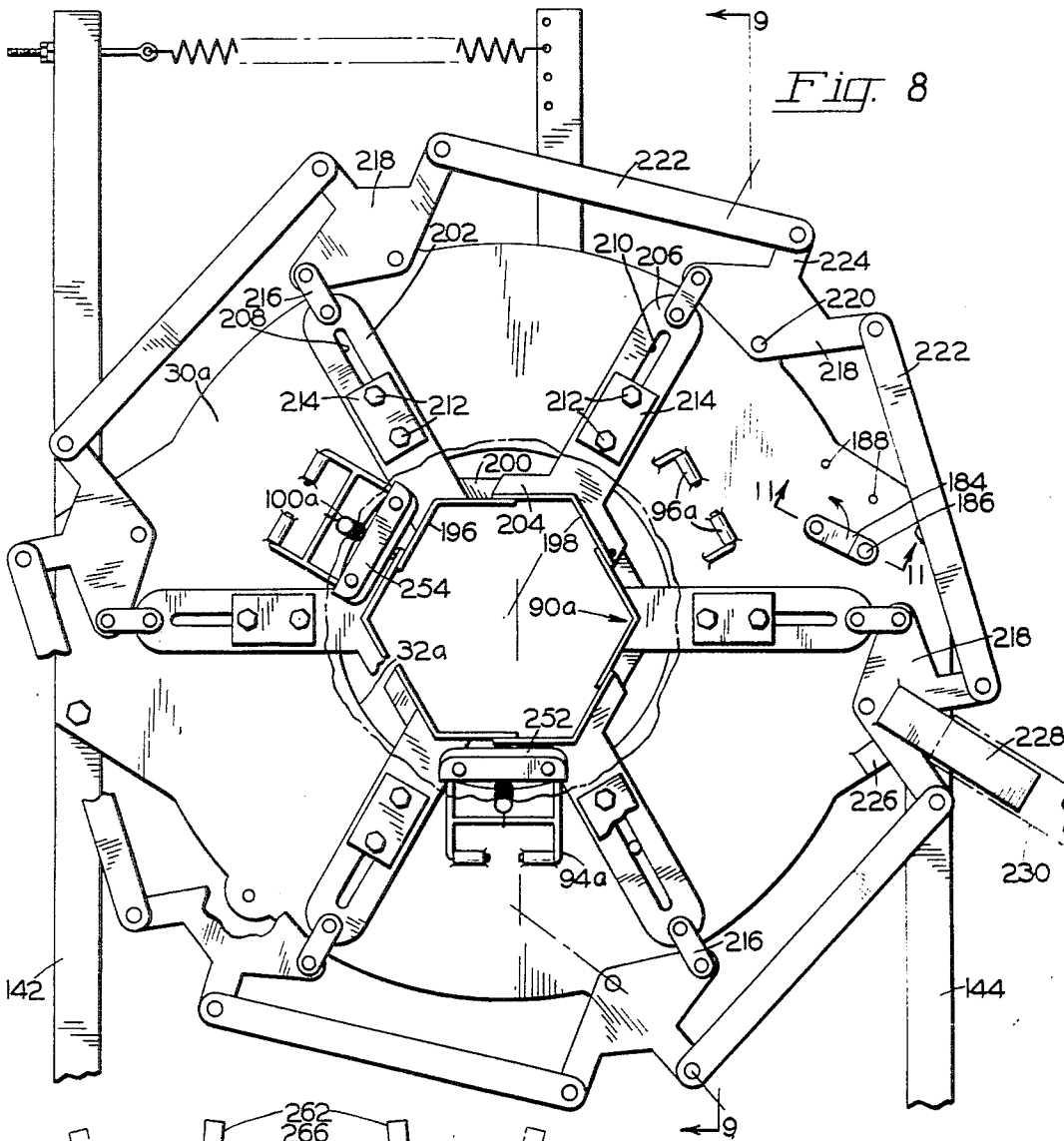


Fig. 8

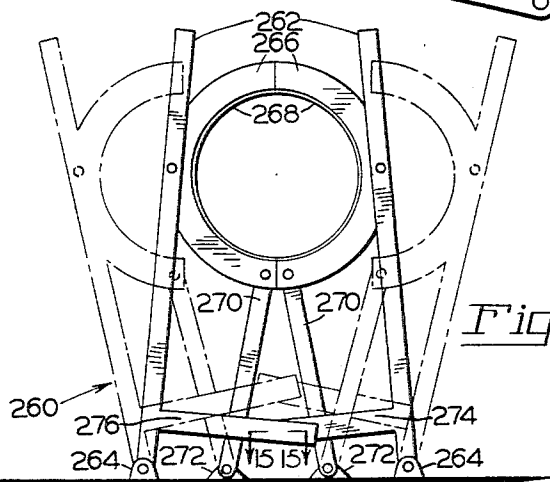


Fig. 14

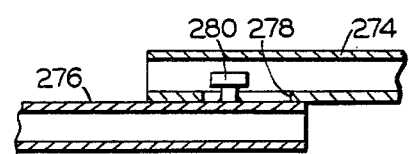


Fig. 15

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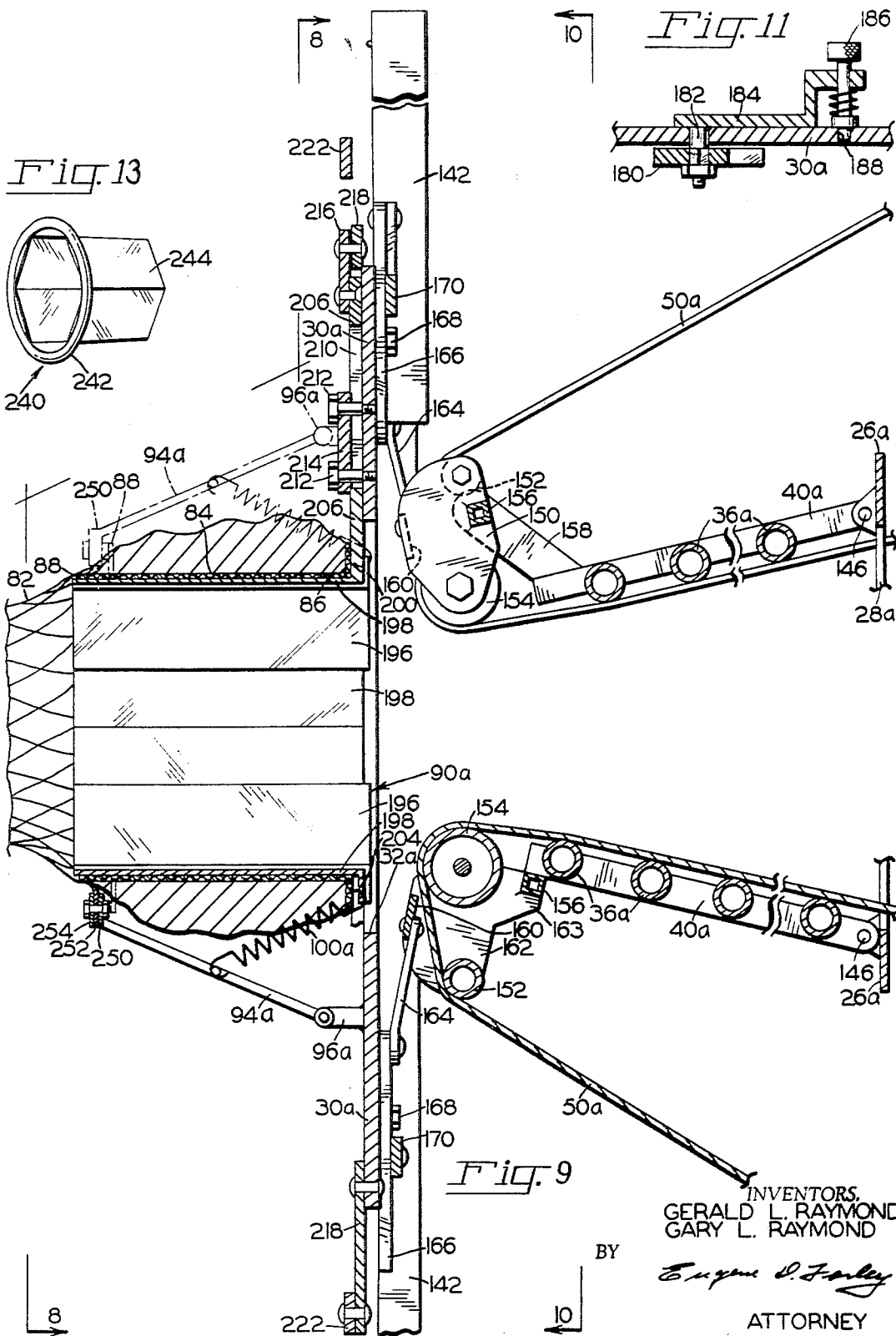
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SHEATHING APPARATUS

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5 Sheets-Sheet 5



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3,473,291

SHEATHING APPARATUS

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Continuation-in-part of application Ser. No. 553,846, May 31, 1966. This application May 18, 1967, Ser. No. 639,344

Int. Cl. B65b 9/10, 25/02, 63/02

U.S. Cl. 53—124

11 Claims

ABSTRACT OF THE DISCLOSURE

Christmas trees and like resiliently compactable articles are sheathed by compacting them laterally to a predetermined diameter. Each article in compacted condition is encased in a tubular sheath of, for example, mesh plastic. The sheath has a diameter greater than the diameter of the compacted article. The article is permitted resiliently to spring back against the confining pressure of the sheath. After the sheath has been applied, it is tensioned in a longitudinal direction and cut while tensioned adjacent the ends of the sheathed article.

This application is a continuation-in-part of the application of Gerald L. Raymond and Gary L. Raymond, Ser. No. 553,846, filed May 31, 1966, for Sheathing Apparatus and Method, now abandoned.

This invention relates to sheathing apparatus. It pertains particularly to apparatus for sheathing Christmas trees in stretchable sheaths made from mesh plastic, or like materials, preliminary to the transportation, storage and marketing of the articles.

The invention is described herein with particular reference to the sheathing and packaging of Christmas trees, although no limitation thereby is intended, it being understood that the invention also is applicable to the sheathing and packaging of other articles as well.

It is the general object of the present invention to provide apparatus and method for encasing Christmas trees and like articles in compacted condition and characterized by the following advantages:

- (1) It is operable on a rapid, continuous basis.
- (2) It is equally applicable in field and plant.
- (3) It may be used to package the trees either individually or in bundles.
- (4) It does not damage the delicate branches of the trees.
- (5) It is applicable equally to the sheathing of large and small trees.
- (6) It is easily loaded.
- (7) It is operable by a crew of only two or three men, reducing labor costs.
- (8) It can be built at relatively low cost, reducing capital investment.

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

FIG. 1 is a schematic view illustrating the sequence of operations by means of which the Christmas trees are enclosed and packaged in a stretchable plastic sheath;

FIG. 2 is a view in side elevation of the compacting and sheathing elements of the apparatus;

FIG. 3 is a view in infeed end elevation of the apparatus of FIG. 2;

FIG. 4 is a view of the outfeed end of the apparatus illustrated in FIG. 2, looking in the direction of the arrows of line 4—4 of that figure, the framing elements of the apparatus being partly broken away better to reveal the inner construction; and

FIG. 5 is a transverse sectional view taken along line 5—5 of FIG. 2 and illustrating knife means for cutting the sheath between individually packaged trees.

FIGS. 6 and 7 are detail fragmentary views of a special knife blade for use in the knife means of FIG. 5, FIG. 7 being a transverse sectional view along lines 7—7 of FIG. 6;

FIG. 8 is a view in elevation of an alternate form of the apparatus, similar to FIG. 4, looking in the direction of the arrows of line 8—8 of FIG. 9;

FIG. 9 is a sectional view of the alternate form of the apparatus of FIG. 8, taken along line 9—9 of FIG. 8;

FIG. 10 is a transverse sectional view of the alternate form of the apparatus shown in FIG. 8, looking in the direction of the arrows of line 10—10 of FIG. 9;

FIG. 11 is a detail fragmentary sectional view taken along line 11—11 of FIG. 8;

FIG. 12 is a fragmentary, longitudinal sectional view of the outfeed end of the apparatus of FIG. 8, illustrating alternate sheath cutting means;

FIG. 13 is a perspective view of a guide ring for use in conjunction with the sheath cutting means of FIG. 12;

FIG. 14 is a view in front elevation of the alternate knife sheath cutting means of FIG. 12, looking in the direction of the arrows of line 14—14 of that figure; and

FIG. 15 is a fragmentary detail sectional view taken along line 15—15 of FIG. 14.

The presently described apparatus and method basically accomplish the following functions:

First the trees or other articles are compressed laterally to relatively small diameters. In the case of trees this is accomplished gradually through a wedging action which permits intracellular fluid flow within the branches and thus prevents breakage. The compacted trees are extruded through a sheath support which mounts spool-fashion a continuous length of mesh plastic or other stretchable, tubular sheath material. As the tree passes centrally through the support 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 sheathed article then is pulled lengthwise to exert longitudinal tension on the sheath segment located between the sheath support and the upstream end of the article. The tension material is tied or stapled at longitudinally spaced intervals and cut in the area between the ties. This is accomplished easily in view of the tensioned condition of the material. The apparatus thus receives a sequence of bushy, uncompacted trees and delivers them undamaged neatly compacted and packaged, continuously, at a high production rate.

Considering the foregoing in greater detail and with particular reference to the drawings:

THE APPARATUS OF FIGS. 1-7

As shown in FIG. 1, in practicing the invention the trees or other articles to be sheathed are passed first through a compacting station 10 where they are compacted over a longitudinal travel interval into relatively small diameter; through a sheathing station 12 where they are encased in stretched mesh plastic or other sheath; through a stapling or tying and cutting station 14 where a sequence of the sheathed articles is divided into individual packaged articles; and through an offbearing station 16 where they are conveyed away to subsequent handling stations, while at the same time tensioning the sheath to facilitate the tying and cutting operations performed at station 14.

The compacting unit

The compacting apparatus located at station 10 is illustrated in FIGS. 2-4 inclusive.

The apparatus is mounted on a frame which includes basically a pair of parallel, longitudinally extending angle iron or other framing members 18, 20 which support spaced parallel, upstream and downstream standards 22, 24, respectively. Upstream standards 22 support a vertical plate 26 having centrally therethrough a hexagonal opening 28. Standards 24 support a vertical plate 30 spaced longitudinally from plate 26 and arranged parallel thereto. Plate 30 is provided with a hexagonal opening 32 aligned with opening 28 in plate 26.

Plates 26, 30 support an elongated inwardly tapered, guideway supported at its infeed end on a plate 33 and serving the dual functions of gradually compacting the trees so that the branches do not break, and of delivering them in compacted condition to the sheathing station.

The guideway is formed in two sections. The upstream section is fabricated from a plurality of tapering, longitudinal plates 34 arranged edge to edge in a polygonal pattern corresponding to the pattern of the openings through plates 26, 30, 33 with which they are aligned.

The downstream section of the guideway is comprised of a plurality of banks of rollers 36 mounted on fixed shafts 38. The shafts of each bank of rollers are supported between pairs of bars 40. The bar pairs extend longitudinally of the apparatus and are welded or otherwise secured to plates 26, 30 in a manner calculated to provide roller surfaces over the entire area of the outfeed portion of the guideway.

Thus the component rollers of each bank of rollers are progressively shorter in the outfeed direction. Also, the banks of rollers are so arranged as to overlap. Still further, the arrangement of rollers is such as to define the polygonal side walls of the outfeed portion of the guideway. The tree branches accordingly do not come in contact with rigid stationary members and are preserved from tearing damage as well as from compacting damage.

Each of bar pairs 40 mounts at its outfeed end a pair of fixed shafts 42 which in turn mount an idler roller 44. The latter roller supports the outfeed end of an endless belt 50 which, together with a group of spaced, longitudinally arranged companion belts constitute a preferred drive for driving the trees through the apparatus. It is to be noted that these belts are of such a width that their downstream segments span almost completely the sides of the polygonal openings in plate 30, as shown in FIG. 3, so that a maximum, positive driving action is obtained.

The upstream ends of drive belts 50 also are mounted in such a manner as to furnish a powerful, positive drive.

Guideway plates 34 mount a plurality of pairs of longitudinally disposed bearing support plates 54, one pair on each guideway plate. Bearing support plates 54 in turn mount longitudinally spaced groups of circumferentially spaced drive rollers and idler rollers.

To mount the drive rollers, bearings 56 are fitted in each of the plate pairs. The bearings support a closed, segmental drive shaft including a number of segments corresponding to the number of sides of the polygonal guideway. For example, if the guideway is hexagonal, the drive shaft has six segments.

As illustrated in the drawings, there thus are provided six driving segments, 60, each provided with a drive roller 62, and six connecting segments 64. All of the segments are arranged end to end and interconnected by universal joints 66.

One of connecting segments 60 is fitted with a sprocket 68. This meshes with a drive chain 70 which also meshes with a sprocket 72 on the drive shaft of motor 74, suitably supported on the frame of the apparatus.

To increase the belt contact surface, and hence to make the belt drive more positive, drive belts 59 also are received about idler rollers 76 rotatably mounted on plates

54, and on cooperating idler rollers 78 rotatably mounted on arms 80 extending outwardly from guideway plate 33. Belts 59 thus are driven synchronously, with their working stretches moving in the direction of the outfeed end of the apparatus, toward sheathing station 12.

The sheathing unit

As noted previously, the function of the sheathing apparatus is to encase the compacted tree with a stretchable sheathing material in order to neatly and securely package the tree. The construction of the sheathing unit is shown particularly in FIGS. 2, 4 and 5.

The mesh plastic or other sheathing material is supplied in the form of a continuous tube 82 of considerable length. The tube in turn is mounted on a spool 84, which conforms in cross section to the guideway of compacting unit 10 with which it is aligned. Thus when the guideway is hexagonal in section, spool 84 also is hexagonal, the faces of the two units being placed in substantial registration with each other.

Spool 84 is made of a suitable structural material, for example, scored and folded container board. At its infeed end it is provided with an outwardly extending radial flange 86 which acts as a retainer. At its outfeed end it is provided with an inwardly tapered guiding section 88.

Spool 84 mounts tubular sheath material 82 in reversely folded condition as shown in FIG. 1. In this way a substantial amount of the sheath material may be packed on each spool. A number of spools normally are preloaded and used one after the other as the sheathing progresses.

Spool 84 with its content of sheath material is dimensioned for mounting on a tubular sheath support or mandrel 90. This also is polygonal in outline. It registers and is coaxial with the guideway through compacting unit 10.

The inner end of sheath support 90 is welded or otherwise fastened to vertical support plate 30, about opening 32 therein. The outer end of the sheath support is formed with inwardly tapering guide sections 92 which facilitates feeding the sheath material over the edges of the support.

Drag or snubbing means are provided for controlling the rate at which the sheath material feeds off the unit, as well as for tensioning the material as it leaves the unit.

The drag or tensioning means comprise a plurality of fingers 94 which are generally U-shaped in outline and made, for example, of heavy wire. As many fingers as required may be provided, as one for every other planar surface of the polygonal spool. In the illustrated form of the invention there are three finger assemblies.

The infeed end of each finger is hinged to plate 30 by means of knuckles 96. The outfeed end of each finger is bent in the direction of the spool, to provide a contact section 98 which contacts the spool surface. Resilient means such as a spring 100 is applied to finger 94 to maintain the finger resiliently pressing against the spool surface as required to place a drag on the sheath material as it feeds out of the apparatus.

It is to be noted that the arrangement of hinge members 96 and springs 100 is such that fingers 94 may be moved angularly through 180° to place them in an inoperative position in which exhausted spools 84 may be removed from mandrel 90 and filled spools placed thereon.

The cutting and tying unit

After leaving sheathing station 12 the sheathed articles pass through a cutting and tying station 14, and onto an endless power conveyor 110 located at offbearing station 16, FIG. 1. Conveyor 110 may be of conventional construction but is driven at a rate which is greater than the rate of progress of the articles through the compacting and sheathing units of the apparatus. Accordingly the stretchable sheathing material, retained against spool 84 by the operation of resilient fingers 94, is stretched and tensioned. In the tensioned condition it is cut very easily by a knife or guillotine assembly, the construction of which is illustrated in FIG. 5.

If desired, preliminary to being cut the stretched sheath between the packaged articles may be stapled or tied at two longitudinally spaced intervals between each adjacent pair of articles, using stapling or tying apparatus not illustrated. The knife then may act to cut the sheathing material in the interval between the staples, resulting in a fully packaged article.

The knife employed for this purpose comprises a vertically positioned blade 120 housed in a vertical case 122. The lower end of the knife is fixed to a horizontal shaft 124 journaled in bearings mounted in the housing. One end of a crank 126 is fixed to shaft 124. The other end of the crank is connected to one end of a connecting link 128. The other end of the connecting link is connected to one end of a lever 130. The lever in turn is connected to a rock shaft 132 to which is fixed a foot pedal 134 stationed conveniently to the operator. Depressing the foot pedal moves the knife from its full to its dotted line position of FIG. 5 against the tension of spring 136, and severs the tensioned sheathing material.

An alternate and preferred form of knife blade for use in the cutting assembly is illustrated in FIGS. 6 and 7. It includes a knife blade 129a having a sharp edge.

A guard 138 overlies the blade and is bolted or riveted to it. The guard is provided with a plurality of spaced fingers 140 which overlie the sharpened cutting edge and extend beyond it. The spacing between the fingers is sufficiently large to permit entry of the sheathed material during the cutting operation. However, it will not permit entry of the fingers of the operator, and thus serves an important shielding function.

Operation of the unit of FIGS. 1-7

An operator standing at the infeed end of compacting unit 10 feeds Christmas trees butt first, one at a time, or in clusters, into the central guideway of the unit defined by the plates 34, belts 50, and banks of rollers 36.

Belts 50 thereupon engage the tree and move it toward the outfeed end of the apparatus.

Since the guideway traversed by the tree is gradually tapered, a wedging effect is produced which gradually compacts the tree. Since an appreciable time interval is required, time is afforded for permitting the fluid contained in the branches of the tree to flow intracellularly, preventing impact breakage of the delicate branches. Furthermore, banks of rollers 36 contact the compacted tree uniformly on all sides, providing moving surfaces which prevent tearing damage to the branches.

As the trees leave compacting unit 10, they next traverse sheathing unit 12. This unit mounts a spool 84 supporting a continuous length of folded mesh plastic or other structural sheathing material. At the beginning of the operation, the endless sheathing material is fed beneath fingers 94 and permitted to extend beyond the plane of mandrel 90 which supports the spool. It thus is placed in the path of the first tree, which engages the mesh material and unravels it from the spool as the tree passes through the sheathing unit.

The tree, still in compacted condition, thus is encased in a smoothly applied resilient sheath. When fully encased, the tree is delivered onto an endless conveyor 110 at offbearing station 16. As noted previously, this conveyor travels at a differential rate which is greater than the rate of travel of the tree through the compacting and sheathing units. As a consequence the sheath is stretched longitudinally so that it may be tied off and cut with knife 120 controlled by foot pedal 134 operated by a workman standing at the outfeed end of the machine. The stretched material between adjacent packaged units is severed cleanly and easily, with or without first tying off or stapling the sheath material in the area to be cut.

Thus two men only, an infeed operator and an outfeed operator, are required to package the trees uniformly and safely, in the field or in the plant, at a packaging rate which is substantially increased over that obtainable

by the use of the apparatus and procedures of the prior art.

THE APPARATUS OF FIGS. 8-15

The apparatus of FIGS. 8-15 provides the significant advantage that it is adjustable to accommodate various sized trees. For example, the sheathing material may be provided in three sizes having diameters of 10, 14 and 18 inches. The trees or bundles of trees to be packaged are pre-sorted accordingly. The apparatus then is set to accommodate a selected size using sheet material of the corresponding diameter. When all the trees of the given size have been packaged, the apparatus may be reset to accommodate the next selected size, and sheath material of corresponding diameter applied.

This desirable result is achieved by making the basic modification of dividing the downstream section of the roller guideway longitudinally into sections, hinging the sections at their upstream ends, and mounting their downstream ends independently of each other so that they may be spread laterally to form discharge openings of greater or smaller diameter as required by the sizes of the trees. Correspondingly, tubular sheath support or mandrel 90 is formed in longitudinally divided sections which may be expanded laterally to mount spools 84 of the appropriate diameter. Thus the guideway and mandrel may be set to provide large, small or intermediate openings, depending upon the sizes of the trees to be packaged.

The modified sheathing apparatus providing these functions is illustrated particularly in FIGS. 8, 9 and 10.

The compacting unit includes a vertical, transversely arranged, plate 26a supported on standards and having centrally therethrough an opening 28a. The unit also includes, downstream from plate 26a, a vertical, transversely arranged plate 30a spaced longitudinally from plate 26a and arranged parallel thereto. Plate 30a is supported on standards 142, 144. It is provided with a central opening 32a aligned with openings 28a in plate 26a.

As in the previously described embodiments, plates 26a, 30a support an elongated, inwardly tapered guideway including banks of interleaved rollers 36a rotatably supported between pairs of bars 40a. Endless belts 50a drive the trees through the apparatus.

To achieve the desired adjustability of discharge opening, the upstream ends of bar pairs 40a are pivoted to support plate 26a by means of pivot pins 146. Additionally, rather than being fixed to downstream support plate 30a, the downstream ends of bar pairs 40a are secured to an expandable mounting resembling an iris diaphragm.

To achieve this purpose, and to permit the necessary interleaving of the roller assemblies as they are moved to their collapsed positions, the six assemblies corresponding to the six sides of the hexagonal mandrel are arranged in two groups of three. The construction and manner of mounting one of such groups is illustrated by the upper assembly of FIG. 9 of the other, by the lower assembly of the same figure.

Each mounting assembly of the first category includes a pair of spaced support plates 150. Rollers 152, 154 are journaled between these plates and mount drive belt 50a. A cross bar 156 is fixed transversely between the plates. At each of its ends it mounts one end of a spacing bar 158, the other end of which is connected to the downstream end of one of roller-support bars 40a. A cross piece 160 welded between the plates serves as the attachment by means of which the assembly is supported and operated.

Each mounting assembly of the second category is constructed similarly to that described above, except that rollers 152, 154 are journaled between plates 162 having integral extensions 163. These mount cross bar 156 which supports the downstream ends of longitudinal roller-support bars 40a.

The transverse support bars 156 in the two categories of mountings thus are spaced from each other in the

manner required to permit interleaving and overlapping of the roller assemblies without conflict.

The drive for the roller and belt mounting assemblies is illustrated particularly in FIG. 10. Each of the mounting assemblies is connected through a link 164 to one end of a bell crank lever 166. The latter comprises a diamond shaped plate pivoted intermediate its ends to structural support plate 30a by means of a pivot pin 168.

The end of bell crank 166 opposite connector 164 pivotally mounts one end of connecting link 170, the other end of which pivotally is connected to the next adjacent bell crank at a point opposite its pivot pin mounting. In this manner all of the bell cranks are connected, so that moving one in a first direction moves all in the same direction. This effects an iris-like closing or opening of the roller and belt elements comprising the guideway.

The bell cranks, and hence the guideway opening, normally are maintained resiliently in their position of maximum closure by means of a spring or other resilient element 172, one end of which adjustably is connected to support post 144 and the other end of which adjustably is connected to a short support post 176 welded to the side face of one of bell cranks 166 parallel to link 164.

The extent of closure of the bell cranks and of the guideway is determined by an appropriately positioned stop 178 welded to the face of structural plate 30a. Spring 172 urges the bell crank into abutment with the stop, limiting the smallest opening of the guideway to the smallest size of sheath material which is to be applied.

The maximum opening of the bell cranks, and hence of the discharge end of the guideway, also is adjusted. This is accomplished by means of an adjustable stop in the form of a cam 180, FIGS. 10 and 11.

Cam 180 has an arcuate cam surface designed to abut against the side edge of a selected one of bell cranks 166. The cam is adjustably mounted on structural plate 30a by means of a shaft 182 which penetrates the plate. One end of the shaft is secured to the cam on one side of the structural plate, the other end to an adjustment arm 184 located on the opposite side of the structural plate. Arm 184 is angular in configuration and mounts a spring-pressed pin 186. This is insertable in a selected one of openings 188 spaced in an appropriate arc on structural plate 30a, FIG. 8.

Cam 180 is set in a position which limits the maximum opening of the guideway to the diameter of the sheath material employed. Stated otherwise, it prevents the guideway from opening to a diameter greater than the diameter of the sheath material. This insures that the tree will be compacted sufficiently to enter the sheath.

The operation of the iris-diaphragm-like mounting of the roller and belt assemblies thus normally is automatic. As the tree progresses through the guideway, the guideway expands to an outer limit determined by the setting of cam 180. However, such expansion takes place against the force exerted by spring 172, which insures that the guideway will follow the contours of the tree, compacting it efficiently.

In certain instances, manual adjustment of the guideway opening may be required. For example, if a tree becomes lodged in the guideway, it may be desirable to augment the closing drive exerted by spring 172 by the application of a momentary, manually exerted pressure.

Such pressure may be applied by means of a lever 190, FIG. 10. The lever is welded to the side face of one of bell cranks 166. It preferably is provided with an extension 192 which during normal operation of the apparatus is removed.

There further is provided a mandrel or sheath support 90a, the diameter of which is adjustable to correspond to the diameter of the discharge opening of the guideway.

Mandrel 90a thus comprises a plurality of longitudinally-extending, angularly-bent plates of two classes, 196 and 198. The plates are present in a number determined by the number of sides of the mandrel, there being six

when the mandrel is formed in the shape of a hexagon. The angle at which the plates are bent is such to permit overlapping of the plate margins, and their uniform expansion and collapse.

To permit the overlap of the plates, plates 196 of the first class are provided with upstream flanges 200 to the outer faces of which are welded slides 202. The upstream ends of mandrel plates 198 of the second class, on the other hand, are provided with flanges 204 formed with integral slides 206. The components of the two classes of mandrel sections thus are offset longitudinally from each other so that the plates can overlap functionally in the desired manner.

The drive for the plates, illustrated particularly in FIG. 8, is similar to the drive for the adjustable guideway.

Angularly extending slides 202, 206 are provided with longitudinal slots or guideways 208, 210, respectively. These receive pins 212 which in turn secure retaining plates 214. The outer ends of slides 202, 206 are connected by means of pivotally attached links 216 to one end of bell crank levers 218.

The latter comprise diamond shaped plates pivotally attached to the periphery of structural plate 30a by means of pivot pins 220.

The ends of bell crank levers 218 opposite from the points of connection of connectors 216 are pivotally attached to one end of elongated connecting links 222. The other ends of the latter links are pivotally connected to short posts 224 extending outwardly from bell cranks 218 at their midpoints, opposite pivotal connections 220.

All of slides 202, 206 thus may be moved inwardly and outwardly as required to determine the diameter of mandrel 90a. The expansion of the mandrel unit is limited by a stop 226 welded to the outer surface of structural plate 30a and positioned for abutment by an edge of one of bell cranks 218. This prevents the component plates of the mandrel unit from separating to such an extent that they no longer engage one another in overlapped relation. The extent of collapse of the mandrel is determined by abutment of the component plates against each other.

To move the mandrel between its expanded and collapsed condition, there is provided a lever 228 arranged radially and welded to the side face of one of bell cranks 218. The lever is provided with an extension 230 normally applied only when the lever is to be actuated.

Mandrel 90a, like mandrel 90, is designed to mount a spool 84 which holds the sheathing material 82.

The spool is mounted on the mandrel by moving lever 228 until the mandrel is fully collapsed. The spool then is placed on the mandrel and the lever moved in the opposite direction until the mandrel engages the inner side walls of the spool. No other means for securing the spool to the mandrel is required, since passage of the compacted trees through the mandrel keeps it expanded to a size limited by the size of the superimposed spool.

Although the knife assembly of FIGS. 5-7 may be used in conjunction with the compacting and guiding assembly of FIGS. 8-12, it may be preferred in some instances to employ the cutting assembly of FIGS. 13-15.

The knife assembly of FIGS. 5-7 is designed to sever the sheath material in the area between adjacent packaged units. Where the packaged unit comprises a Christmas tree or bundle of Christmas trees of substantial length, it is necessary to encase the article centrally only, leaving the butt and tip protruding. Encasing the butt and tip thus involves the useless application of several feet of sheathing material for each tree, adding substantially to the cost of packaging.

The severing apparatus of FIGS. 13-15 is designed to overcome this problem and to cut the sheath at any desired location in which it overlies the packaged article.

To effectuate the desired result, there is used in conjunction with mandrel 90a and spool 84a a guide ring

indicated generally at 240 at FIG. 13, also seen in FIG. 12. The guide ring comprises a rolled ring 242, which may be fabricated from metal. It has integrated, rearwardly-extending leaves 244. The leaves are bent angularly to form a hexagon, and are dimensioned to slip over the mandrel inside the spool.

To mount the assembly, the loaded spool is placed on the leaves of the ring, which thereafter is slipped over the mandrel.

Ring 242 has a diameter sufficiently large to space the sheath material substantially outwardly from the tree or other item being packaged. This affords opportunity for the knife assembly to sever the material without engaging the branches of the tree.

As the sheath pays off spool 84, it is maintained under tension by means of a plurality of tensioning devices 94a generally similar in construction, function and manner of mounting to fingers 94 of the embodiment of FIGS. 1-7.

Each finger comprises a U-shaped length of rod or heavy wire. The infeed end of each finger is hinged to plate 30a by means of pivot posts 96a. The outfeed end of each finger is provided with a block 250 to which are bolted, in sequence, a contact strip 252 and a retaining plate 254. The contact strip is made of rubber or other resilient material. It is arranged to press the sheath material against the surface of spool 84, or, where ring 240 is used, against the peripheral surface of ring element 242 of that device.

The sheath thus is spaced from the tree in the manner illustrated in FIG. 12 so that it may be severed in any desired location without damaging the tree.

The severing means employed for this purpose is mounted immediately adjacent to, and downstream of, ring 240. It is indicated generally at 260. It comprises a pair of opposed vertical levers 262, the lower ends of which are pivoted to the floor on bearings 264. Two semi-circular halves of an annular knife assembly are fastened at their midpoints to the upper portions of the levers, one half being bolted to each lever. Each half includes a frame 266 on which is mounted an arcuate knife 268 having a serrated cutting edge.

The lower margins of each of the semi-circular halves of the knife assembly are pivoted to the upper ends of a second pair of levers 270. The lower ends of the levers are pivoted in bearings 272 mounted on the floor inside of bearings 264.

Levers 262 are coupled and work together by means of links 274, 276. Link 274 is provided with a slot 278; link 276 with a pin 280.

Pin 280 is received in slot 278 pivotally connecting the two elements in such a manner that as one of levers 262 is moved outwardly, the companion lever also is moved outwardly through the connecting linkage. At the same time, the semi-circular halves of the ring assembly are separated so that the sheath material can pass freely between them.

However, the diameter of the semi-circular knives is somewhat less than the diameter of guide ring 242. Accordingly, when it is desired to sever the moving sheath material at any desired point, levers 262 may be advanced, closing the knife ring. As a consequence the sheath material is snagged on the serrated knife blade in the manner shown in FIG. 12, and immediately severed.

The operation of the apparatus of FIGS. 8-15 thus is generally similar to that of the apparatus of FIGS. 1-7.

However, to accommodate trees or other articles to be packaged of varying diameter, spool 84 first is inserted on mandrel 90a with the mandrel in its collapsed position. Lever 228 then is shifted to expand the mandrel to its open position in which it engages the inside of the spool. Cam 180, FIG. 10, is set in a perforation 188, FIG. 8, which corresponds to the diameter of the spool which has been placed on the mandrel.

The trees are run through the apparatus, whereupon the roller units 36a and companion belts 50a expand and contract in the manner of an iris diaphragm against

the resiliency of spring 172, but to an outer limit determined by the setting of cam 180.

As the trees pass through the apparatus, the sheathing material may be severed between each pair of consecutive units by means of the knife of FIG. 5. In the alternative, it may be severed at any intermediate point by the knife of FIG. 14, provided spacing ring 240 previously has been inserted on the mandrel in the manner shown in FIG. 12. In this manner, a single apparatus may be used not only to package articles of varying diameter, but also, at the election of the operator, to apply the sheathing material along the entire length of the articles being packaged, or to selected segments thereof only.

It is to be understood that the forms of our invention herein shown and described are to be taken as illustrative examples 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 in illustrative embodiments, we claim:

1. Sheathing apparatus comprising

(a) an inwardly tapering enclosed guideway having relatively large and small open ends,

(b) a tubular sheath support mounted on the small end of the guideway aligned and communicating therewith,

(c) the sheath support being adapted to mount a length of folded tubular sheath material and including tensioning drag means positioned in bearing engagement with the sheath material as it pays off the sheath support, the tensioning drag means comprising a plurality of circumferentially spaced fingers arranged longitudinally of the sheath support, the outfeed ends of the fingers being in frictional contact with the sheath material, pivotal mounting means mounting the infeed ends of the fingers to the outfeed end of the guideway, and resilient means connected to the fingers for maintaining them resiliently in contact with the sheath material, and

(d) drive means mounted in the guideway for driving articles to be sheathed through the guideway and the communicating sheaths support, thereby compacting the articles and discharging them through the outfeed end of the sheath support in sheathing engagement with the tubular sheath material mounted thereon.

2. The sheathing apparatus of claim 1 wherein the sheath support is formed of interconnected longitudinal segments, and including means operatively connected to the segments for reciprocating them between expanded and retracted positions relative to each other.

3. The sheathing apparatus of claim 1 including a spool dimensioned for demountable mounting on the sheath support and adapted to mount a length of reversely folded sheath material.

4. Sheathing apparatus comprising

(a) an inwardly tapering enclosed guideway having relatively large and small open ends,

(b) a tubular sheath support mounted on the small end of the guideway aligned and communicating therewith,

(c) the sheath support being adapted to mount a length of folded tubular sheath material, and

(d) drive means mounted in the guideway for driving articles to be sheathed through the guideway and the communicating sheath support, thereby compacting the articles and discharging them through the outfeed end of the sheath support in sheathing engagement with the tubular sheath material mounted thereon,

(e) the drive means comprising a plurality of endless drive belts arranged longitudinally of the guideway in frictional contact with the articles and including

(1) a plurality of banks of rollers mounted longitudinally within the guideway in the down-

stream portion thereof, each bank comprising a plurality of longitudinally spaced rollers disposed substantially normal to the longitudinal axis of the apparatus and arranged in operative contact with the articles to be sheathed,

- (2) pivotal mounting means mounting the upstream ends of the drive belts and roller banks, and
- (3) adjustable mounting means mounting the downstream ends thereof for radial expansion and contraction as required to pass articles of varying size.

5. The sheathing apparatus of claim 4 wherein the adjustable mounting means comprises a plurality of interconnected bell crank levers arranged peripherally about the drive belts and roller banks.

6. The sheathing apparatus of claim 4 including stop means for limiting the minimum adjustment of the adjustable mounting means and adjustable cam stop means operatively associated with the adjustable mounting means for limiting the maximum adjustment of the adjustable mounting means.

7. Sheathing apparatus comprising

- (a) an inwardly tapering enclosed guideway having relatively large and small open ends,
- (b) a tubular sheath support mounted on the small end of the guideway aligned and communicating therewith, the sheath support comprising a plurality of interconnected longitudinal segments and including drive means operatively interconnecting the segments for adjusting them to fixed positions of radial expansion and contraction to accommodate the support to tubular sheath material of predetermined diameters,
- (c) the sheath support being adapted to mount a length of folded tubular sheath material, and
- (d) drive means mounted in the guideway for driving articles to be sheathed through the guideway and the communicating sheath support, thereby compacting the articles and discharging them through the outfeed end of the sheath support in sheathing engagement with the tubular sheath material mounted thereon.

8. The sheathing apparatus of claim 7 wherein the drive means for the segments comprises a plurality of interconnected bell crank levers arranged peripherally outside the sheath support.

9. Sheathing apparatus comprising

- (a) an inwardly tapering enclosed guideway having relatively large and small open ends,
- (b) a tubular sheath support mounted on the small end of the guideway aligned and communicating therewith,
- (c) the sheath support being adapted to mount a length of folded tubular sheath material and
- (d) drive means mounted in the guideway for driving articles to be sheathed through the guideway and the communicating sheath support, thereby compacting the articles and discharging them through the outfeed end of the sheath support in sheathing engagement with the tubular sheath material mounted thereon,

(e) and knife means positioned downstream from the apparatus for transversely severing the sheath material between the sheathed articles, the knife means comprising an elongated knife blade, a standard, pivot means mounting an end of the knife blade to the standard, and resilient spring pressed lever means connected to the knife blade for swinging it in an arc substantially normal to the path of the sheathed articles.

10. Sheathing apparatus comprising

- (a) an inwardly tapering enclosed guideway having relatively large and small open ends,
- (b) a tubular sheath support mounted on the small end of the guideway aligned and communicating therewith,
- (c) the sheath support being adapted to mount a length of folded tubular sheath material and
- (d) drive means mounted in the guideway for driving articles to be sheathed through the guideway and the communicating sheath support, thereby compacting the articles and discharging them through the outfeed end of the sheath support in sheathing engagement with the tubular sheath material mounted thereon,
- (e) and knife means positioned downstream from the apparatus for transversely severing the sheath material between the sheathed articles, the knife means comprising a serrated knife blade formed in two coplanar, meeting, semi-circular halves, and spring pressed lever means mounting the halves intermediate their ends, the knife blade halves being mounted on opposite sides of the sheathed articles and being shiftable by the lever means from a retracted position wherein they clear the sheath and an advanced position wherein they engage the sheath.

11. The sheathing apparatus of claim 10 including spacing ring means and means for mounting the same coaxially on the sheath support for traversal by the sheath material, thereby spacing the sheath material outwardly from the packaged articles for engagement in selected locations by the knife means.

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