June 13, 1933. A. C. HUSTON ET AL 1,913,447

TUBE FORMING MACHINE

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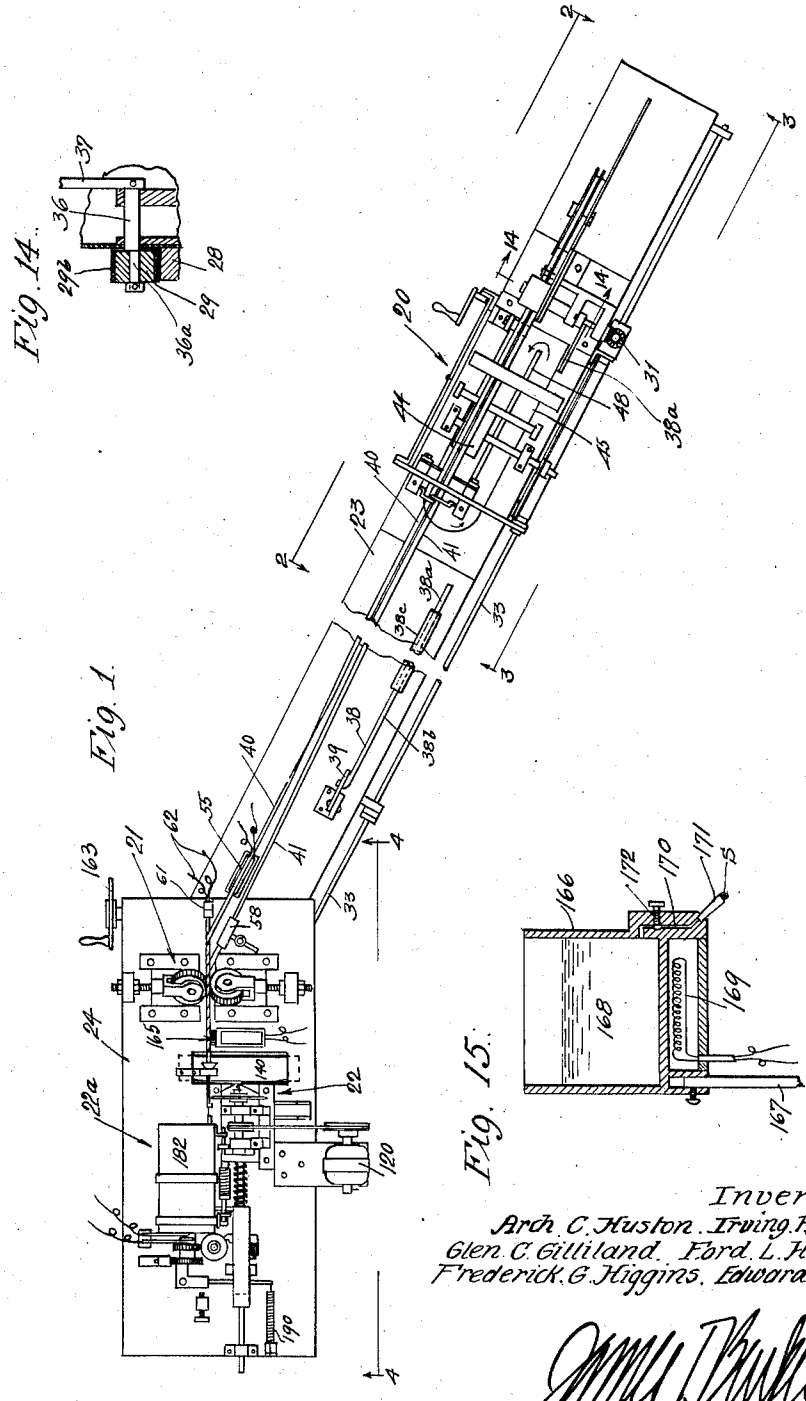


Fig. 1.

Fig. 14.

Fig. 15.

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June 13, 1933. A. C. HUSTON ET AL 1,913,447

TUBE FORMING MACHINE

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Fig. 2.

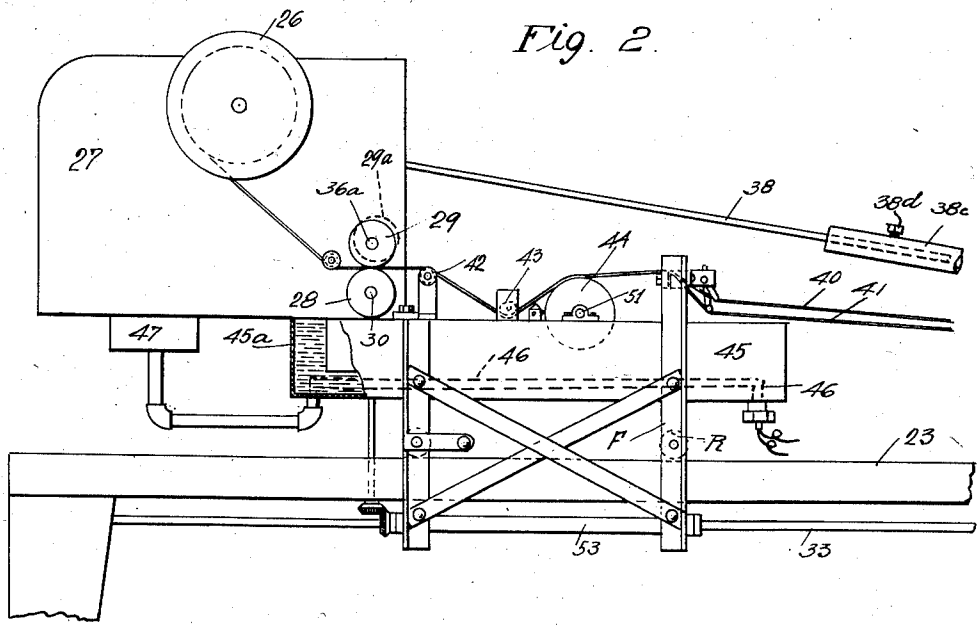
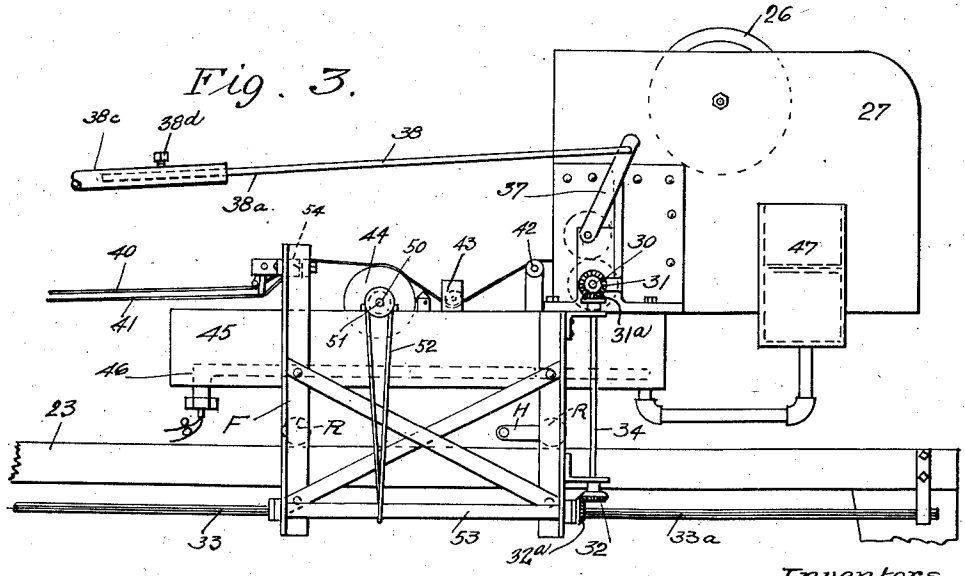


Fig. 3.



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June 13, 1933. A. C. HUSTON ET AL 1,913,447

TUBE FORMING MACHINE

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Fig. 5.

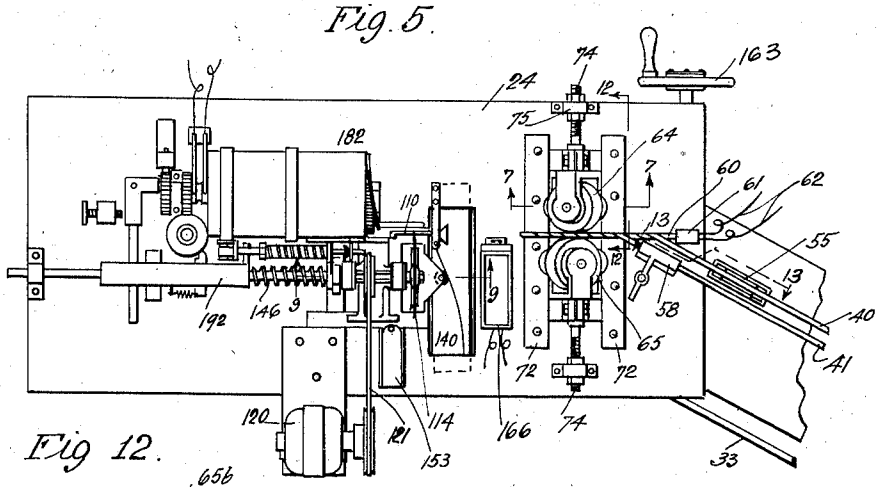


Fig 12.

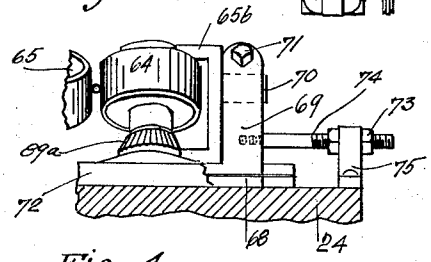


Fig. 4.

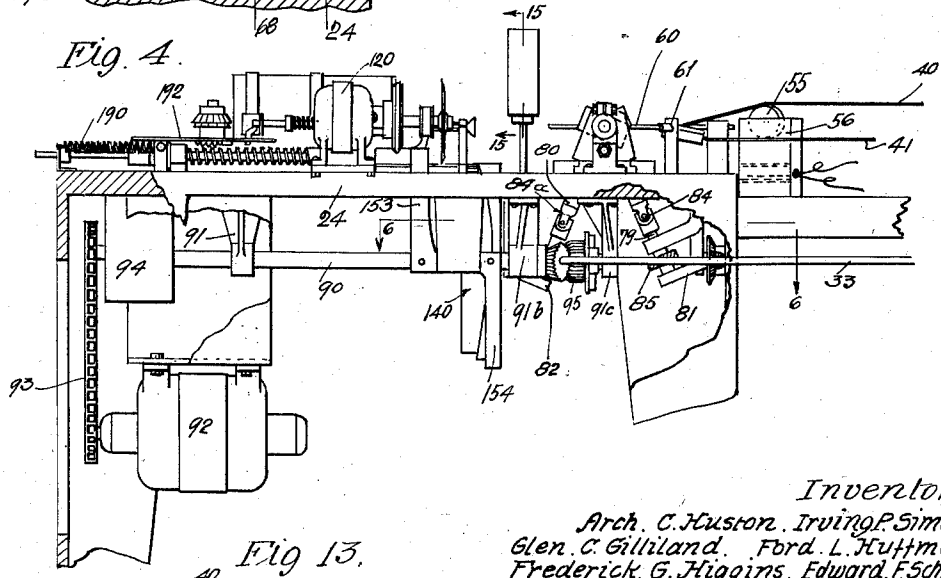
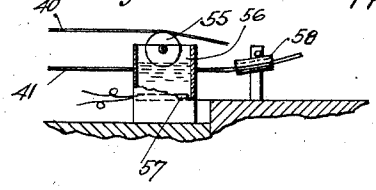


Fig 13.



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TUBE FORMING MACHINE

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Fig. 6.

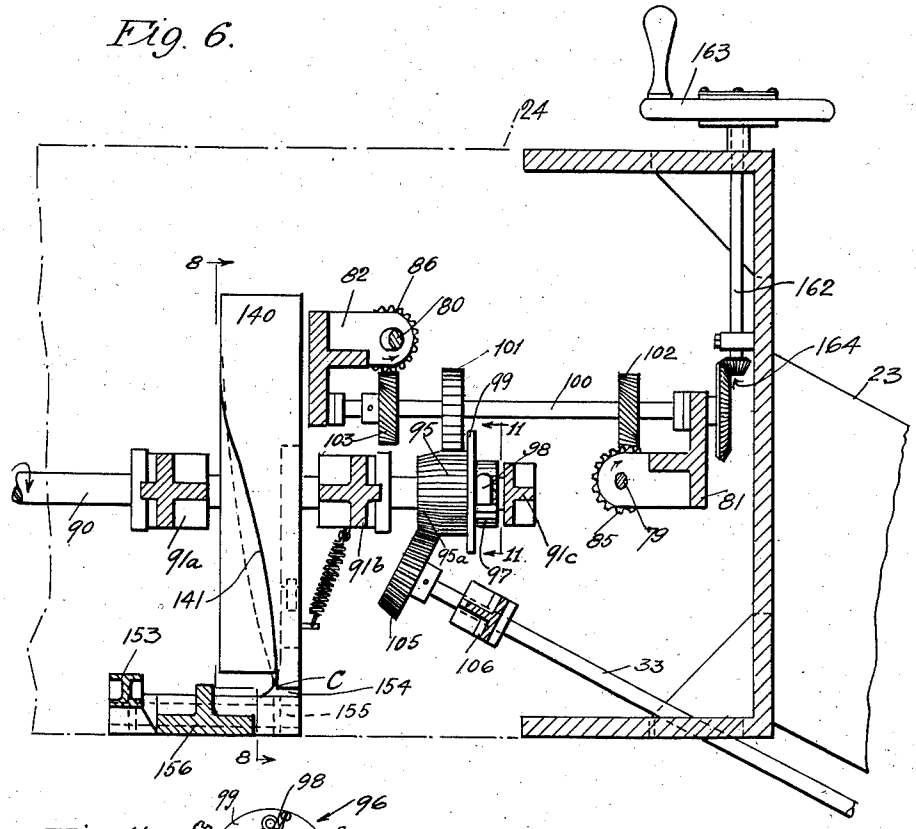


Fig 11.

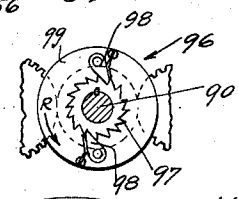


Fig. 7.

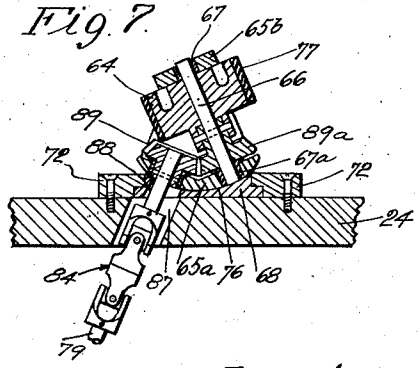
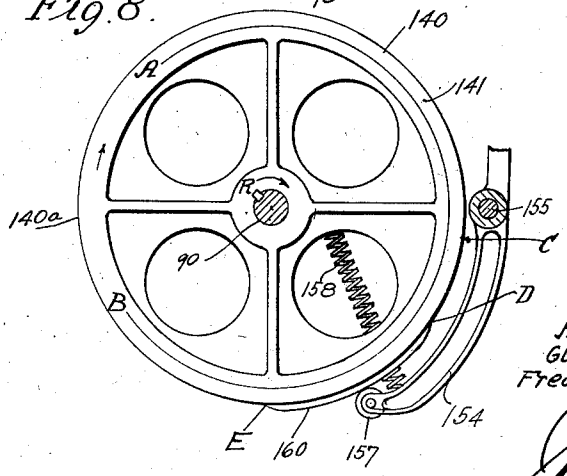


Fig. 8.



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TUBE FORMING MACHINE

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Fig. 9.

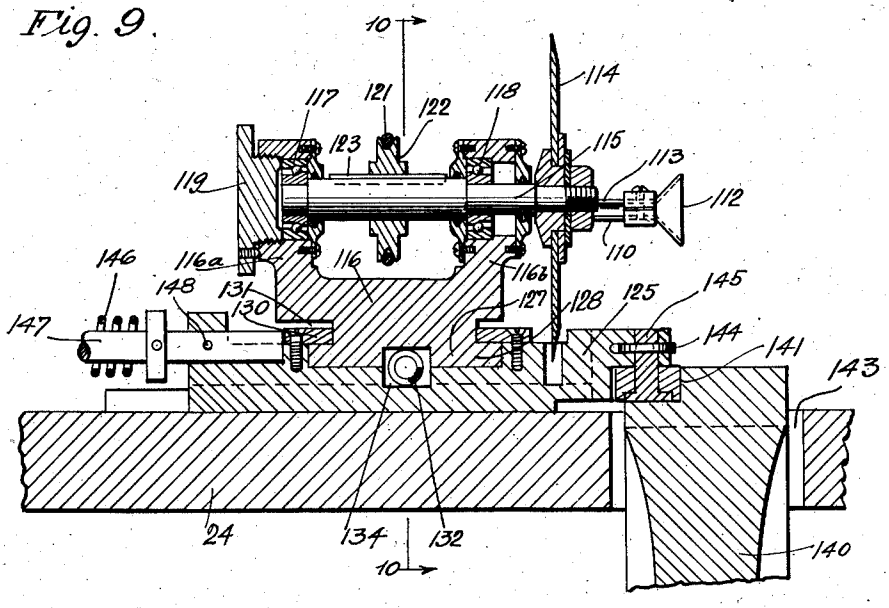
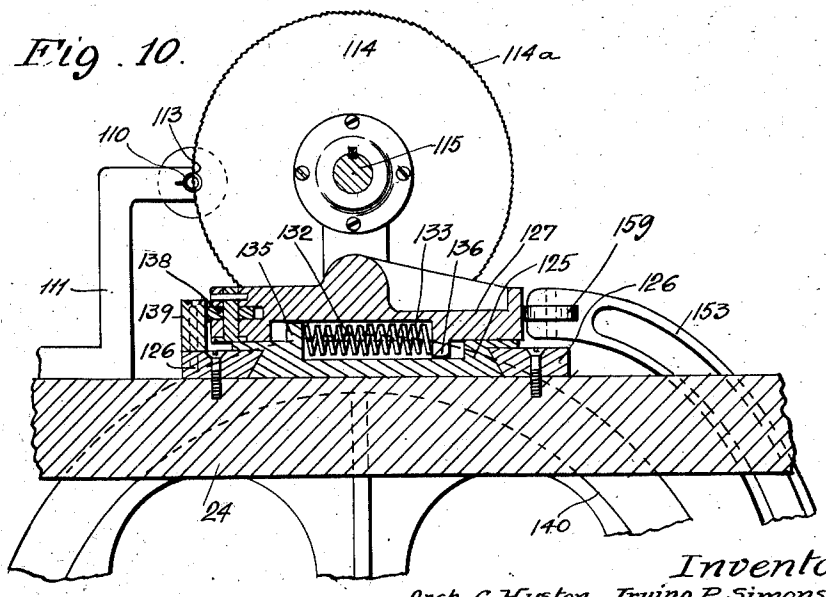


Fig. 10.



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TUBE FORMING MACHINE

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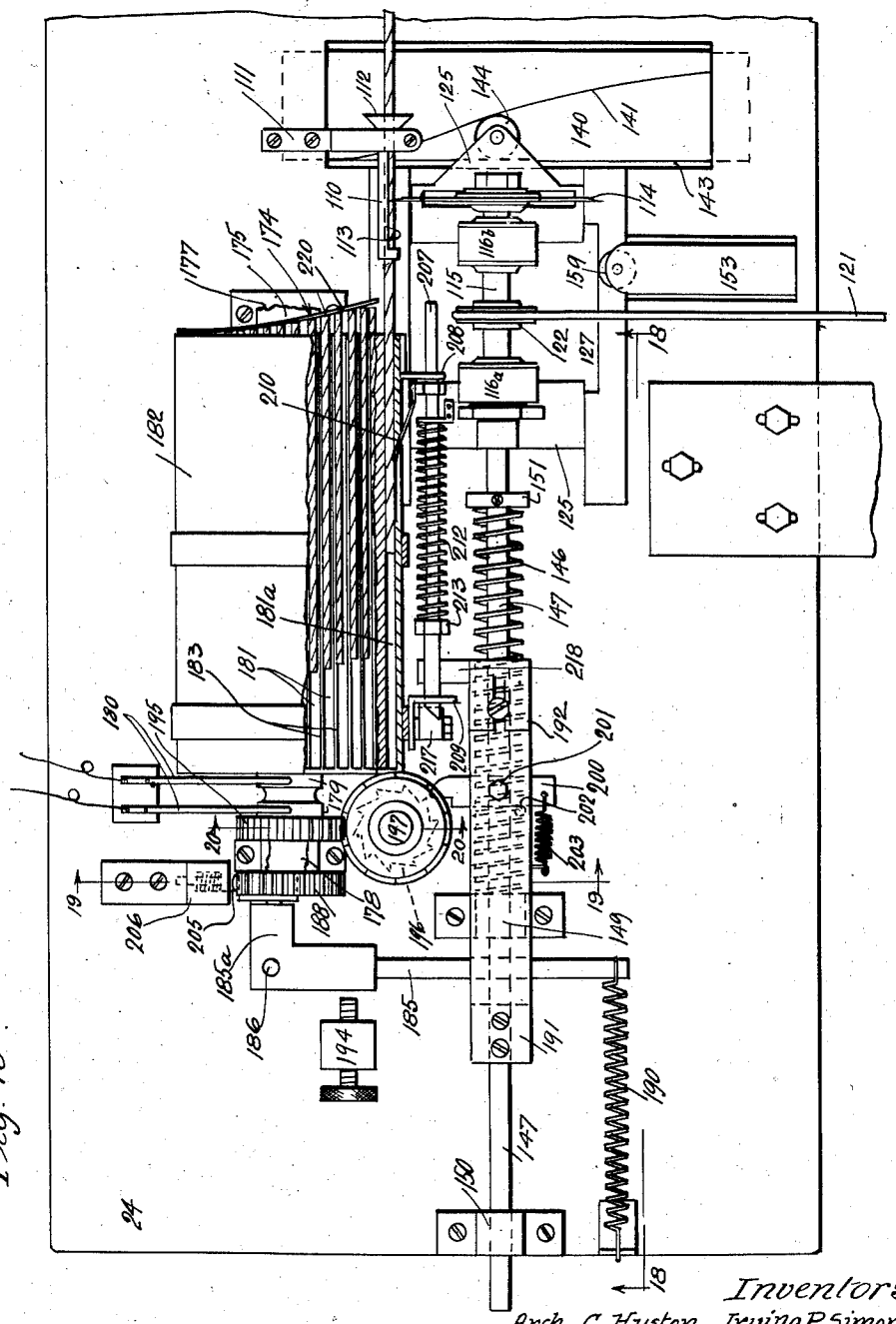


Fig. 16

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TUBE FORMING MACHINE

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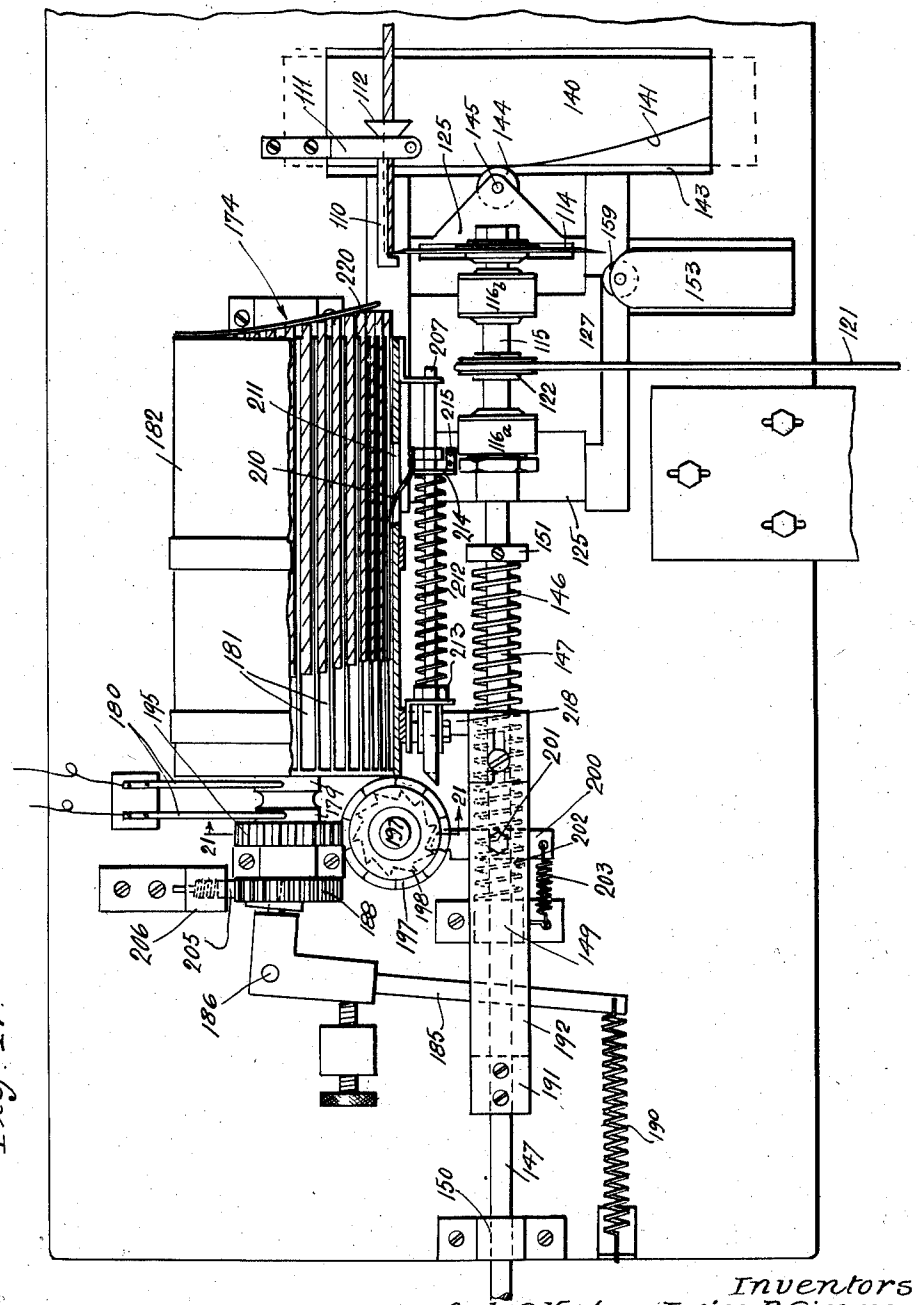


Fig. 17.

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TUBE FORMING MACHINE

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Fig. 19.

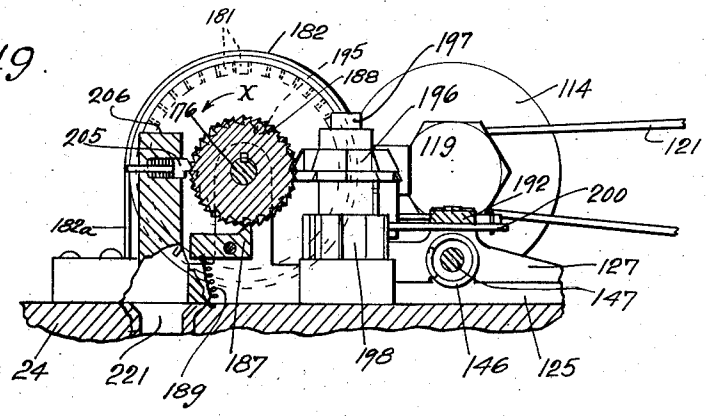


Fig 18.

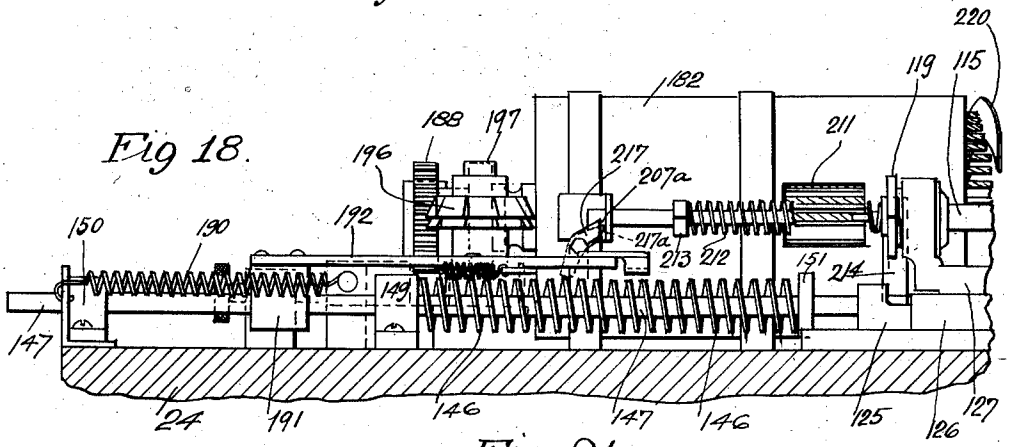


Fig 21.

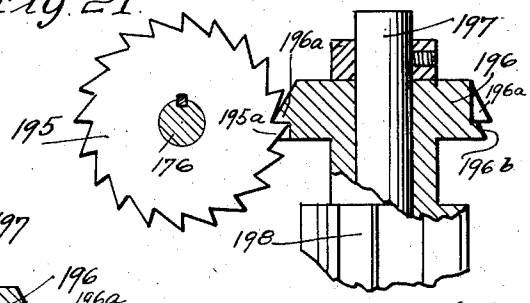
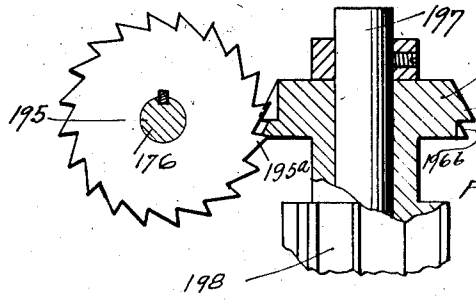


Fig 20



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UNITED STATES PATENT OFFICE

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TUBE FORMING MACHINE

Application filed April 14, 1930. Serial No. 444,087.

This invention relates in general to tube forming machines, and is particularly concerned with machines for manufacturing spirally wound tubing such as paper soda straws, and the like. Although the invention in various of its aspects is applicable to the manufacture of spirally wound tubing in general, it has at present its widest usage in the making of soda straws, and will therefore be described hereinafter as embodied in a machine adapted for this purpose.

Among the foremost objects of the invention is to provide a machine capable of forming smooth-cut straws of accurately uniform length at a high rate of production. It may be mentioned preliminarily that difficulty is commonly encountered in the making of paper straws in cutting them smoothly and into even lengths, due primarily to the facts that the straw must be severed while moving fairly rapidly, and that usually its rate of movement is not uniform due to slippage that necessarily takes place in the winding operation. Various types of tube cutting devices are in use which are designed particularly for the purpose of severing the straw while it is being advanced as formed, and in such a manner as to cause it to be cut smoothly and prevented from buckling as a result of the cutting operation. Typical of such cutting devices are some which cause a sharp blade to traverse the path of the straw at such a high rate of speed as to sever the straw so as to not interfere with its advancing movement, and others which cause a cutter to move along with the straw and at the same rate of speed, during the cutting operation, the cutter in this later type remaining relatively stationary longitudinally of the straw, while severing it. The cut-off mechanism in the present machine is of this latter general type, the cutter being caused to be intermittently moved into and out of the path of the straw to sever same, and to move with the straw and at exactly the same rate of speed, while severing it.

In order for the straw to be severed with the desired smoothness by a traveling cutter moving along with the straw, it is desirable that the cutter and straw move together at the same rate, otherwise a rough cut will result. Heretofore it has been proposed to time the movement of the cutter with the operation of the tube winding mechanism. The latter consists, in the usual machine for making spirally wound tubing, in a winding element, such as an endless tape, for winding the strip stock from which the straw is formed, about a mandrel, the winding element serving to advance the straw from the mandrel as it is formed, as well as to effect the winding thereof. In this operation however, a certain amount of slippage, and which it may be mentioned is desirable, always occurs between the winding element and the straw being formed on the mandrel, with the result that the rate of propulsion of the formed straw will vary somewhat. Variation in the rate of propulsion of the formed straw of course results in variation of the relative speed of the cutter and straw, thus making it virtually impossible to cause both to move at the same uniform speed, which is a necessary requisite for smooth cutting.

This difficulty is overcome in accordance with the present invention by causing the formed straw and cutter to travel together at the same speed while the cutter is moved into the path of the straw to sever it, by operating the cutter in timed relation to a suitable mechanism for feeding or releasing the strip stock to the winding mechanism, instead of timing the operation of the cutter with that of the winding mechanism, as previously practiced. Since it is readily possible to feed the strips to the winder at a constant rate, by proper regulation of the movement of the cutter, the latter may be caused to travel at exactly the same rate as the formed straw. In the present machine for certain advantageous reasons the winding

mechanism preferably is operated in a manner such that it tends to advance the tube at a greater rate than that permitted by the feed release. However, since the traveling cutter is operated in timed relation with the rate of feed, the relative movement between the cutter and formed straw is independent of whatever slippage that may occur in the winding operation.

As previously mentioned, in usual machines of this character the winding element comprises an endless tape wound about the mandrel. Although in the broader aspects of the invention, any suitable form of winding or tube forming means may be used in the present machine, the improved winding device will be preferred over the usual winder such as an endless tape for various reasons which will hereinafter appear. The present type of winder may be generally described as comprising a pair of rollers disposed at opposite sides of the mandrel and mounted angularly with relation thereto, the rollers being adapted to be rotated so as to cause the strip stock to be spirally wound on the mandrel and the formed tube to be propelled to the cutting device. The winding rolls are capable of adjustment so as to vary the rate of advancement of the tube in the mandrel to vary to a certain degree the pitch of the wind and also to wind tubes of various diameters.

As will later be more fully explained, the winding mechanism, by virtue of its capability of varying the pitch of the wind, also is capable, within certain limits, of varying the speed at which the formed tube is advanced. This feature is of advantage in that the timing of the feed release with the cutter operation need not necessarily be so precise that the movement of the formed tube, as governed by the rate of feed release, will be exactly that of the cutter, since the winding mechanism may be adjusted to regulate the movement of the tube to a nicety such that its travel will correspond to that of the cutter travel. In other words, the winding mechanism may serve the purpose of a secondary or final means for controlling the rate of movement of the tube in accordance with that of the cutter.

We have also provided what broadly may be considered a carrier which is adapted to receive the severed tubes directly from the cutter mechanism, and to move the severed tubes transversely out of the path of the advancing tube being formed. The characteristics of operation of the carrier are such that immediately, or soon after a tube is severed, that tube is advanced ahead of the subsequent tube being formed, a rate of movement greater than that of said tube being formed, and without interfering with its advancing movement. The carrier serves also as a heater whereby the straws after having been paraffined, are automatically maintained for a predetermined length of time at a temperature such as will allow the paraffine to thoroughly permeate the straws and thereby render them liquid proof and resistant to hot liquid. The combined heater and carrier thus operates to automatically take the straws directly from the cut-off and heat them for a certain length of time before delivering them to the finished straw container.

The above and additional features and objects of the invention will be understood most readily and discussed to best advantage in the following detailed description of a machine representing a typical and preferred embodiment of the invention. Reference is had for purposes of description to the accompanying drawings, in which:

Fig. 1 is a general plan view of the machine;

Fig. 2 is an enlarged fragmentary side elevation of the feed release and adhesive applying mechanism, as viewed on line 2—2 of Fig. 1;

Fig. 3 is an elevation of the opposite side of the parts shown in Fig. 2, as indicated by line 3—3 of Fig. 1;

Fig. 4 is an enlarged side elevation of the winding and cut-off mechanism as viewed on line 4—4 of Fig. 1;

Fig. 5 is a plan view of Fig. 4;

Fig. 6 is an enlarged section on line 6—6 of Fig. 4, showing particularly the gearing of the main drive shaft with the winding roller and feed release shafts;

Fig. 7 is an enlarged fragmentary section on line 7—7 of Fig. 5, showing the winding roller mounting and the roller drive shaft;

Fig. 8 is a fragmentary view on line 8—8 of Fig. 6, showing the cutter operating cam wheel in end elevation;

Fig. 9 is an enlarged fragmentary section taken longitudinally through the cut-off device as indicated by line 9—9 of Fig. 5;

Fig. 10 is a section on line 10—10 of Fig. 9, the cutter being shown advanced into severing position;

Fig. 11 is a section on line 11—11 of Fig. 6;

Fig. 12 is a fragmentary enlarged side elevation of one of the winding rollers and its mounting, as viewed on line 12—12 of Fig. 5;

Fig. 13 is an elevational view as indicated on broken line 13—13 of Fig. 5;

Fig. 14 is an enlarged fragmentary section on line 14—14 of Fig. 1;

Fig. 15 is an enlarged section through the paraffine container indicated on line 15—15 of Fig. 4;

Fig. 16 is an enlarged plan view of the cut-off device and the heater and heater operating mechanism, the cut-off being shown in an intermediate tube severing position, and the

other parts associated therewith in corresponding positions;

Fig. 17 is similar to Fig. 16 but illustrates the parts in changed positions after the straw has been severed;

Fig. 18 is a side elevation of the carrier and its operating mechanism, as viewed from the front of Fig. 16, on line 18—18;

Fig. 19 is a sectional end elevation taken on line 19—19 of Fig. 16;

Fig. 20 is a fragmentary enlarged section on line 20—20 of Fig. 16, showing the escapement and heater operating ratchet gears in one position; and

Fig. 21 is a section similar to Fig. 20 illustrating the gears in changed position.

Referring first to Fig. 1, the machine may be characterized generally as comprising, the feed release and adhesive applying mechanism generally indicated at 20; the winding mechanism 21 for forming the strip stock released from the mechanism 20 into spirally wound straws; the cut-off mechanism generally indicated at 22, which operates to sever the formed straws into equal lengths; and the carrier and heater 22*a* wherein the severed and externally paraffined straws are subjected to heating for a suitable period of time. The feed release and adhesive applying mechanism 20, is supported on a table or bed 23 which extends angularly with relation to bed 24 supporting the winding, cut-off and carrier mechanisms, the parts being arranged in this manner in order to enable the strip stock to be taken straight from the feed release to the mandrel and at the proper angle relative thereto. The invention will perhaps be most clearly understood by describing the various parts of the machine in the order in which they operate upon the strip stock, beginning with the feed release and adhesive applying mechanism; then describing the winding and cut-off mechanisms, and finally the automatically operated heater and carrier.

It will be understood that any suitable means may be used for feeding or releasing the strip stock to the winding mechanism, it only being required that the stock feed or release mechanism, whichever it may be considered, be capable of feeding the strips at a constant rate and of operating in timed relation with the cutting mechanism. The release mechanism hereinafter described is therefore to be considered merely as typical of any suitable means for feeding or releasing the strips at a constant rate.

Referring particularly to Figures 2 and 3 of the drawings, double rolls of the strip stock are carried on reels 26 mounted on a support 27, the strips 40 and 41 being led from the reels between a pair of friction rollers 28 and 29. Roll 28 is carried on shaft 30 which is driven by way of shafts 33 and 34 through bevel gears 31, 31*a* and 32, 32*a*. Gear 32*a* is carried on the end of sleeve 53 which is journaled in the end members of frame F, hereinafter described, and which is splined to shaft 33 so as to be movable longitudinally thereon. It will suffice to state at this point that shaft 33, and therefore roller 28, is operated in timed relation with the cut-off mechanism 22, further details of the shaft drive being described at a later point. Roller 29 is carried on an eccentric extension 36*a* of shaft 36 (see Fig. 14) and is operated to be thrown into and out of such close proximity to roller 28 as to frictionally hold the strips therebetween, by rotating shaft 36. Thus during operation, the strips are advanced between the rollers due to the rotation of roller 28, and at the exact peripheral speed of the latter. The feed of stock to the winder may be stopped at will however, by swinging roller 29 to the dotted position 29*a*, as described, so as to frictionally release the strips. Shaft 36 may be rotated, and roller 29 swung from operating position to the dotted line releasing position 29*a*, by operating arm 37 secured to shaft 36, by way of rod 38 and lever 39. Lever 39 is preferably located near the winding and cut-off mechanism in order that should the strips or formed tube become fouled at any time during their passage through the winder and cut-off, the operator will be able to stop the feed without having to shut down the entire machine.

In order to prevent slippage of the strips between the rollers, one or both of the rollers may be provided with a peripheral facing of rubber or other suitable material. In the present case, the power roller 28 is entirely of metal. Roller 29 however is provided with a rubber peripheral facing 29*b*, so as to frictionally engage the strips and thereby assure that the strips will be advanced at precisely the same peripheral speed as the power roller.

From the feed release mechanism described, the strips 40 and 41 pass through guides 42 and 43 over an adhesive applying roller 44, the lower portion of which is immersed within a heated body of adhesive contained in the glue pot 45. The adhesive is heated and maintained at the desired fluidity by means of an electrical heating element 46 extending within water jacket 45*a* surrounding the glue pot, the jacket being supplied with water from container 47. The glue pot preferably is constructed as best shown in Fig. 1, there being a partition 48 extending longitudinally within the pot and spaced from the ends thereof so as to enable the adhesive to be circulated around the partition. Roller 44, it will be noted is immersed in the adhesive at one side of the partition so that as the roller is rotated, it tends to cause the adhesive to circulate around the partition as indicated by the arrows. Roller 44 may be operated in any suitable manner,

for example by means of pulley 50 on the roller shaft 51, the pulley being driven by belt 52 extending around sleeve 53. The strips pass from the adhesive applying roller 44 over a scraper 54 which serves to remove excess adhesive from the strips, the removed adhesive dropping back into the glue pot.

It is of considerable importance that the adhesive applied to the strips have just the right moisture content at the point at which the strips are wound together on the mandrel, in order for the straws to be properly formed. So subject is the adhesive to moisture changes between the applying roll 44 and the mandrel, due to changes in atmospheric temperature and humidity, that it becomes desirable to provide means for varying, in effect, the time during which the coated strips are exposed to the air, in accordance with atmospheric conditions. For this purpose, we mount the described strip release mechanism and glue pot on a frame F which is supported on rollers R on top of bed 23. Thus by turning handle lever H which operates one of the rollers, the frame F and all parts supported thereon may be moved longitudinally on the bed so as to vary the distance of roll 44 from the mandrel. In order to permit such movement of the frame, rod 38 is made in relatively longitudinally movable sections 38*a*, 38*b*, the latter slidably terminating in a sleeve 38*c* secured to section 38*a* by set screw 38*d*. The feed release and adhesive applying mechanisms may be operated from shaft 33 regardless of the position of frame F on the bed, since sleeve 53, journaled in the end members of the frame, and from which both said mechanisms are driven, is slidable longitudinally on the shaft spline 33*a*.

One of the strips 40 is passed over a roll 55, see Fig. 13, which serves to coat the reverse side of the strip with paraffine, the strip being twisted in its travel from roll 44, as indicated in Fig. 1, so as to present the side not coated with adhesive, to the paraffine applying roll. As shown in Fig. 13, the latter has its lower portion submerged within a paraffine bath in container 56, the paraffine being heated by means of heating element 57 in the lower portion of the container. Strip 40 is then wound about the mandrel with the paraffined side adjacent thereto. Strip 41 is passed beneath a guide 58 and is then wound about the mandrel on the prewound strip 40 and in overlapping relation relative therewith.

The paraffine applied to the underside of strip 40 in addition to serving as an impregnating and water-proofing material for the interior of the straw, serves also as a lubricant to facilitate its sliding movement on the mandrel. As shown in Figs. 4 and 5, the mandrel consists of a horizontal rod extending longitudinally of bed 24 and terminally carried on post 61. The mandrel preferably is warmed by an internal electrical heating element having lead wires 62, this being desirable in order to promote free sliding of the paraffined inner surface of the straw on the mandrel, and to accelerate setting of the glue, due to the moisture being driven out by the heated mandrel.

In the broader aspects of the invention any suitable winding mechanism may be employed which will operate to wind and advance the formed tube on the mandrel at a rate at least equal to, and preferably have a tendency to advance the tube at a rate greater, than that permitted by the feed release. As previously mentioned however, the illustrated type of winder has numerous advantageous features which render it preferable over the heretofore used devices.

The winding mechanism comprises a pair of rollers 64 and 65 mounted at opposite sides of the mandrel and inclined relative thereto in opposite directions. Each of the rollers is supported on a carrier or yoke 65*b* and rotatably mounted on pintle shaft 66 journaled in bearings 67 and 67*a* in the upper and lower portions of the yoke. The yoke and roller assembly is supported on a slide rest 68 which has an integral post 69 within which a trunnion 70 on the yoke is journaled, the trunnion normally being clamped within the post by means of screw 71 so as to prevent turning movement of the yoke. Slide rest 68 is adjustable laterally of the mandrel between guide strips 72, and is fixed in adjusted position by means of lock nuts 73 on rod 74 extending through bearing 75. As shown most clearly in Fig. 7, the bottom face of the base portion 65*a* of the yoke is cylindrically shaped longitudinally of the slide rest, and is seated within a correspondingly shaped recess 76 in the latter, the center of curvature of the recess being about the axial center of trunnion 70 so as to permit the yoke to bear flush against the slide rest for all positions of lateral adjustment. Thus by virtue of the capability of the yoke for adjustment about its trunnion, the position of inclination of the roller relative to the mandrel may be adjusted as desired. For all positions of the rollers relative to the mandrel, their center of bearing against the mandrel will be in line with the axis of trunnion 70. It may be mentioned that as the rollers are brought toward positions of parallelism with the mandrel, the tendency is for them to advance the straw at a greater rate than when moved toward positions of greater angularity with the mandrel, and to increase the pitch of the wind. As will readily appear, the rollers, in producing their winding action on the strips, move angularly in opposite directions relative to the mandrel.

It will be apparent that although the strips are fed to the mandrel at a constant rate, the speed at which the formed tube is advanced on the mandrel will be governed by the pitch of the wind. And, as mentioned, by varying the position of inclination of the winding rollers relative to the mandrel, adjustment of the pitch at which the strips are wound, may be made as desired. Therefore, within the limits of pitch variation which can be brought about by adjustment of the rollers, the speed of advancement of the formed tube may be regulated accordingly.

The lock nuts on rods 74 are adjusted so as to cause the rollers to bear more or less snugly against the straw so as to insure that the strips being fed to the mandrel will always be taut. On the other hand however the engagement of the rollers with the straw will be such as to permit a certain amount of slippage therebetween in accordance with the differential in rate at which the strips are released and that at which the rollers tend to advance the straw, due to the fact that most generally the rollers will tend to advance the straw at a greater rate than that permitted by the feed release.

The winder rollers preferably are provided with bearing surfaces 77 of a fairly soft rubber in order to insure the required frictional engagement with the straw and to provide a greater surface contact between the rollers and straws. Although the pressure of the rollers against the surface of the straw will be such as to permit slippage therebetween, it will be sufficient to cause the rubber bearing surfaces 77 to fit around and grip a considerable surface area of the straw, thereby firmly pressing the strips together to form a compactly wound straw. By maintaining the strips taut from the feed release, a tight wind on the mandrel is assured, and, as mentioned by virtue of the pressure exerted by the rolls, the strips are pressed compactly together during the winding operation. In some instances it may be desirable to provide more than two winding rollers arranged about the mandrel, but ordinarily in the making of small tubes such as soda straws, two oppositely arranged rollers of the character described will suffice.

Each of the winding rollers 64 and 65 is driven by way of what may be termed flexible shafts 79 and 80 journaled at their lower ends in brackets 81 and 82, respectively, depending from the underside of the supporting bed 24. Each of the roller drive shafts is made up of upper and lower sections interconnected by universal joints 84, 84*a*, (see Fig. 4) which in effect, render the shafts flexible so as to permit adjustment of the roller mountings as described. The lower sections of shafts 79 and 80 carry gears 85 and 86, respectively, (Fig. 6) which are driven from the main drive shaft of the machine as will be described. The upper ends of shafts 79 and 80 extend through openings 87 and 88 in the bed 24 and slide rest 68, respectively, and carry bevel gears 89, the shank or neck portions of which are journaled in the yoke base 65*a* as indicated in Fig. 7. Gears 89 mesh with bevel gears 89*a* keyed to the winding roller shaft 66.

A main drive shaft 90 journaled in hangers 91, 91*a*, 91*b*, and 91*c*, is driven by motor 92 by way of chain 93 and the gear box conventionally indicated at 94, the shaft being rotated in the direction of arrow R, see Fig. 8. Rotatably mounted on the drive shaft is a master gear 95 having a tapered portion 95*a*, giving it the characteristics of both a spur and bevel gear. During normal operation of the machine, gear 95 is driven from shaft 90 by way of the ratchet mechanism generally indicated at 96, comprising a ratchet gear 97 (see Fig. 11) which is keyed to the shaft and caused to engage the pawls 98 carried on the back side of a flange 99 integral with gear 95, when the drive shaft rotates in the direction of arrow R. It may be mentioned that the ratchet connection between gear 95 and the drive shaft is employed in order to enable manual operation of the feed release and winding mechanism without operating the cut-off, as will presently be described.

The winding roll operating shafts are driven from gear 95 by way of shaft 100 journaled at its ends in hangers 81 and 82, and carrying spur gear 101 meshing with gear 95 and gears 102, 103 meshing with gears 85 and 86, respectively. The relative positions of the latter gears of course remain constant since whatever adjustment of the winding roll mountings may be made, is taken care of by the universal joints 84 and 84*a*.

The feed release operating shaft 33 extending longitudinally along the side of bed 23, is journaled beneath bed 24 in hanger 106 and also in the glue pot supporting frame F, as previously described. Shaft 33 is driven from the main drive shaft by way of bevel gear 105 meshing with the beveled or tapered portion of gear 95.

The straw passes from the mandrel through a guide tube 110 mounted on a suitable support 111, the tube having a flared or funnel shaped mouth 112 for guiding the straw. The inner side of tube 110 is cut away as at 113 to expose substantially half the diameter of the straw to the cutter, as will more fully be explained hereinafter.

The cut-off mechanism, generally designated at 22, comprises a rotating disk cutter 114 mounted on shaft 115 carried on a supporting yoke 116. Cutter 114 preferably, though not necessarily, is provided with very small saw teeth 114*a*. Yoke 116 is shaped to provide arms 116*a*, 116*b*, within which are contained the shaft thrust bearings 117 and

118. Any longitudinal play that may develop in the cutter shaft may be taken up by plug 119 threaded in arm 116*a* and bearing against the thrust bearing 117. It will suffice to state at this point that the cutter and its supporting yoke is intermittently caused to move longitudinally of the guide tube 110 along with the straw, and the cutter at such intervals to move laterally into and out of the path of the straw. The cutter shaft is rotatably driven by motor 120, the motor belt 121 passing around pulley wheel 122 which is keyed to the shaft by means of spline 123. Pulley 122 is permitted to slide freely longitudinally on the shaft so that during reciprocating movement of the shaft, the pulley remains substantially in one position relative to the motor without causing deflection of the belt in the direction of movement of the shaft. Belt 121 is sufficiently flexible so as to permit lateral movement of the shaft away from the motor as the cutter is brought into the path of the straw.

The cutter shaft carrier 116 is mounted upon what may be termed a compound slide rest, having such characteristics as will permit the cutter to travel along with the straw and to simultaneously move transversely into the path thereof, that is within guide tube recess 113, during the cutting operation. The compound slide rest comprises a carriage block 125 confined between guide pieces 126 extending longitudinally of the supporting bed 24, block 125 being adapted to intermittently move reciprocally between guides 126 in a path parallel with cutter shaft 115 and the path of movement of the straw. A second slide rest, movable transversely of the direction of movement of block 125, is provided by the base portion 127 of yoke 116, said base being seated within transverse groove 128 formed in the carriage block. The upper slide rest is held within groove 128 by means of pieces 130 extending within grooves 131 in the side of base 127. Relative transverse movement between the upper and lower slide rests is resisted by spring 132 inserted within grooves 133 and 134 formed in the top and bottom surfaces of block 125 and base 127, respectively. Spring 132 is confined between stop lugs 135 and 136 projecting within the grooves, and which serve, should the hereinafter described cam arm 153 be removed, to limit the travel of the upper slide rest, and therefore the cutter, away from the straw. When the cutter is in its straw severing position, the slide rests will have the relative positions shown in Fig. 10, spring 132 being compressed and base 127 moved to the full extent of its travel to the left on the lower slide rest 125. The transverse travel of the upper rest in moving the cutter into severing position, is limited by the engagement of roller 138 with a stationary stop 139 carried on guide strip 126.

The described compound slide rest is operated to impart the proper timed movement to the disk cutter by means of a cam wheel 140 mounted on the main drive shaft 90, and having peripheral and side cam faces for actuating slide rests 127 and 125, respectively. The cam wheel is shaped to provide a peripheral shoulder 141 extending inwardly from end face 140*a* of the wheel between points A and B, see Fig. 8. Cam wheel 140 projects upwardly above the top surface of supporting bed 24 through opening 143, so as to bring shoulder 141 and the inner end of the wheel adjacent the end of block 125. A cam follower roller 144 is mounted on pin 145 in the end of block 125, and is caused to bear against cam face 141 and end portion 140*a* of wheel 140 throughout rotative movement of the latter. Roller 144 is urged against the cam face on wheel 140 by the action of spring 146 placed about a longitudinal reciprocating guide rod 147 joined at 148 to slide block 125, and extending through bearings 149 and 150. Spring 146 is confined between the stationary bearing 149 and collar 151, the latter being adjustable longitudinally on rod 147 so as to regulate the tension of the spring.

The operation of the lower slide rest 125 may be explained by describing a cycle of operation assuming the slide rest to be at its limiting position to the right, in which position roller 144 engages the peripheral wheel face 141 at a point C furthest distant from the end 140*a* of the cam wheel. Assuming the cam wheel to rotate in the direction of arrow R, as shown in Fig. 8, upon rotation of the cam through the angular distance between points C and A, the latter being the point at which cam face 141 conforms to the end face 140*a* of the cam wheel, slide rest 125 is moved the full length of its travel to the left, carrying with it the cutter 114 at the same rate of movement as the straw. During travel of the cam past the roller between points A and B, the slide rest remains stationary at the end of its travel, and thereafter as the cam rotates a distance corresponding to the spacing between points B and C, the slide rest, under the action of spring 146, returns to its original position to the right.

The transversely moving upper slide rest 127 is operated by way of arms 153 and 154 mounted on a rock shaft 155 journaled in hanger 156, see Figs. 4 and 6. Terminally carried on arm 154 is a roller 157 which rides the peripheral surface of wheel 140 to the right of cam shoulder 141, roller 157 being urged into engagement with the surface of the cam wheel by spring 158 attached to the arm and the cam shaft hanger 91*b*. Arm 153 also carries a terminal roller 159, see Fig.

10, which bears against the side edge of the upper slide rest 127, spring 132 operating to maintain roller 159 at all times in engagement with said upper slide rest.

On the periphery of cam wheel 140 is a raised surface 160, see Fig. 8, which, when brought past roller 157, causes arm 154 to swing outwardly and arm 153 to swing inwardly in a reverse direction to move the upper slide rest. Cutter 114 is thus moved into the path of the straw in the position shown in Fig. 10, and is maintained in this position throughout the greater portion of the travel of the lower slide rest toward the left. The point D at which arm 154 is initially swung outward to move the cutter into severing position will be located at such a point that the inward movement of the cutter will occur slightly after the starting of the movement of the lower slide rest toward the left, or in other words soon after the start of travel of the cutter with the straw. The period of time during which the cutter is maintained in its severing position will be substantially the same or slightly less than the time interval during which the lower slide rest is caused to move to the left and the cutter to travel with the straw. Point E, will be so located as to cause the cutter to be moved out of the path of the straw substantially at, or very soon before the limit of its movement with the straw.

As hereinabove explained, in order to assure that the straw will be smoothly cut, it is essential that the cutter 114 travel at exactly the same rate of speed as the straw during the cutting operation. Due to the fact that the cut-off mechanism and the feed release are both operated from the same drive shaft 90 as described, it will be noted that the two mechanisms, are operated in certain timed relation. Thus by the proper design of cam 141 in accordance with the operation of the feed release through gears 31, 32 and 105, cutter 114 may be caused to travel at precisely the same rate of movement as the straw.

As previously explained, the advancing movement of the straw from the mandrel may be controlled by varying the pitch of the wind by adjusting the winding rollers, as well as by controlling the rate of feed release. Therefore, should there exist a differential in the rate of travel of the cutter, and the rate of advancing movement of the straw, due to inaccuracies in timing the operation of the feed release with that of the cutter, the speed of movement of the straw may be adjusted to a nicety, and to correspond exactly with the cutter travel, by proper adjustment of the winding rolls.

In starting operations, it is necessary to manually twist the strips for a few turns about the mandrel and to feed them between the winder rollers. In order to obviate the necessity for having to operate the entire machine while such preliminary adjustments are being made, means is provided for manually and selectively operating the winder and feed release to start the straw on the mandrel. For this purpose an auxiliary shaft 162 operated by hand wheel 163 is geared to shaft 100 as at 164. By turning wheel 163, the winding rollers are operated through gears 85, 102 and 86, 103, and the feed release through gears 95, 101 and 105, as previously described. However, since in this case gear 95 is driven by gear 101, instead of by the drive shaft through the ratchet mechanism 96, gear 95 may turn about shaft 90 without rotating the latter and without causing the cut-off mechanism to operate.

In passing between the winder and cut-off mechanisms the straw is externally coated with paraffin by the device generally indicated at 165, and shown in detail in Fig. 15. The device 165 comprises a container 166 within which is a body of melted paraffin 168 heated by an electrical heating element 169 in the bottom of the container. Extending through the bottom of the container is a passage 170 through which the fluid paraffin flows to a brush 171 which engages the outer surface of the straw S. The delivery of paraffin to the brush may be regulated by suitable valve means as at 172. Due to the straw being continuously rotated as it is advanced, its entire exterior surface will be coated with paraffin in moving past brush 171.

We have provided, in combination with the hereinabove described parts, a carrier mechanism adapted to receive a severed straw direct from the cutter mechanism, and to move the severed straw out of the path of the subsequent advancing straw being formed. The carrier also has the characteristics of a heater, whereby the severed straws are heated for a predetermined period of time sufficient to cause the exteriorly and internally applied paraffin to permeate the straws and thereby give them a maximum degree of waterproofness. The combined carrier and heating device comprises an intermittently rotatable cylindrical cage, generally indicated at 174, having axial trunnions 175, 176, journaled in bearings 177 and 178, respectively. A suitable heating element, not shown, is provided within the heater cylinder 174, the heating element having leads communicating with surfaces 179 on trunnion 176, and to which current is supplied through brushes 180. Cylinder 174 will be maintained at a temperature such that during the period within which the straws are subjected to heating, as will be hereinafter described, the paraffin will be caused to thoroughly and evenly permeate the straws.

In the surface of cylinder 174 is formed

a series of longitudinal flutings or grooves 181 which are adapted to successively receive the straws as they are advanced from the cutoff, as will presently appear. The position of the carrier relative to guide tube 110 is such that one of the grooves 181, for example groove 181*a* in Fig. 16, will be in direct alinement with the guide tube, so that the straw being advanced from the cut-off will register with the groove. Carrier 174 is enclosed by a stationary sheath or covering 182 extending closely about the upper exterior of the carrier, the sides 182*a*, see Fig. 19, of the cover extending downwardly from the sides of the cage to the top of supporting bed 24.

It will suffice to note at this point that the carrier cage is intermittently revolved in the direction of arrow X, see Fig. 19, an angular distance corresponding to the spacing between grooves 181, and in a manner such that after one of the severed straws is advanced into one of the grooves 181, the carrier is instantaneously revolved so as to bring the next groove into alinement with guide tube 110 so as to be in position to receive the next straw. Due to the fact that the straws are being formed and advanced at a fairly fast rate, it is necessary that the cage be rapidly, and in fact almost instantaneously, revolved between the described intervals of rotation, in order to prevent a subsequent straw, after one has been advanced into one of grooves 181, from becoming fouled by engaging a rib 183 between that groove and the next succeeding. We have accordingly provided what may be termed a trip, or snap-acting mechanism for intermittently and rapidly actuating the carrier in the manner described, and have also provided a similar type of mechanism for advancing each severed straw into the carrier grooves ahead of the subsequent straw being formed.

The carrier is intermittently rotated by means of an arm 185 pivoted for horizontal swinging movement on pin 186, the arm carrying on its end 185*a* a pivoted pawl 187 which engages ratchet gear 188 carried on the end of trunnion 176. Pawl 187 is maintained in engagement with ratchet teeth by spring 189, as shown in Fig. 19. Arm 185 is operated to actuate the heater cage by means of spring 190 attached to the outer end of the arm. The pitch of the teeth ratchet 188 will bear such relation to the spacing of grooves 181, that as the ratchet is turned by pawl 187 the pitch distance of the teeth, the carrier will be rotated a distance corresponding to the spacing of the grooves.

Carrier 174 is operated in timed relation with the operation of the cut-off mechanism, by actuating arm 185 in accordance with the movements of guide rod 147 which, it will be recalled, reciprocates with the described slide rest block 125. Rod 147 carries a collar 191 upon which is mounted a supporting arm 192 extending above and parallel with said rod toward the cut-off mechanism. When rod 147 is in its furthest position to the right, collar 191 will have engaged arm 185 so as to move it to the position shown in Fig. 16. Upon subsequent movement of rod 147 to the left, collar 191 is moved away from the arm so as to put the latter under the influence of spring 190, which tends to swing the arm about pivot 186 and to rotate the ratchet 188 and the carrier in the direction of arrow X. Such movement of the carrier is prevented however, until rod 147 reaches substantially the limit of its travel to the left, by the escapement means, hereinafter described. At the point at which ratchet 188 is released by the escapement mechanism, arm 185 is suddenly swung by the action of spring 190 to the position shown in Fig. 17, the ratchet simultaneously being rotated the pitch distance of the teeth. The position to which arm 185 is swung is limited by the adjustable stop 194. Due to there being a constantly applied force tending to swing the arm in operating the ratchet, that is, by the action of spring 190, at the point at which the ratchet is released by the escapement, the carrier is, literally, snapped from one position to the next with a rapid speed of movement. Upon return movement of rod 147 to the right, collar 191 engages arm 185, returning it to the position of Fig. 16 and bringing pawl 187 into engagement with the next ratchet tooth.

Carried on trunnion 176 at the inner side of bearing 178 is a second ratchet gear 195, the tooth pitch of which is twice that of ratchet 188, so that for each of the described intermittent movements of the latter, ratchet 195 will be rotated half the pitch distance of its teeth. The operation of ratchet 188 is controlled by an intermittently rotated escapement gear 196 mounted on vertical shaft 197, and having vertically spaced, downwardly facing and relatively staggered teeth 196*a*, 196*b*, one of which is engaged by one of the teeth of ratchet 195. Escapement gear 196 has an integral lower ratchet gear 198, the tooth pitch of which corresponds with the horizontal or radially angular pitch of the downwardly facing teeth 196*a* and 196*b*, so that as the escapement is rotated the pitch distance of the teeth of ratchet 198, the escapement gear will turn, for example, from the position shown in Fig. 20, in which the ratchet tooth 195*a* engages one of the lower teeth 196*b*, to that of Fig. 21 wherein tooth 195*a* is brought into engagement with an adjacent upper tooth 196*a*. Upon subsequent movement of the escapement gear from the position of Fig. 21, ratchet tooth 195*a* will be released from tooth 196*a* and the following ratchet tooth will become engaged by the next lower escapement tooth. The vertical pitch or spacing of the downwardly facing

teeth 196*a* and 196*b* is such as to permit ratchet 195 to rotate half its pitch distance for each turn of the escapement gear. Ratchet 188 is therefore permitted to turn the pitch distance of its teeth for each movement of the escapement gear.

Gear 198 is intermittently operated by means of a pawl arm 200 pivotally mounted at 201 on the under side of supporting arm 192, arm 200 being adapted to intermittently engage ratchet 198 upon movement of guide rod 147 to the left, as will presently appear. Arm 200 normally is positioned in engagement with stop pin 202 by spring 203, joined to the forward end of the pawl and to arm 192.

We will now describe briefly the operation of the escapement mechanism in combination with the hereinabove described carrier actuating arm 185. Upon movement of rod 147 to the left, pawl arm 200 is brought into engagement with ratchet 198, turning the escapement gear 196 so that at substantially the end of movement of rod 147, ratchet 195 will be released by the escapement so as to permit ratchet 188 to turn as described, and therefore to permit the carrier to rotate a distance corresponding to the spacing of its longitudinal surface grooves. In order to prevent back lash, or reverse rotation of ratchet 188, a detent 205 mounted in post 206, see Fig. 19, is provided, its action being to snap in behind the successive ratchet teeth and thereby prevent reverse movement. Upon return movement of guide rod 147 to the right, arm 200 is permitted to pass by the ratchet 198 and to thereafter resume its normal position, prior to subsequent movement to the left, as will be readily understood.

As previously mentioned, a secondary snap acting mechanism is provided for advancing a severed straw into the carrier ahead of the straw being formed, in order to provide a time interval for turning movement of the cage to prevent the on-coming straw from engaging one of the ridges 183 during turning movement of the cage, and also to prevent the severed ends of the straw from becoming roughened due to their being in engagement. This intermittent straw advancing mechanism comprises a reciprocating rod 207 mounted on brackets 208 and 209 extending from the sides of the carrier cover 182, the rod carrying a resilient finger or arm 210 which projects through an opening 211, see Fig. 18, in the side of cover 182, and into engagement with the straw being advanced into groove 181*a*. Placed on rod 207 is a spring 212 which is confined between nut 213 threaded on the rod and a vertically extending arm 214 attached at its base at 215 to the lower cutter slide rest 125. Thus as the cut-off mechanism assembly is moved to the left, arm 214 puts spring 212 under compression, the latter thereby exerting a thrust on rod 207 tending to move it in the direction of movement of the straw being advanced into groove 181*a*.

Rod 207 is releasably locked against such movement by dog 217 pivotally mounted on the side of cover 182, the dog engaging in the notched end 207*a* of the rod when the parts are in the position shown in Fig. 18. Mounted on the under side of arm 192 and adjustable longitudinally thereof is a dog actuating arm 218, projecting beneath rod 207 so as to engage the lower end of the dog as rod 147 is moved to the left.

In the operation of the mechanism just described, assuming the parts to be in the position shown in Fig. 16, upon movement of arm 214 to the left, spring 212 is compressed up to the point at which arm 218 is brought into engagement with dog 217 so as to swing the latter to the dotted line position 217*a*, see Fig. 18, to release rod 207. The point at which rod 207 is thus released will occur at some intermediate point in the travel of rod 147, and substantially immediately after the straw has been severed by cutter 114. Thus at the point at which rod 207 is released by the action of dog 217, the rod is suddenly thrown forward under the action of spring 212, and the severed straw is simultaneously carried forward by the flexible arm 210. Due to the compression and sudden release of spring 212, the rate at which the straw is advanced into the cage will of course be much greater than its normal rate of movement under the influence of the winder, and therefore there will be a considerable gap between the severed straw and the following straw being formed. Immediately after the severed straw has been advanced into the cage grooves in the manner described, the carrier will be rotated under the action of the escapement mechanism as previously described, to bring the next groove 181 into straw receiving position. As rod 147 is returned to its starting position to the right, arm 218 is brought to engage nut 213 and to thereby move rod 207 to the right until it again becomes locked by the action of dog 217.

In case the severed straws are not advanced entirely within the grooves of the carrier cage by the action of arm 210, means may be provided for pushing the projecting ends of the straws into the cage as the latter rotates. For this purpose we have illustrated a circular gathering flange 220 secured to the cover 182 at the forward end thereof, flange 220 gradually curving inward in the direction of rotation of the carrier. Thus as the carrier rotates, the projecting straws are moved entirely within the grooves by engagement with flange 220 as will be readily understood from the illustration in Figs. 16 and 17. As shown in Fig. 19, an opening 221 is formed longitudinally in bed 24 beneath the rear side of the carrier. The straws are car-

ried around in the cage to a point above opening 221, and are then permitted to drop out of the carrier through the opening into a suitable container, not shown, beneath the supporting bed 24.

It is to be understood that although the mechanism first described has the combined advantages of a carrier and heater, and preferably it will be utilized for both such purposes, its operation as a carrier is independent of its function as a heater. In other words, should it be desirable to dispense with the heating operation, or to heat the straws subsequent to their being discharged from the carrier, the carrier may be used, as such, in the absence of provision for heating it. Therefore, we do not limit the invention to the use of a heated carrier, but prefer that it be regarded as optional whether or not the carrier be heated.

We claim:—

1. In a tube forming machine, means for continuously forming and advancing a tube, means for intermittently cutting the formed tube into equal predetermined lengths, means for feeding stock to said tube forming means, and means for operating said feed means in timed relation to the operation of said cutting means.

2. In a tube forming machine, means for continuously forming and advancing a tube, means for intermittently cutting the formed tube into equal predetermined lengths, means for feeding stock to said tube forming means, and means for operating said feed means in timed relation to the operation of said cutting means, said forming means tending to advance the tube at a greater rate than that permitted by said stock feeding means.

3. In a tube forming machine, means for continuously forming and advancing a tube, a cutter for intermittently severing the formed tube into equal lengths and adapted to travel with the tube during the cutting operations, means for feeding stock to said tube forming means, and means for operating said feed means in timed relation to the operation of said cutter.

4. In a tube forming machine, means for continuously forming and advancing a tube, means for releasing stock to said tube forming means, said tube forming means tending to advance the tube at a greater rate than that permitted by said stock releasing means, a cutter for severing the formed tube and adapted to travel with the tube during the severing operation, means for operating said cutter in timed relation with said feed release, and means to cause the cutter and formed tube to travel at the same speed.

5. In a tube forming machine, means for continuously winding and advancing a tube, means for feeding strip stock to said tube winding means at a constant predetermined rate, said winding means tending to advance the tube at a greater rate than that permitted by the stock feeding means, and said winding means being adjustable to vary the pitch of the wound strips.

6. In a tube forming machine, a mandrel, means for continuously forming a spirally wound tube on said mandrel and for advancing the formed tube from the mandrel, means for feeding strip stock to said tube forming means at a constant predetermined rate, said forming means tending to advance the tube at a greater rate than that permitted by the stock feeding means, said winding means being adjustable to vary the pitch of the wound strips, a cutter, and means for operating said cutter in timed relation to said feed means.

7. In a tube forming machine, a mandrel, means for continuously winding a tube on said mandrel and for advancing the formed tube from the mandrel, a pair of feed release friction rolls adapted to release strip stock to said winding means at a constant predetermined rate, a cutter for severing the formed tube and adapted to travel with the tube during the severing operation, means for operating said cutter in timed relation with said feed release rolls, and means to cause the formed tube and cutter to travel at the same speed.

8. In a tube forming machine, a mandrel, a pair of feed release friction rolls adapted to release strip stock to said mandrel at a constant predetermined rate, and a pair of rollers disposed at opposite sides of said mandrel and adapted to wind said strip stock on the mandrel to form the tube, said rollers being positioned oppositely angularly relative to the mandrel, and means for rotatably driving said rollers in opposite directions relative to the mandrel.

9. In a tube forming machine, a mandrel, means for continuously winding strip stock into a tube on said mandrel and for advancing the formed tube from the mandrel, a disk cutter for intermittently severing the formed tube into equal predetermined lengths and adapted to travel with the tube during the cutting operation, means for releasing strip stock to said winding means at a predetermined rate, said winding means tending to advance the tube at a greater rate than that permitted by said stock releasing means, and means for operating said cutter and the stock releasing means in timed relation.

10. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel and a pair of rollers disposed at opposite sides of said mandrel and adapted to wind said strip stock on the mandrel to form and advance the tube, a cutter adapted to sever the formed tube into predetermined lengths, and means for operating said cutter in timed relation to said stock feeding means.

11. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of rollers disposed at opposite sides of said mandrel and adapted to wind said strip stock on the mandrel to form the tube, and advance the tube, a disk cutter adapted to sever the formed tube into predetermined lengths and to travel with the tube during the cutting operation, and means for operating said cutter and stock feeding means in timed relation to cause the cutter and tube to travel at the same rate.

12. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, and a pair of winding rollers rotatably mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, and means for rotatably driving the strip engaging surfaces of said rollers in opposite directions relative to the mandrel, said rollers being adapted to engage and wind said strip stock on the mandrel and to rotate and advance the formed tube thereon.

13. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, and a pair of winding rollers rotatably mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, and means for rotatably driving the strip engaging surfaces of said rollers in opposite directions relative to the mandrel, said rollers being adapted to engage and wind said strip stock on the mandrel and to rotate and advance the formed tube thereon, and said rollers having yieldable peripheral surfaces.

14. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, and a pair of winding rollers rotatably mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, and means for rotatably driving the strip engaging surfaces of said rollers in opposite directions relation to the mandrel, said rollers being adapted to engage and wind said strip stock on the mandrel and to rotate and advance the formed tube thereon, and each of said rollers comprising a body mounted on a shaft and a removable rubber work engaging ring carried on said body.

15. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding rollers rotatably mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, and means for rotatably driving the strip engaging surfaces of said rollers in opposite directions relative to the mandrel, said rollers being adapted to engage and wind said strip stock on the mandrel and to rotate and advance the formed tube thereon, and means for adjusting said rollers laterally of the mandrel.

16. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, drive means for said members, and means for adjusting the positions of angularity of said surfaces with relation to the mandrel.

17. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, drive means for said members, means for adjusting said strip engaging surfaces laterally of the mandrel, and means for adjusting the positions of angularity of said surfaces with relation to the mandrel.

18. In an automatic tube forming machine, means for continuously forming and advancing a tube, means for intermittently cutting the formed tube into equal predetermined lengths, means for feeding stock to said tube forming means in timed relation to the operation of said cutting means, and means for manually operating said tube forming means and said stock feeding means independently of said cutting means.

19. In a tube forming machine, means for continuously forming and advancing a spirally wound tube, means for feeding strip stock to said tube forming means, said forming means being adjustable to vary the pitch of the wound strips, a cutter for intermittently severing the formed tube into equal lengths and adapted to travel with the tube during the severing operation, and means for operating said cutter in timed relation with the operation of said stock feed means.

20. In a tube forming machine, means for continuously forming and advancing a tube, means for feeding stock to said tube forming means, a cutter for intermittently severing the formed tube into equal lengths and adapted to travel with the tube during the severing operation, and means for operating said cutter in timed relation with the operation of said stock feed means, the last mentioned means including cam actuated means for moving the cutter in the direction of movement of the tube, and cam actuated means for moving the cutter laterally into and out of the path of movement of the tube.

21. In a tube forming machine, means for continuously forming and advancing a tube, means for feeding stock to said tube forming means, cutter means for severing the formed tube into equal lengths and comprising a disk cutter and a slide rest mounting

for said cutter, and cam means for actuating said slide rest, operated in timed relation with the operation of said stock feed means.

22. In a tube forming machine, means for continuously forming and advancing a tube, means for feeding stock to said tube forming means, cutting means for severing the formed tube into equal lengths and comprising a disk cutter and a compound slide rest mounting for said cutter, said mounting embodying a supporting member slidable longitudinally of the path of movement of the tube and a second supporting member slidable laterally of said path, and means for operating said supporting members in timed relation to said stock feeding means.

23. In a tube forming machine, means for continuously forming and advancing a tube, means for feeding stock to said tube forming means, cutting means for severing the formed tube into equal lengths and comprising a disk cutter and a slide rest mounting for said cutter, said mounting embodying a supporting member slidable longitudinally of the path of movement of the tube and a second supporting member slidable laterally of said path, yielding means resisting movement of said supporting members in one direction of their respective travels, and cam means for operating said members in timed relation to said stock feeding means.

24. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube into equal lengths during its advancing movement, and a heated carrier adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube.

25. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube into equal lengths during its advancing movement, a carrier adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and means associated with said carrier for heating the tubes received thereby for a predetermined period of time.

26. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube during its advancing movement, a carrier adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and means for advancing said severed tube to the carrier at a rate in excess of the speed of movement of the advancing subsequent tube.

27. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube during its advancing movement, a carrier adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and intermittently operable means for advancing said severed tube to the carrier at a rate in excess of the speed of movement of the subsequent tube.

28. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube into equal lengths during its advancing movement, an intermittently operated carrier adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and means for advancing said severed tube to the carrier at a rate in excess of the speed of movement of said advancing subsequent tube.

29. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube into equal lengths during its advancing movement, an intermittently operated carrier adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and intermittently operable means for advancing said severed tube to the carrier at a rate in excess of the speed of movement of said advancing subsequent tube.

30. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube into equal lengths during its advancing movement, a carrier intermittently operated in timed relation with the operation of said cutter and adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and means operated in timed relation with said cutter for advancing said severed tube to the carrier at a rate in excess of the speed of movement of said advancing subsequent tube.

31. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube during its advancing movement, and a heated, intermittently rotatable carrier cage adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advanc-

ing subsequent tube, said carrier being operated in timed relation to the operation of said cutter mechanism.

32. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube during its advancing movement, and a rotatable carrier cage adapted to receive a severed tube direct from said cutter mechanism and to move said severed tube out of the path of the advancing subsequent tube, and means for advancing said severed tube to the carrier cage at a rate in excess of the speed of movement of said advancing subsequent tube.

33. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube during its advancing movement, and a heater receiving the severed tubes directly from said cutter mechanism.

34. In a tube forming machine, the combination comprising, means for continuously forming and advancing a tube, a cutter mechanism adapted to intermittently sever the formed tube during its advancing movement, and means for taking the severed tubes direct from said cutter mechanism and for heating them for a predetermined length of time.

35. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, drive means for said members, a cutter for severing the formed tube, and means for operating said cutter in timed relation to the operation of said means for feeding strip stock to the mandrel.

36. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, drive means for said members, means for adjusting the positions of angularity of said surfaces with relation to the mandrel, a cutter for severing the formed tube, and means for operating said cutter in timed relation to the operation of said means for feeding strip stock to the mandrel.

37. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, drive means for said members, means for adjusting said strip engaging surfaces laterally of the mandrel, means for adjusting the positions of angularity of said surfaces with relation to the mandrel, a cutter for severing the formed tube, and means for operating said cutter in timed relation to the operation of said means for feeding strip stock to the mandrel.

38. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel, a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, a power source, and flexible drive means operatively connecting said winding members with said power source.

39. In a tube forming machine, a mandrel, means for feeding strip stock to said mandrel a pair of winding members mounted at opposite sides of said mandrel and arranged oppositely angularly relative thereto, said members being adapted to engage and wind said strip stock on the mandrel and having strip engaging surfaces movable angularly in opposite directions relative to the mandrel, means for bodily adjusting said winding members relative to the mandrel, a power source, and drive means operatively connecting said winding members with the power source, said drive means permitting adjustment of said winding means relative to the mandrel.

40. In a tube-forming machine, means for continuously forming and advancing a tube, means for continuously applying a coating to said tube as it is formed, means for cutting the formed tube into predetermined lengths, and a heated carrier adapted to receive said lengths of tube as they are severed and retain them for a predetermined time at a desired high temperature to effect distribution and absorption of said coating on said tube.

41. In a tube-forming machine, a heated mandrel, means for feeding a strip of paper stock to said mandrel, means for wrapping said stock about said mandrel and advancing it therealong, means for applying a coating material having a melting point above atmospheric temperature to the face of said tape in contact with said mandrel before said tape reaches said mandrel, means for applying coating material to the exterior of the formed tube, means for cutting the formed tube into predetermined lengths, and a heated carrier

adapted to receive said lengths of tube as they are severed and retain them for a predetermined time at a desired high temperature to effect distribution and absorption of said coating on said tubes.

In witness that we claim the foregoing we have hereunto subscribed our names this 2nd day of April 1930.

ARCH C. HUSTON.
IRVING PERCY SIMONSEN.
GLEN C. GILLILAND.
FORD L. HUFFMAN.
FREDERICK G. HIGGINS.
EDWARD F. SCHRODECK.