June 22, 1965 J. SNYDERMAN ETAL 3,190,195

CONVOLUTE TUBE MAKING MACHINE

Filed May 27, 1963 4 Sheets-Sheet 1

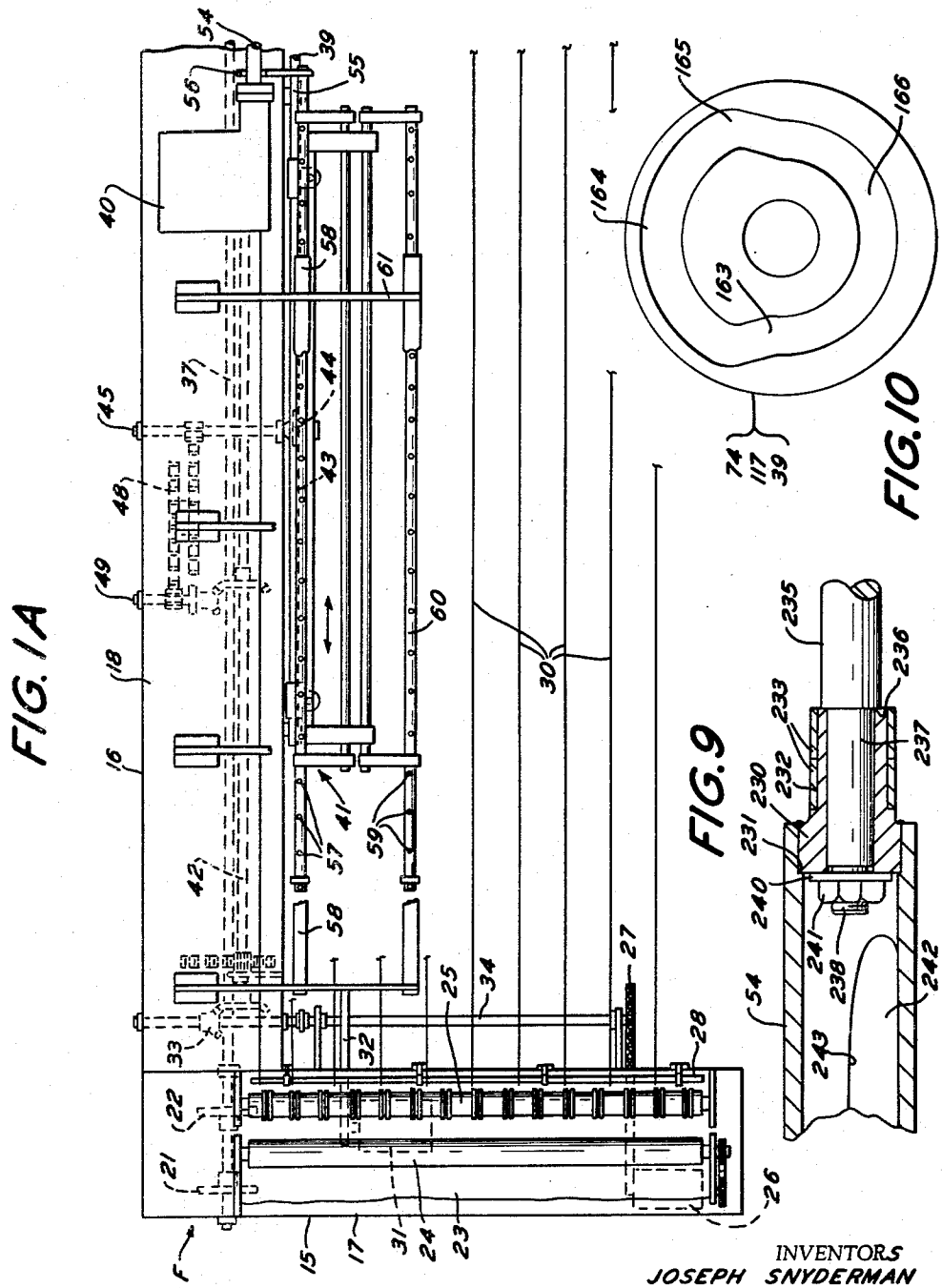


FIG. 1A

FIG. 10

FIG. 9

INVENTORS
JOSEPH SNYDERMAN
MARTIN SCHNABL

BY B. T. Wobensmith III

ATTORNEY

June 22, 1965 J. SNYDERMAN ETAL 3,190,195

CONVOLUTE TUBE MAKING MACHINE

Filed May 27, 1963 4 Sheets-Sheet 2

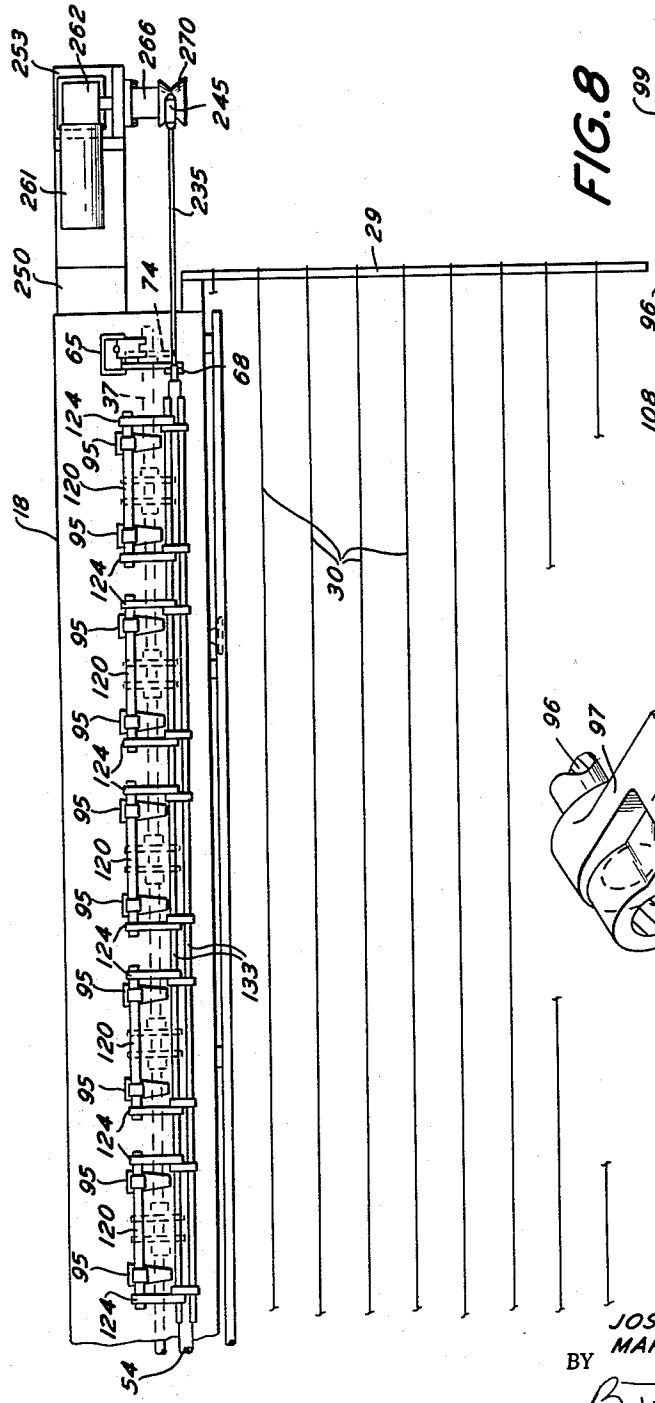


FIG. 1B

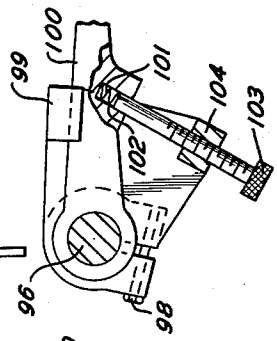


FIG. 8

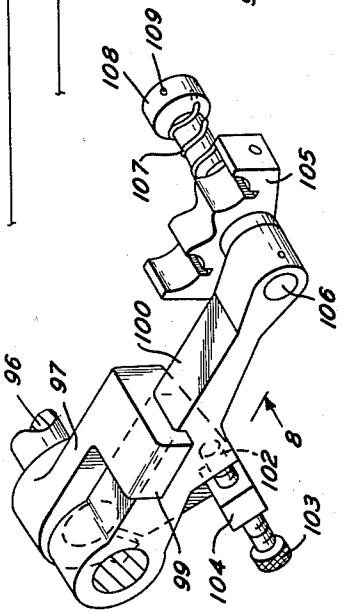


FIG. 7

INVENTORS
JOSEPH SNYDERMAN
MARTIN SCHNABL

BY B. T. Wolbensmith

ATTORNEY

June 22, 1965 J. SNYDERMAN ETAL 3,190,195

CONVOLUTE TUBE MAKING MACHINE

Filed May 27, 1963 4 Sheets-Sheet 3

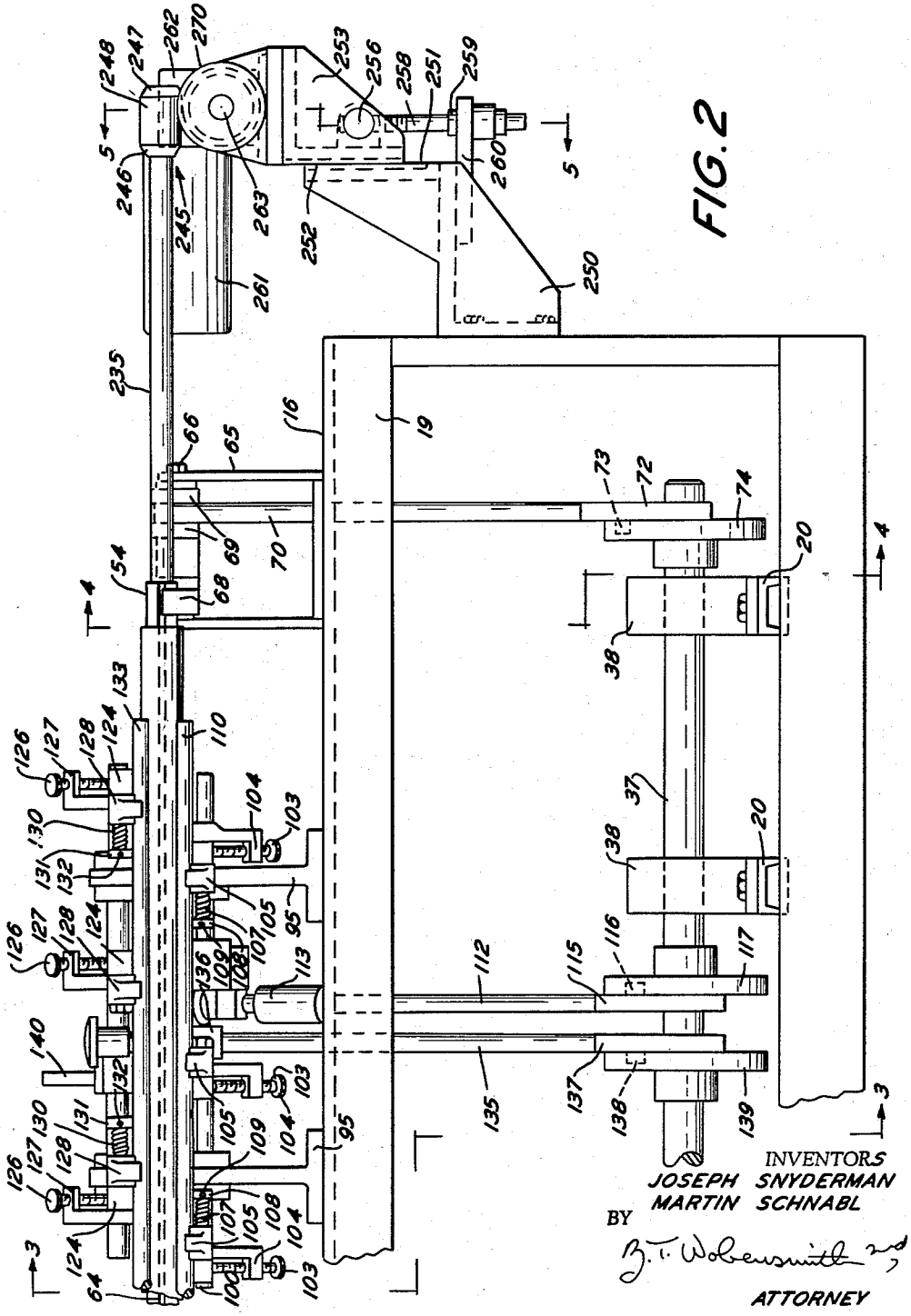


FIG. 2

INVENTORS
JOSEPH SNYDERMAN
MARTIN SCHNABL
BY
B. T. Wolbensmith 2nd
ATTORNEY

June 22, 1965 J. SNYDERMAN ETAL 3,190,195

CONVOLUTE TUBE MAKING MACHINE

Filed May 27, 1963 4 Sheets-Sheet 4

FIG. 3

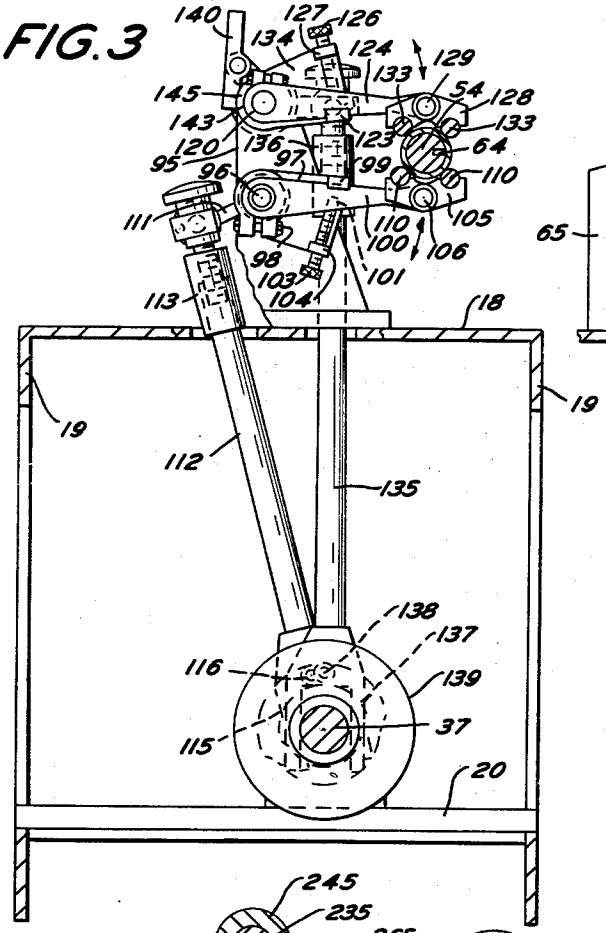


FIG. 4

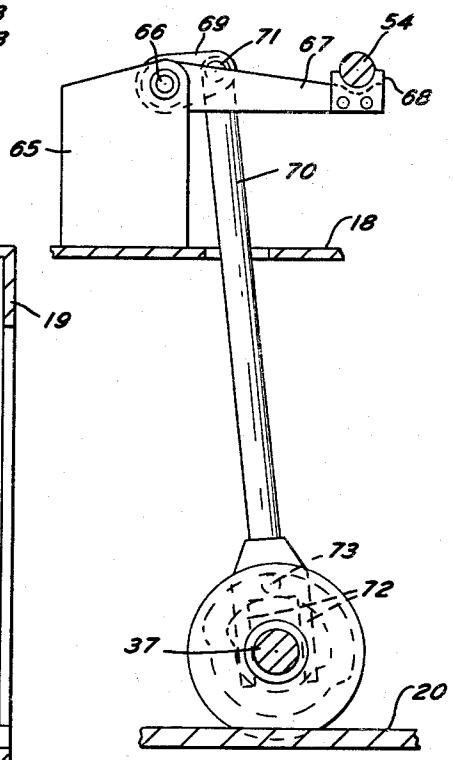


FIG. 5

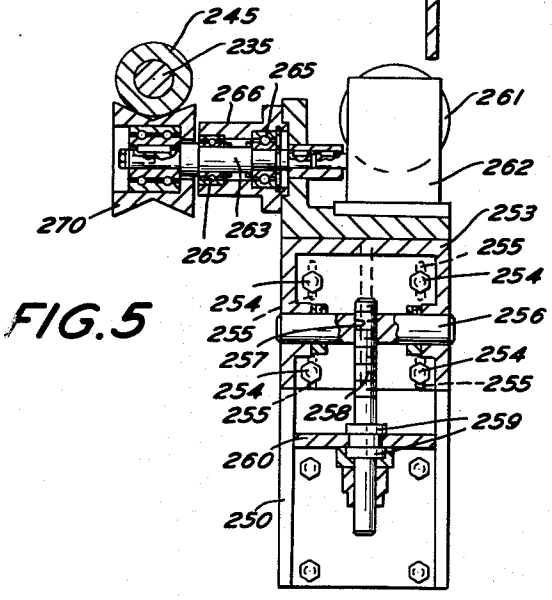
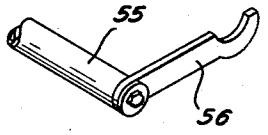


FIG. 6



INVENTORS
JOSEPH SNYDERMAN
MARTIN SCHNABL

BY

ATTORNEY

United States Patent Office 3,190,195 Patented June 22, 1965

3,190,195

CONVOLUTE TUBE MAKING MACHINE

Joseph Snyderman, Philadelphia, and Martin Schnabl, Elkins Park, Pa., assignors to John Eppler Machine Works, Inc., Philadelphia, Pa., a corporation of Pennsylvania

Filed May 27, 1963, Ser. No. 283,268
14 Claims. (Cl. 93—81)

This invention relates to a convolute tube making machine.

Tube making machines have been made over a long period of years which included provisions for feeding from a roll and glue coating an elongated strip of paper, advancing the strip along a mandrel onto which it is to be wound, cutting the strip to the desired length in accordance with the length of the paper tube to be made, further advancing the strip along the mandrel to a location for winding, winding the strip onto the mandrel to form a convolute paper tube, stripping the wound paper tube from the mandrel after completion of the winding by moving a tube stripper along the mandrel, returning the tube stripper to its initial position, all in timed sequence, and repeating the foregoing operations for the continuous production of paper tubes of predetermined length.

In prior machines of successful nature, where a length of paper tube of the order of 80 inches or less was to be wound and because of the length of mandrel there employed and the cantilever mounting of the mandrel, an end support was provided for the free end of the mandrel, this end support being retracted in timed relation to permit the operation of the stripper and removal of the paper tube.

The demands of the trade for longer tubes has necessitated employing a longer mandrel. With longer mandrels to accommodate tubes of lengths of two hundred inches or more, it was previously supposed that intermediate support of the mandrel and tube during winding, and of the mandrel and tube during stripping, and preferably at a plurality of spaced locations along the mandrel, was necessary. Such intermediate supports necessitated the use of considerable operating mechanism.

In prior machines, also, provisions had been made to smooth the paper from above during its winding onto the mandrel, and also to provide paper smoothing or slicker elements below the mandrel. In earlier and smaller machines the slicker elements were simultaneously retracted, while in later and larger machines the upper slicker elements were all retracted at the commencement of the tube stripping while the lower slicker elements were successively retracted in groups.

It is the principal object of the present invention to provide a convolute tube winding machine of greatly simplified construction which can employ a long winding mandrel, so that a long paper tube can be made at each operation.

It is a further object of the present invention to provide, in a convolute tube winding machine having a mandrel, in addition to a supporting element for the mandrel at the end of the working portion of the mandrel a supporting element therebeyond which is effective upon retraction of the first supporting element.

It is a further object of the present invention to provide, in a convolute tube winding machine having a mandrel with a supporting element for the end of the mandrel, an auxiliary supporting element beyond the end of the mandrel which can additionally serve the purpose of facilitating the stripping of the tube after winding.

It is a further object of the present invention to provide a convolute tube winding machine for tubes of a length of the order of two hundred inches or more of simpler construction than has heretofore been available, and in which improved structure is provided for facilitating the stripping of the wound paper tube.

It is a further object of the present invention to provide, in a convolute tube winding machine having a mandrel and slicker elements for smoothing the paper on the mandrel during the winding, an auxiliary support for the mandrel located beyond the end of the mandrel and beyond the slicker elements.

It is a further object of the present invention to provide a convolute tube winding machine having a winding mandrel with a retractable support at its free end and an auxiliary support therebeyond, the auxiliary support having positive provisions for aiding in the retraction or stripping of the wound paper tube.

Other objects and advantageous features of the invention will be apparent from the description and claims.

The nature and characteristic features of the invention will be more readily understood from the following description taken in connection with the accompanying drawings forming part thereof, in which:

FIGURE 1A is a top plan view of the entrance end of a convolute tube making machine in accordance with the invention;

FIG. 1B is a continuation of FIG. 1A to the tube delivery or discharge end of the machine;

FIG. 2 is a fragmentary front elevational view, enlarged, of part of the machine shown in FIGS. 1A and 1B, and illustrating the free end support for the mandrel, part of the upper and lower paper smoothing or slicker elements, and the auxiliary support;

FIG. 3 is a vertical sectional view taken approximately on the line 3—3 of FIG. 2, illustrating details of the upper and lower paper smoothing elements and the control of the positioning thereof;

FIG. 4 is a vertical sectional view taken approximately on the line 4—4 of FIG. 2, illustrating the mandrel free end support and the control of the positioning thereof;

FIG. 5 is a vertical sectional view taken approximately on the line 5—5 of FIG. 2 and illustrating details of the auxiliary support;

FIG. 6 is a fragmentary perspective view of the tube stripper arm and the shaft on which it is mounted;

FIG. 7 is an enlarged fragmentary perspective view showing details of one of the lower paper smoothing elements;

FIG. 8 is a horizontal sectional view taken approximately on the line 8—8 of FIG. 7;

FIG. 9 is an enlarged fragmentary longitudinal sectional view of the end of the mandrel, showing the attachment of the tube receiving shaft; and

FIG. 10 is an elevational view of the cam for controlling the positioning of the upper and lower slicker elements and the mandrel free end support.

It should, of course, be understood that the description and drawings herein are illustrative merely, and that

various modifications and changes can be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

Referring now more particularly to drawings in which one embodiment of the invention is illustrated, a frame F is provided L-shaped as seen from above with a transverse frame portion **15** and a longitudinal frame portion **16** (see FIGS. 1A and 2). The frame portion **15** has a top horizontal transverse frame plate **17**. The frame portion **16** has a top horizontal longitudinal frame plate **18**, at the same level as the frame plate **17**, and side sections **19** with transverse frame rails **20** therebetween at a plurailty of spaced locations.

The frame portion **15** can carry therealong paper pinching devices (not shown) controlled by a cam **21**, and a paper cut off knife (not shown) controlled by a knife cam **22**.

The frame portion **15** has a glue pan **23** with provisions for glue application to the paper including glue transfer rollers **24**, and glue applying and transfer rolls **25**, as has heretofore been common practice. The rollers **24** and rolls **25** are intermittently driven as the paper is advanced through a transmission unit **26** which is in turn driven by a chain drive **27** from a transverse drive shaft **34**.

Transverse frame bars **28** and **29** have wires **30** extending therebetween for supporting the paper strip advanced from the paper supply roll (not shown) in preparation for winding into convolute tubular form. A motor **31** is provided connected through a suitable chain drive **32** to the shaft **34**. The shaft **34** through gearing **33** drives a clutch drive shaft **42**.

The clutch drive shaft **42** is connected through gearing **40** to drive the cam shaft **37** and the cam shaft **37** is in turn connected through gearing **50** to a shaft **49** and then through a deceleration drive mechanism **48** to a shaft **45**.

The shaft **42** is also connected through a clutch drive and speed controller and reducer **40** to a tube winding mandrel **54** for intermittently driving the same. As an illustration of a specific motion during each cycle the mandrel can be rotated for 168° for paper winding, followed by a 12° shift, with the drive then disconnected for a 168° period of rest utilized for tube stripping and new paper strip feed, which is followed by a 12° shift to engage the drive.

The cam shaft **37** is supported in spaced bearings **38** carried by the transverse frame rails **20**.

The frame portion **16** has mounted thereon upper and lower carriage rails **39** for carrying the stripper carriage **41** which forms part of the tube stripper. The carriage **41** is operated with a controlled motion, with reciprocation in timed relation in a horizontal path, and with the drive slowing down the carriage movement at each end of its movement in a well known manner. For this purpose the shaft **45** drives a sprocket **44** with which a rectangular loop of chain **43** is in engagement on the upper run thereof. The chain **43** has a shuttle mechanism (not shown) connected to a selected location on the chain **43** for moving the carriage **41** horizontally with a decreased acceleration and a dwell at each end of the horizontal movement while the vertical paths of the chain **43** are followed.

The stripper carriage **41** has a stripper arm shaft **55** mounted thereon with a stripper arm **56** (see FIG. 6) for sliding movement along the mandrel **54** to strip the finished tube therefrom.

The stripper carriage **41** on the stripper arm shaft **55** also has a plurality of paper feed pins **57** for feeding the paper transversely of the wires **30** to the mandrel **54** past the paper guide rails **58**, aided by feed pins **59** carried on a shaft **60** which is raised by an arm **61**. The arm **61** is positioned by spaced cams (not shown) on the carriage **41**.

The mandrel **54** has a longitudinal slot **64** thereon for the reception of the leading longitudinal edge of the sheet to be wound thereon as the same is fed along the wires **30**.

The mechanism for feeding the paper along the wires **30**, for applying glue thereto, for severing the paper at the trailing transverse edge, for advancing the paper along and to the mandrel **54**, and for rotating the mandrel **54**, is well known in the art.

The frame plate **18** contiguous to the end of the mandrel **54** (see FIGS. 2 and 4) has a bracket **65** mounted thereon in which a stub shaft **66** is pivotally mounted. The stub shaft **66** has a supporting arm **67** secured thereto with a mandrel socket **68** for supporting engagement with the mandrel **54**. The stub shaft **66** also has an actuating arm **69** carried thereby to which a cam rod **70** is pivotally connected by a pivot pin **71**. The cam rod **70** extends through the frame plate **18** and has a bifurcated cam follower **72** straddling the cam shaft **37** with a cam follower pin **73** engaged with a mandrel free end supporting cam **74** on the cam shaft **37**. The cam **74** has a shape as shown in FIG. 10.

The frame plate **18**, at a plurality of spaced locations between the ends of the mandrel **54**, has slicker or smoothing element brackets **95** mounted thereon in spaced pairs. One of these brackets **95** and its associated structure is shown in FIG. 3.

Each of the pairs of brackets **95** has a lower slicker shaft **96** pivotally mounted therein with spaced limit bracket plates **97** adjustably held with respect thereto by clamp bolts **98**. The bracket plates **97** have limit fingers **99** thereon. Each shaft **96** also has presser arms **100** movably mounted thereon and urged towards engagement with the limit fingers **99** by springs **101** in sockets **102** and which have adjustable screws **103** mounted in projections **104** on the plates **97** bearing thereagainst. A limited movement of the presser arms **100** is thus provided. The presser arms **100** have rockers **105** pivotally mounted thereon on rocker shafts **106**. Restoring coil springs **107** each have one end engaged in a rocker **105** and the other in an adjusting collar **108** on the rocker shafts **106**. The collars **108** are held in adjusted position by set screws **109**.

The rockers **105** have a spaced pair of continuous presser rods **110** secured thereto for engagement from end to end with the tube being rolled onto the mandrel **54**.

Each shaft **96** also has an actuating arm **111** secured thereto to the end of which a cam rod **112** is connected. The cam rod **112** has a threaded insert **113** for adjustment of the length thereof.

The lower end of the cam rod **112** has a bifurcated cam follower **115** straddling the cam shaft **37** with a cam follower pin **116** engaged with a lower slicker control cam **117** which has a shape as shown in FIG. 10.

Each of the pairs of brackets **95** has an upper slicker shaft **120** pivotally mounted thereon with spaced limit bracket plates **121** adjustably held with respect thereto by clamp bolts **122**. The bracket plates **121** are similar to the bracket plates **97** and have limit fingers **123** thereon. Each shaft **120** also has presser arms **124** movably mounted thereon and urged towards engagement with the limit fingers **123** by springs (not shown) but like the springs **101**, with adjustable screws **126**, mounted in projections **127** on the plates **121**, bearing thereagainst. A limited movement of the presser arms **124** is thus provided. The presser arms **124** have rockers **128** pivotally mounted thereon on rocker shafts **129**. Restoring coil springs **130** each have one end engaged in the rockers **128** and the other in an adjusting collar **131** on the rocker shafts **129**. The collars **131** are held in adjusted position by set screws **132**.

The rockers **128** have a spaced pair of continuous presser rods **133** secured thereto for engagement from end to end with the tube being rolled onto the mandrel **54**.

Each shaft **120** also has an actuating arm **134** secured thereto to the end of which a cam rod **135** is connected.

The cam rod 135 has a threaded insert 136 for adjustment of the length thereof.

The lower end of the cam rod 135 has a bifurcated cam follower 137 straddling the cam shaft 37 with a cam follower pin 138 engaged with an upper slicker control cam 139, which has a shape as shown in FIG. 10.

In order to permit of quick release of the top presser bars 133 a lock mechanism can be provided which includes lock levers 140 pivotally mounted on pivot pins 141 carried on brackets 142. The lock levers 140 have locking tongues 143 urged into engagement with complemental sockets 144 in collars 145 by springs 146. The collars 145 are secured to the shafts 120.

The cam shaft 37 has mounted thereon the cams 74, 117 and 139 for controlling the positioning of the mandrel free end of support 68, the lower presser rods 110 and the upper presser rods 133. These cams are preferably all as shown in detail in FIG. 10, seen from the end of the mandrel 54 and with a counter-clockwise direction of rotation. The cams 74, 117 and 139 are similar in shape and are oriented on the cam shaft 37 to provide the desired interrelation between the upper and lower slicker bar retraction and the retraction of the support 68 to permit the stripping.

The cam 74 has a short portion 151 of a hold up dwell 152 followed by a fall 153 through about 31°. A down dwell 154 of about 122° is then followed by a rise 155 through about 31°. This is followed by the hold up dwell 152 through about 176°, including the portion 151.

The cam 117, which controls the lower presser rods 110 has, a rise 155 through about 31°, a retract or open dwell 154 through about 122°, a fall 153 through about 31° and a lower or closed dwell 152 through about 176°.

The cam 139 which controls the upper presser rods 133, is timed the same as the cam 117, has a rise 155 through about 31°, followed by an open or retract dwell 154 of about 122°, a fall 153 of about 31° and an apply or close dwell 152 of about 176°.

The mandrel 54, at the free end thereof (see FIG. 9), has an end collar 230 secured therein in abutting relation to an interior shoulder 231. The collar 230 has a reduced outer end portion 232 and can have sleeves 233 thereon, of nylon or the like for reducing wear upon the engagement therewith of the mandrel socket 68. A tube receiving shaft 235 is provided having, at one end, a shoulder 236 abutting against the collar 230, an end extension 237 received within the collar 230, and a threaded end 238 for the reception of a washer 240 and nut 241. The nut 241 is accessible through the opening 242, a plough edge 243 of which serves to guide the leading edge of the paper into smooth relation inside the wound tube as the same is stripped from the mandrel 54.

The tube receiving shaft 235, at the other end, has a tube receiver sleeve 245 with tapered ends 246 and 247 and a central portion 248 preferably the same or slightly smaller diameter than the outside diameter of the mandrel 54.

The longitudinal frame portion 16, contiguous to the bracket 65 has a support bracket 250 secured thereto. The bracket 250 has a vertical face 251 to which the vertical face 252 of a motor support bracket 253 is secured by bolts 254 in elongated slots 255. A horizontal rod 256 has a threaded opening 257 in which a threaded adjusting rod 258 is in engagement. The rod 258 has spaced heads 259 on opposite sides of a horizontal frame plate 260 carried by the support bracket 250. Rotation of the rod 258 facilitates raising or lowering the motor support bracket 253 which is then secured at the adjusted position by the bolts 254.

The motor support bracket 253 has an electric motor 261 carried thereon with a transmission housing 262 containing speed reducing gearing and an overrunning clutch (not shown) interposed between the motor 261 and a horizontal driven shaft 263. The shaft 263 is supported in bearings 265 in a bearing housing 266 carried by the motor support bracket 253.

The shaft 263 has a tube and shaft support pulley 270 thereon, preferably with a V shaped periphery 271. The pulley 270 can be of any desired material such as synthetic plastic and preferably has a friction face on the periphery 271 to apply friction onto the exterior of the wound tube to aid in stripping.

The pulley 270, by the direct engagement of the tube receiver sleeve 245 thereon can provide support for the free end of the mandrel 54, and with the tube being stripped moving along the sleeve 245 can provide support for the tube and the mandrel 54.

The mode of operation will now be pointed out.

The motor 31, through the chain drive 32 effects rotation of the shaft 34. A strip of paper, with glue applied thereon by the intermittently operated glue applying rolls 25 is supplied and advanced by the carriage 41 onto the wires 30, and along the slot 64 in the mandrel 54 and cut off by the action of the knife (not shown) controlled by the knife cam 22, while the mandrel 54 is at rest and before it commences the rotating phase of its actuation.

The longitudinal advance of the paper strip and the advance thereof into winding position with respect to the mandrel 54 is effected by the operation of the carriage 41 and the actuation of the paper feed pins 57 and 59.

Assuming that the carriage 41 has been retracted and is to be advanced for stripping a previously wound paper tube on the mandrel 54 by advancing the stripper arm 56 along the mandrel 54 and simultaneously advancing another paper strip along the wires 30.

The support provided by the mandrel socket 68 at the free end of the mandrel 54 must be retracted and remain out of the path of the paper tube as it is stripped from the mandrel 54 and this is effected by the cam 74.

The stripper arm 56 can be considered as about to start to move toward the right in FIGS. 1A and 1B.

The upper presser bars 133 are all elevated together out of engagement with the paper tube by the respective cams 139, and remain in this condition during the stripping and new paper feed.

As the mandrel socket 68 is retracted the free end of the mandrel 54 tends to fall but support is then provided by the engagement of the sleeve 245 on the pulley 270.

The wound paper tube is stripped off the mandrel 54 over the free end thereof, along the tube receiving shaft 235 and the tube receiver sleeve 245, urged from the other end by the stripper arm 56 which advances beyond the free end of the mandrel 54 and partially along the tube receiving shaft 235. The stripper arm 56 does not however move as far as the sleeve 245.

As the stripper arm 56 advances to the right the cams 117 retract the lower pressure bars 110 to permit the stripper arm 56 to pass, and during the remainder of the cycle the pressure bars 110 can be returned to their original upper positions in mandrel supporting and pressure applying position or can remain in retracted positions.

As the wound tube is moved by the stripper arm 56, for stripping the tube, onto and along the sleeve 245 the tube is interposed between the sleeve 245 and the pulley 270.

The pulley 270, driven by the motor 261, and with a peripheral speed at the places of engagement with the tube substantially equal to advancing speed of the stripper arm 56 aids in the stripping and removal of the wound tube. If the wound tube should be advanced more rapidly along the sleeve 245 this is accommodated by the overrunning clutch in the transmission housing 262.

After the stripper arm 56 reaches the end of its stripping stroke it moves downwardly and returns toward its starting location. The mandrel socket 68 returns to its mandrel supporting position and remains there until it is again retracted for tube stripping.

It will be noted that the auxiliary support for the mandrel provided by the pulley 270, the sleeve 245 and the

tube receiving shaft 235 is applied beyond the surfaces of the mandrel 54 onto which paper is wound.

We claim:

1. In a tube winding machine having a rotatable winding mandrel mounted at one end for tube winding, members for driving said mandrel, a carriage movable along said mandrel having a tube stripper carried thereby, a member for supporting said mandrel at the other end thereof, members for retracting said supporting member in timed relation to the movement of said tube stripper, said free end of said mandrel having an extension therebeyond of lesser diameter than said mandrel, and a support member at a fixed height for engagement by a tube impelled along said extension by said tube stripper, said extension spaced at a location beyond said mandrel, whereby upon retraction of said supporting member, support is provided for said mandrel.

2. A tube winding machine as defined in claim 1 in which said support member has a portion rotatably mounted on an axis transverse to the longitudinal axis of the extension for engagement by the tube during movement past said support member.

3. A tube winding machine as defined in claim 1 in which said support member has a portion rotatably mounted on an axis transverse to the longitudinal axis of the extension for engagement by the tube during movement past said support member, and positive driving means is provided for said rotatable portion.

4. A tube winding machine as defined in claim 1 in which said support member has a portion rotatably mounted on an axis transverse to the longitudinal axis of the extension for engagement by the tube during movement past said support member, positive driving means is provided for said rotatable portion, and an overrunning clutch is interposed between said driving means and said rotatable portion.

5. A tube winding machine having a rotatable winding mandrel mounted at one end for winding sheet material thereon in tube form, members for actuating said mandrel in cyclic relation, a carriage movable along said mandrel in predetermined timed relation and having a tube stripper carried thereby, a cam shaft, members for actuating said cam shaft, a mandrel supporting member at the other end of said mandrel for supporting said mandrel at said other end during tube winding, a cam on said cam shaft for controlling the positioning of said mandrel supporting member with respect to said mandrel, said cam having a portion for retracting said mandrel supporting member to a position out of the path of movement of said tube and said tube stripper, tube forming material smoothing bars above and below said mandrel, cams on said cam shaft for advancing and retracting said bars with respect to the mandrel, and an auxiliary support for said mandrel beyond said other end and at a fixed elevation supporting said mandrel during retraction of said mandrel supporting member and during stripping of said tube.

6. In an apparatus having a rotatable mandrel about which sheet material is adapted to be wound in the forming of convolute tubes thereon, and said apparatus including a stripper for engaging the mandrel therebeneath and applying a pushing force against the rear end of the tube and longtiudinally toward and beyond the free end of the mandrel for stripping the tube off the mandrel; the combination therewith of

(a) a mandrel support positioned at the free end of said mandrel and engageable with the tube during winding of the tube,

(b) means to release said support from engagement with said tube as the tube approaches the support,

(c) said mandrel having a shaft of lesser diameter than said mandrel extending from the free end thereof; and

(d) means at a fixed location beyond said mandrel and below said shaft for supporting said shaft as the tube passes therealong and during the remainder of the period in which the tube is being pushed off the free end of the mandrel so as to limit sagging of the mandrel.

7. Apparatus as defined in claim 6 in which said last means includes a roller supported on an axis transverse to said shaft.

8. Apparatus as defined in claim 6 in which said last means includes

(e) a roller supported on an axis transverse to said shaft, and

(f) positive driving means for said roller.

9. Apparatus as defined in claim 6 in which said shaft has a sleeve thereon for engagement with the interior of the tube during movement therealong for stripping, said sleeve having at least one end thereof tapered.

10. Apparatus as defined in claim 6 in which adjusting members are provided for determining the vertical positioning of said last means.

11. In an apparatus having a rotatable mandrel about which sheet material is adapted to be wound in the forming of convolute tubes thereon, and said apparatus including stripper means for engaging and applying a pushing force against the rear end of the tube and longitudinally toward the free end of the mandrel for stripping the tube off the mandrel; the combination therewith of

(a) a mandrel support engageable with said mandrel intermediate its ends during winding of the tube,

(b) means to release said support from engagement with said mandrel as the end of the tube approaches said support,

(c) said mandrel having a shaft of lesser diameter than said mandrel extending from the free end thereof;

(d) means at a fixed location below said shaft for supporting said shaft as the tube passes therealong and during the remainder of the period in which the tube is being pushed off the free end of the mandrel,

(e) a plurality of longitudinally extending circularly spaced and substantially longitudinally aligned upper and lower slicker bars adjacent upper and lower portions of said mandrel and normally spaced therefrom, and

(f) means for retracting said slicker bars during stripping of the tube.

12. A method of stripping elongate convolute tubes forwardly off the free end of a mandrel whose rear end is journaled and about which each successive tube is wound which comprises the steps of

(a) engaging and applying a pushing force against the rear end of the tube and longitudinally of the mandrel,

(b) withdrawing support from the tube as its front end approaches said point of support, and

(c) positively supporting said mandrel at a fixed level at a location beyond the free end of the mandrel and during passage of the tube past such location.

13. A method of making elongate convolute tubes from relatively thin sheet material utilizing an elongate rotatable mandrel about which sheet material is adapted to be wound and having a free end beyond which each successive tube is moved upon being formed; said method comprising

(a) rotating said mandrel and taking up the sheet material thereon to form the tube while supporting the mandrel at its free end;

(b) then stripping the tube off the free end of the mandrel before forming a succeeding tube thereon by applying a pushing force against the trailing end of the tube opposite from the free end of the mandrel,

(c) withdrawing said support from the mandrel before the tube reaches said support; and

(d) supporting said mandrel at a fixed level and at a location beyond said free end while said first support is withdrawn while applying an assisting force for stripping at such location.

14. A method of stripping elongate convolute tubes forwardly off the free end of a mandrel about which each successive tube is wound which comprises the steps of

(a) moving the formed tube forwardly toward said free end of the mandrel while positively supporting the tube and mandrel at a location at the free end of said mandrel,

(b) withdrawing support of the mandrel at the free end as the tube approaches the free end;

(c) positively supporting said tube at a fixed level at a location beyond the free end of the mandrel during the remainder of the period in which the tube is moving off the free end of the mandrel and therebeyond, and

(d) applying a stripping force on said tube at said location.

References Cited by the Examiner

UNITED STATES PATENTS

3,073,218 1/63 Roediger et al. ---------- 93—81

FOREIGN PATENTS

401,220 8/09 France.

FRANK E. BAILEY, *Primary Examiner.*

BERNARD STICKNEY, *Examiner.*