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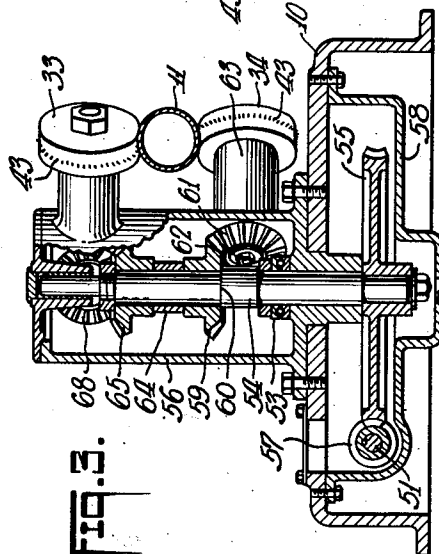
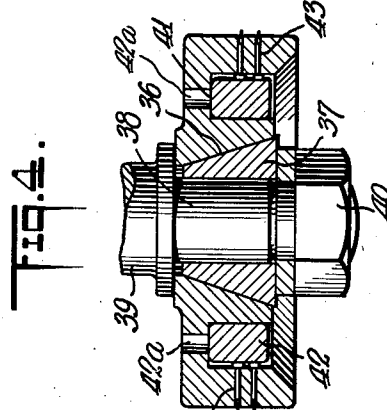
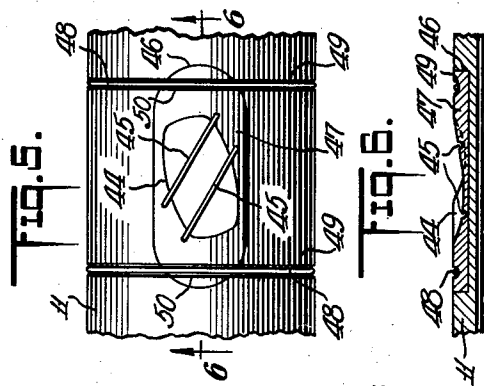
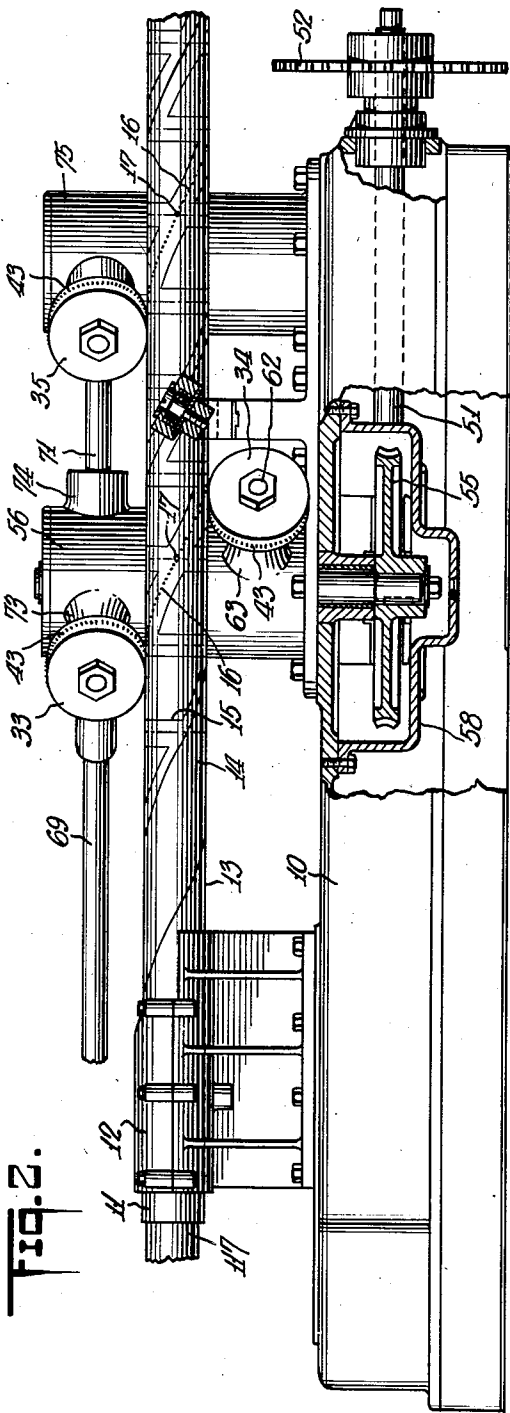
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2,051,922

FORMING AND FILLING OF SPIRALLY WOUND TUBES

Filed July 18, 1934

6 Sheets-Sheet 2



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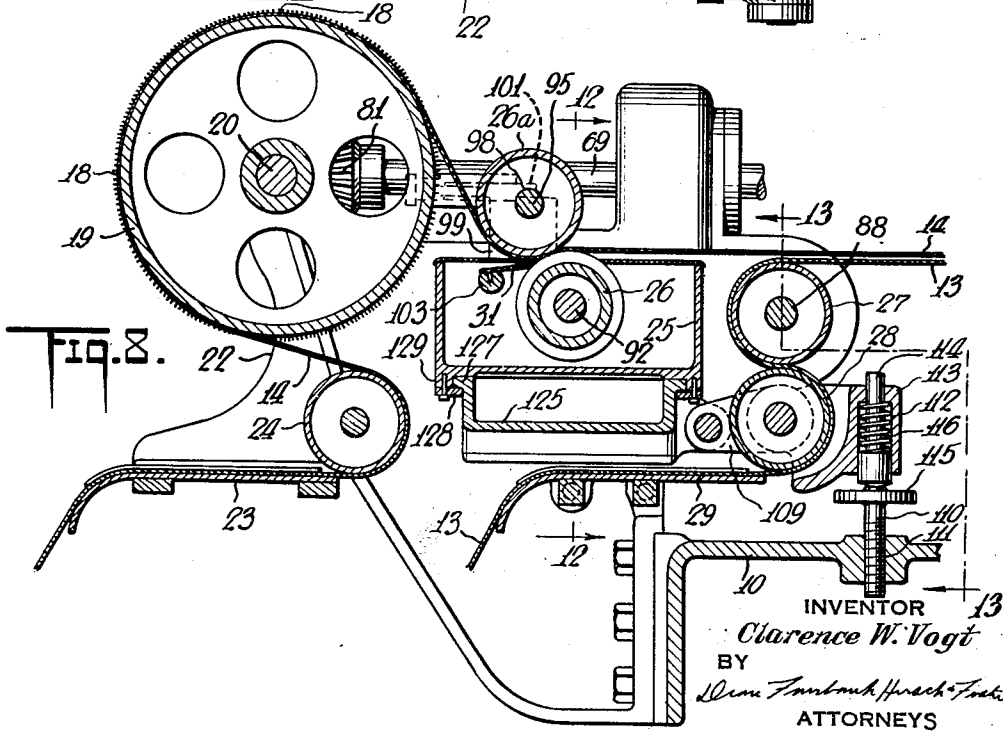
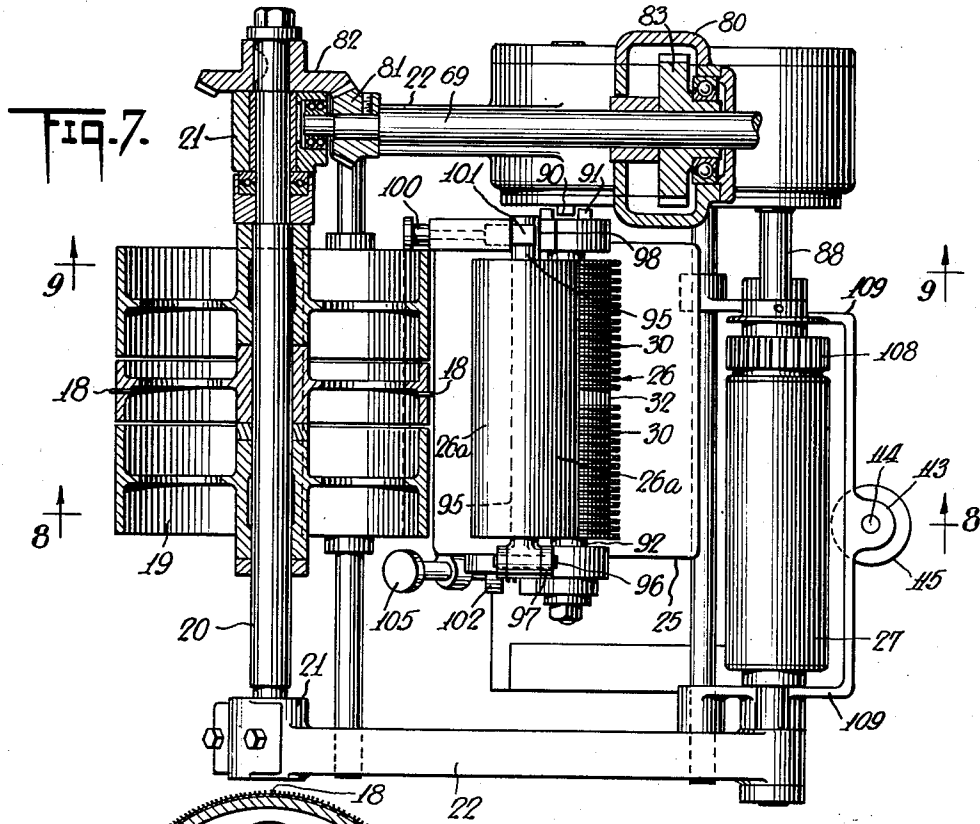
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FORMING AND FILLING OF SPIRALLY WOUND TUBES

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6 Sheets-Sheet 3.



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FORMING AND FILLING OF SPIRALLY WOUND TUBES

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Fig. 9.

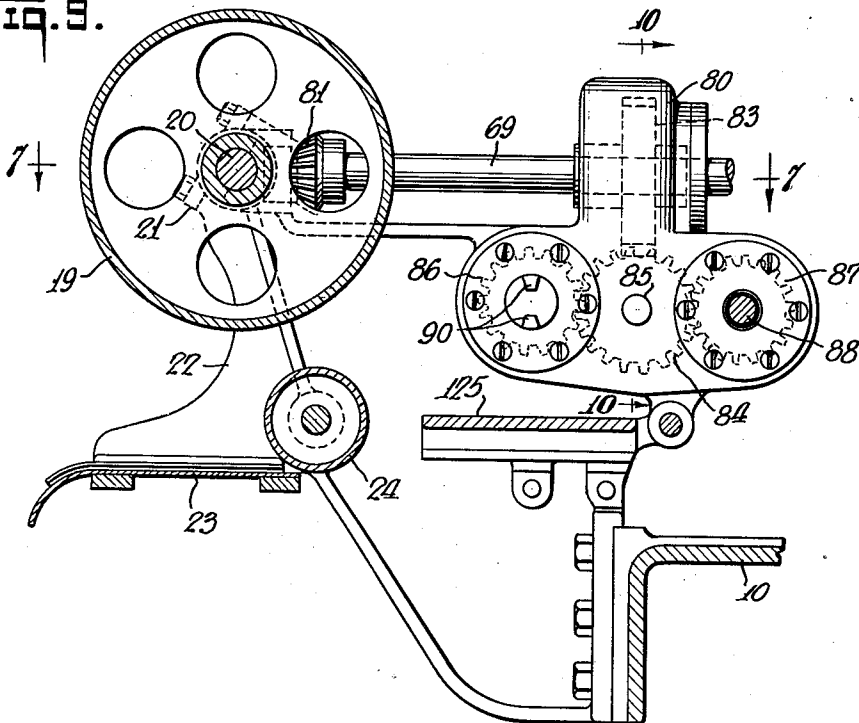


Fig. 10.

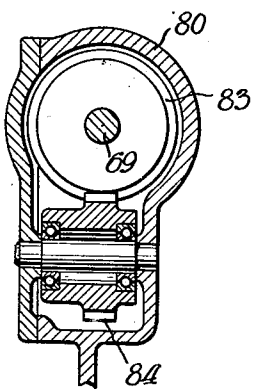
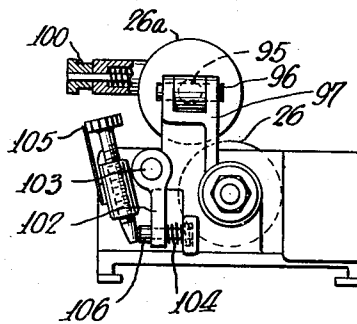


Fig. 11.



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FIG. 12.

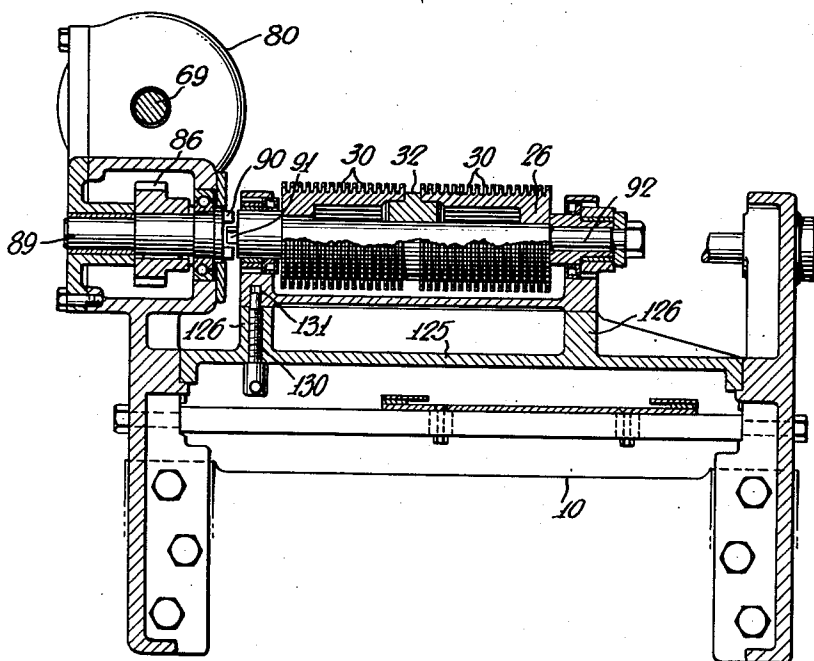
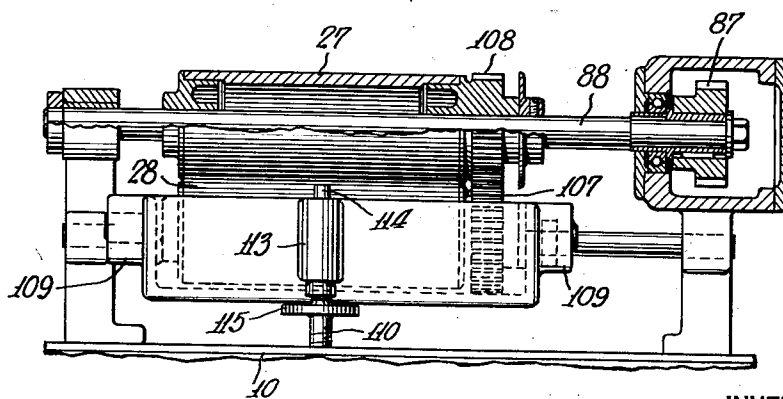


FIG. 13.



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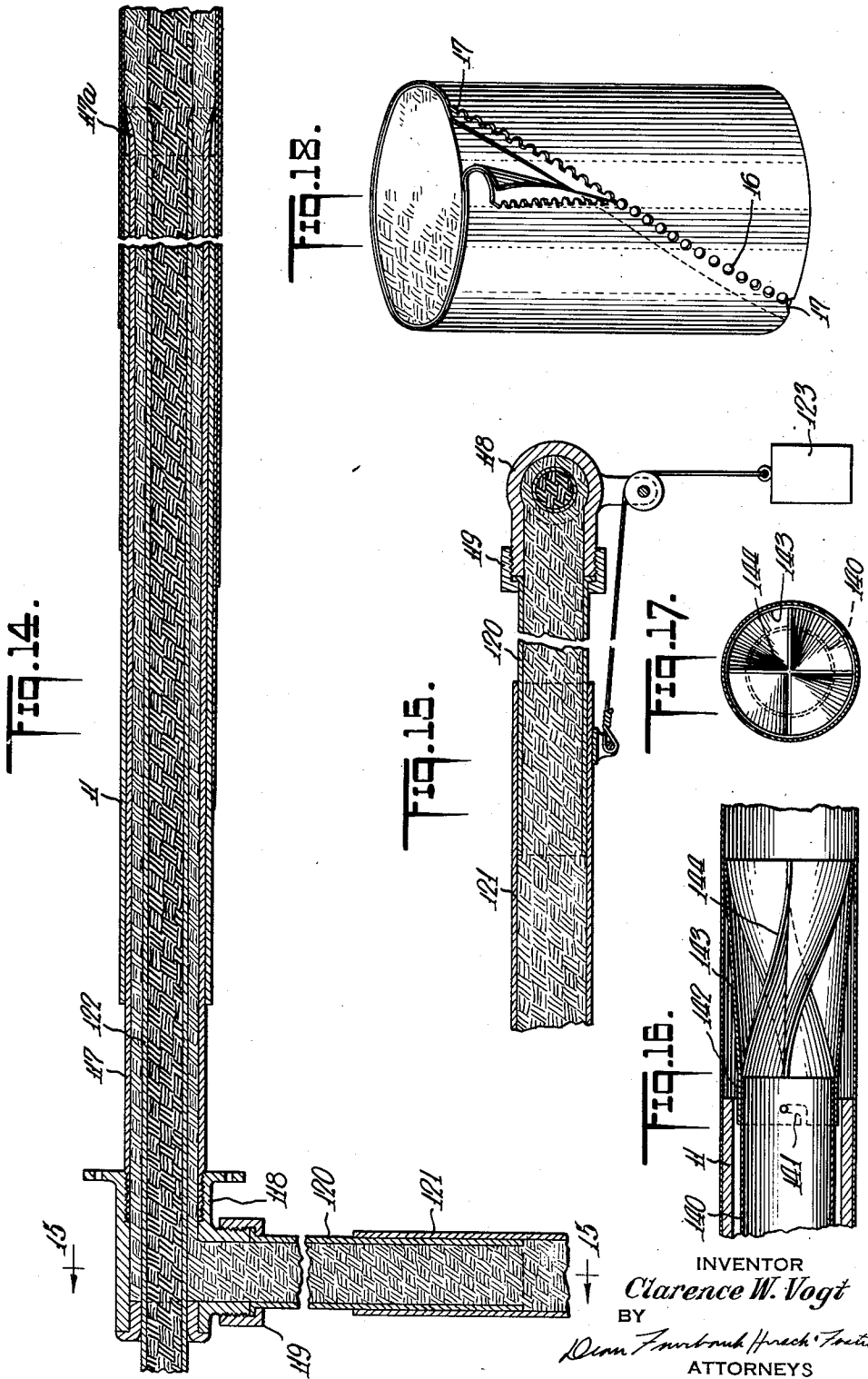
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2,051,922

FORMING AND FILLING OF SPIRALLY WOUND TUBES

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UNITED STATES PATENT OFFICE

2,051,922

FORMING AND FILLING OF SPIRALLY
WOUND TUBESClarence W. Vogt, Greenwich, Conn., assignor
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Application July 18, 1934, Serial No. 735,740

17 Claims. (Cl. 93—3)

It has heretofore been common practice to form tubes by spirally winding strips of paper stock about a stationary mandrel. One or more driven winding belts wrapped about the stock on the mandrel have served to draw the paper from the supply roll, spirally wind it and cause it to continuously advance axially along the mandrel and off the end to a tube cut off mechanism. Customarily two strips with their lateral edges offset are wound one about the other so that the lines of abutment of the spirally wound inner strip are concealed by the outer strip, the strips being adhesively joined throughout.

The feeding of the paper is non-positive because of slippage of the winding belts on the paper and on their pulleys and slippage of the paper strips upon each other. This is not a serious disadvantage if there is no printing on the paper, which must register with the cut-off mechanism or if the cut-off mechanism be operated by a trip in the path of movement of the advancing tube to obtain sections of uniform length. The non-positive feeding makes the gearing together of the cut-off mechanism and the feeding mechanism and cutting at predetermined points in respect to printing of the paper, difficult if not impossible if sections of uniform length are desired.

As one feature of the invention there is provided dependable positive mechanism for withdrawing the strip stock from the supply rolls and spirally winding it about the mandrel so that the outer strip may bear a succession of printed forms which will have exact and predetermined registration with the cutter at each cutting operation, due to the absolutely uniform rate of tube formation and advance.

As another feature there are provided means which interlock with indexing apertures in the outer strip of paper, whereby the strip if indexed in respect to the paper withdrawing mechanism, the winding mechanism and cutoff mechanism and cutting on lines predetermined in respect to the printing is insured.

As another feature there are provided winding rolls having means to penetrate the outer strip and engage the under strip and positively advance the two strips together in spiral fashion about the mandrel. Such means permits the winding of wide strips in steeply pitched spirals whereas the standard belt drive slips more and more as the pitch of the spiral and width of the paper is increased and becomes virtually inop-

erative at pitches which the machine of the present invention handles with ease.

As another feature, the outer strip is provided with a line of perforations which are but slightly offset from the spiral line of abutment of the inner strip, whereby tearing of the outer tubular wrapper on the perforated lines easily opens up the tube along the line of spiral abutment of the inner strip and permits the ready removal of the tube from material which it may encase.

As another feature of the invention the mandrel is provided with a depression of such form that the winding roll may be disposed with its axis parallel to the direction of movement of the paper and with its periphery in the depression so that the paper is depressed by the roll and the roll has its surface engaging the paper for a substantial distance.

As another feature the winding roll has its periphery provided with projecting pins which pierce the paper and move through a groove in depression of the mandrel so that no slippage of the paper in respect to the mandrel or roll is possible.

As another feature the paper feeding mechanism and the paper winding mechanism are geared together and form the tube at a positive and definite rate whereby the cutting mechanism may also be geared to them and cut off sections of uniform length.

As another feature of the invention there is provided means for filling the tube as it is formed, preferably with a plastic material such as partially frozen ice cream or the like, the mandrel being hollow and the plastic material being extruded through the mandrel and into the tube at a velocity corresponding to the speed at which the formed tube progresses axially beyond the mandrel.

Another feature is the provision of means for effectively expanding the plastic mass as it leaves the bore of the mandrel and enters the larger diameter tube.

In my prior Patents Nos. 2,006,375 and 2,006,376, issued July 2, 1935, I have shown apparatus for continuously forming a paper tube and filling it with plastic material and which may be cut into peripherally wrapped individual service portions of ice cream. By the present invention I may also produce peripherally wrapped individual service portions of ice cream but the apparatus is more particularly intended for use in the formation of larger, stiffer and stronger ice cream filled containers adapted to withstand rougher handling and which may be of pint, quart or

other such size. As the filled tube comes from the machine and is cut into sections, each section forms a spirally wound tubular container substantially filled with ice cream. The open ends may then be closed by caps to complete the final package.

It should be understood that reference to paper as the material from which the tube stock is formed is merely a term of convenience, since the invention obviously contemplates the formation of spirally wound strips of any suitable material sufficiently flexible to be spirally wound. Also in referring to ice cream as the substance which is forced through the mandrel and into the tube, I intend to include any plastic substances, as the invention is not limited by the nature of the material which is used to fill the tube.

Furthermore so far as the broader aspects of the invention are concerned, the filling of the tube is not essential, as the tube may be made and cut into sections to be later filled or used for any purpose desired.

Other and more general objects of the invention are to provide a method and apparatus for forming, filling and severing spirally wound tubes which are characterized by simplicity, practicability, positiveness, expedition and facility of operation.

The invention may be more fully understood from the following description in connection with the accompanying drawings wherein:—

Fig. 1 is a top plan view of a tube forming machine embodying the invention, parts of the machine being shown in section for the sake of clearness,

Fig. 2 is a view partly in side elevation and partly in vertical section of the machine,

Fig. 3 is a view mainly in transverse section on the staggered line 3—3 of Fig. 1,

Fig. 4 is an enlarged sectional detail of one of the paper engaging and advancing rollers,

Fig. 5 is an enlarged detail showing the depression or recess in the surface of the mandrel and the grooves for coaction with the roller of Fig. 4,

Fig. 6 is a sectional detail on the line 6—6 of Fig. 5,

Fig. 7 is an enlarged view partly in top plan and partly in section, of the mechanism for applying the adhesive and for withdrawing the paper from the supply roll,

Fig. 8 is a vertical sectional view on the line 8—8 of Fig. 7,

Fig. 9 is a vertical sectional view on the line 9—9 of Fig. 7,

Fig. 10 is a vertical sectional view on the line 10—10 of Fig. 9,

Fig. 11 is a side elevational view of the glue pot and associated mechanism,

Fig. 12 is a vertical sectional view on the line 12—12 of Fig. 8,

Fig. 13 is a vertical sectional view on the line 13—13 of Fig. 8,

Fig. 14 is an enlarged sectional plan view showing means for feeding of two different plastic materials through the hollow mandrel and into the tube,

Fig. 15 is a sectional view on the line 15—15 of Fig. 14,

Fig. 16 is a longitudinal sectional detail of a modified form of material delivery pipe including material expanding means,

Fig. 17 is an end view of the apparatus shown in Fig. 16, and

Fig. 18 is a perspective view of a severed length

of filled tube showing the manner in which the tube may be torn open to release its contents.

The tube forming mechanism illustrated in Figs. 1 to 13 inclusive, included a cast base 10 above which a stationary hollow mandrel 11 is supported and firmly clamped at one end in a sectional support bracket 12. The flexible strip stock, which is supplied to and wound about the mandrel to form the spirally wound tube includes an inner strip of paper 13 and an outer strip of paper 14, the latter having printing 15 in repetitive design or pattern thereon. The strip 13 constitutes the inner shell of the completed tube and may if desired be stiffer than the strip 14 which constitutes the outer wrapper of the tube. The two strips are of nearly equal width, the outer one being only slightly wider than the inner to accommodate for its larger diameter when wound about the inner strip. The strips are laterally offset to a distance which may be equal to half the width of a strip, so that the abutting edges of the strips are out of registration.

Extending longitudinally of the strip 14 is a proposed tearing line formed by a row of perforations 16 illustratively shown as of circular shape, and at regular intervals in lieu of one of the circular perforations, there is provided a larger indexing perforation 17 of different size or shape, illustratively diamond shaped.

These perforations are engaged by pins 18 (Fig. 7) projecting radially from the periphery of a sectional paper feed roll or drum 19. The central pin carrying section of the drum is keyed upon a shaft 20 journaled in suitable bearings 21 in the upper outer end of bracket arms 22 rising from one end of the base casting. The end sections of the drum are not keyed to the shaft 20 but may rotate freely thereon so that the tension of the paper will always be transmitted to pins 18 and the paper cannot become skewed or torn by undue tension or friction of its edges with the ends of the drum.

The pins or sprocket teeth 18 of the paper feed roll 19 correspond in cross-sectional shape to the perforations 16 and 17 in the strip 14, there being provided a pin of diamond-shaped cross-section, at regular intervals and the remaining pins being of circular cross-section and spaced according to the perforations in the paper.

The paper feed drum 19, the center section of which is positively driven in a manner to be later described, draws the strip 14 from a supply roll (not shown) over a guide platform 23 which bridges the bracket frames 22 and around a guide roll 24. The axis of the shaft 20 is disposed at such an angle with respect to the axis of the mandrel that the paper drawn directly from the feed roll will be wrapped about the mandrel in spiral fashion at a pitch depending on the diameter of the mandrel and the width of the strip.

One of the paper strips, for instance the strip 14, upon leaving the feed drum 19 has adhesive applied to the paper by any suitable adhesive applying mechanism before being led to the mandrel. One satisfactory type of adhesive applying mechanism is illustrated in Fig. 8, wherein a glue pot 25 has a roll 26 partially submerged in the liquid adhesive therein and against which the paper leaving the feed drum 19 is pressed by pressure roller 26a.

The strip 13 is drawn from a supply roll (not shown) by a pair of cooperating rollers 27 and 28. The roller 27 is positively driven in a manner to be later described and the cooperating roller 28 is a pressure roller also positively driven and

which insures the frictional gripping and advance of the strip 13 which is led over the guide platform 29 around the pressure roller 28 between the rollers 27 and 28 and around the roller 27, whence it passes to the mandrel.

As best seen in Figs. 7 and 12, the adhesive applying roll 26 is provided with a plurality of annular ribs 30 and as the roll rotates, excessive adhesive material is scraped from the ribbed surface thereof by a scraper member 31 micrometrically adjustable toward and away from the surface of roll 26 in a manner to be later described. By virtue of the ribbed and grooved surface of the adhesive applying roll, stripes of adhesive are applied to the under surface of the paper strip 14, but when this web is pressed against the strip 13 as an incident of wrapping the strips about the mandrel and advancing them, the adhesive strips may spread somewhat under pressure without being squeezed out at the edge of either strip. The adhesive applying roll is provided with a relatively deep and wide groove 32 in its periphery so that the line of apertures in the web 14 and the portion of the web adjacent the apertures do not receive any adhesive for a purpose to be more fully hereinafter described.

The axis of the feed rolls 27 and 28 are parallel to the axis of the shaft 20, but the feed rolls 27, 28 are axially offset with respect to the feed roll 18 so that the two strips 13 and 14 will be fed to the mandrel with their edges in staggered relationship, whereby the lines of abutment of each spirally wound strip are out of registry with the corresponding lines of abutment of the other strip. The line of perforations 16, 17 are but slightly out of registration with the edge of the strip 13 and preferably no adhesive is applied to the portion of the outer strip which comes between the line of perforations and the abutment line of the inner strip.

Means are provided for positively engaging the superimposed paper webs as they reach the mandrel and rolling them spirally therearound. This means includes a suitable number of positively driven web-engaging rollers 33, 34, 35. The axes of these rollers are at an angle to that of the mandrel and are substantially at right angles to the direction of travel of the paper spirally around the mandrel at the point between the mandrel and the roller.

Fig. 4 illustrates in detail the construction of one of the paper gripping and advancing rollers, the three rollers being similarly constructed. The roller has a tapered hub portion 36 frictionally fitting over a conical sleeve 37 clamped on the reduced end 38 of the roller driving shaft 39 by a nut 40. The roller also has a peripheral wall spaced from the hub by a relatively deep annular groove 41. A series of paper engaging pins 43 extend radially through the peripheral wall of the roller with the head of the pins lying in the groove 41 and the points of the pins projecting beyond the surface of the roller. A single row of pins 43 may be provided as shown in Figs. 1-3, but it is advantageous to have two rows of these pins as shown in the detail view of Fig. 4. A ring 42 fits within the groove 41 and engages the heads of the pins and blocks them against inward radial movement. When the pins become dull the collar 41 may be removed (as by a tool inserted through knockout holes 42a) and the pins withdrawn and replaced.

Wherever one of the rollers 33 or 34 or 35 is in operative relationship to the mandrel, the surface of the mandrel is shaped to conform to

the curvature of a portion of the peripheral surface of the roller. Preferably the mandrel surface has a depression 44 (Fig. 5) so that the periphery of the roller may force the paper into this depression. Within the depression 44 are parallel grooves 45 in the path of movement of the pins and providing clearance for the points of the pins. The projecting ends of the pins 43 are long enough to penetrate both of the paper webs and positively spirally wind them about the mandrel.

While the material of the mandrel itself might be recessed and grooved, I prefer to provide the mandrel with a pocket or chamber 46 and the recess 44 and grooves 45 are formed in a separate replaceable wear plate 47 which is placed in the pocket or chamber and secured in position in any suitable manner as by annular bands 48 lying in grooves 49 in the mandrel and in grooves 50 in the plate 47.

By forming the depression 44 and the grooves 45 so that the paper winding, pin carrying rolls actually interfit with the mandrel, it will be apparent that several of the pins will be in engagement with the paper at the same time and the danger of the paper tearing and slipping is accordingly minimized and the driving engagement of each pin with the paper is consequently prolonged.

The rollers 33, 34, 35 are spaced apart a distance along the spiral. For instance the spacing may correspond to half a spiral convolution of the paper. Preferably they are progressively of slightly greater diameter (say .001 of an inch) whereby each roller tends to pull the paper slightly faster than the one before and the paper is wrapped more tightly about the mandrel by each successive roller and is held under tension between each pair of rollers. Other methods of progressively slightly increasing the surface speed of the successive rollers (as by differential gearing) would serve the same purpose. The surface speed of roller 33 is very slightly greater than that of drum 19 to maintain tension on the paper strip 14 which is advancing toward the mandrel and cause slight stretch of the paper. In this connection the pins 18 engaging the perforations 16 and 17 really act as brakes, the free floating end sections of the drum offering no substantial frictional resistance.

The purpose of the conical sleeves 37 is to permit retraction of the rollers 33, 34, 35 from the grooves 44 in the mandrel when the pins are to be replaced. With nut 40 removed and sleeve 37 drawn out, the roller is sufficiently loose on its shaft 39 to be moved radially to a position where the pins 43 clear the groove 44 and the roller can be slid axially off its shaft.

A suitable power transmitting apparatus for driving the various paper feeding and tube forming rollers includes a drive shaft 51 journaled under the base 10. Power is applied to shaft 51 in any suitable manner, as through the sprocket wheel 52 secured to the projecting end of the shaft. Housed within a turret 56 rising from the base casting and supported upon a thrust bearing 53 is a vertical shaft 54 which extends through the base casting and at its lower end carries a gear 55, the latter being driven from a worm 57 carried by a shaft 51. A housing 58 for the worm and worm gear may be bolted to the underface of the base 10.

The three rollers 33, 34 and 35 are all driven at the same rate of speed from the shaft 54, driving connections being as follows: A down-

wardly facing bevel gear 59 is keyed to the shaft 54 and rests upon a shoulder 60 of the shaft. The gear 59 is in mesh with a bevel gear 61 secured to the inner end of a shaft 62 corresponding to shaft 39. This shaft is journaled in a sleeve 63 projecting laterally from the turret 56 and the pin carrying roller 34 is fixed upon the end of the shaft under the mandrel 11.

A collar 64 keyed to the shaft 54 rests upon the gear 59 and an upwardly facing bevel gear 65 also keyed to the shaft 54 rests upon the collar and meshes with three bevel gears 66, 67 and 68 (Fig. 1) fixed respectively to the inner ends of shafts 69, 39 and 71 which extend radially outwardly through bearing sleeves 72, 73 and 74 integral with the turret 56. The roller 33 as above described is fixed to the outer end of the shaft 39 above the mandrel. The shaft 71 extends into a second turret member 75 rising from the base 10 and carries a bevel gear 76 meshing with a smaller gear 77 on the inner end of a shaft 78 mounted in a bearing sleeve 79 forming part of the turret member 75. Shaft 78 at its outer end carries roller 35 which is disposed in parallelism with the roller 33 and spaced from the roller 33 a distance corresponding to one spiral turn of the paper web about the mandrel.

Power transmitted to the shaft 69 is used for driving the paper feed drum 19, the adhesive applying roll 26 and the paper feeding roll 27, the illustrated drive being merely typical of one of many arrangements which might be utilized to accomplish this result.

The shaft 69 extends through the upper end of a gear casing 80 and the end of the shaft beyond the gear casing carries a beveled pinion 81 meshing with a beveled gear 82 fixed upon the end of the drum shaft 20. That portion of the shaft 69 which is encased within the housing 80 carries a spiral gear 83 driving a gear 84 on a shaft 85 which is journaled in the lower portion of the casing 80 at right angles to the axis of shaft 69. Gear 85 meshes with a pair of gears 86 and 87 disposed at opposite sides thereof and which serve respectively to drive the adhesive applying roll 26 and the paper feed roll 27.

The gear 87 is fixed directly on the shaft 88 which carries feed roll 27 and the gear 86 is fixed upon a shaft 89 journaled in the walls of the gear case 80. The end of this shaft is provided with a pair of clutch teeth 90 adapted to engage with corresponding clutch teeth 91 projecting from the end of the shaft 92, which carries the adhesive applying roll 26.

Means are provided to permit the guide roll 26a to be swung out of the way when the paper is being trained over the glue roll 26. With this in view the shaft or pintle 95 upon which the roll 26a rotates is hingedly connected as at 96 to a support member 97 rising from an edge of the glue pot. The free end of the pintle 95 rests in a bearing groove 98 in a support member 99 rising from the opposite edge of the glue pot and a spring pressed latch 100 has a pintle engaging end 101 normally spring projected over the free end of the pintle 95 to lock the pintle against upward movement. By withdrawing the latch member 100 the pintle may be swung on its hinge 96 to permit the paper to be trained over the glue roll 26.

Any suitable adjusting mechanism for the scraper 31 may be employed, a typical mechanism being shown in Figs. 7 and 11. This includes a rocker arm 102 disposed outside of the glue pot

and fixed to the end of the shaft 103 which carries the scraper blade. The coiled extension spring 104 acts on the rocker arm 102 and normally tends to move the scraper blade 31 inwardly against the roll 26. An adjusting screw 105 having camming engagement with a button 106 fixed to the rocker arm is adjustable to rock this arm against the spring 104 and thereby very finely adjust the distance of the scraper blade from the surface of the glue applying roll 26.

The pressure roll 28 (Fig. 13) has a gear 107 fixed to one end thereof which is driven by a gear 108 carried on the roll 27 to insure uniform peripheral speeds of the smaller sized rolls 27 and 28. Any suitable mechanism for adjusting the pressure of the roll 28 may be employed, a typical arrangement being illustrated in Fig. 8. Here it will be noted that the roll 28 is journaled in swinging bracket arms 109 and that a vertical shaft 110 having a screw-threaded adjustment at 111 in the base casting 10 projects into and through a pocket 112 in a bridging member 113 which connects the free ends of the arms 109. A coiled expansion spring 116 encircling the reduced end 114 of the shaft 110 engages the bottom of the pocket 112 and tends to rock the arms 109 in a direction to move the roll 28 against the surface of the roll 27. A knurled flange 115 on the shaft 110 permits convenient manual adjustment of this shaft to regulate the tension of the spring 116.

The glue box or pot 25 is bodily removable from its support for purposes of cleaning. As best seen in Figs. 8, 9 and 13, the support means for the glue pot includes a plate 125 having a pair of upstanding flanges 126 upon which the ends of the glue pot rest. Projecting lugs 127 at the ends of these flanges are adapted to interlock with short inwardly turned rails 128 carried by flanges 129 projecting downwardly from the sides of the glue pot. The glue pot may further be secured by one or more screws 130 (Fig. 12) extending upwardly through one of the flanges 126 and having ends entering sockets 131 in the bottom of the pot. To remove the glue pot screws 130 are retracted and the pot is slid endwise until the rails 128 clear the flanges or lugs 127, whereupon the pot may be lifted directly upwardly. The advantage of having the loose four-tooth clutch connection at 90, 91 is that the clutch carrying end of the glue roller shaft may be slid axially into engagement with the clutch face at the end of the shaft 89 without having to accurately align clutch elements on these shafts.

A plastic mass may be supplied through the hollow mandrel 11 for filling the spirally wound tube as it leaves the mandrel. One, two or more flavors of ice cream may be forced through the mandrel to produce a plastic mass having a core section or segment of one flavor of ice cream, one or more adjacent or encircling portions of different flavor.

As shown in Figs. 14 and 15 the hollow mandrel 11 is lined by a rigid tube or pipe 117 of stainless or non-corrodible material which projects beyond both ends of the mandrel and is screwed at one end into one end of an elbow fitting 118 which may be connected to the outlet of a continuous pressure freezer, such as shown in my Patents 1,783,864, 1,783,865, 1,783,866 and 1,783,867, issued December 2, 1930. Suitably coupled as at 119 to the opposite end of the elbow fitting is the fixed section 120 of a sectional ice cream supply pipe. The movable section 121 of this pipe tele-

scopes over the end of the first section and a counterweight 123 normally tends to draw the section 121 into fully telescoped position. The opposite end of pipe 117 may be flared outwardly to a sharp edge at 117a so that the plastic material extended through this tube is guided outwardly into contact with the inner surface of the spiral tube.

Concentric with the pipe 117 is a smaller rigid tube 122 which extends through the elbow fitting 118 and is rigidly supported by said fitting. The external diameter of the tube 122 is less than the internal diameter of the pipe 117.

Ice cream of one flavor continuously supplied under pressure through the pipe 120, 121, flows around the tube 122 and through the tube 117, and ice cream of another flavor is forced under pressure through the inner tube 122. Tube 117 terminates just beyond the end of the mandrel so that the core of cream emanating from the tube 122 and the ring of ice cream extruded from between the pipes 117 and 122 enter the spirally wound casing just after it leaves the mandrel.

It will of course be understood that the ice cream should be fed at a rate corresponding to the rate of formation and advance of the spirally wound tube. The telescopic action between the pipe sections 120 and 121 is merely illustrative of one means for accommodating for too rapid or too slow feed of the cream. These two pipes will tend to telescope in the event that insufficient pressure is being applied to the cream advancing through them and will be relatively extended if too rapid advance of the cream builds up unduly high back pressure. This movement may be utilized for controlling the relative speeds of the tube forming and cream forcing mechanism.

It will be understood that the ice cream which is passing through the inner tube 122 may also have its rate of feed properly regulated but the entire regulation may be by one cream stream only. Both streams of ice cream are preferably advanced from continuous freezers of the general type illustrated in my prior Patent No. 1,783,864, dated December 2, 1930.

Figs. 16 and 17 illustrate a slightly modified arrangement for causing the extruded stream of ice cream to expand into the spirally wound tube. To simplify illustration it is shown for supplying only one flavor of ice cream fed through a tube 140 of slightly smaller external diameter than the internal diameter of the mandrel 11. The tube terminates just beyond the end of the mandrel and attached to the tube end, as by a bayonet joint 141, is the cylindrical end 142 of a frusto-conical expanding tube 143, the mouth of which terminates closely adjacent the inner surface of the spirally wound paper tube. Arranged within the expanding tube 143 are a plurality of spiral vanes 144 so that as the plastic mass leaves the tube 140, a spiral motion is imparted thereto by the vanes 142 and in the same direction as the direction of rotation of the paper tube. This serves a three-fold function. It expands the stream of ice cream so that it completely fills the paper tube; the skin friction afforded by the spiral vanes gives an added back pressure on the extruded plastic mass, and the friction between the ice cream and the rotating paper tube, as the cream enters the tube, is minimized.

It will be borne in mind that such metal parts as the tubes 140 and 143 and the spiral vanes 144 will rapidly assume the same temperature as the ice cream which is passing through them but that the paper tube which is advancing axially

off the mandrel will always be relatively warm and will have a tendency to further soften the plastic, partially frozen mass of cream as the cream contacts it, with resultant lubrication of the paper by the softened cream and minimization of such skin friction as would otherwise tend to aid in building up back pressure on the extruded plastic material and insure complete filling of the tube. By correctly designing the spiral vanes the cream leaving the expanding tube 143 may already be rotating as fast or faster than the paper tube. It may actually assist in winding the paper tube but in any event the slippage between the cream and the tube is minimized and the tube is completely filled with cream.

The ice cream as delivered fills the continuously formed tube and the filled tube then passes to a suitable travelling cutting mechanism where the advancing end of the tube is intermittently severed into suitable package forming lengths by cutting on the lines between printed forms and thereafter the open-ended cylindrical containers are capped to complete the package.

It will be understood that the cutting mechanism is synchronized with or geared to the tube filling and forming apparatus so that absolutely uniform lengths of cream-filled tubing may be produced.

The purpose of omitting a stripe of adhesive from the under-surface of the web 14 adjacent the line of perforations will be apparent from Fig. 18 which shows a final package partly opened. The indexing perforations 17 come at the ends and afford a tearing guide for initiating tearing of the outer cover of the tube along the line of perforations 16. Since the outer strip is not adhesively secured to the inner strip along that area which lies between its perforated line and the spirally abutting edges of the inner strip, it will be apparent that as the outer cover is torn on the line of perforations, the abutting edges of the inner spirally wound shell will be freed and liberate the contents of the tube, or may be peeled off from such contents. Preferably the end caps are removed before the tearing is begun.

While the operation of the apparatus will be for the most part understood from the foregoing description, it will be briefly reviewed as follows:

The paper web 14 is trained over the feed drum 19, the circular perforations of the paper registered with the circular pins and the diamond-shaped indexing perforations registering with the diamond-shaped pins of the feed drum. The roll 26a is swung upwardly and then relatched to clamp the paper between the glue-applying roll 26 and the roll 26a.

The lower strip or web 13 is trained around and between the rolls 27 and 28. The latter roll may of course be conveniently, manually depressed against the action of its spring 116 to permit the paper to be passed between the rolls. The two superimposed but laterally offset webs 13 and 14 are then led to the mandrel and under the first roll 33 of the tube forming and advancing rolls 33, 34, 35. After the paper has been completely wrapped once about the mandrel it will lie under all three of the rolls 33, 34 and 35 and the operation of the machine is started.

Due to the fact that the rolls 33 take into recess 44 which conform to the radii of curvature the rolls 33, 34 and 35, a considerable length of peripheral surface of said rolls will always be operating on the paper webs which are being engaged and advanced. The pins 43 pass through the outer paper web 14 and penetrate the inner

web 13 so that the advance of the paper webs and the formation of the tubes is positively effected. The feed drum 19, the feed rolls 27, 28, the glue applying rolls 26 and the pin carrying winding rolls 33, 34 and 35 are all caused to travel at substantially the same peripheral speed due to the interlocked driving connections although minute increases in the peripheral speeds of drum 19 and rolls 33, 34, 35 are desirable as described above. There can be no lag in the rate at which the paper is fed. Furthermore, due to the positive action of rolls 33, 34 and 35 there will be no slippage between these rolls and the paper webs or between the paper webs themselves. Of course slight slippage of the lower web 13 would not be particularly serious and for this reason this web need not be perforated and advanced by sprocket teeth on a supply roll. The most important thing is to advance and fill the outer wrapper 15 with absolute precision so that the cutting mechanism will always sever the completely wound tube in accordance with the spacing of the series of printed forms on the outer wrapper of the finished cylindrical ice cream package.

Where the formed package is adapted to be subsequently opened by tearing one of the spiral lines of abutment of the material which forms the tube, it will be apparent that the steeper the pitch of the spiral the greater the ease of separation of the final package along the lines of the spiral.

The standard winding belts which have been previously employed for winding these tubes are not only subject to slippage, but as suggested above have very definite limitations as to the width of tube forming material which can be handled for any given diameter and in fact are incapable of winding steeply pitched spirals. The positive action, however, of pin-bearing winding rollers in the present case makes it possible to take a very wide strip of flexible material and spirally wind it at a very steep pitch.

In cases where the tubes are not to be filled at the time they are formed, the mandrel could either have much thicker walls or it could be solid. Instead of presenting a stationary surface to complement the winding rolls, a mating rotary surface such as a ball bearing roller could be employed as part of the mandrel. With such an arrangement the paper webs could be very effectively gripped and pinched even without the use of penetrating pins.

A completed package which may be formed by severing lengths of filled tubing and capping such lengths is disclosed in my copending application Serial No. 735,911 filed July 19, 1934.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. Apparatus for forming spirally wound tubes including a stationary mandrel about which a length of flexible material is to be wound, a roll arranged closely adjacent to the surface of the mandrel at an angle to engage and spirally wind the material about the mandrel, the surface of the mandrel having a shallow recess therein following the curvature of the periphery of the roll whereby a substantial length of the material is always in operative engagement with the roll.

2. Apparatus for forming spirally wound tubes including a stationary mandrel about which a length of flexible material is to be wound, a roll arranged closely adjacent to the surface of the mandrel at an angle to engage and spirally wind

the material about the mandrel and provided with penetrating devices projecting from the surface of the rolls for engaging and advancing the material, the surface of the mandrel having a shallow recess therein following the curvature of the periphery of the roll whereby a substantial area of the periphery of said roll is always in operative engagement with the material, said recess also having grooves therein to accommodate said penetrating devices.

3. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs and a plurality of rollers arranged closely adjacent the surface of the mandrel and spaced apart axially of the mandrel, and corresponding to partial spiral convolutions of the proposed tube to engage the webs and wind them in spiral fashion about the mandrel.

4. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs, the outermost only of said webs having indexing perforations therein at regular intervals and said web advancing means having devices to engage said perforations, and a plurality of rollers arranged closely adjacent the surface of the mandrel and spaced apart axially of the mandrel, and corresponding to partial spiral convolutions of the proposed tube to engage the webs and wind them in spiral fashion about the mandrel.

5. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs, the outermost only of said webs having indexing perforations therein at regular intervals and said web advancing means having devices to engage said perforations, a plurality of rollers arranged closely adjacent the surface of the mandrel and spaced apart axially of the mandrel, and corresponding to partial spiral convolutions of the proposed tube to engage the webs and wind them in spiral fashion about the mandrel, and means for positively driving said advancing means and said winding means in timed relationship, whereby said indexing perforations insure severance of the formed tube at predetermined intervals by a tube cut-off operated in synchronism with the winding rolls.

6. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs as it advances toward the mandrel, means to engage the webs and wind them in spiral fashion about the mandrel, the outermost of said webs having a row of perforations therein arranged closely adjacent to the edge of the inner web and said adhesive applying means including a roller having a groove therein to prevent applying adhesive which would seal together the two webs between said perforated line and the edge of the under web.

7. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs as it advances toward the mandrel, means to engage the webs and wind them in spiral fashion about the mandrel, the outermost of said webs having a row of perforations therein arranged closely adjacent to the edge of the inner web and said adhesive applying means including a roller having a groove therein to prevent applying adhesive which would seal together the two webs between said perforated line and the edge of the under web, certain of said perforations serving as indexing means and the web advancing means including devices to engage in said indexing perforations.

8. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs as it advances toward the mandrel, means to engage the webs and wind them in spiral fashion about the mandrel, the outermost of said webs having a row of perforations therein arranged closely adjacent to the edge of the inner web and said adhesive applying means including a roller having a groove therein to prevent applying adhesive which would seal together the two webs between said perforated line and the edge of the under web, said outer web having a succession of printed forms thereon adapted to serve as the outer wrappers of cylindrical containers cut from the tube stock.

9. Apparatus for winding spiral tubes including a stationary mandrel, means for engaging a pair of paper webs and advancing them toward the mandrel with the edges of the webs laterally offset with respect to each other, means for applying an adhesive to the surface of one of said webs as it advances toward the mandrel, means to engage the webs and wind them in spiral fashion about the mandrel, the outermost of said webs having a row of perforations therein arranged closely adjacent to the edge of the inner web and said adhesive applying means including a roller having a groove therein to prevent applying adhesive which would seal together the two webs between said perforated line and the edge of the under web, said outer web having a succession of printed forms thereon adapted to serve as the outer wrappers of cylindrical containers cut from the tube stock, said indexing perforations being larger than the other perforations and arranged at the line of juncture of adjacent printed forms, whereby to afford readily accessible tearing guides for opening the containers.

10. A machine for forming spirally wound tubes including a mandrel, means for positively delivering a pair of paper webs to the mandrel with their edges in laterally offset relationship, means for applying adhesive to the face of one web, means for positively spirally winding the webs about the mandrel and advancing the rotating spirally wound tube axially therebeyond, the outermost of said webs having a series of printed forms displayed on its face and having indexing apertures therein, means arranged in advance of the mandrel for coacting with said indexing apertures and thereby predetermining the lines of

severance of the tube by a cutter arranged beyond the mandrel.

11. A machine for forming spirally wound tubes including a mandrel, means for positively delivering a pair of paper webs to the mandrel with their edges in laterally offset relationship, means for applying adhesive to the face of one web, means for positively spirally winding the webs about the mandrel and advancing the rotating spirally wound tube axially therebeyond, the outermost of said webs having a series of printed forms displayed on its face and having indexing apertures therein, means arranged in advance of the mandrel for coacting with said indexing apertures and thereby predetermining the lines of severance of the tube by a cutter arranged beyond the mandrel, said indexing apertures forming part of a line of longitudinally extending apertures in the outer web arranged closely adjacent one edge of the inner web and means to prevent the application of adhesive material to the overlying portions of the webs between the line of perforation in the upper strip and the line of abutment of the under strip.

12. A spiral tube winding machine including a mandrel and a roller arranged adjacent the surface of the mandrel, said mandrel having an arcuate groove therein following the curvature of the periphery of the roller and within which a portion of the roller lies and paper penetrating devices projecting from the periphery of the roller, said mandrel being also cut away to provide clearance for the movement of said penetrating devices.

13. Apparatus for forming and filling a spirally wound tube including a stationary hollow mandrel, means for winding a spiral tube about the mandrel and axially advancing the rotating tube therebeyond and means for extending a plastic tube filling material under pressure through the hollow mandrel at substantially the same rate of speed as the speed of axial advance of the formed tube and means for imparting a spiral movement to the extruded plastic mass as it enters and fills the rotating axially moving tube.

14. Apparatus for forming and filling a spirally wound tube including a stationary hollow mandrel, means for winding a spiral tube about the mandrel and axially advancing the rotating tube therebeyond and means for extending a plastic tube filling material under pressure through the hollow mandrel at substantially the same rate of speed as the speed of axial advance of the formed tube, and means for guiding the plastic mass into contact with the inner surface of the tube whereby to compensate for the difference in the internal diameter of the tube and the internal diameter of the mandrel through which the mass is extruded.

15. An apparatus for winding spiral tubes, including a stationary mandrel, means closely adjacent to said mandrel for engaging a pair of paper webs and winding them in spiral fashion about the mandrel, one of said webs having a series of perforations, and a feed roller having projections engaging said perforations.

16. An apparatus for winding spiral tubes, including a stationary mandrel, means closely adjacent to said mandrel for engaging a pair of paper webs and winding them in spiral fashion about the mandrel, one of said webs having a series of perforations approximately midway between its edges, and web feeding means therefor including a driven roller having projections engaging said perforations, and idler rollers co-

axial with said first mentioned roller and engaging the web adjacent to its edges.

17. An apparatus for winding spiral tubes, including a stationary mandrel, means for delivering a pair of paper webs to the mandrel with their edges in lateral offset relationship, an adhesive applying roller having a plurality of an-

nular flanges for applying a plurality of narrow spaced stripes of adhesive to the surface of one of said webs, and means adjacent to said mandrel for pressing said webs together and applying them spirally of the mandrel.

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