MACHINE FOR APPLYING PAINT ROLLER COVERINGS TO CORE TUBING

Filed March 10, 1954 6 Sheets-Sheet 1

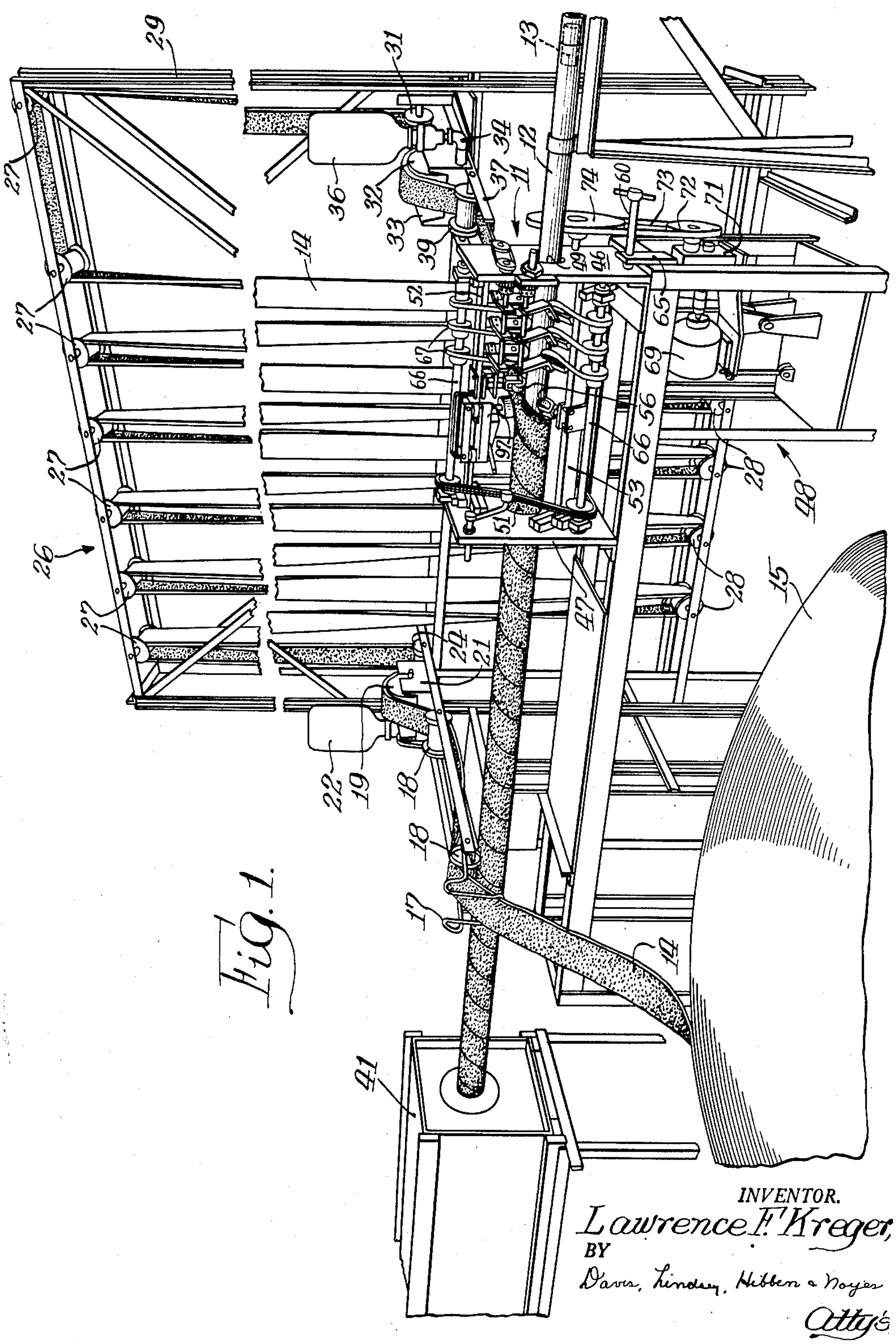


Fig. 1.

INVENTOR.
Lawrence F. Kreger,
BY
Davis, Lindsey, Hibben & Noyes
Atty's

Jan. 8, 1957 L. F. KREGER 2,776,698

MACHINE FOR APPLYING PAINT ROLLER COVERINGS TO CORE TUBING

Filed March 10, 1954 6 Sheets-Sheet 2

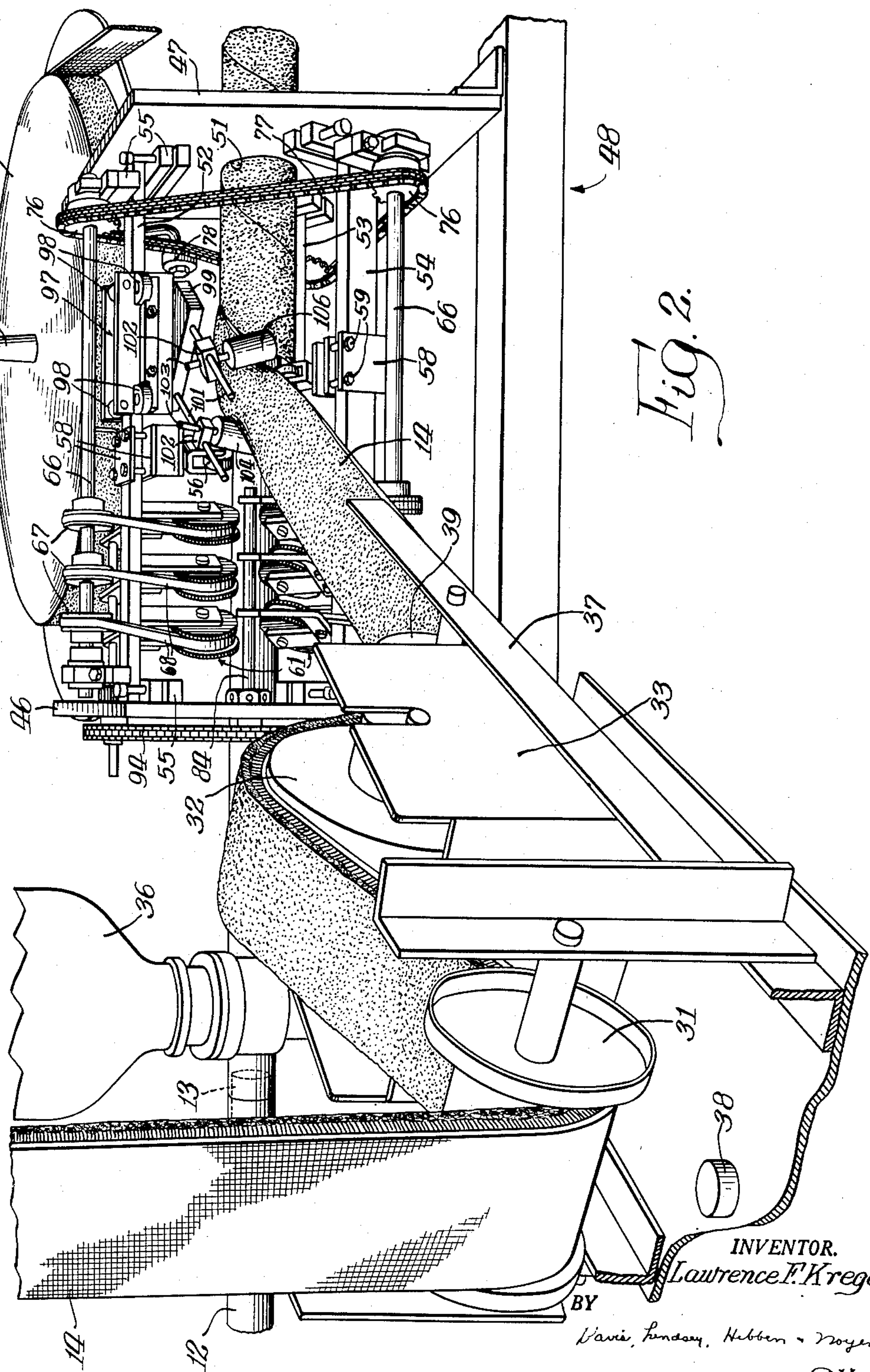


Fig. 2.

INVENTOR.
Lawrence F. Kreger,
BY
Davis, Lindsey, Hibben & Noyes
Att'ys.

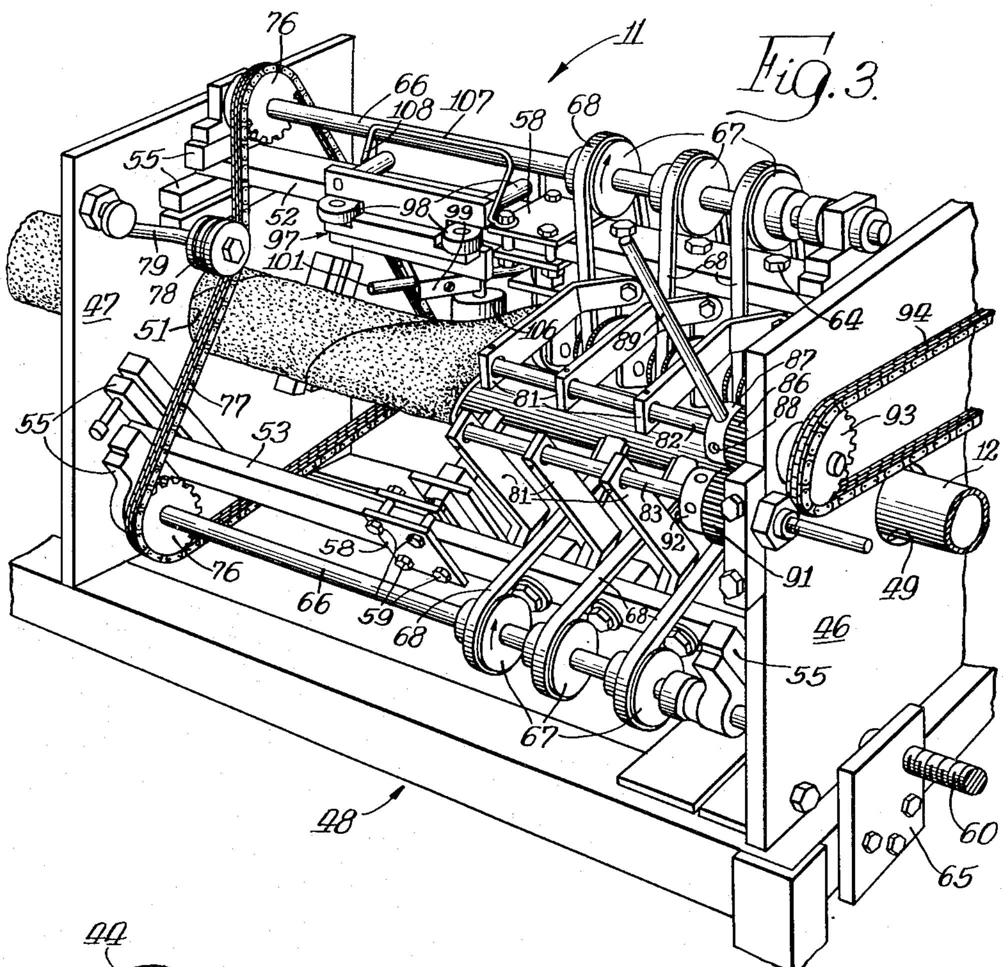


Fig. 3.

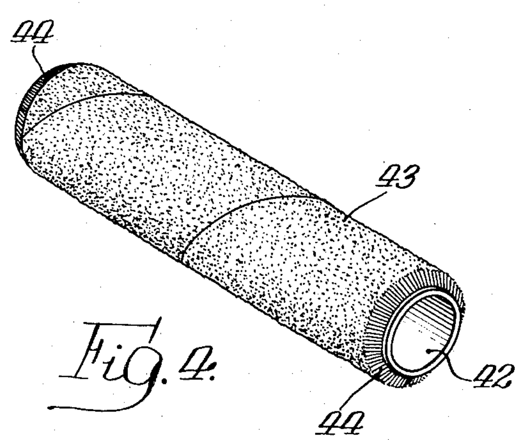
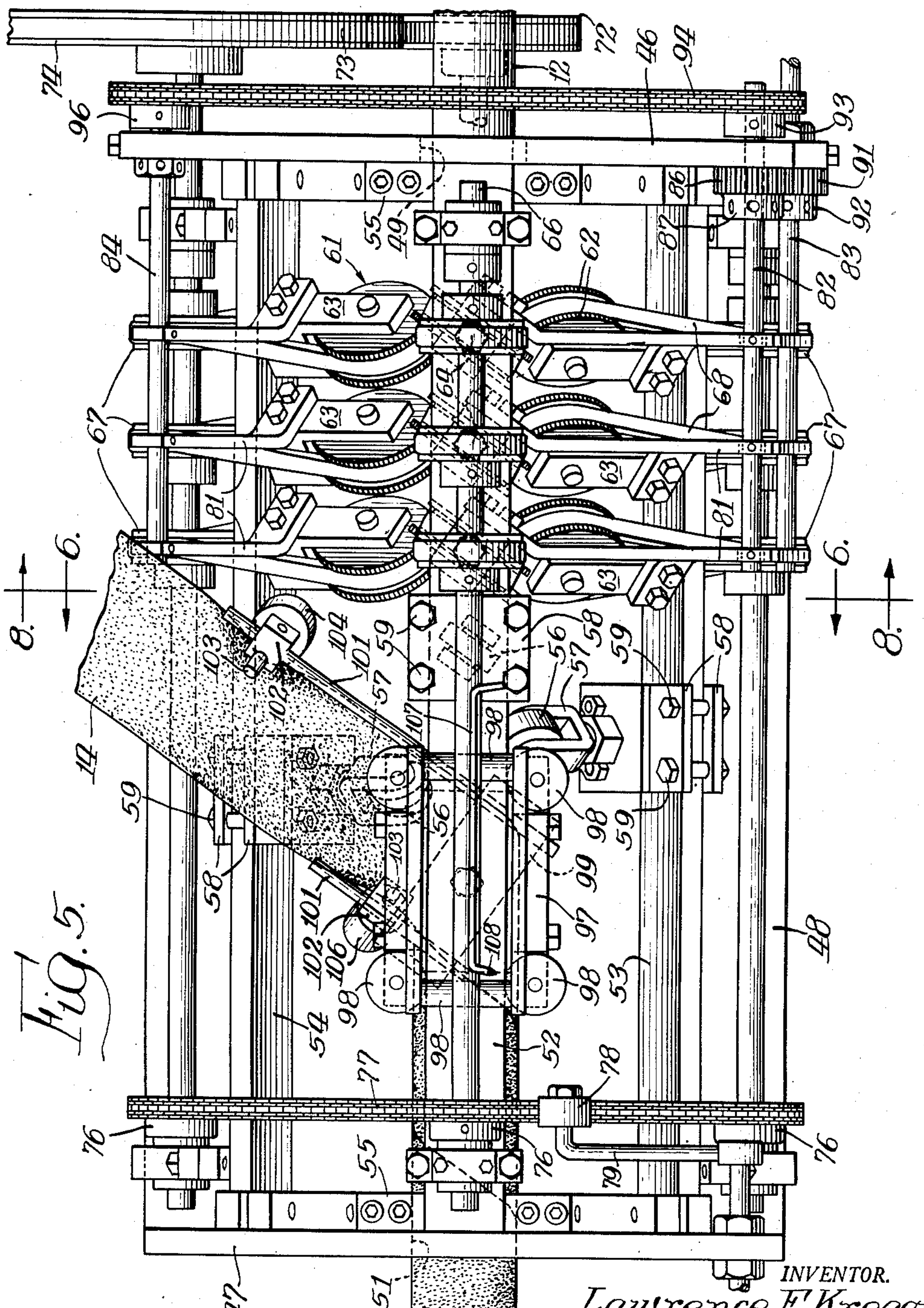


Fig. 4.

INVENTOR.
Lawrence F. Kreger,
BY
Davis, Lindsey, Hibben & Noyes
Attys.



INVENTOR.
Lawrence F. Kreger,
BY
Davis, Lindsey, Hibben & Noyes
Att'ys.

Jan. 8, 1957 L. F. KREGER 2,776,698

MACHINE FOR APPLYING PAINT ROLLER COVERINGS TO CORE TUBING

Filed March 10, 1954 6 Sheets-Sheet 5

Fig. 6.

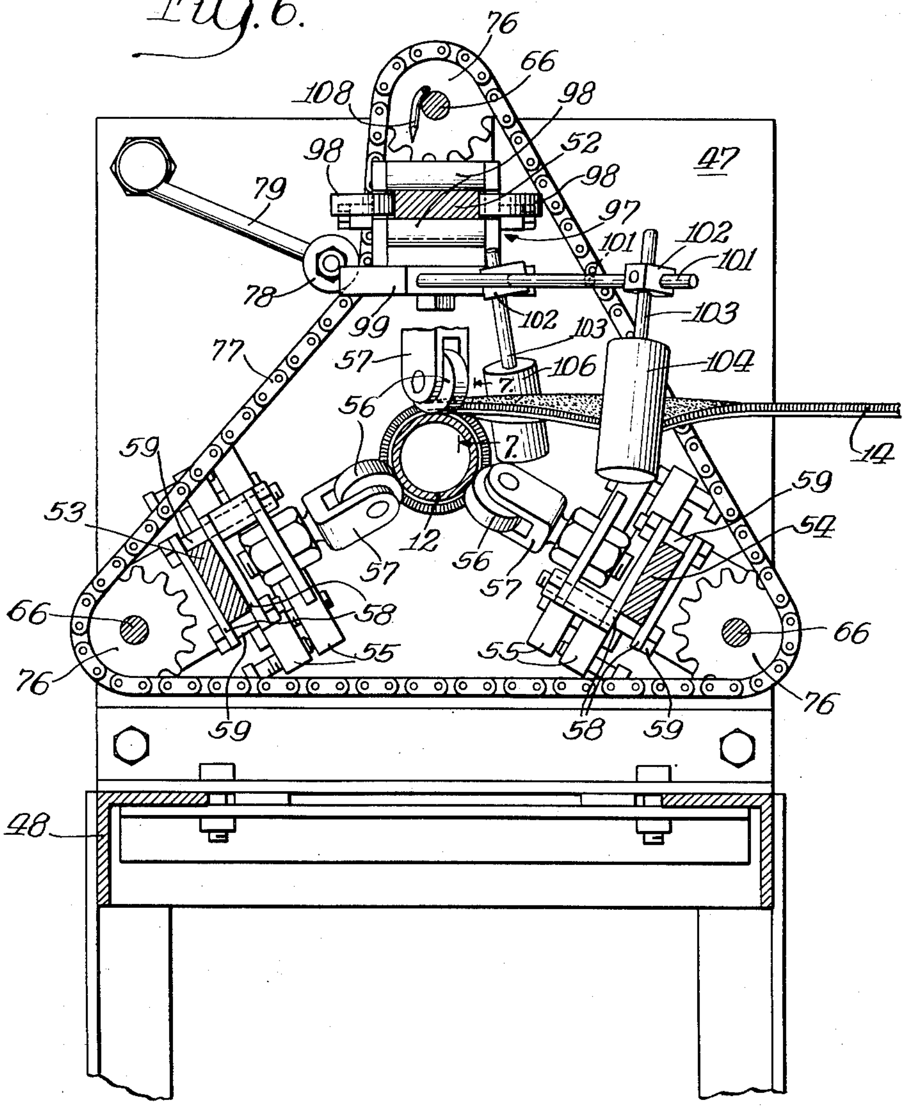
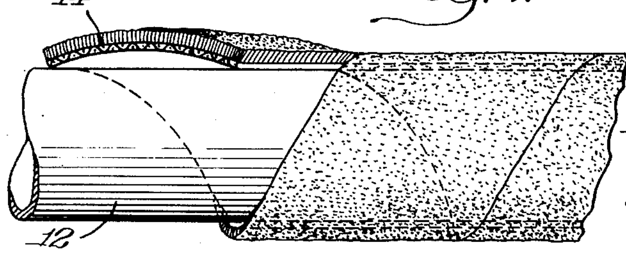


Fig. 7.



INVENTOR.
Lawrence F. Kreger,
BY
Davis, Lindsey, Hibben & Noyes
Att'ys.

MACHINE FOR APPLYING PAINT ROLLER COVERINGS TO CORE TUBING

Filed March 10, 1954 6 Sheets-Sheet 6

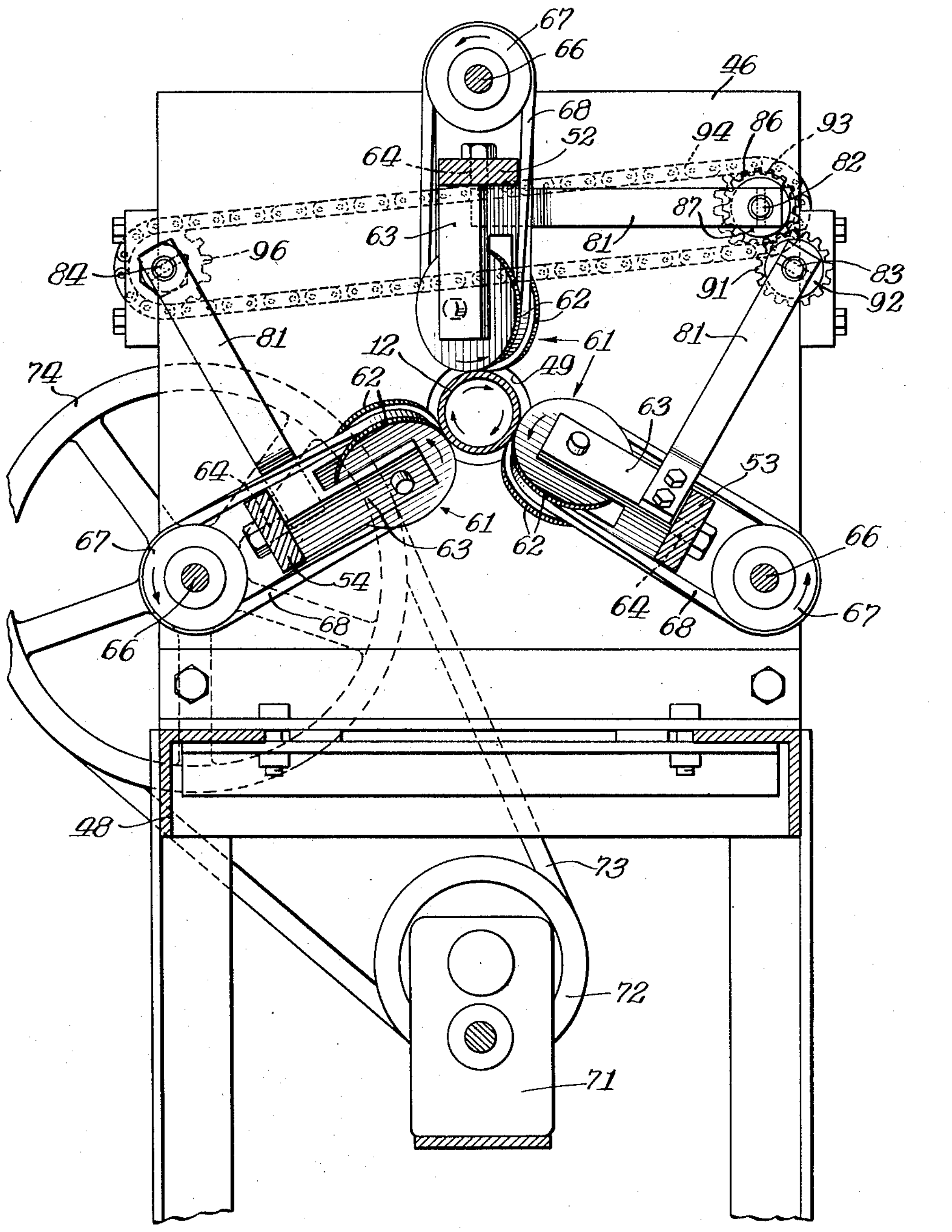


Fig. 8.

INVENTOR.
Lawrence F. Kreger
BY
Davis, Lindsey, Hibben & Noyes
Att'ys.

United States Patent Office

2,776,698

Patented Jan. 8, 1957

1

2,776,698

MACHINE FOR APPLYING PAINT ROLLER COVERINGS TO CORE TUBING

Lawrence F. Kreger, Chicago, Ill.

Application March 10, 1954, Serial No. 415,408

18 Claims. (Cl. 154—1.8)

This invention relates to improvements in the manufacture of covered tubes such as those having a fluid-retaining covering and used in paint rollers or the like. More particularly, the invention relates to a novel machine and method for continuously applying an outer covering to tubing.

As is well known, roller type fluid applicators for paint or the like utilize an applicator tube having an outer covering of fabric, lamb's wool, pile or other suitable paint-retaining material. The covered tube is supported on a core structure which is in turn rotatably mounted on the axle portion of a generally T-shaped handle. Heretofore, such covered applicator tubes have been made by relatively slow and inefficient techniques involving manual operations to a large extent, e. g. by manually guiding an elongated strip of covering material or fabric so that the latter is spirally wound on a rotating cardboard or heavy paper tube. Moreover, because of the relatively slight rigidity of the tube it has been considered necessary to utilize a mandrel or like device for supporting the tube internally during rotation.

A primary object of the present invention is to provide a novel machine for making covered tubes which is adapted for high speed continuous operation with a minimum of manual operations.

A further object of the invention is to provide a novel machine and associated apparatus for spirally winding and adhering a covering strip on a length of tubing.

Another object of the invention is to provide a machine of the character described which eliminates the need for an internal mandrel to support the rotating tube.

Still another object of the invention is to provide a machine of the character described having novel means for rotating and axially advancing the tube during spiral winding of the covering strip thereon.

An additional object of the invention is to provide a machine of the character described having novel means for regulating the rate of axial movement of the tube to compensate for variations in the width of the covering strip being wound thereon.

A still further object of the invention is to provide a novel method for making covered tubes.

Other objects and advantages of the invention will become evident from the subsequent detailed description taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a perspective view at one side of a machine for making paint roller tubes and comprising one specific embodiment of the invention;

Fig. 2 is a fragmentary perspective view of a portion of the machine as seen from the opposite side;

Fig. 3 is a fragmentary perspective view on an enlarged scale of a portion of the machine shown in Fig. 1;

Fig. 4 is a perspective view of a completed paint roller tube;

Fig. 5 is a top plan view on an enlarged scale of the portion of the machine seen in Fig. 3;

2

Fig. 6 is a sectional view looking toward one end of the machine as taken along the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary enlarged sectional view as taken along the line 7—7 of Fig. 6; and

Fig. 8 is a sectional view looking toward the opposite end of the machine as taken along the line 8—8 of Fig. 5.

As best seen in Figs. 1 and 2, the machine comprises a drive and winding section designated generally at **11** into which an elongated tube **12** of cardboard, heavy paper, plastic or the like is fed continuously. The tube **12** is composed of individual sections of suitable length which are frictionally fitted together by means of joining plugs such as cylindrical wood plugs **13**. Each such individual section is of sufficient length to form a number of finished paint roller tubes. As hereinafter described in detail, the drive and winding section **11** effects both rotation and axial advancement of the tube **12** at a controlled rate. An elongated continuous strip **14** of a suitable covering material is fed from a supply coil **15** rotatably supported on a spindle **16** (Fig. 2) and after application of a suitable adhesive is spirally wound under pressure on the tube **12** by reason of the simultaneous rotary and axial movement of the tube.

For convenience, the covering material **14** is frequently referred to as fabric, but it will be understood that in the case of paint rollers at least the covering material need not be strictly a fabric. In fact it is frequently a pile or lamb's wool having a fluid-absorptive or fluid-retentive side and a relatively smoother backing at the opposite side which is adhered to the roller tube.

The strip **14** extending from the coil **15** passes through a guide **17** and over and under a pair of guide spools or rollers **18** and thence to an adhesive applicator roll **19**. The smooth side of the strip **14** passes in contact with the roll **19** which is partially submerged in a body of suitable fluid adhesive material in a container **21**. The container **21** is fed with adhesive from a fountain supply bottle **22** communicating through a conduit (not shown). Any suitable fluid adhesive may be used. For example, a commercially available rubber base adhesive is particularly suitable for paint rollers since in its cured state it is highly resistant to the action of the usual solvents and thinners contained in paints. From the adhesive applicator roll **19** the strip **14** then passes under a guide roll **24** and through a drying rack or section **26** which comprises a plurality of upper and lower rollers or pulleys **27** and **28** journaled in an upright rectangular frame **29**. As will be evident from Fig. 1, the strip **14** with the freshly applied adhesive on its smooth side is trained around the pulleys **27** and **28** and is twisted axially through 180° between each successive pair of pulleys **27** and **28** so that only the uncoated fluid-retentive side of the strip is in contact with the pulleys.

After passage through the drying section **26** the adhesive coating on the strip **14** is substantially dry and has permeated the backing of the strip sufficiently so that a second adhesive coating can now be applied without soaking into the backing to an excessive degree. For this purpose another fountain type adhesive applicator is provided at the opposite end of the frame **29** which is substantially the same as the applicator means **19—21—22** heretofore described. Thus, the exit strip **14** with the preliminarily dried adhesive coating passes under a guide roller **31** and thence over an adhesive applicator roll **32** mounted on an adhesive container **33** which is supplied through a conduit **34** from a supply bottle **36**. In this case, the adhesive applicator structure and the roller **31** are supported on an elongated guide channel **37** having a swivel mounting **38** on the frame **29** for a purpose to be described below. Following the application of the second adhesive coating, the strip **14** passes under another guide roller **39** on the channel **37** and travels at a predetermined feed angle into the drive and winding section **11**.

In section **11** the continuous strip **14** is spirally wrapped under tension around the continuous tube **12** as the latter rotates and moves axially through section **11**, the adhesive coated side of the strip **14**, of course, being in contact with the tube. The tube **12** with its wound covering then passes through an elongated heated oven **41**, the inlet end of which is seen in Fig. 1. The oven is maintained at a suitable temperature for drying and curing the adhesive so that the covering is firmly bonded to the tube. For example, in the case of a commercially available rubber base adhesive a temperature of about 240° F. will be satisfactory but this may vary somewhat dependent upon the nature of the adhesive, the length of the oven, and the axial speed of the tube. Although not shown in the drawings, the covered tube as it emerges from the oven **41** is then cut into suitable lengths which are subjected to additional finishing operations for making the completed paint roller tubes. In Fig. 4, a completed paint roller tube is shown comprising a section of inner tubing **42** with the spirally wound and bonded outer covering indicated at **43**. The end portions of the pile or wool covering are preferably beveled or chamfered, as at **44**.

Referring particularly to Figs. 2, 3 and 5–8, the mechanism in section **11** for driving the tube **12** will now be described. A pair of spaced upright walls **46** and **47** are supported on a base structure **48** and are provided with openings **49** and **51**, respectively, through which the tube **12** extends, the wall **46** being at the inlet or feed end of section **11** and the wall **47** being at the outlet or discharge end. Between the walls **46** and **47**, a plurality of elongated support bars are provided in rigid fixed relation. In this instance, three such bars **52**, **53**, and **54** are spaced around tthe tube **12** at approximately equal radial distances therefrom and with substantially equal circumferential spacing between the bars (Figs. 6 and 8). The bars **52**, **53**, and **54** are rigidly secured at their ends to the walls **46** and **47** by means of sets of clamping blocks **55** which are adjustable on the walls **46** and **47** for varying the radial spacing of the bars **52**, **53**, and **54** whereby to accommodate different diameters in the tube **12**. Each bar **52**, **53**, and **54** has mounted thereon a smooth surfaced freely rotatable caster wheel **56** which firmly engages the exterior of the tube **12** closely adjacent the portion of the tube being wrapped for rigidly holding the tube against lateral movement while at the same time permitting rotation of the tube about its axis. The caster wheels **56** are journaled in a plurality of radially extending yokes **57** each of which is in turn adjustably mounted on the bars **52—53—54** by means of a bracket structure including a pair of plates **58** clamped at opposite sides of the support bars by bolts **59**. As best seen in Fig. 5, the casters **56** are preferably arranged in axially spaced relation along the tube **12** so that each caster is positioned as closely as possible to the portion of the tube being wrapped without interference with the spiral wrapping operation. By loosening the bolts **59**, the supporting clamps can be adjusted longitudinally along the bars **52—53—54** and thereafter the bolts **59** are tightened for holding the casters **56** in fixed position relative to each other and axially of the tube **12**. The entire drive section **11** may be adjusted longitudinally along the base **48** by means of an elongated adjusting screw **60** (Figs. 1 and 3) which has a rotatable connection in the end wall **46** and extends in threaded engagement through an apertured plate **65** rigidly mounted on the base **48**.

Intermediate thte casters **56** and the wall **46** at the feed end of the device, three sets of adjustable driving elements are mounted on the bars **52—53—54** for rotating and axially advancing the tube **12**. Each set of driving elements comprises a plurality of rollers in the form of double flanged pulleys **61**, three such pulleys being provided in side-by-side relation in each set in this instance. The parallel spaced flanges of the pulleys **61** are toothed or serrated, as at **62**, for frictional driving engagement with the exterior of the tube **12**, and each pulley **61** is rotatably supported in a yoke **63** having a swivel mounting **64** on the corresponding bar **52**, **53**, or **54**. For driving the pulleys **61**, I provide a plurality of drive shafts **66** rotatably mounted between the end walls **46** and **47** and located in parallel relation outwardly of the fixed bars **52—53—54**. Each shaft **66** has a set of three pulleys **67** rotatable with the shaft and having belt drive connections **68** with the respective toothed pulleys **61**. A main drive for the unit is provided through a motor **69** (Fig. 1) mounted on the base base **48** adjacent the wall **46**, a gear reduction **71**, a pulley **72**, a belt drive **73**, and a pulley **74** mounted on one of the drive shafts **66**. The drive shaft **66** having the pulley **74** is in turn drivingly connected to the other two shafts **66** by means of a plurality of sprocket wheels **76** mounted on the shafts **66** adjacent the wall **47** and a chain drive **77**. A tensioning roller **78** operatively engages the chain **77** and is carried on a lever arm **79** pivotally mounted on the end wall **47** for adjustment of slack in the chain for different radial positions of the bars **52**, **53**, and **54**.

By the above-described arrangement it will be seen that the rotation in unison of the toothed pulleys **61** effects direct or positive rotary driving of the tube **12** without the necessity for an internal supporting mandrel or the like. At the same time the angular positions of the drive pulleys **61** are regulated so that axial movement of the tube is also obtained. In other words, by reason of the swivel mounting of the yokes **63**, the axes of rotation of the pulleys **61** can be positioned at some predetermined angle, less than 90°, relative to the axis of the tube **12** so that the driving force imparted by the teeth **62** has both a rotational component and an axial component whereby simultaneous rotary and axial movement of the tube **12** is obtained. For reasons to be described shortly it is important that this angular relation be adjustable in order to control and coordinate the axial speed of the tube. To this end, each swivel yoke **63** has rigidly attached thereto an outwardly extending lever arm **81** and the parallel outer end portions of the arms **81** for each set of yokes **63** are interlocked or linked by means of an axially adjustable rod as indicated at **82**, **83**, and **84**. In the form shown, the rods **82—83—84** extend through apertures in the ends of the corresponding arms **81** and are pinned to the respective arms. As best seen in Fig. 3, the rod **82** is provided with a threaded end portion (not shown) which extends in operative engagement through an internally threaded adjusting nut **86** rotatably supported on the end wall **46**. The adjusting nut **86** has an operating portion **87** provided with a plurality of radial bores **88** into which a detachable handle **89** may be fitted for turning the nut **86**. As will be evident, by rotating the nut **86** in either direction the rod **82** is shifted axially for either increasing or decreasing the driving angle of the interconnected toothed pulleys **61** relative to the axis of the tube **12**.

In order to coordinate the angular positions of each set of drive pulleys **61**, the rods **82**, **83**, and **84** are interconnected so that any rotary adjustment of the rod **82** is substantially duplicated by the rods **83** and **84**. Thus, the rod **83** is provided with an adjusting nut **91** having an internal threaded engagement with the rod **83**, and the nuts **86** and **91** have intermeshing external gear teeth so that they move into unison. The nut **91** also has an operating portion **92**, similar to the portion **87** of the nut **86**, so that the desired adjustment may be made with the handle **89** on either of the nuts **86** or **91**. The nut **86** has a tubular extension projecting through the wall **46** and carries at its outer end a sprocket wheel **93** which is connected by a chain drive **94** to a sprocket wheel **96** (Fig. 8) having a similar threaded nut operatively engaging the rod **84**. The gear connection between the nuts **86** and **91** on the rods **82** and **83** and the sprocket and chain connection between the rods **82** and **84** thereby provide a fixed ratio between all three of the rods **82**, **83**, and **84** so that adjustment of either the nut **86** or the nut **91** is sufficient to change the angular positions of all of the pulleys **61** substantially equally and as a unit.

As previously mentioned, the adhesive coated strip **14** as it emerges from the guide channel **37** extends at a predetermined feed angle to the axis of the tube **12** so as to obtain the desired continuous spiral wrapping of the covering strip on the tube. The rotation of the tube **12** exerts a pull or tension on the strip **14** which is sufficient to insure a tight wrap of the strip on the tube and is also adequate to overcome all frictional resistance throughout the adhesive application and drying sections of the apparatus. Thus, unwinding of the freely rotatable reel or supply coil **15** is automatic in response to rotation of the tube **12** and no positive drive for the strip **14** is needed. In fact, the frictional drag or resistance on the strip during its passage through the adhesive application and drying stages is an advantage in that it provides a substantially uniform tension in the strip during the spiral wrapping operation and thereby minimizes the chance of variations in the width of the strip due to differences in tension. Furthermore, the maintenance of proper tension in the strip **14** by the aforementioned frictional drag provides the necessary pressure during winding of the adhesive-coated strip on the tube **12** to obtain effective adhesive bonding of the strip to the tube.

However, it is necessary that provision be made for insuring proper butt edge relation between successive spiral turns of the strip **14** as it is wound on the tube **12**. For this purpose I provide a carriage **97** (see Figs. 5 and 6) movably mounted on the bar **52** by means of a plurality of rollers **98** engaging the top and sides of the bar so as to permit free longitudinal movement of the carriage along the bar **52**. At the underside of the carriage **97** an adjustable mounting block **99** is carried which is preferably disposed substantially perpendicularly across the width of the strip **14** as it extends from the channel **37**. A pair of rods **101** project outwardly from the block **99** adjacent the side edges of the strip **14** and carry a pair of longitudinally and angularly adjustable blocks **102**. The blocks **102** have depending spindles **103** which mount a pair of elongated guide elements or rollers **104** and **106** adapted to engage the longitudinal side edges of the strip **14**, as seen in Figs. 2, 5, and 6. The axes of the rollers **104** and **106** are preferably canted slightly to insure effective operative engagement with the edges of the strip **14**. In addition, as best seen in Fig. 5, the roller **104** is positioned outwardly on its supporting rod **101** at a relatively remote distance from the carriage **97** and the tube **12**, i. e. in the direction of the channel **37**, while the roller **106** is located closely adjacent the carriage **97** and the tube **12**. It will, of course, be understood that the relative adjustability of the blocks **102** on the rods **101** and of the spindles **103** in the blocks **102** permits positioning of the rollers **104** and **106** at the desired locations and angles.

The carriage **97** is positioned on the bar **52** so that the roller **104**, which engages the trailing side edge of strip **14** as it emerges from the channel **37**, tends to urge the strip **14** bodily toward the already wrapped portion of the tube **12**, i. e. to the left as viewed in Fig. 5 or to the right as viewed in Fig. 2. In the absence of the roller **106**, the incoming strip **14** would thus tend to overlap at its marginal leading edge the adjacent spiral edge of the preceding turn on the tube **12**. However, the transverse spacing between the rollers **104** and **106** at their points of engagement with the opposite edges of the strip **14** is somewhat less than the width of the strip **14** so that the roller **106** located closely adjacent the tube **12** acts as a back-up roller and causes bulging or buckling of the strip under the pressure of the roller **104** (see Fig. 7). As a result of this bulging of the strip **14**, the leading edge of the strip adjacent the roller **106** is prevented from overlapping the edge of the previously wound turn and is guided into edgewise abutment or alignment with the previously wound turn. As long as the width of the strip **14** is uniform, proper spiral winding of the strip on the tube is readily obtained with the edges of adjacent turns in desired butting relation and completely covering the tube **12**. Moreover, for a strip of uniform width the reaction forces on the rollers **104** and **106** are substantially equal so that there is no tendency to shift the carriage **97**.

As a practical matter, however, the width of the strip **14** is subject to variation as a result of different tension effects in the strip which is stretchable to some extent. Also in the manufacture of the strip of covering material, such strip is formed by slitting a wider piece and the cutting is not always exact so that there are unavoidable difference in the lateral dimension of the strip from time to time. Inasmuch as a wider strip of covering material will cover a correspondingly greater length of the tube **12** than a narrower strip, it will be seen that when the strip **14** is wider than usual the axial feed of the tube **12** may be increased. Conversely, when the strip **14** is narrower than usual it will be necessary to decrease the axial feed of the tube **12** in order to avoid gaps between successive spiral turns of the wrapping strip. With the arrangement above described, variations in the width of the strip **14** will be reflected by a visible shifting movement of the carriage **97** along the bar **52**. Thus, if the width of the strip **14** increases, an excessive force is developed in the buckled or bulged strip as a result of the reaction between the butting edge of the incoming strip and the coacting edge of the previous turn on the tube, thereby causing a greater reaction force on the roller **104** and gradual movement of the carriage toward the feed end of the machine, i. e. toward the end wall **46**. The channel **37** being freely pivotable about its swivel support **38** also swings toward the wall **46** to accommodate automatically the feed angle of the strip to the increasing strip width. If the width of the strip **14** decreases appreciably, the reaction force on the roller **106** is decreased accordingly, and the reaction force on the roller **104** is, therefore, greater so that the carriage **97** is shifted in the opposite direction along the bar **52** with the guide channel **37** swinging in the opposite direction about its pivot **38**.

The movement of the carriage **97** is readily observed by the operator of the machine and signals the need for an adjustment in the axial speed of the tube **12**. To facilitate this observation, since the movement of the carriage is usually slight, a fixed arm **107** is rigidly fastened to the upper caster support **58** and has a pointed indicator portion **108** (Fig. 3) disposed over the upper visible portion of the carriage **97**. A scale having index marks or other indicia (not shown) is preferably provided on the movable carriage adjacent the pointer **108** so that even slight movements of the carriage are readily apparent. As the operator observes a persistent trend of movement of the carriage **97** in one direction or the other he can readily make the proper adjustment, heretofore described, of the nut **86** or **91** so that the drive angle of the pulleys **61** is appropriately changed either to speed up or slow down the rate of axial movement of the tube **12** as the case may be whereby to compensate for variations in the width of the strip **14**. Although not shown, it will be evident that automatic control means could be arranged to coact between the indicator carriage **97** and the adjusting nuts **86** or **91** so that the axial speed of the tube **12** would be regulated automatically in response to movement of the carriage **97** in either direction.

It will be apparent that my invention provides a highly advantageous continuous tube wrapping machine and method which can be operated efficiently with a minimum of manual operations and at relatively high production rates. The mechanism for adjusting the speed of axial travel of the tube to accommodate variations in width of the covering material insures a uniformly acceptable finished product under practical operating conditions and with normally available materials.

Although the invention has been described with particular attention to a certain structural embodiment, it is to be understood that various modifications and equivalents may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. An apparatus for wrapping a tube of the character described comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube for simultaneously rotating and axially advancing the tube, means for continuously supplying an adhesive-coated strip of covering material to said tube forwardly of said driving elements, said strip being spirally wrapped around the tube during rotation and axial advancement of the latter, and support means comprising a plurality of rollers disposed intermediate said driving elements and the portion of the tube being wrapped, said rollers being engageable with the exterior of the tube closely adjacent the portion thereof being wrapped for laterally supporting and retaining the tube during wrapping thereof.

2. An apparatus for spirally wrapping a strip of covering material around an elongated tube of relatively slight rigidity, comprising rotating tube-driving means engageable with the tube at only the exterior thereof for rotating the tube about its axis, said tube-driving means also including means for axially advancing the tube simultaneously with rotation thereof, means for continuously feeding an adhesive-coated strip of covering material to said tube forwardly of said tube-driving means for spirally wrapping the strip around the tube during rotation and axial advancement of the latter, and supporting means engageable with the unwrapped tube only at its exterior for imparting lateral rigidity to the tube without the use of an internal mandrel, said supporting means comprising a plurality of rollers adapted to engage the outer periphery of the tube forwardly of said tube-driving means and closely adjacent the portion of the tube being wrapped and said rollers being spaced circumferentially around the tube.

3. An apparatus for performing an operation on an elongated tube of relatively slight rigidity whereby the tube is subjected to forces tending to move the tube laterally, said apparatus comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube at circumferentially spaced points therearound for simultaneously rotating the tube about its axis and axially advancing the tube, and a plurality of supporting rollers spaced forwardly from said driving elements and engageable with the exterior of the tube closely adjacent the portion of the tube being operated upon, said rollers also being spaced circumferentially around the tube for imparting lateral rigidity to the tube.

4. The apparatus of claim 3 further characterized in that said driving elements comprise a plurality of rollers having toothed surfaces for frictionally engaging and rotating the tube.

5. In an apparatus for wrapping a tube of the character described, a plurality of rotating driving elements frictionally engageable with the exterior of the tube for rotating the tube about its axis, a plurality of radially extending yokes located at circumferentially spaced points around the tube and carrying said driving elements, means operatively connected to said driving elements for driving the same in unison, means providing a swivel support for each of said yokes individually, a plurality of actuating arms extending outwardly from said yokes and rigidly connected thereto, and adjustable means operatively connected to said arms for swiveling said yokes in unison whereby to vary the angular relation of said driving elements to the axis of the tube and thereby effecting axial advancement of the tube at a predetermined rate simultaneously with rotation of the tube.

6. In an apparatus for wrapping a tube of the character described, a plurality of rotating driving elements frictionally engageable with the exterior of the tube for rotating the tube about its axis, a plurality of radially extending yokes located at circumferentially spaced points around the tube and carrying said driving elements, means operatively connected to said driving elements for driving the same in unison, means providing a swivel support for each of said yokes individually, a plurality of actuating arms extending outwardly from said yokes and rigidly connected thereto, a plurality of axially movable rods operatively connected to said actuating arms, and rotary adjustment means operatively interconnecting said rods for shifting the rods axially in unison and thereby swiveling said yokes in unison whereby to vary the angular relation of said driving elements to the axis of the tube and thereby effecting axial advancement of the tube at a predetermined rate simultaneously with rotation of the tube.

7. In an apparatus for spirally wrapping a strip of covering material around an elongated tube, a plurality of sets of rotating driving elements frictionally engageable with the exterior of the tube at circumferentially spaced points around the tube, each of said sets comprising a plurality of rotating driving elements arranged in side-by-side relation axially of the tube, means operatively connected to said driving elements for driving the same in unison, a plurality of swivel supports for individually supporting the driving elements in each of said sets, a plurality of actuating arms extending outwardly from said swivel supports and rigidly connected thereto. means interconnecting the actuating arms for each of said sets of driving elements for movement thereof substantially as a unit, and adjustable means having operating connections with each set of interconnected actuating arms whereby to vary in unison the angular relation of said driving elements to the axis of the tube and thereby effecting axial advancement of the tube at a predetermined rate simultaneously with rotation of the tube.

8. The apparatus of claim 7 further characterized in that said means interconnecting the actuating arms for each set of driving elements comprises a plurality of axially movable rods, each rod having rigid connections with one set of arms, and said adjustable means comprises a plurality of rotatable members threadedly engaged with said rods for axially moving the rods in response to rotary adjustment of the rotatable members, said rotatable members being operatively interconnected for effecting movement of the rods in unison upon adjustment of one of said rotatable members.

9. An apparatus for spirally wrapping a strip of covering material around an elongated tube, comprising a pair of spaced upright walls with aligned apertures therein adapted to have the tube extend therethrough, a plurality of elongated members extending rigidly between said walls and spaced radially from and circumferentially around the tube, a plurality of radially extending yokes swivelly mounted on said elongated members and carrying rotatable driving elements frictionally engageable with the exterior of the tube for rotating the tube about its axis, drive means operatively connected to said driving elements for driving the same in unison, means for continuously supplying an adhesive-coated strip of covering material to said tube forwardly of said driving elements for spirally wrapping the strip around the tube during rotation thereof, a plurality of radially extending caster supports rigidly mounted on said elongated members and carrying rotatable caster wheels engageable with the outer periphery of the tube forwardly of said driving elements and closely adjacent the portion of the tube being wrapped, said caster wheels imparting lateral support and rigidity to the tube during wrapping thereof, and adjust-

able means operatively connected to said yokes for varying in unison the angular relation of said driving elements to the axis of the tube whereby to regulate the rate of axial advancement of the tube.

10. The apparatus of claim 9 further characterized in that said drive means comprises a plurality of rotatable shafts extending between said walls adjacent said elongated members, means operatively interconnecting said shafts for rotation thereof in unison in response to driving of one of the shafts, and individual driving connections between said shafts and said driving elements.

11. An apparatus for wrapping a tube of the character described comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube for effecting simultaneous rotation and axial advancement of the tube, means for continuously feeding an adhesive-coated strip to the tube for spirally wrapping the strip on the tube during rotary and axial movement of the latter, guide means coacting with said strip for urging the incoming portion of said strip forwardly of the tube into butt edge relation with the portion of the strip already wrapped on the tube, shiftable means operatively connected to said guide means and movable in response to changes in width of the strip, and means for regulating the rate of axial advancement of the tube to compensate for changes of the width of said strip.

12. An apparatus for wrapping a tube of the character described comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube for effecting simultaneous rotation and axial advancement of the tube, means for continuously feeding an adhesive-coated strip to the tube for spirally wrapping the strip on the tube during rotary and axial movement of the latter, swivel support means for said driving elements, guide means coacting with said strip for urging the incoming portion of the strip forwardly of the tube into butt edge relation with the portion of the strip already wrapped on the tube, shiftable means operatively connected to said guide means and movable in response to changes in the width of the strip, and adjustable means operatively connected to said swivel support means for varying the angular relation of said driving elements to the axis of the tube and thereby permitting regulation of the rate of axial advancement of the tube to compensate for changes in the width of said strip.

13. An apparatus for wrapping a tube of the character described comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube for effecting simultaneous rotation and axial advancement of the tube, means for continuously feeding an adhesive-coated strip to the tube for spirally wrapping the strip on the tube during rotary and axial movement of the latter, a shiftable carriage mounted for movement longitudinally of the tube, guide means rigidly supported from said carriage and coacting with the opposite side edges of said strip for urging the incoming portion of the strip forwardly of the tube into butt edge relation with the portion of the strip already wrapped on the tube, said carriage being movable in response to changes in the width of the strip, and means for varying the angular relation of said driving elements to the axis of the tube and thereby permitting regulation of the rate of axial advancement of the tube to compensate for changes in the width of said strip.

14. An apparatus for wrapping a tube of the character described comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of an elongated tube for effecting simultaneous rotation and axial advancement of the tube, means for continuously feeding an adhesive-coated strip to the tube for spirally wrapping the strip on the tube during rotary and axial movement of the latter, a shiftable carriage mounted for movement longitudinally of the tube, a guide element rigidly supported from said carriage and engageable with the trailing side edge of said strip for urging the incoming portion of said strip forwardly of the tube, a coacting guide element rigidly supported from said carriage and engageable with the opposite or leading side edge of said strip for effecting transverse bulging of the strip and alignment of the leading side edge thereof in tight butt edge relation with the portion of the strip already wrapped on the tube, said carriage being movable in response to changes in width of the strip, and means for varying the angular relation of said driving elements to the axis of the tube thereby permitting regulation of the rate of axial advancement of the tube to compensate for changes in the width of said strip.

15. The apparatus of claim 14 further characterized in that said means for continuously feeding the adhesive-coated strip to the tube comprises an elongated guide channel adapted to direct the incoming portion of the strip at a predetermined feed angle to the tube for obtaining spiral wrapping of the strip on the tube, and means swivelly supporting said guide channel at the inner end thereof, said guide channel being swingable about its swivel support for varying said feed angle in response to variations in the width of said strip.

16. An apparatus for spirally wrapping a strip of covering material around an elongated tube, comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube at a predetermined angle to the axis of the tube for simultaneously rotating and axially advancing the tube, swingable means for directing an elongated adhesive-coated strip to said tube at a predetermined feed angle for obtaining spiral wrapping of the strip around the tube during rotation and axial advancement of the latter, said swingable means being pivotally movable for changing said feed angle in response to variations in the width of said strip, and means for varying the angular relation of said driving elements to the axis of the tube thereby permitting regulation of the rate of axial advancement of the tube to compensate for changes in the width of said strip.

17. An apparatus for spirally wrapping an elongated strip of covering material around an elongated tube, comprising tube-driving means including a plurality of rotating driving elements frictionally engageable with the exterior of the tube for simultaneously rotating and axially advancing the tube, first applicator means for continuously coating one side of the strip of covering material with a first adhesive coating, a drying rack supporting the adhesive-coated strip for movement therethrough to dry said first adhesive coating, second applicator means for continuously applying a second adhesive coating to said strip, and means for directing the strip from said second applicator means to the rotating and axially advancing tube at a predetermined feed angle for obtaining spiral wrapping of the strip under tension on the tube.

18. An apparatus for wrapping a tube of the character described comprising a pair of spaced upright walls with aligned apertures therein adapted to have the tube extend therethrough, a plurality of elongated members extending rigidly between said walls and spaced radially from and circumferentially around the tube, a plurality of radially extending yokes swivelly mounted on said elongated members and carrying rotatable driving elements frictionally engageable with the exterior of the tube for rotating the tube about its axis, means operatively connected to said driving elements for driving the same in unison, means for continuously supplying an adhesive-coated strip of covering material to said tube forwardly of said driving elements for spirally wrapping the strip around the tube during rotation thereof, a plurality of radially extending caster supports rigidly mounted on said elongated members and carrying rotatable caster wheels engageable with the outer periphery of the tube

forwardly of said driving elements and closely adjacent the portion of the tube being wrapped, said caster wheels imparting lateral support and rigidity to the tube during wrapping thereof, a shiftable carriage movably mounted on one of said elongated members for back and forth movement longitudinally of said tube, guide means rigidly supported from said carriage and coacting with the side edges of said strip for urging the incoming portion of the strip forwardly of the tube into butt edge relation with the portion of the strip already wrapped on the tube, said carriage thereby being movable in response to changes in the width of the strip, and adjustable means operatively connected to said yokes for varying the angular relation of said driving elements to the axis of the tube and thereby permitting regulation of the rate of axial advancement of the tube to compensate for changes in the width of said strip.

References Cited in the file of this patent

UNITED STATES PATENTS

1,883,401	Rolfs et al.	Oct. 18, 1932
2,489,503	Sampson et al.	Nov. 29, 1949
2,502,638	Becht	Apr. 4, 1950
2,625,979	Harris et al.	Jan. 20, 1953