Aug. 8, 1961 A. FORSYTE 2,995,315

WINDING APPARATUS

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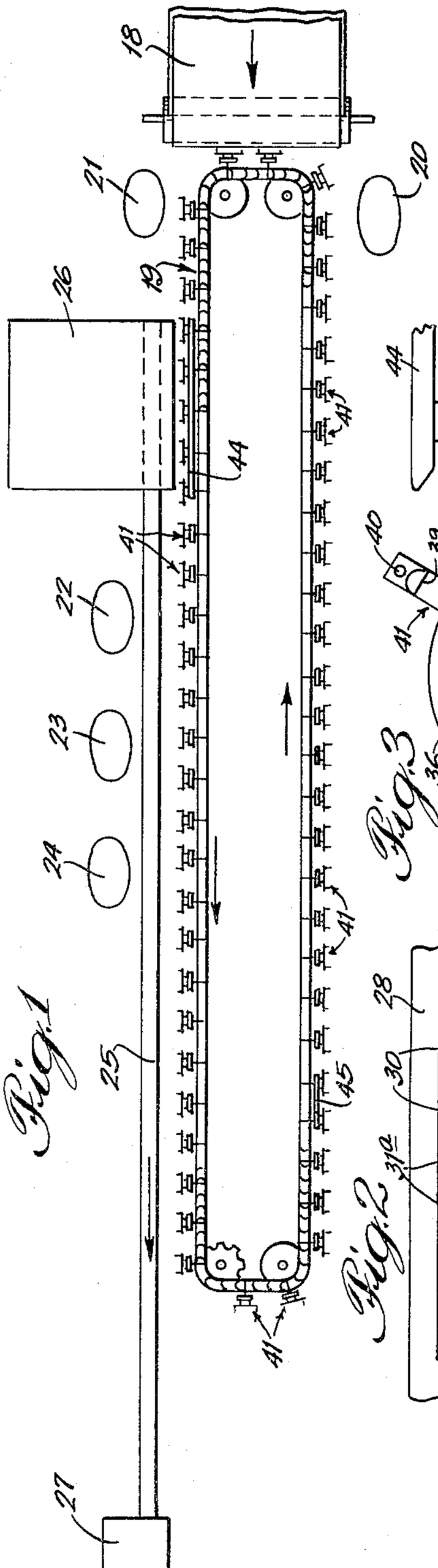

Fig. 1

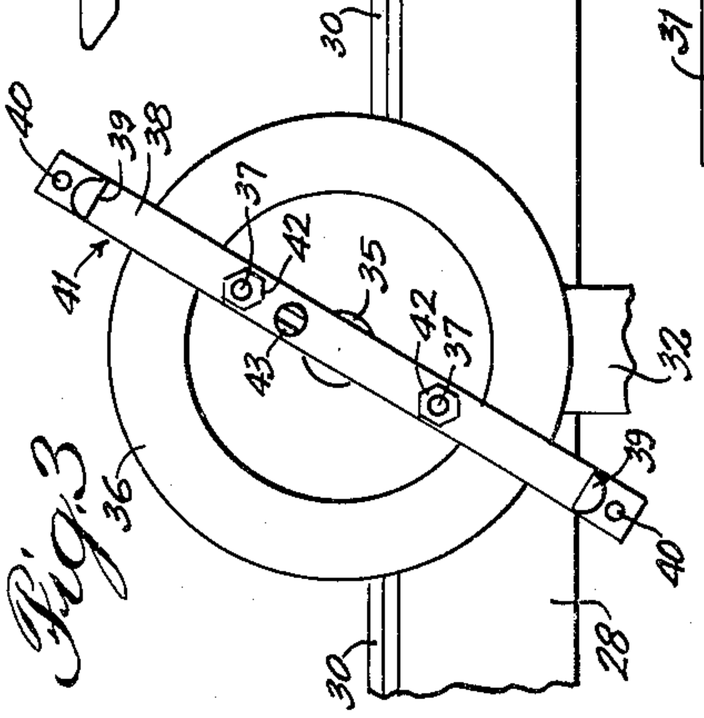

Fig. 3

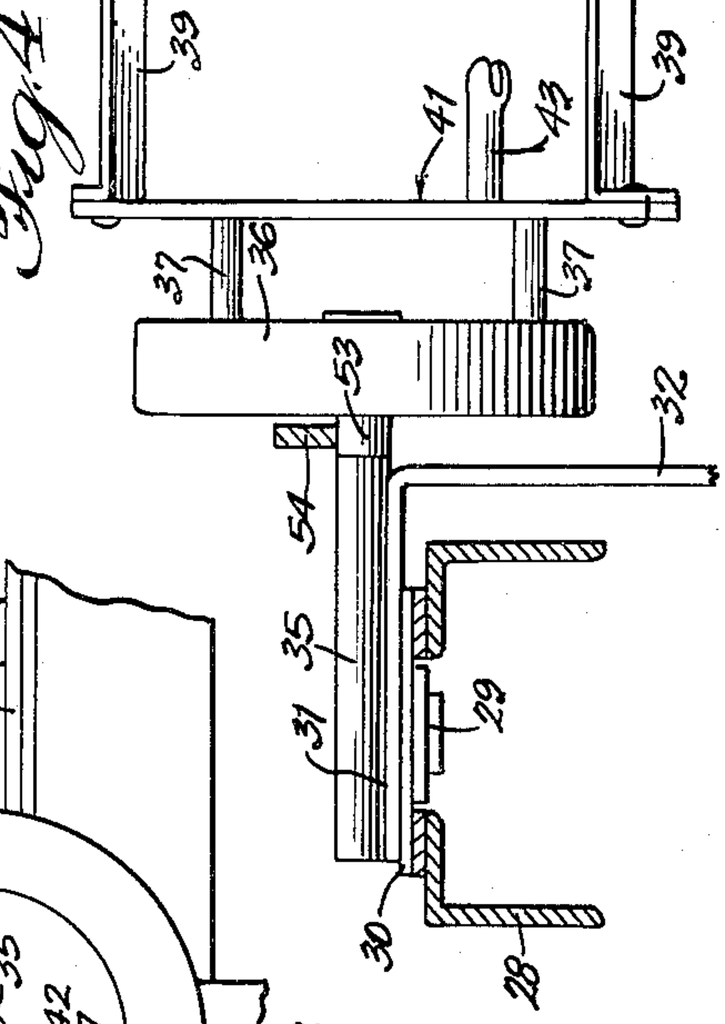

Fig. 4

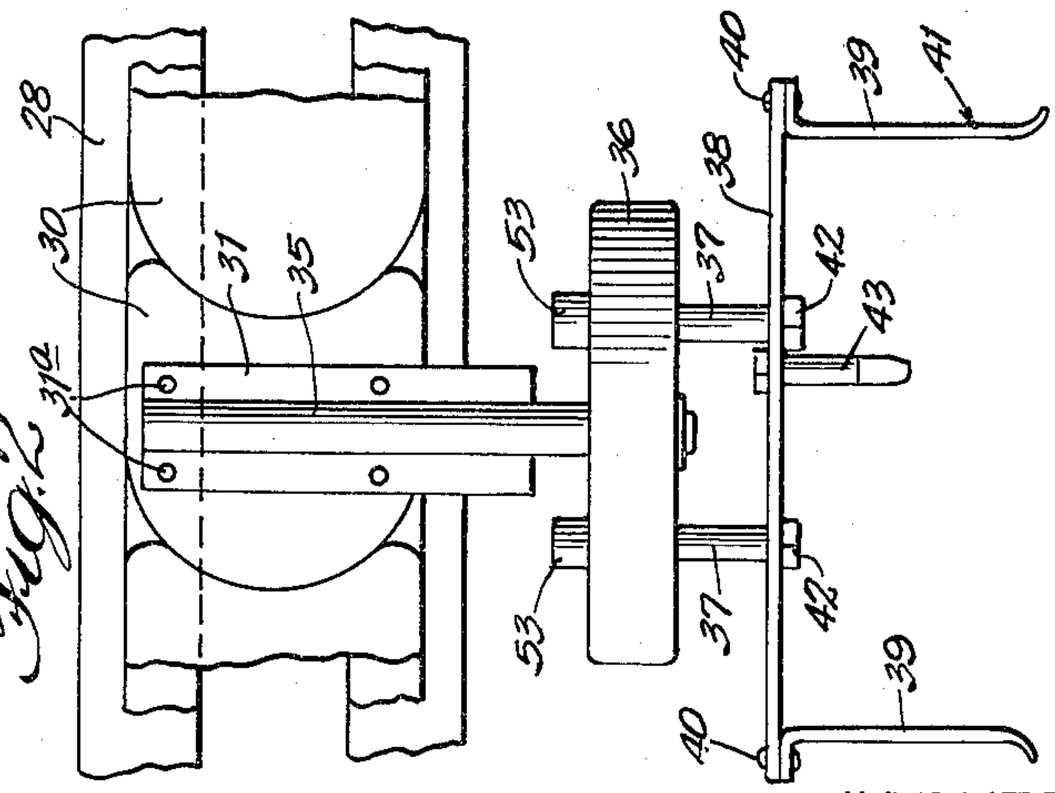

Fig. 2

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Fig. 5

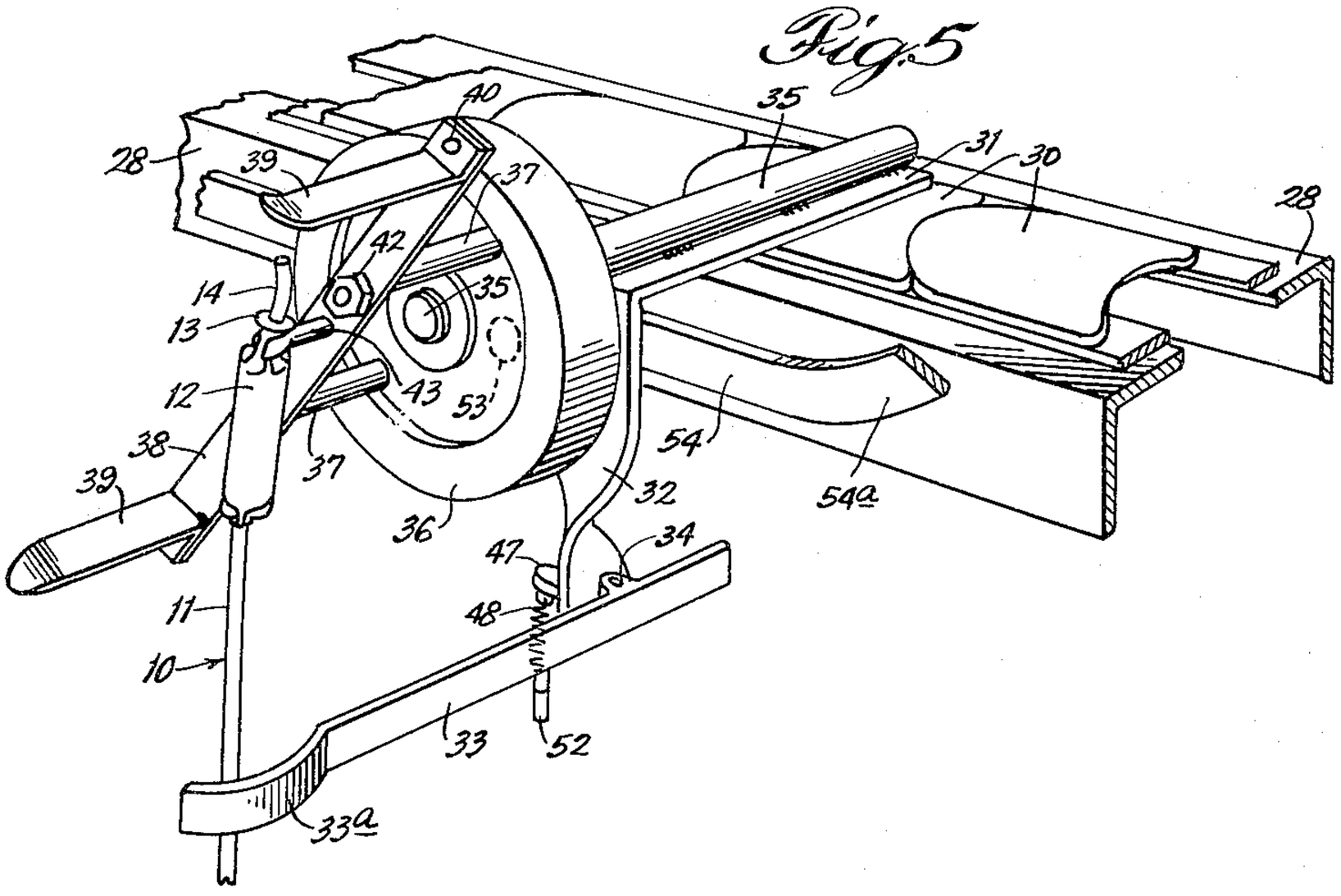

Fig. 6

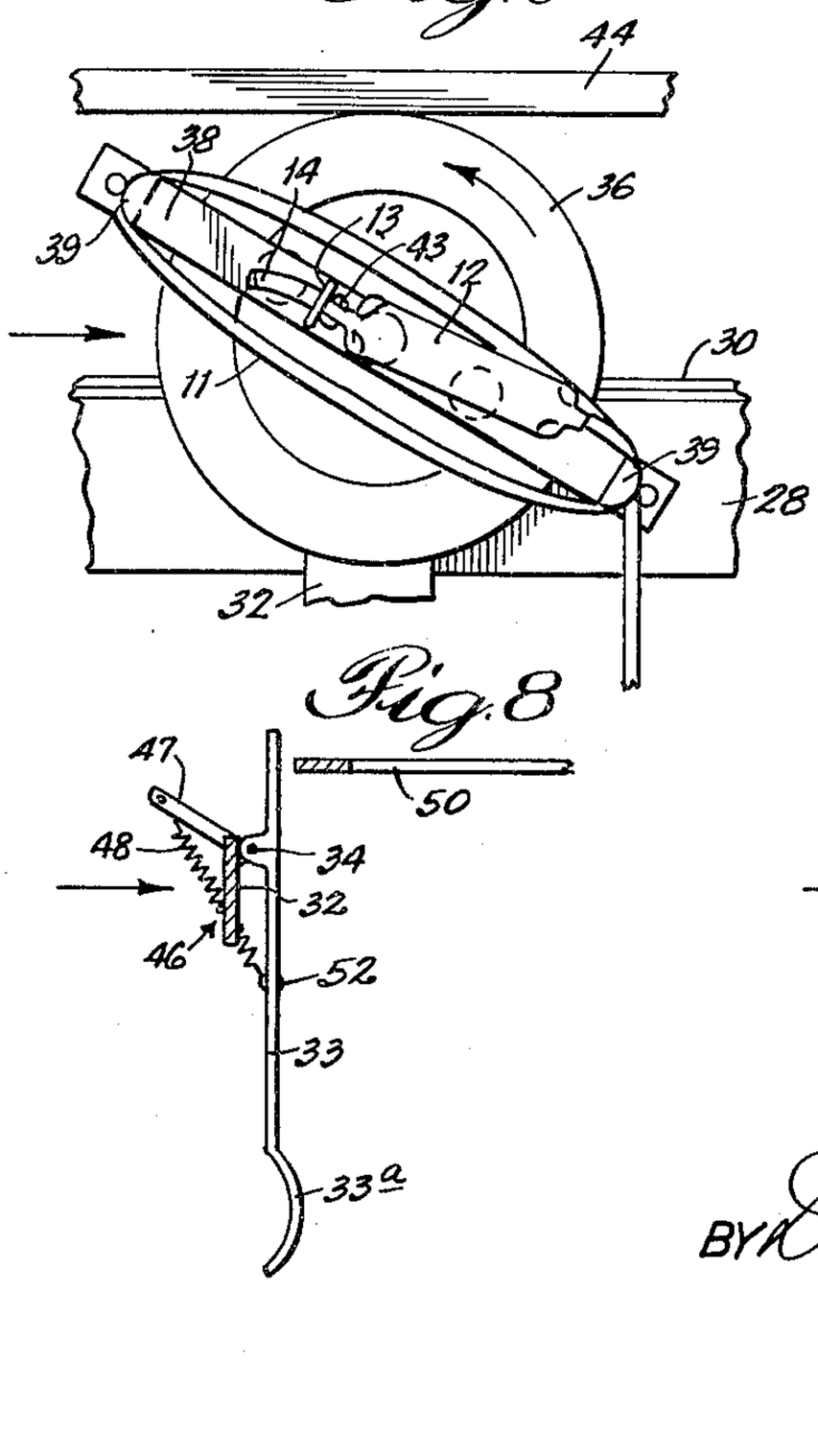

Fig. 7

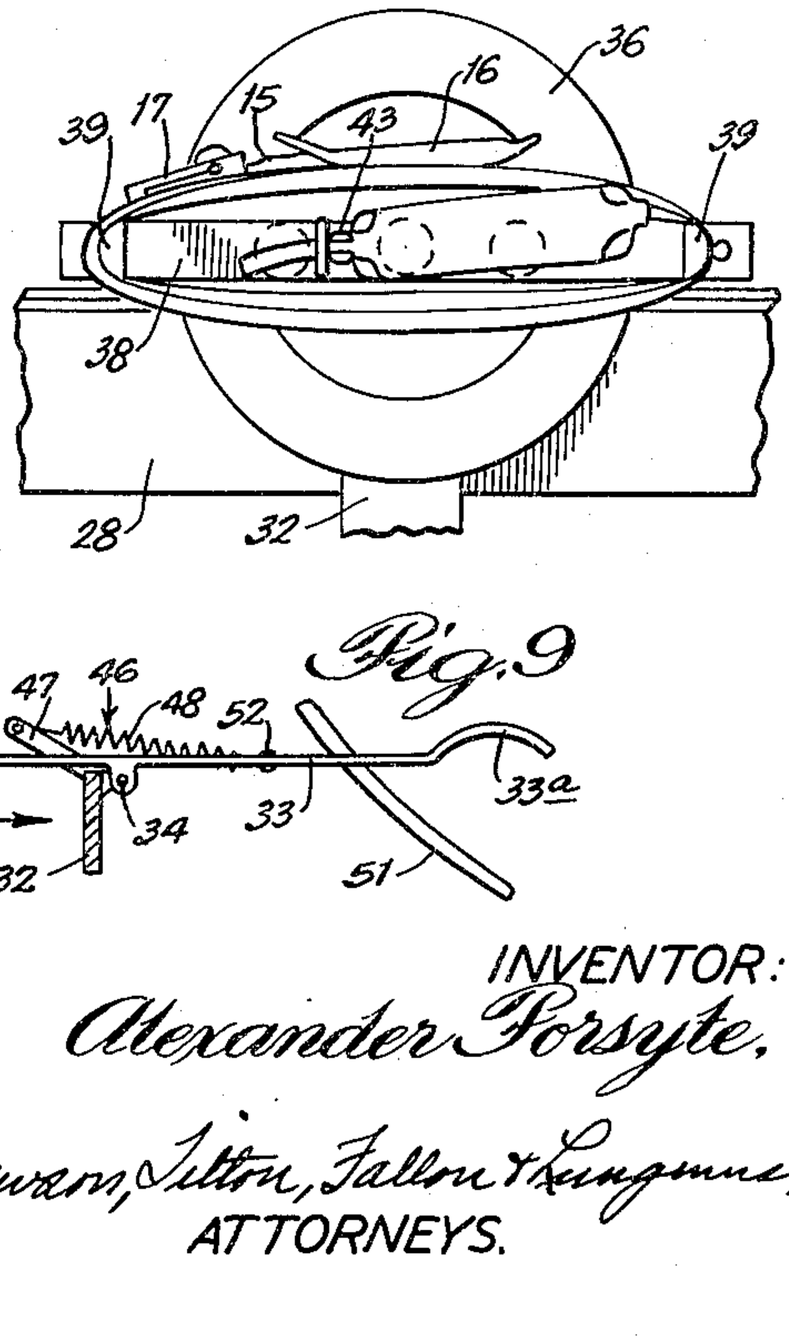

Fig. 8

Fig. 9

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Fig. 10

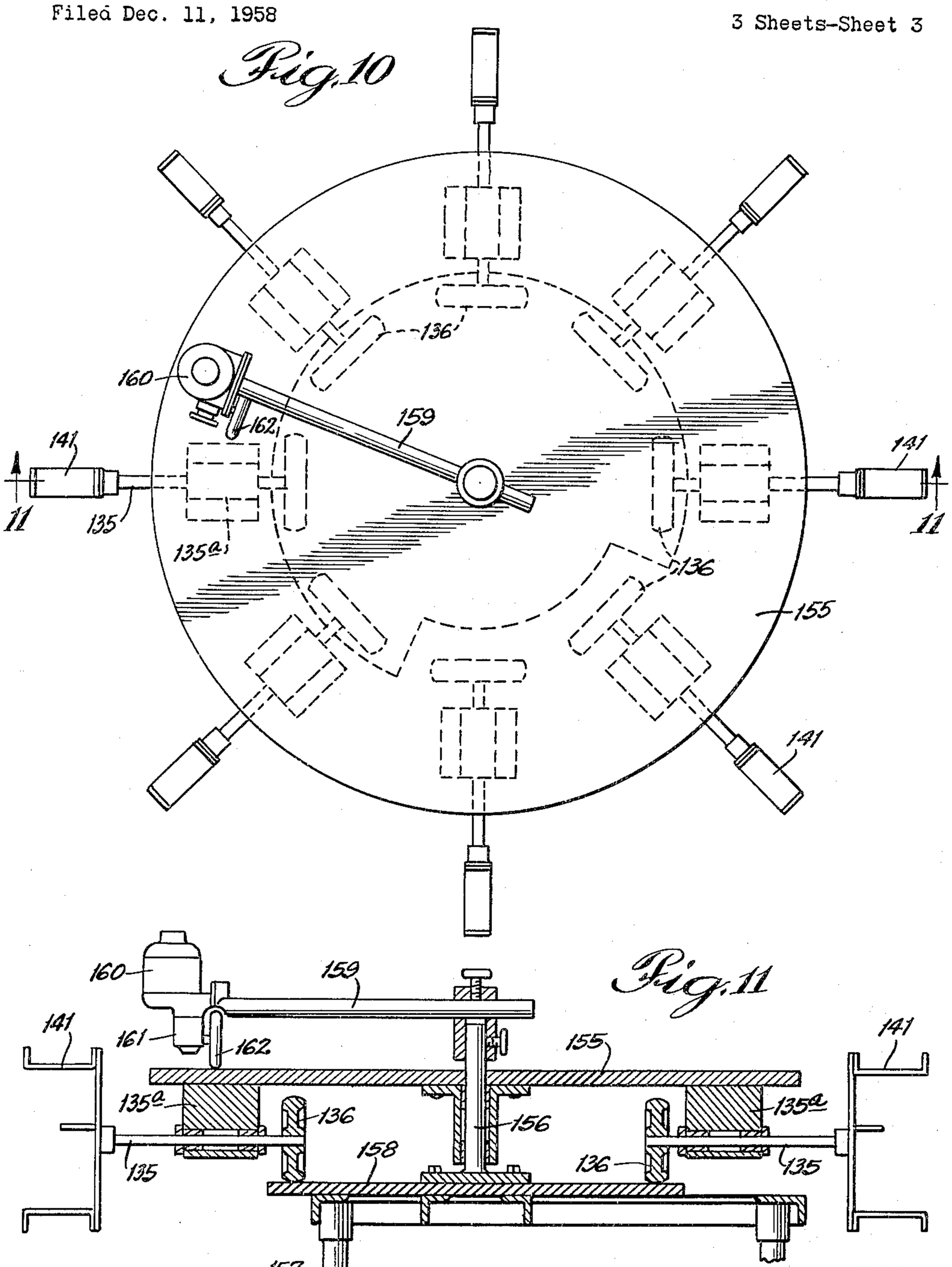

Fig. 11

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WINDING APPARATUS

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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

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

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 **31***a* (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 sidesway 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 **33***a* 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-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 **33***a* 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 **54***a* 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 **135***a* (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 **135***a* 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-

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

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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