June 11, 1929. E. CONTI 1,716,424

TUBE FORMING MACHINE

Original Filed May 15, 1925 4 Sheets-Sheet 1

Fig. 1

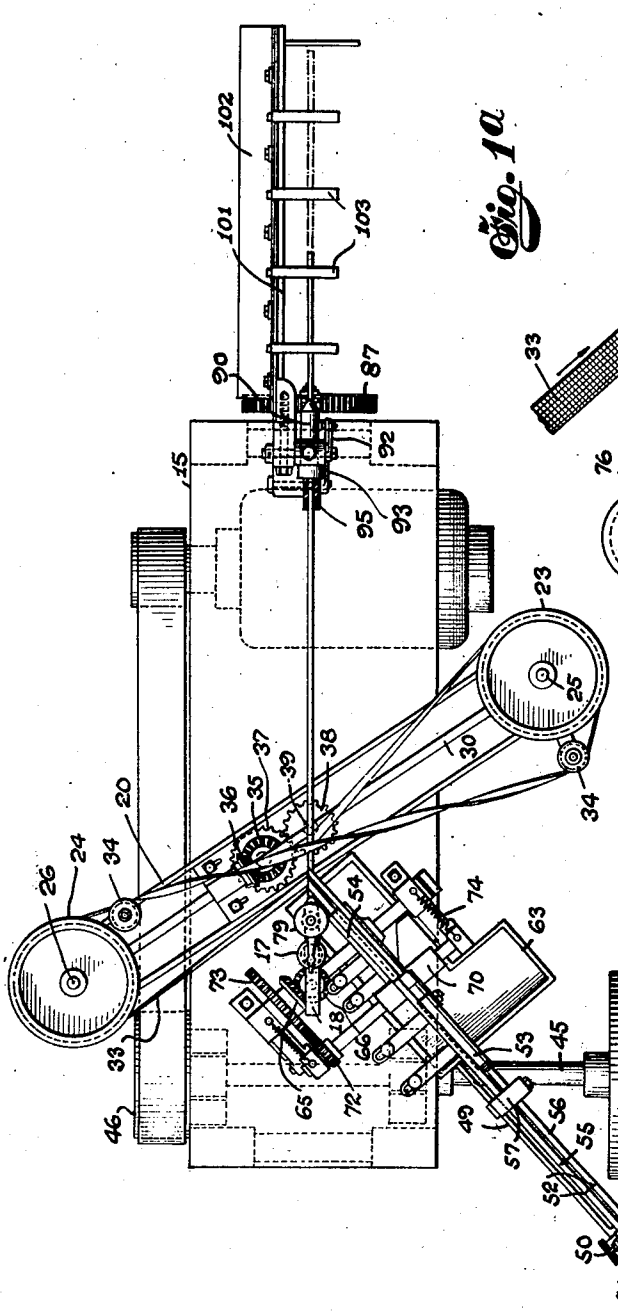
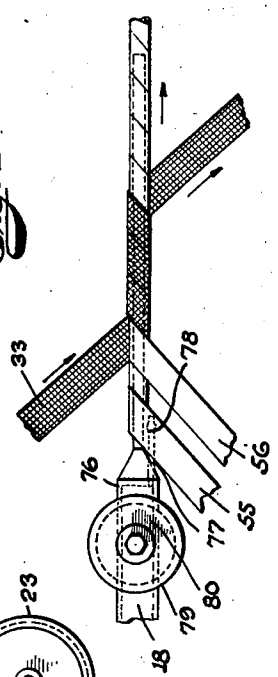


Fig. 1a



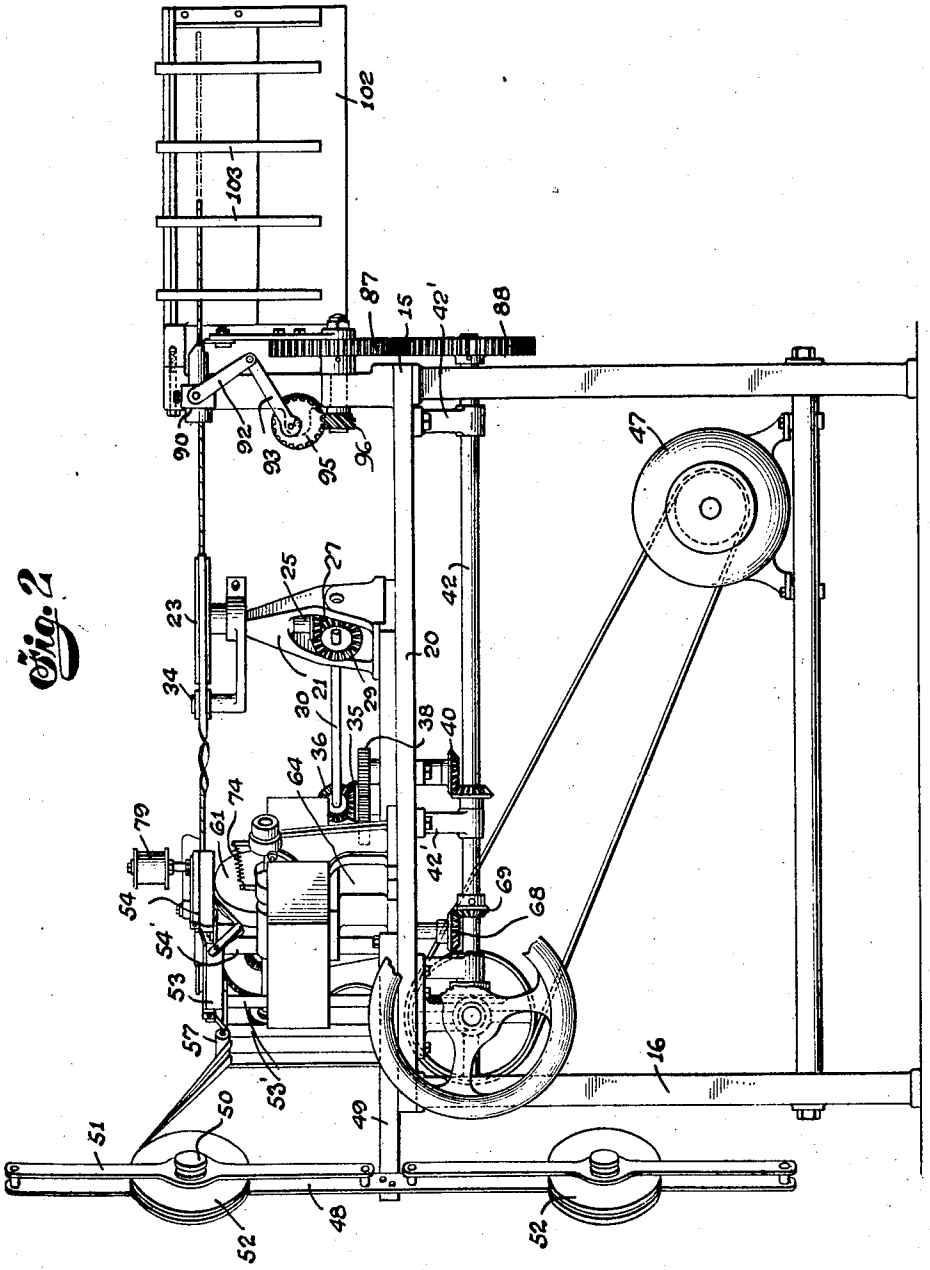
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Fig. 2



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TUBE FORMING MACHINE

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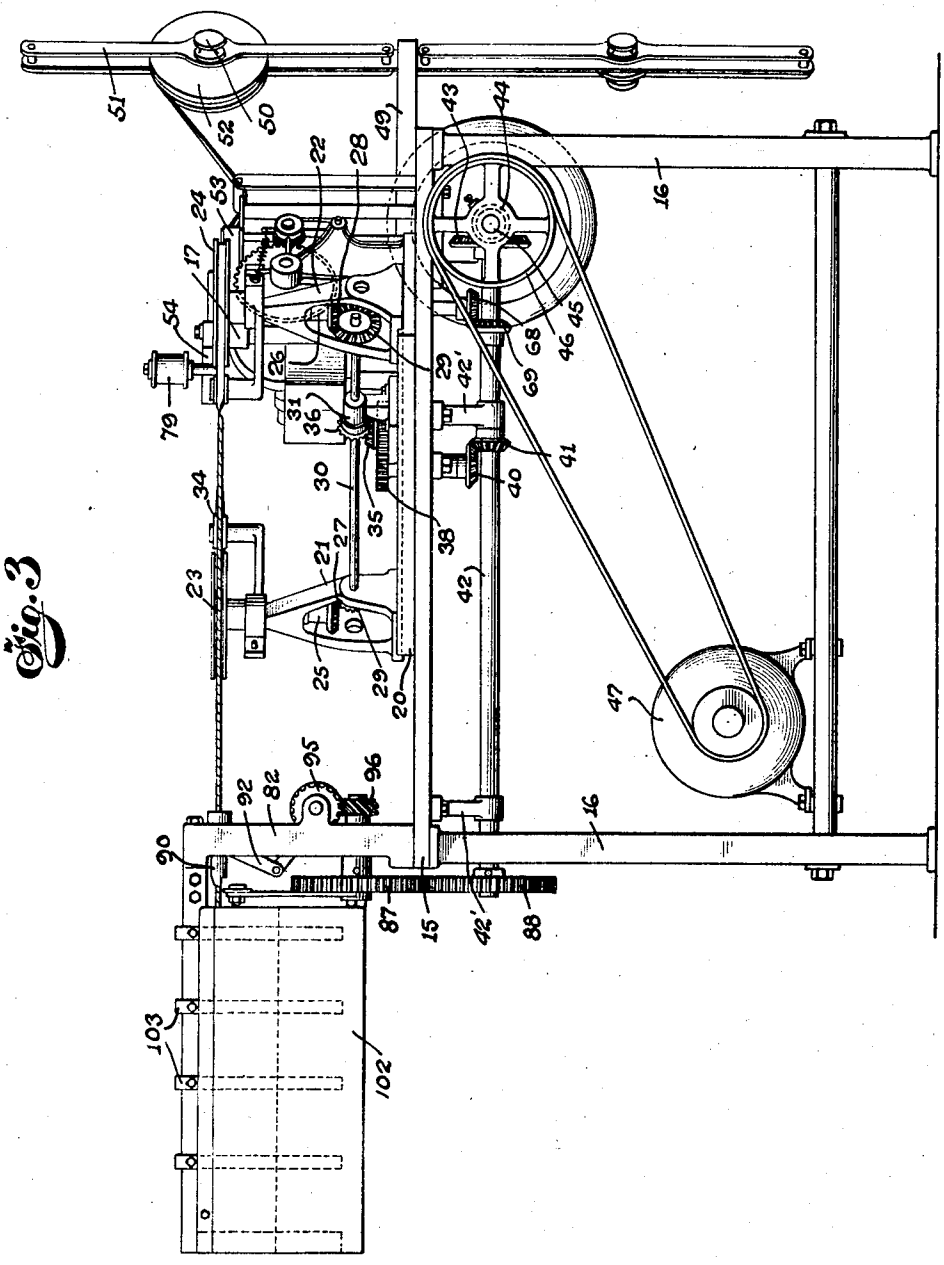


Fig. 3

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TUBE FORMING MACHINE

Original Filed May 15, 1925 4 Sheets-Sheet 4

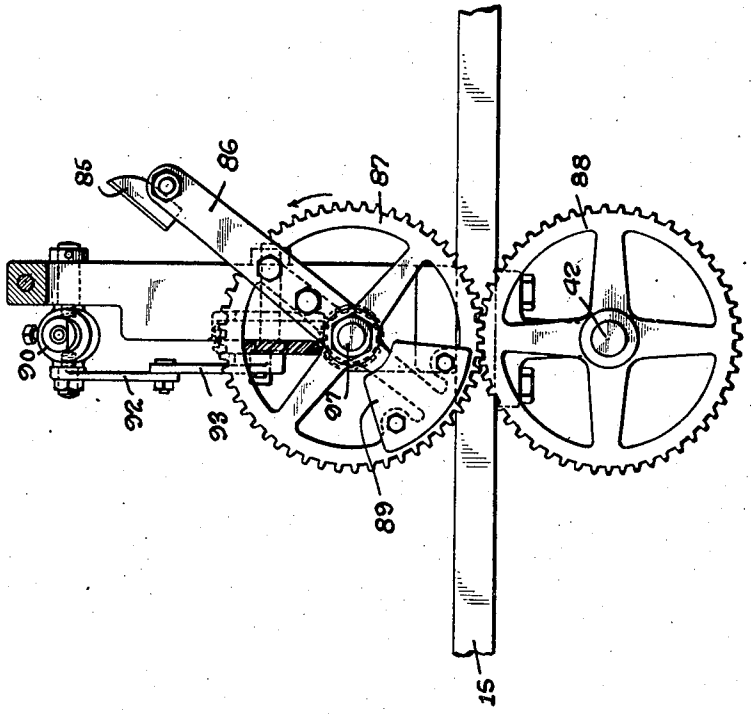


Fig. 5

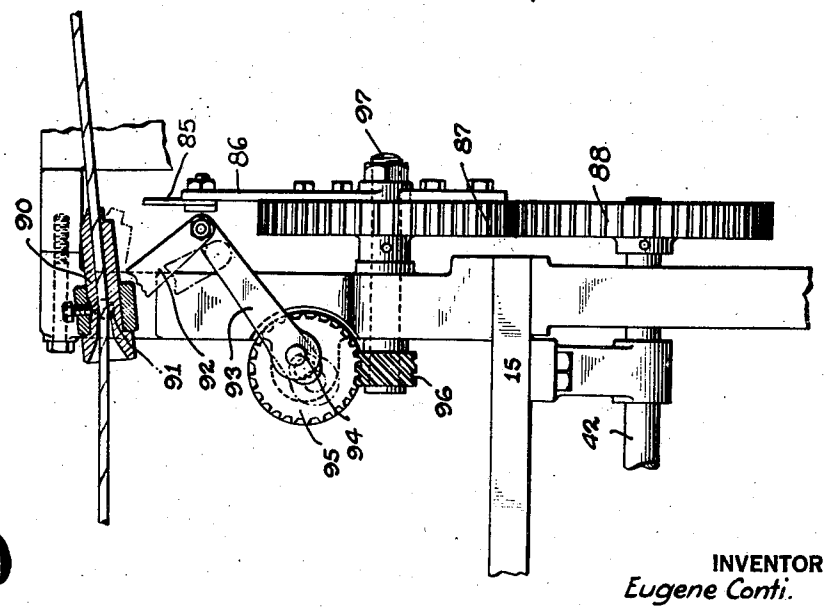


Fig. 4

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UNITED STATES PATENT OFFICE.

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TUBE-FORMING MACHINE.

Application filed May 15, 1925, Serial No. 30,399. Renewed January 22, 1929.

The present invention relates to machines for forming paper tubes.

The invention contemplates the provision of mechanism for forming a continuous tube and mechanism for cutting off predetermined lengths thereof while the formed tube is fed continuously forward from the forming mechanism. The speed of operation of machines of this character is usually limited by the speed at which the cut-off mechanism can be effectively operated without unduly mutilating the tubes at the point of severing and without too great strain upon the cut-off mechanism or other parts of the machine.

The present invention has for an object to provide an improved machine of this character having a cut-off mechanism which will be effective in use and which may be operated at high speed.

The nature and objects of the invention will be better understood from a description of particular illustrative embodiment thereof and for the purpose of such description reference should be had to the accompanying drawings forming a part hereof and in which—

Figure 1 is a plan view of the illustrative embodiment of the invention;

Figure 1ª is a detail showing the manner in which the strips of stock are fed to and wound upon the mandrel, and showing the relation of the strips to the winding tape;

Figure 2 is a side elevation of the machine;

Figure 3 is an elevation looking at the opposite side to that shown in Figure 2; and

Figures 4 and 5 are detail views of the cut-off mechanism.

This illustrative embodiment of the invention includes a bed 15, which is supported by legs 16 and in turn sustains the operating parts of the machine.

A mandrel, which is of the stationary type, is supported, in substantially horizontal position, at one end only and is free at its other end. The support for this mandrel includes a post 17 rigidly associated with and extending upwardly from the bed 15. This mandrel 18 is mounted in the post for horizontal adjustment and is secured in its various adjusted positions by means such as a set screw. In order that the strips of stock may be wound upon the stationary mandrel to form a tube, I have provided a bolster 20, which extends transversely of the bed in a predetermined relation to the mandrel, and beneath the same. Cross heads 21 and 22 extend upwardly from the ends of the bolster 20, and support horizontally disposed pulleys 23 and 24, which are rigid with vertically downwardly extending shafts 25 and 26, having bearings in the cross heads and having rigid with their lower ends beveled gears 27 and 28, which mesh with similar gears 29 on a shaft 30. The shaft 30 extends longitudinally of the bolster and is supported by a bearing 31, being actuated in a manner which will later be described.

A winding tape passes around the pulleys 23 and 24 with the reaches of the tape crossed between the pulleys. One reach 32 extends directly from one pulley to the other, while the other reach 33 is wrapped about the mandrel several times so as to provide means for engaging and forming the strips of stock into the continuous tube. Tensioning rollers 34 are mounted on the cross heads 21 and 22 adjustably and engage the reach 32 of the winding tape. The disposition of the bolster with relation to the mandrel is such that the turns of the reach 33 about the mandrel will, in the formation of the tube, result in the proper overlapping of the strips of stock and the proper feeding of the tube of the diameter being made.

The pulleys 23 and 24 are actuated to draw the winding tape around the stationary mandrel by the shaft 30, which receives its motion through the intermeshing of beveled gears 35 and 36, the latter being on the shaft 30 and the former rigid with a gear 37 which meshes with a similar but smaller gear 38 rigid with a shaft 39 extending through the bolster and having a bearing in the bed 15. The speed of the shaft 30 and consequently the speed of rotation of the pulleys 23 and 24 may be varied by changing the ratio of the gears actuating the same. For instance the gears 37 and 38 are so mounted that they may be removed and replaced by other gears to change the ratio between the same. Thus the speed of the winding tape may be varied to accommodate it to the different conditions of the tube being formed. That is to say the slipping of the tape may be overcome and the rate of formation of the tube may be controlled without changing the rapidity of action of the related parts of the machine. Thus with the cut-off mechanism ac-

tuated at a constant rate the gears 37 and 38 may be changed to change the rate at which the tube is formed and fed to the cut-off mechanism. Consequently the length of the cut-off portion of the tube will be varied. A beveled gear 40 is rigid with the lower end of this shaft 39 and meshes with a similar gear 41 on a shaft 42 which is supported in bearings 42', depending from the bed 15 of the machine. This shaft 42 extends longitudinally beneath the bed 15 so that it will be most conveniently located not only for the actuation of the winding tape pulleys 23 and 24, but also for the other units of the machine, as will later appear. This shaft 42 is actuated by the intermeshing of a beveled gear 43, which is rigid therewith and a pinion 44 on a transverse pulley shaft 45. The shaft 45 is actuated by a belt which passes around the pulley 46 on the end thereof and around the pulley on the commutator shaft of a motor 47, the motor being supported by a suitable frame extending between the legs 16.

Means is provided for feeding strips of stock, such as paper, to the mandrel in proper angular relation thereto, under tension and supplied with the desired adhesive to cause the strips to adhere to each other and with a lubricant to reduce the friction between the mandrel and the strips as they are wound into a tube and fed from the mandrel in the form of a tube. This means includes mechanism for applying a lubricant to one of the strips, that is, the one which comes into direct contact with the mandrel, and includes also a mechanism for applying adhesive to the other strip so that when it is wound upon the previously wound lubricant carrying strip it will adhere to the outer face thereof and result in the formation of a rigid tube. The embodiment of this means illustrated includes a carrier bar 48 which extends substantially vertically from, and is rigid with, an extension 49 of the bed 15. This carrier bar is provided, both above and below the bed 15, with removable trunnions 50 which extend from both sides of the bar and through guides 51, the latter being held in spaced relation to the bar. The trunnions 50 are adapted to support rolls 52 of strip stock, so that a pair of rolls will be disposed above the bed 15 and, if desired, a pair of rolls may be disposed below the bed 15. By this arrangement the minimum time will be consumed in threading new strips of stock to the mandrel after the strips from one pair of supply rolls are consumed. For instance, presuming that the strip stock is being fed from the upper supply rolls 52 shown in Figure 2, the lower supply rolls 52 are in readiness to be threaded when the upper rolls 52 are exhausted.

Channeled guides 53 and 54 are mounted on suitable supports 53' and 54', above the bed of the machine, and are arranged in suitable angular relationship to the mandrel to respectively accommodate the strips 55 and 56, which pass from the supply rolls beneath a guide roller 57. Each of these channeled guides is provided with a suitable tensioning device. These devices tension the strips as they pass to the mandrel and are wound into the form of a tube. The strip 55 which passes through the guide 53 is suitably gummed by means of an adhesive applying roll 61, Figure 2, mounted in an adhesive supply reservoir 63 supported on a standard 64 extending upwardly from the bed of the machine and independent of the bolster 20. The rotation of the roll 61 is accomplished by means of beveled gears 65 and 66, Figure 1, the former being rigid with the shaft 62 and the latter with a vertical shaft 67, Figure 2, which is actuated by intermeshing beveled gears 68 and 69, the gear 69 being rigid with the longitudinally disposed shaft 42.

The amount of adhesive carried by the roll 61 to the strip 55 as the latter passes over the roll is controlled by a roller 70 and is itself rotated by intermeshing gears 72 and 73, the former being rigid with the roller 70 and the latter with the shaft 62. This roller 70 is normally drawn toward the roll 61 by a spring 74, and against adjustable abutments 75 by means of which the space between the roller 70 and the adhesive applying roll 61 is controlled to thereby control the amount of adhesive applied to the strip 55 as it passes over the roll 61. The other strip 56 passes directly from the channeled guide 54 to the mandrel and forms the base of the tube on which the adhesive coated strip 56 is wound. In order that the face of the strip 55 which contacts with the stationary mandrel may be lubricated to reduce the friction between the mandrel and the tube as the latter is formed and fed along the mandrel, I have enlarged the end of the mandrel as at 76, Figure 1a and extended from this enlarged end a lubricator 77 which is arranged in the path of travel of the strip 55 and has an upwardly facing opening 78 therein from which a lubricant such as oil flows to contact with the under surface of the strip. This lubricator 77 is supplied with a lubricant from a reservoir 79 carried by the enlarged end 76 of the mandrel through a duct 80 in said enlarged end.

Thus the strip 55 is lubricated before it reaches the mandrel and consequently the friction between the mandrel and the strip is reduced to a minimum, and the strip 56 is on its under surface coated with adhesive so that when it is wound on the previously wound strip 55 it will adhere thereto and form a rigid tube.

In order that the tube as it is continuously formed and fed from the mandrel 18 may be cut into predetermined lengths, without interrupting the continuous movement of the tube, and without distorting it, I have provided means for severing the tube which means operates very quickly while the tube is moving forward an inappreciable distance. The embodiment of this means illustrated in the drawing includes a cutter 85 which operates in a path transverse to the direction of movement of the tube as indicated in Figure 5. As shown the cutter 85 consists of a very sharp blade which is carried by an arm 86 to which it is removably secured, the arm 86 being secured to the gear wheel 87 which in turn is driven by a gear wheel 88 secured to shaft 42, a counter weight 89 is also secured to the gear wheel 87 to balance the weight of the arm 86.

Means is provided for moving the tube toward and from the path of movement of the cutter 85. As shown when the tube is moving forward along a predetermined path of movement, it will be engaged by the cutter 85. When, however, it is moving along a path of movement more remote from the cutter the cutter will pass by without engaging the tube. By this arrangement it is possible to rotate the cutter blade at a very high speed and to move the tube into the path of movement of the blade at such periods as desired for cutting the tube to the desired lengths.

As shown, the tube as formed is fed through a guide sleeve 90. This guide is so manipulated that when it is positioned to guide the tube in a predetermined path, the tube will be engaged by the blade 85 to sever the tube at a point closely adjacent the end of the guide which thus supports the tube and facilitates the cutting operation. Suitable means is provided for moving the guide to bring the tube to and from that predetermined path of movement in which it may be severed at suitable times. As shown, the guide is mounted to rock about a pivot 91, the movement of the guide thus causing a flexing of the tube to move it toward and from the cutter. An arm 92 rigidly connected to the guide member is pivotally connected to a link 93 which engages an eccentric crank pin 94 secured to a spiral gear 95. The gear 95 is driven from a similar but smaller spiral gear 96 secured to the shaft 97 to which shaft the gear 87 is also rigidly secured. By this arrangement the cutter 85 and the guide 90 are actuated in suitable timed relation so that the tube being delivered from the mandrel 18 will be severed into predetermined lengths by a quick action of the cutter 85.

The ratio of the gears 87 and 88 and of the gears 95 and 96 may be changed as desired to provide for cutting of tubes of different lengths as will be obvious.

Means is provided for delivering the cut off blanks of tube from the cut off mechanism, which means includes a bracket 101 which extends outwardly and carries the vertical plate 102. Guide fingers 103 extend from the upper edge of this plate 102 in substantially horizontal positions and thence downwardly in spaced relation to the plate and beyond the lower edge thereof.

Summarizing the operation of the machine, the strips 55 and 56 of the stock are fed to the stationary mandrel 18, the former supplied on its under face, that is, the face which contacts with the mandrel, with oil and the latter supplied on its under face, which engages the previously wrapped strip 55, with adhesive. The passage of these strips between the turns of the winding tape and the mandrel winds them into a continuous tube, and feeds the tube longitudinally of the mandrel to the cut off mechanism, the cutting blade 85 of which latter mechanism traverses the path of movement of the tube in a fixed path and cuts the tube into predetermined lengths. These cut off portions are guided by the delivery mechanism to a suitable receptacle or mechanism for subsequently operating on the tubes.

The description of the illustrative embodiment is illustrative merely and is not intended as defining the limits of the invention.

What I claim is:

1. In a tube forming machine, the combination with a stationary mandrel, of means for forming a tube thereon and continuously feeding the formed tube therefrom, means for moving the formed tube laterally to and from a predetermined path of movement, and means adapted to traverse that path of movement in a fixed plane to sever the tube into predetermined lengths.

2. In a tube forming machine, the combination with a mandrel, of means for helically winding strips of material into a tube on said mandrel and for continuously feeding the formed tube from the said mandrel, means for moving the formed tube laterally to and from a predetermined path of movement, and means adapted to traverse that path of movement in a fixed plane to sever the tube into predetermined lengths.

3. In a tube forming machine, the combination with a stationary mandrel, of means for forming a tube thereon and continuously feeding the formed tube therefrom, means for moving the formed tube laterally to and from a predetermined path of movement, and a cutter blade adapted to traverse that path of movement in a fixed plane to sever the tube into predetermined lengths.

4. In a tube forming machine, the combination with a mandrel, of means for con-

tinuously feeding the formed tube from the said mandrel, means for moving the formed tube laterally to and from a predetermined path of movement, and a cutter blade adapted to traverse that path in a fixed plane to sever the tube into predetermined lengths.

5. In a tube forming machine, the combination with means for continuously feeding a formed tube, means for moving the formed tube laterally to and from a predetermined path of movement, of means adapted to traverse that path of movement in a fixed plane to sever the tube into predetermined lengths.

6. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a cutter blade movable adjacent the normal path of movement of the tube in a fixed plane to sever the tube into predetermined lengths, and means for moving the tube laterally into position for engagement by the cutter blade at predetermined times.

7. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a cutter blade movable transversely with respect to the path of movement of the tube and means for causing relative movement between the cutter blade and tube to bring the tube into and out of the path of movement of the blade for severing the tube.

8. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a cutter blade rotatable in a plane transverse to the path of movement of the tube and about an axis substantially parallel to the said path of movement of the tube and means for causing a relative lateral movement between the tube and cutter blade to bring the tube into and out of the path of movement of the blade at predetermined times.

9. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a rotatable shaft substantially parallel to the path of movement of the tube, a cutter blade carried by said shaft and rotatable in a fixed plane and means for causing relative bodily movement between the shaft and tube to bring the tube into the path of movement of the blade at predetermined intervals.

10. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a cutter movable in a fixed plane transverse to the path of movement of the tube and means for bending the tube into the path of movement of the cutter at predetermined intervals for causing a severing of the tube into lengths.

11. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a cutter movable in a fixed plane transverse to the path of movement of the tube and means for bending the tube into the path of movement of the blade during one movement of the blade and out of the path of movement of the blade during the next movement of the blade.

12. In a tube forming machine, the combination with means for continuously feeding a formed tube of a guide for the tube, a cutter movable transversely with respect to the path of movement of the tube and gearing actuating said guide and cutter in timed relation to move the tube into the path of movement of the cutter at predetermined intervals to sever the tube into lengths.

13. In a tube forming machine, the combination with a stationary mandrel, of means for supplying said mandrel with strips of material, means for winding said strips of material in superimposed relation into a tube and for feeding the tube from the mandrel, means for applying adhesive to one of said strips, means for applying a lubricant to the other of said strips prior to its engagement with the mandrel, means adapted to traverse a path of movement of the formed tube in a fixed plane to sever the same, and means to move the tube laterally toward and from that path of movement at predetermined intervals to cause the tube to be severed into predetermined lengths.

14. In a tube forming machine, the combination with a mandrel, of means for supplying the same with strips of material, means for winding said strips of material into a tube, means for applying adhesive to one of said strips, and means for applying a lubricant to the other of said strips prior to its engagement with the mandrel, a cutter and means for moving the tube laterally into position to be severed by said cutter at predetermined intervals.

15. In a tube forming machine, the combination with means for winding strips of material into a helical tube and for feeding the formed tube longitudinally, of means operating in a plane transverse to the path of movement of the tube to sever the same into predetermined lengths, means for moving the tube laterally toward and from the severing means, and means for arresting the lateral displacement of the severed lengths of tube under the influence of the severing means and for delivering said lengths from the machine.

16. In a tube forming machine, the combination with means for winding strips of material into a helical tube and for feeding the formed tube longitudinally, of means operating transversely of the path of movement of the tube to sever the same into predetermined lengths, means for deflecting the tube into cooperation relative to the severing means, and means for arresting the lateral displacement of the severed lengths of tube under the influence of the deflecting

and severing means and for delivering said lengths from the machine.

17. In a tube forming machine, the combination with tube mechanism including a mandrel from which the tube is fed, of a rotary cutter for severing the formed tube into predetermined lengths, a common shaft for actuating the cutter and the tube mechanism and means for making said rotary cutter alternately operative and inoperative to sever the tube.

18. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a cutter rotating about an axis parallel to the path of movement of the tube, and means for deflecting said tube into and out of cutting relation with said cutter to sever the tube.

19. In a tube forming machine, the combination with means for continuously feeding a formed tube, of a rotary cutter, and means for moving the formed tube laterally into position to be severed by said rotary cutter at predetermined intervals.

In testimony whereof, I have signed my name to this specification this 6th day of May, 1925.

EUGENE CONTI.