

Aug. 8, 1961

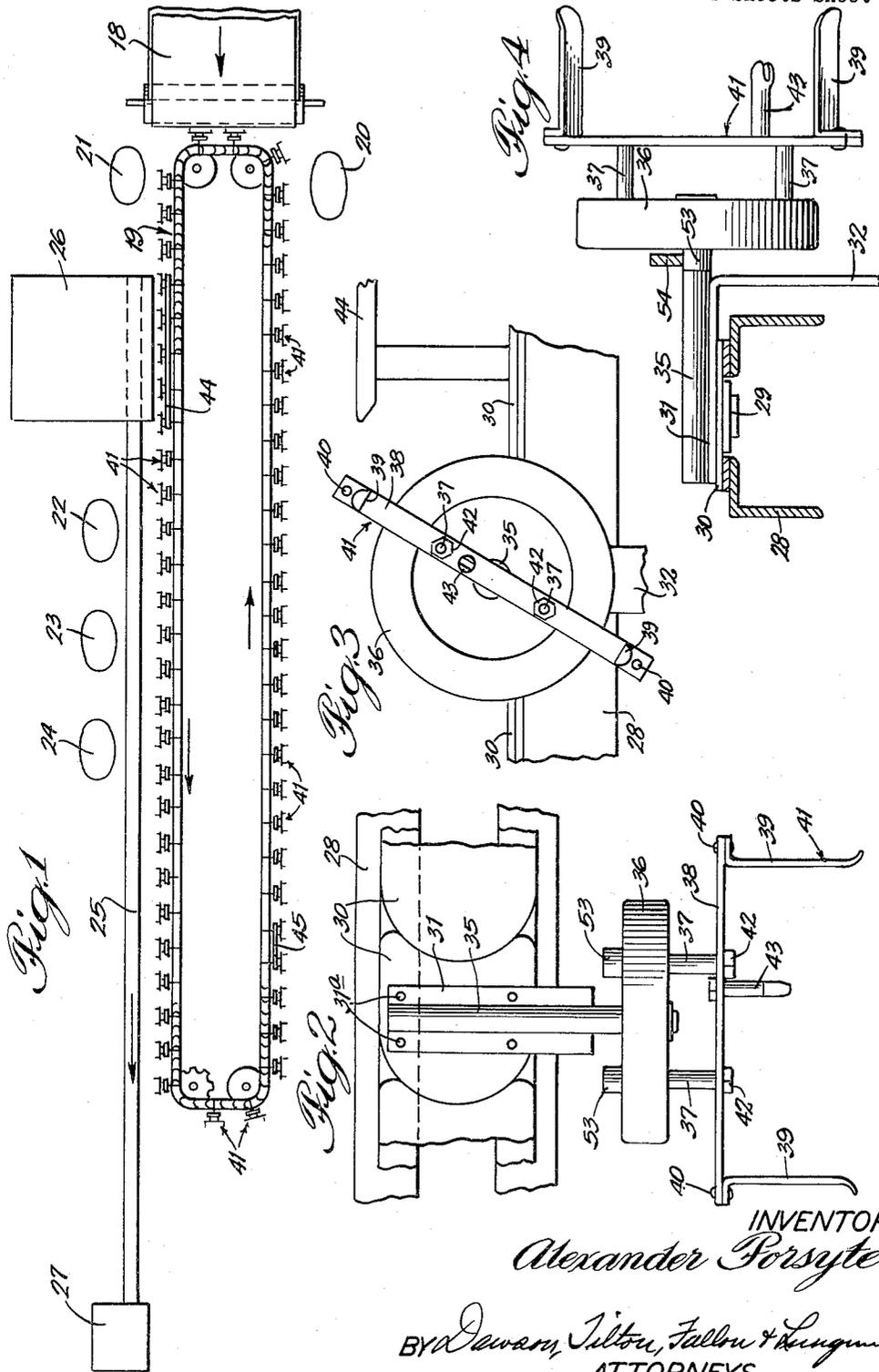
A. FORSYTE

2,995,315

WINDING APPARATUS

Filed Dec. 11, 1958

3 Sheets-Sheet 1



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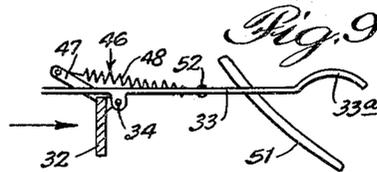
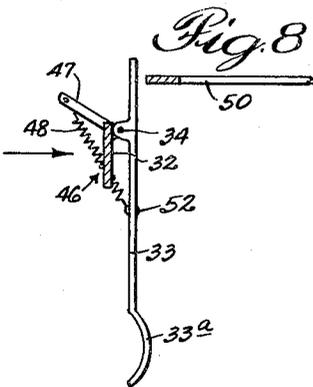
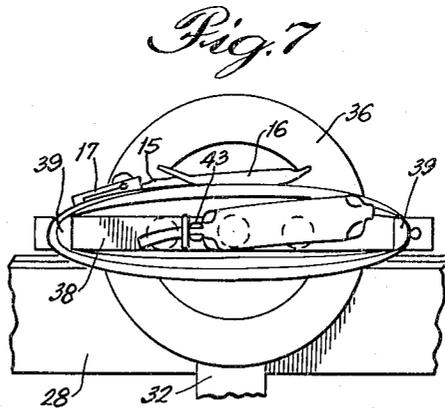
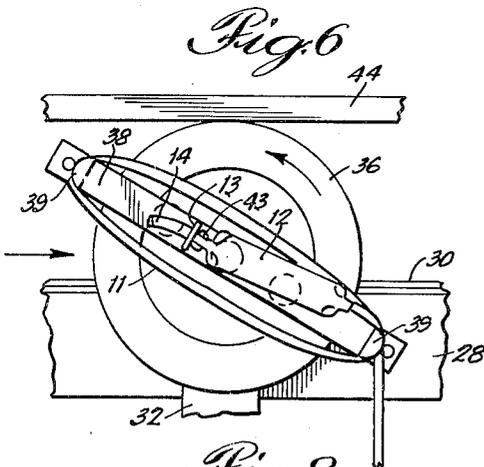
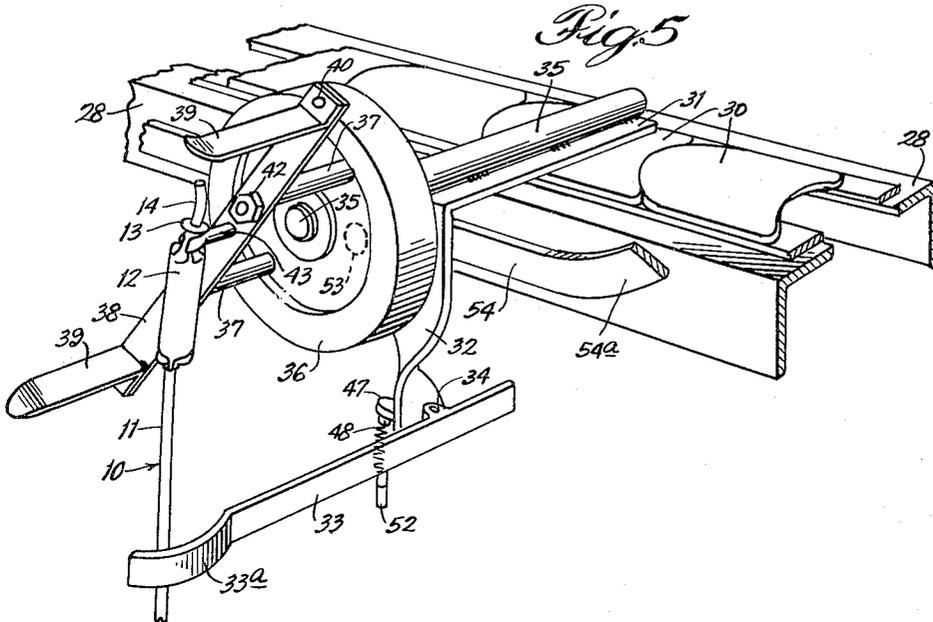
A. FORSYTE

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WINDING APPARATUS

Filed Dec. 11, 1958

3 Sheets-Sheet 2



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A. FORSYTE
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3 Sheets-Sheet 3

Fig. 10

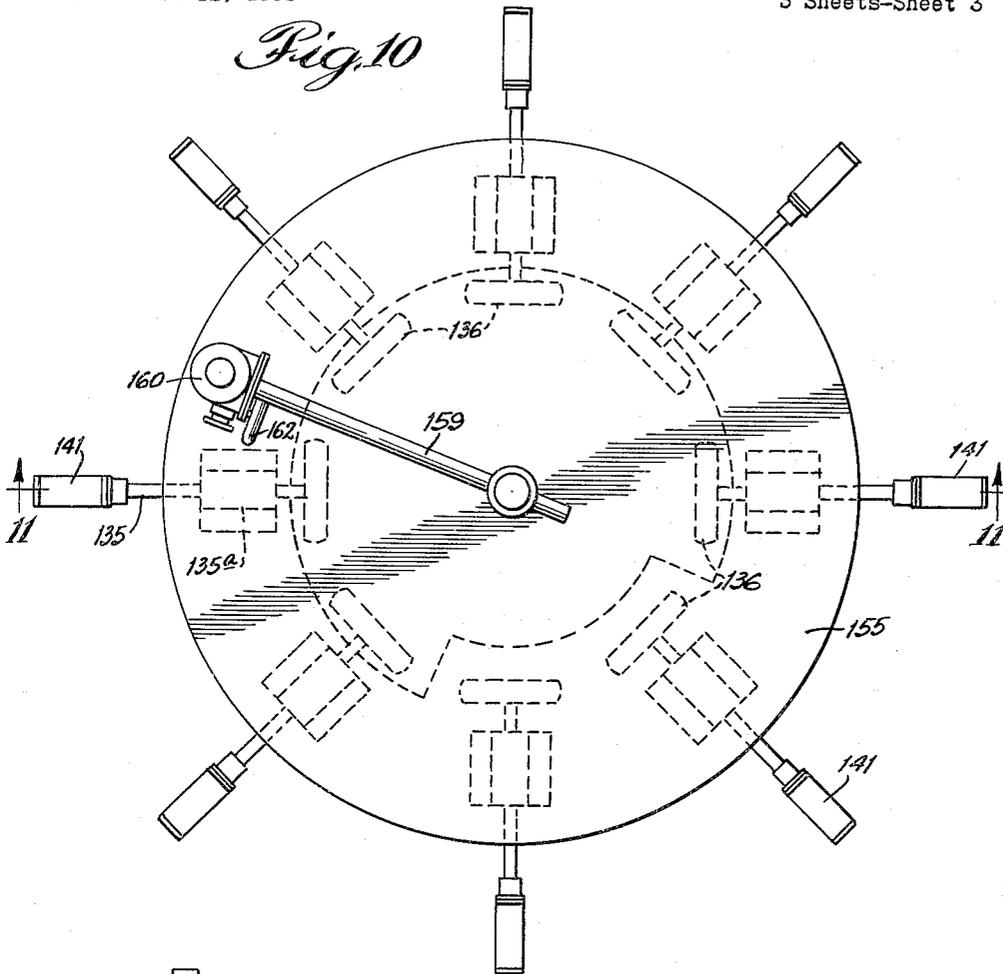
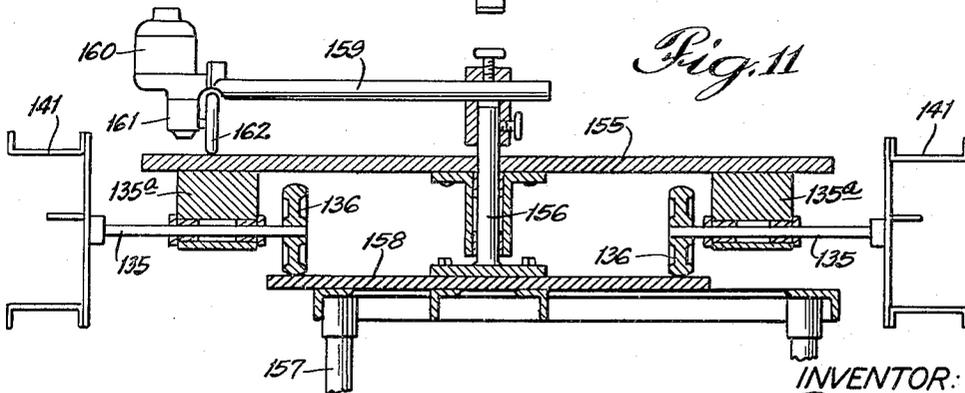


Fig. 11



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2,995,315

WINDING APPARATUS

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Filed Dec. 11, 1958, Ser. No. 779,612

6 Claims. (Cl. 242-85)

This invention relates to winding apparatus, and, more particularly, to winding apparatus for coiling parenteral tubing sets on themselves.

The tubing equipment or devices with which this invention has to do can be generally characterized as having as the main portion an elongated flexible tube. These are employed for conducting parenteral solutions such as blood, glucose, saline, etc., between a bottle or other container and a human. The elongated nature of these devices can be appreciated from the fact that very often in an administration of fluids, the bottle source is suspended some three feet above the intended recipient. Thus, a set may be as long as sixty inches or more.

The parenteral tubing set equipment which employs the elongated flexible tubing is also equipped with devices at the ends of the tubing for making the respective connections to the bottle or other fluid container and the human. Usually, both connections are in the form of needles or needle adapters. Also, where the set is to be employed for infusing fluid by the drip method, a drip-meter or drip-counting chamber is also interposed in the elongated conduit.

These devices are all well known to the art and are characterized by a host of minor variations in the different connectors, drip tubes, etc. Notwithstanding this wide variation, it is an absolute uniform practice in the production and use of these devices to maintain their interiors absolutely sterile and free of any contamination. This poses a problem in the packaging of the devices, in that it is mandatory that the interior of the elongated conduit be maintained in absolutely sterile condition. Any stressing of the parenteral tubing set may result in a loosening of one of the components making up the elongated conduit, with the chance that a contaminated set results. Not only is the entrance of microorganisms to be avoided, but the entire length of the set must be substantially impervious to air penetration. A loose connection, for example, between the drip tube and the flexible tubing may result in air being aspirated into the set, which may result in an embolism in the patient. Therefore, the practice has been in packaging these sets to wind them by hand. It was felt that conventional winding techniques would impart undesirable stresses to the set, with a possible separation of the various parts, or cause these parts to lose their air-tight sealing relation with each other.

It is an object of this invention to provide novel winding apparatus especially useful in coiling elongated flexible tubes, and the like, on themselves. Another object is to provide winding apparatus useful in winding parenteral tubing equipment where the tubing is wound substantially free of tensile stresses which otherwise might tend to disrupt the air-tight connection of the various parts making up the set. Still another object is to provide winding apparatus for sets employed for transferring parenteral fluids in which proper tensioning is achieved by supporting the set at its upper end while the set is stabilized against vibration at an intermediate point. Yet another object is to provide winding apparatus for parenteral tubing sets in which one end of the set is supported between a pair of parallel, spaced-apart, rotating arms with the other end dependent, whereby a kink-free coiled set is achieved.

A further object is to provide winding apparatus for

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parenteral tubing sets in which a plurality of winding devices are provided for continuous movement in a closed path in a horizontal plane, whereby one station may be employed for loading and another for unloading. A still further object is to provide a winding device for sets in which winding means move in a closed path, the path providing the means for rotating the winding means. Other objects and advantages of this invention can be seen as this specification proceeds.

This invention will be explained in conjunction with the accompanying drawing, in which—

FIG. 1 is a fragmentary top plan view of a packaging production line which features the winding apparatus of the invention;

FIG. 2 is an enlarged top plan view of a section of the conveyor portion of the winding apparatus and equipped with the means for winding sets;

FIG. 3 is a front elevational view of the apparatus seen in FIG. 2;

FIG. 4 is a side elevational view, partly in section, of the apparatus seen in FIGS. 2 and 3;

FIG. 5 is a fragmentary perspective view of the winding apparatus seen in FIG. 1 and which is seen in various projections in FIGS. 2-4;

FIG. 6 is a view similar to FIG. 3 and showing a front elevational view of a particular winding device and which is shown in an operative condition in winding a parenteral tubing set upon itself;

FIG. 7 is a view similar to FIG. 6 but showing the parts thereof in yet another operative position;

FIG. 8 is a schematic representation of the stabilizing means employed in connection with the winding apparatus seen in FIG. 5;

FIG. 9 is a view similar to FIG. 8 but showing the apparatus in a different operative condition;

FIG. 10 is a top plan view of a modified form of winding apparatus; and

FIG. 11 is a side elevational view, partially in section, of the apparatus seen in FIG. 10.

Referring now to the drawing and to FIG. 5 in particular, a parenteral tubing set generally designated 10 is seen in fragmentary perspective view and about to be coiled upon itself through the device to be disclosed in detail herein. The set 10 includes a length of flexible, transparent tubing 11, generally constructed of a plastic material and, as pointed out before, may be of considerable length, i.e., three to six feet. The upper end of the tubing 11 is connected to a drip housing 12, while the upper end of the drip housing 12 is connected to a plug-in connector or cannula 13, suitably equipped with a protector sleeve 14.

The lower end of the tubing set can be seen in FIG. 7 and the other end of the tubing 11 is equipped with a needle adapter 15 also suitably covered by a protector sleeve 16. Intermediate the ends of the length of tubing 11 may be positioned a clamping device such as is designated by the numeral 17 in FIG. 7. The parenteral tubing set just described may be seen in greater detail in Thomas et al. Patent No. 2,777,443, or Treptow Patent No. 2,855,173. However, it is to be appreciated that the precise type of parenteral tubing set handled by the apparatus herein may take many forms other than that pictured.

Briefly, the invention contemplates manipulating a set 10 as disposed in FIG. 5 and winding it upon itself in the operational sequence shown in FIGS. 6 and 7. Thereafter, the set 10 is removed from the winding equipment and packaged for shipment. A production line set up for this is seen in FIG. 1, in which the numeral 18 designates an in-feed conveyor which delivers uncoiled sets to the winding apparatus, designated generally by the numeral 19. With the apparatus 19 arranged as indicated, there

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are two positions 20 and 21 available for operators to remove sets from the in-feed conveyor 18 and place them on the winding equipment in the condition seen in FIG. 5. When the winding operation on a set is completed, the set may be removed in the condition seen in FIG. 7 from several stations designated by the numerals 22, 23 and 24 in FIG. 1. The operators at these stations also have in front of them an out-feed conveyor 25 which carries on it opened cartons supplied from a source 26 and into which the coiled sets are positioned for collection and distribution at 27.

The winding apparatus 19, as best seen in FIGS. 4 and 5, includes a conveyor frame 28, on which is slidably mounted a conveyor 29 made up of a plurality of crescent-shaped elements 30. With elements 30 as pictured, the conveyor is adapted to turn fairly sharp corners, as seen in FIG. 1. The conveyor 29 is equipped at spaced-apart points with brackets 31 that extend horizontally and outwardly of the closed path of the horizontally-disposed conveyor. The brackets 31 are generally L-shaped, with the outwardly-extending portion of the bracket being depending as at 32 in FIG. 5, and equipped with a guide member 33 pivotally mounted on the bracket 31 as at 34. The two positions of the guide member 33 can be seen in FIGS. 8 and 9 in a schematic representation.

The bracket 31, which may be bolted to one of the crescent-shaped members 30 as at 31a (see FIG. 2) also carries a horizontally-extending shaft 35. Rotatably mounted on shaft 35 is a wheel 36, the wheel 36 being at the outer end of shaft 35. The wheel 36 in turn is equipped with a pair of spaced-apart, horizontally-extending posts 37, which carry a transverse framing member 38. The transverse framing member 38 (as best seen in FIG. 2) is equipped at its ends with horizontally-disposed, outwardly-extending arm members 39 which are bolted to the transverse frame member 38 as at 40. Thus, rotation of wheel 36 causes a like rotation of the sub-bracket generally designated 41 and which includes the arms 39 bolted as at 40 to the transverse frame member 38, the transverse frame member 38 being secured to posts 37 by means of nuts 42.

In the illustration given, the arms 39 are equally spaced from the center of wheel 36, while the holding fork 43 for the tubing set 10 is slightly off-center of the wheel, although mounted on transverse member 38 between arms 39.

In the operation of the device, one end of the set 10 is positioned on the fork 43 and thereafter rotation of the wheel 36, as seen in FIGS. 6 and 7, causes the set 10 to be coiled on itself and about arms 39.

Rotation of the wheel 36 is provided by a track 44 seen in FIGS. 1 and 3. The track 44 is secured to the frame 28 of the conveyor and rotates wheel 36 through frictional engagement of the wheel with the track. In the illustration given, a second track 45 (seen only in FIG. 1) is provided between the last unloading station 24 and the first loading station 20, in order to rotate the wheel 36 to a predetermined loading position. For example, the track 44 may be of a length to rotate the wheel 36 about three and one-half revolutions, while track 45 will provide the fractional revolution necessary to make the entire circular motion of the wheel an integral number of revolutions.

During the winding of set 10 on arms 39, the guide bar 33 supports the depending length of tubing 11 at an intermediate position and prevents sideway or vibration in the same. For this purpose, the guide bar 33 is positioned a spaced distance below the bracket frame 41 and continuously presents a sideways force against tubing 11. The guide bar 33 is equipped at its unattached end (as best seen in FIG. 5) with a curved portion 33a which further inhibits vibration of set 10 in the winding apparatus so that especially the portion of length of the set being wound is supported in a substantially vibration-

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less condition. At the time the set 10 is being mounted in the fork 43, the guide arm 33 is pivoted to a direction substantially parallel with the travel of the conveyor and which is shown schematically in FIG. 9. Thereafter, the guide arm 33 is pivoted to the position shown in FIG. 8, where it can provide its desirable support of the tubing 11. The pivotal movement of the guide arms 33 on the depending legs 32 of bracket 31 is constrained to the two positions shown in FIGS. 8 and 9 through a toggle and spring arrangement generally designated by the numeral 46. The arrangement 46 includes a toggle member 47 connected between the pivot point 34 on leg 32, and one end of a spring 48. The other end of the spring 48 is connected to an intermediate point on guide arm 33 as at 49. The conveyor frame 28 is equipped with a cam surface 50 (seen in FIG. 8) which engages the end of guide arm 33 remote from the curved portion 33a and causes the guide arm 33 to rotate from the condition shown in FIG. 8 to that of FIG. 9 (also as seen in FIG. 5). Subsequently, a second cam surface 51 (seen only in FIG. 9) and provided as a part of conveyor frame 28 engages a depending post 52 (see FIG. 5) on guide arm 33 to bring about the pivotal outward movement of guide arm 33.

The inner face of wheel 36 is equipped with a pair of inwardly-extending posts 53 (best seen in FIG. 4). When the wheel 36 is out of frictional engagement with the tracks 44 and 45, a restraining bar 54 provided as part of frame 28 bears against these two posts 53 to immobilize wheel 36 against rotation. To insure the proper engagement of the posts 53 with the rail 54, the rail 54 may be inclined upwardly at its two ends as at 54a so as to engage the posts 53 irrespective of their rotational position and to permit the track 44 to cause wheel 36 to rotate without binding.

A modified form of the winding apparatus is seen in FIGS. 10 and 11. As before, a wheel is provided, designated in FIGS. 10 and 11 by the numeral 136, which is fixed to a shaft 135 suitably journaled in a bearing 135a (see FIG. 11). The end of shaft 135 opposite that to which wheel 136 is fixed rigidly carries a bracket frame 141 analogous to that described heretofore in connection with FIGS. 1-9. The bearing blocks 135a are secured in a depending position through a work table 155, which is journaled for rotation about a centrally-disposed, vertically-extending standard 156. The standard 156 is carried by a platform 157 which on its upper surface provides a platform 158. The standard 156 carries a laterally-extending arm 159, on which is mounted an electric motor 160. The electric motor 160, through a gear arrangement 161, drives a wheel 162. Thus, as the wheel 162 rotates under the power delivered to it from motor 160, the arm 159 being immobilized in a predetermined radial position, the work table 155 rotates about the standard 156. The rotation of work table 155 induces rotation of wheels 136 on platform 158, thereby causing rotation of the bracket frames 141 to wind sets in the procedure described hereinbefore.

While, in the foregoing specification, I have set forth a detailed description of an embodiment of the invention for the purpose of illustration, those skilled in the art will perceive many variations in the details thereof without departing from the spirit and scope of the invention.

I claim:

1. In apparatus for winding parenteral tubing sets, endless conveyor means, a bracket supported on said conveyor means, a sub-bracket mounted on said bracket for rotation about a generally horizontal axis, means for rotating said sub-bracket, said sub-bracket member providing horizontally-extending, spaced-apart arms, means on said sub-bracket between said arms for releasably supporting one end of a set, arm means stabilizing a portion of said set remote from said one end by fric-

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tionally engaging the same, the stabilizing means being pivotally supported on said bracket a spaced distance below said sub-bracket, and means on said conveyor means for selectively pivoting said stabilizing means.

2. The structure of claim 1 in which a wheel is rotatably supported on said bracket, said sub-bracket being secured to said wheel, interrupted track means on said conveyor means for frictionally engaging said wheel for selectively rotating said sub-bracket.

3. The structure of claim 2 in which said conveyor means is equipped with means for immobilizing said wheel in a predetermined position when said wheel is out of frictional engagement with said track means.

4. In winding apparatus for parenteral tubing sets, a frame, an endless conveyor on said frame for travel in a closed path in a horizontal plane, a plurality of equally-spaced, horizontally-extending bracket supports on said conveyor, a bracket on each support and rotatably carrying a wheel for rotation in a vertical plane, a pair of spaced-apart, horizontally-extending arms on one face of each wheel, means on said one face of each wheel for supporting one end of a parenteral tubing set between said arms, a length of track on said frame frictionally engaged by said wheel adjacent a portion of said conveyor, post means on the other face of said wheel, and

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means on said frame for contacting said post means to orient said wheel in a predetermined position.

5. The structure of claim 4 in which said bracket is equipped with a laterally-extending guide bar spaced below said wheel.

6. The structure of claim 5 in which said guide bar is pivotally mounted on said bracket and means are provided on said frame for pivoting said guide bar.

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