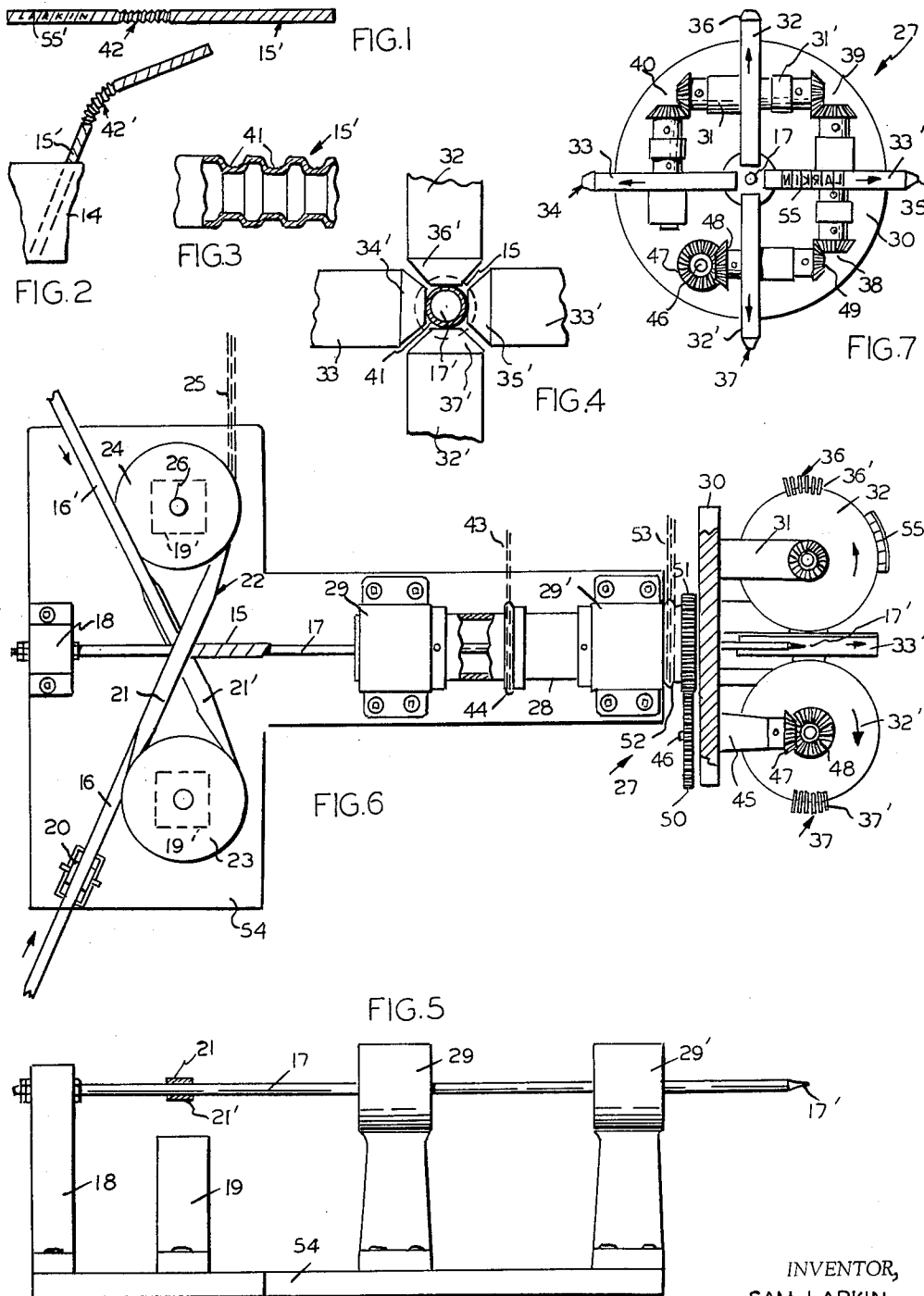


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APPARATUS FOR USE IN THE MANUFACTURE OF SIPPING
STRAWS AND THE LIKE, AND OTHER TUBULAR PRODUCTS
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APPARATUS FOR USE IN THE MANUFACTURE OF SIPPING STRAWS AND THE LIKE, AND OTHER TUBULAR PRODUCTS

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The present invention relates to the manufacture of corrugated tubular products and one of its adaptations is for the making of sipping straws having a corrugated section so that each can be easily bent to extend one end into a tumbler and its other end into the mouth of the user without bending his neck.

Machinery exists which for instance makes a spirally wound paper tube out of a supply of tape material continuously fed onto a fixed cantilever mandrel of suitable diameter for a sipping straw. This tube rotates on said mandrel and moves therealong to leave the mandrel's free end. At some appropriate region on the machine, said tube is successively cut into suitable lengths.

Various attempts have heretofore been made to corrugate sections of the tube, but the machinery therefore is complicated, expensive and spoilage often occurs in the corrugating operation.

It is therefore the principal object of this invention to provide a simple, inexpensive, novel and improved mechanism to safely and properly corrugate a section of the tube while it is in motion on the mandrel. If desired, the entire tube may be corrugated with my apparatus. The product may have uses in the packaging of various bent wire forms as for instance to serve as a protective sheath on precision spring, elbow and zig-zag wire forms and machines may be made in accordance with this invention to make partially or wholly corrugated tubing of various diameters and of various pliable materials as of metal foil for example.

Another object of this invention is to provide a novel and improved mechanism of the character described, for making an imprint on each straw either in conjunction with the making of the corrugated and hence flexible section or by having the device with only a marking wheel.

Still another object thereof is to provide a novel and improved apparatus which is positive in its operation and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For the practice of this invention, the tube is pressed in by blades extending radially from the periphery of wheels, the general plane of each of which passes through the tube's axis. When this pressing action occurs, corresponding blades on each of the wheels, together encompass the tube. The peripheral speed of the edges of these blades when said wheels turn, and they turn continuously during the operation of the machine, is the linear speed of the tube along the mandrel on which it is formed from tape material fed onto such mandrel. All of said wheels are rotatably carried on a member which continuously rotates about an axis coaxial with the mandrel. Such member is about the mandrel and is a flange on a tubular shaft preferably positioned about the mandrel and concentric therewith. Said tubular shaft rotates at the same speed as the tube does on the mandrel. Hence the only relative movement of said pressing or corrugating blades in relation to the tube being worked on, is the "digging" in of said blades into the wall of said tube. There is no chance for the tube to tear. Said blades do their work on the tube at the free end part of said mandrel which

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is shaped to properly support the tube portion being corrugated.

A more detailed description will now be given of an embodiment of this invention for which I shall refer to the accompanying drawing forming part of this specification, in which drawing similar characters of reference indicate corresponding parts in all the views.

FIG. 1 shows a sipping straw having a corrugated section between its ends; said corrugations being the work done by the apparatus which is the subject of this invention.

FIG. 2 shows the straw bent and in a tumbler of liquid, ready to be used.

FIG. 3 is a fragmentary enlarged view showing a longitudinal section of said corrugated section of the straw.

FIG. 4 is an enlarged fragmentary view showing the corrugating blades of my apparatus doing their work on the tube material which is being continuously made from strip stock just before reaching said blades.

FIG. 5 is an elevational view of framework for my apparatus and for tube-making mechanism with which my apparatus is associated. This view also shows the cantilever mandrel on which the tube is made and indicates driving belts used to feed strip or tape material onto said mandrel as will be further shown and explained.

FIG. 6 is a top plan view of a preferred embodiment of tube-corrugating apparatus in accordance with the teachings of this invention and associated mechanism for continuously forming the tube material on the said mandrel, all mounted on the framework shown in FIG. 5.

FIG. 7 is an end view of FIG. 6.

As shown in the drawing, one way of making the tube 15 continuously is to feed two paper tapes 16, 16' one onto the other with overlap onto a cantilever horizontally positioned mandrel 17, to wind thereon spirally with successive turns overlapping. One of the tapes 16' mentioned, meets the underside of the mandrel and the other tape 16 meets the upper side thereof. The resulting tube 15 is a secure structure because the upper tape 16 has glue applied to its underside by passing on a glue-supplied roller 20 before it gets to the mandrel 17. Said tapes are fed to and given their motion around the mandrel by having the respective flights 21, 21' of an endless belt 22 arranged to press them respectively against the mandrel which may be aided by idler rollers (not shown) against said belt flights, to have them bear flat against the tapes respectively which meet the mandrel in angular relation; the flights of said belt being crossed to accommodate tape travel to the mandrel and said belt 22 being around the spaced pulleys 23, 24, one of which is continuously driven by a belt 25 on wheel means not shown on the shaft 26. The continuous tube 15 so made on the mandrel 17, will continuously move along the mandrel towards the latter's free end and simultaneously continuously turn on it as a sleeve. The mechanism thus far specifically described together with a periodically-acting tube-slicing means, not shown, at an appropriate region of the machine, is well known in this art, for which I provide means indicated generally by the numeral 27, for periodically corrugating a section of said tube 15 before it leaves the mandrel and before the slicing means.

My apparatus 27 may assume the form shown. There is a tubular shaft 28 of greater inside diameter than the outer diameter of the tube 15, journaled in the bearings 29, 29' and extending outwardly from the latter where it ends in an outward flange 30 from which extend posts as 31, 31' in the direction of the mandrel. These posts serve as bearings for the axles of the wheels 32, 32' and 33, 33'. Each of said wheels carries an equal series of slightly spaced corrugating blades which extend across the periphery and radially outward. These sets of blades are de-

noted respectively by the numerals 34, 35, 36 and 37. It is practical to have four wheels equi-spaced around the tip end of the mandrel and the axles to which they are fixed, associated with mitre gears as at 38, 39 and 40, so that upon rotation of one of said wheels 32, 32', 33, 33', each will have an identical speed and their respective directions of rotation will be that if they touched the tube 15 on the mandrel 17, such tube would be urged by each of said wheels in the direction towards the free end of the mandrel. Said wheels are in such relative position that upon rotation, each of the first blades thereon reaching the tube 15, will simultaneously dig into such tube and form a corrugation circumferentially therearound. Of course there will be as many corrugations 41 formed in said tube as there are blades in each set, and hence for each revolution of the said four wheels, a corrugated section 42 will be formed in the tube 15 on the mandrel. These sections will be spaced because the tube is moving along the mandrel towards said wheels, at a definite linear speed. Said wheels rotate so that the peripheral speed of the tip edge of each blade is the said linear speed of the tube 15 along the mandrel. Hence said blades will not propel the tube 15 when any of them engage it. It must here be noted that the tubular shaft 28 is made to rotate by belt 43 on the wheel 44 fixedly carried by such shaft, at the same speed as the tube 15 spins on the mandrel 17. Hence the blades 34, 35, 36, 37 will have no relative movement with respect to the tube 15, except their digging in into the wall of such tube at the mandrel portion 17' which is preferably a concave cone whose radius of concavity is equal to the distance from the center of a wheel to the tip of a blade thereon plus the thickness of the wall of the tube 15, so the tube wall is pressed in by the blades and not cut into.

To turn the wheels 32, 32', 33, 33', I have a bearing 45 on the flange 30, through which is a rotatable axle 46. This axle carries a mitre gear 47 which meshes with a mitre gear 48 fixed on the axle 49. Said axle 46 has fixed at its other end where it passes through said flange, the spur gear 50 which is in engagement with the spur gear 51 riding free on the tubular shaft 28. A wheel 52 driven by a belt 53 also is free on said tubular shaft and is fixed to the gear 51.

All belts 25, 43 and 53 may be chain belts and their wheels are then sprockets driven by a main power shaft not shown. Their speeds are to effect the speed relationships mentioned and to effect the desired spacing between the corrugated sections made in the tube 15.

The post 18 for supporting the mandrel 17, the posts 19, 19' for supporting the pulleys 23, 24 respectively and the bearings 29, 29' for supporting the tubular shaft 28, are all mounted on the base 54.

The work is cut to form sipping straws as 15' whose corrugated section 42 can be bent as shown at 42' when it is set into for instance a tumbler 14 containing a liquid.

Coming back to FIG. 7, the tube will run clear because here the blades are away from it. When the blades engage the tube 15, as in FIG. 4, corrugations 41 will be formed therein. Then the blades will move away from the tube and it will again run clear until again met by the blades. In FIG. 4, the corresponding blades of the sets on the several wheels, are indicated by the numerals 34', 35', 36', 37'.

It is to be noted that dimensions shall be such that the peripheral distance the extreme edge of a blade travels per revolution of the wheel it is on, shall be equal to the uniform length of the pieces the tube 15 is to be cut into to have the individual straws 15', and that the placement of the corrugating blades or the position of the tube-slicing means shall make the corrugated section an identical definite region of each straw.

The corrugating blades whose function it is to make dents in the tube 15, may be type to mark the tube with a name, trademark or other insignia and such type may be on a clear portion of the periphery of one blade-carry-

ing wheel as shown at 55, or a one wheel device may be made with the type only, as will be readily understood without further illustration, and it is intended that the designation as to corrugating anywhere mentioned in this specification and the appended claims shall be indicative and protect the use of type 55, in addition to or in place of the blades on a wheel. The upright components of the letters delineated on the type 55, are essentially blades across the periphery of the wheel which dent the wall of the tube 15 like the corrugating blades do, though together with the other letter segments dent in or imprint a name or other insignia as shown at 55'.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiments shown herein shall be deemed illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the accompanying claims rather than to the specific showing and description herein, to indicate the scope of this invention.

I claim:

1. In combination with an apparatus for continuously making a tube of pliable tape material on a cantilever mandrel so that said tube continuously rotates about the mandrel at a constant speed and also continuously moves towards the free end of the mandrel at a constant speed, a means to form corrugations in said tube while it so moves on the mandrel, comprising a member mounted for rotation coaxially with the mandrel, a wheel rotatably mounted on said member, having a plurality of corrugating blades extending across the periphery of said wheel and substantially equally radially outward thereof; the axis of the mandrel being in the general plane of said wheel and said wheel being so positioned that upon rotation thereof on said member, said blades will successively dent a tube region which is about the mandrel, means to rotate said member at the same speed the tube rotates on the mandrel and means to rotate said wheel so that the peripheral speed of the extreme free edges of the blades thereon is the same as the speed of travel of the tube along the mandrel and in the same direction the tube would urge the wheel when contacted by a blade; said member being spaced from said mandrel to allow the tube to leave the mandrel and continue in a straight line.

2. The combination as defined in claim 1, wherein the free end of the mandrel is conical in form and said wheel is so positioned that its blades contact a tube region which is around said end of the mandrel.

3. The combination as defined in claim 2, wherein said conical form is concave; the radius of such concavity being equal to the distance between the axis of rotation of said wheel to the extreme free edge of a blade plus the thickness of the wall of the tube.

4. The combination as defined in claim 1, wherein said member is a rotatably mounted hollow shaft and the means to turn said blade-carrying wheel comprises a driven wheel mounted loose on said hollow shaft and means connecting said wheels so that upon the rotation of said loose wheel, the blade-carrying wheel will be turned.

5. In combination with an apparatus for continuously making a tube of pliable tape material on a cantilever mandrel so that said tube continuously rotates about the mandrel at a constant speed and also continuously moves towards the free end of the mandrel at a constant speed, a means to form corrugations in said tube while it so moves on the mandrel, comprising a member mounted for rotation coaxially with said mandrel, a plurality of wheels rotatably mounted in spaced relation on said member, each having a plurality of corrugating blades extending across the periphery of said wheel and substantially equally radially outward thereof; the axis of the mandrel being in the general plane of each of said wheels and said wheels being so positioned that upon rotation thereof on

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said member, said blades will successively dent a tube region which is about the mandrel, means to rotate said member at the same speed the tube rotates on the mandrel and means to rotate said wheels so that the peripheral speed of the extreme free edges of the blades thereon is the same as the speed of travel of the tube along the mandrel and in the same direction the tube would urge the wheels respectively when contacted by a blade on each of said wheels respectively; said member being spaced from said mandrel to allow the tube to leave the mandrel and continued in a straight line; the radii from the center of each wheel to the extreme free edges of the blades it carries, being substantially equal.

6. The combination as defined in claim 5, wherein the free end of the mandrel is conical in form and said wheels are so positioned that their blades contact a tube region which is around said end of the mandrel, when they reach the tube.

7. The combination as defined in claim 6, wherein said conical form is concave; the radius of such concavity being equal to one of the mentioned radii plus the thickness of the wall of the tube.

8. The combination as defined in claim 5, wherein said member is a rotatably mounted hollow shaft and the means to turn said blade-carrying wheels comprises a driven wheel mounted loose on said hollow shaft and means connecting all the wheels so that upon rotation of said loose wheel, the blade-carrying wheels will be turned.

9. The combination as defined in claim 5, wherein said blade-carrying wheels are equally spaced around the mandrel.

10. The combination as defined in claim 5, wherein the blade-carrying wheels are so positioned that when a blade on one of such wheels meets the tube, a blade on each of the others will also meet the tube.

11. The combination as defined in claim 5, wherein said member is a hollow shaft having an outward flange; said blade-carrying wheels being supported on said flange aside one face thereof; the means to turn said blade-carrying wheels comprising a driven wheel mounted loose on said hollow shaft and the means connecting all the wheels for rotation comprising a spur gear loose on said hollow shaft and fixed to said loose wheel; each of said blade-carrying wheels having an axle secured thereto respectively, bevel gear, one carried on one end of one of said axles and one carried on each end of each of the other axles respectively; the gear on said axle having only one gear thereon, being in meshed engagement with the gear on the axle next to it; those gears which are on all the other of said axles, which are next to one another, being in meshed relation, an additional bevel gear fixed on one end of an additional axle rotatably mounted on and extending through said flange to the loose gear on the tubular shaft; said additional bevel gear being in meshed engagement with the gear which is adjacent the end of the axle which is gear-less and a gear fixed on the other end of said additional axle which is at the gear on the hollow shaft, in meshed engagement with said gear on the hollow shaft.

12. The combination as defined in claim 11, wherein the number of blade-carrying wheels is four which are

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equally spaced on said flange around the mandrel; all bevel gears being mitre gears.

13. In combination with an apparatus for continuously making a tube of pliable tape material on a cantilever mandrel having a portion engaging the interior of the tube, so that said tube continuously moves on and along said portion towards the free end of the mandrel, a means to form corrugations in said tube while it so moves along the mandrel, comprising a member mounted for rotation coaxially with the mandrel, a wheel rotatably mounted on said member, having a plurality of corrugating blades extending across the periphery of said wheel and substantially equally radially outward thereof; the axis of the mandrel being in the general plane of said wheel and said wheel being so positioned that upon rotation thereof on said member, said blades will successively dent a tube region which is coaxial with the mandrel and which is a part of a tube traveling on the aforesaid mandrel portion, means to rotate said member around the axis of the mandrel and means to rotate said wheel so that the extreme free edges of the blades thereon move successively into, along with and away from the moving tube at substantially the same speed as the tube; said member being disposed relative to the mandrel to allow the tube to move continuously past the member in a straight line coaxial with the mandrel.

14. A method of making sipping straws having a corrugated portion therein, comprising forming a continuous straw tube by causing pliable tape material to be continuously wound on a mandrel and continuously moving the formed tube lengthwise coaxially of and along the mandrel, moving a series of tube-denting blades along a circular path that lies in a plane in which the axis of the mandrel also lies, said circular path approaching close to said axis so that the edges of the blades successively engage the tube moving along the axis, and causing said circular path with the blades carried therein also to move around said axis in a path defined by rotation of the center of said circular path in a second circular path concentric with said axis, the aforesaid step of moving said blades in said first-mentioned circular path being effected at a rate for bringing the blades successively into, along with and away from the moving tube at approximately the same speed as the tube, said series of blades occupying only a minor part of said first-mentioned circular path so that sets of dents are formed in the moving tube at regions spaced lengthwise thereof, and successively cutting the dented tube after it moves past the said blades, at localities of the tube in the spaces between the sets of dents, to deliver successive sipping straws each having a corrugated portion therein.

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