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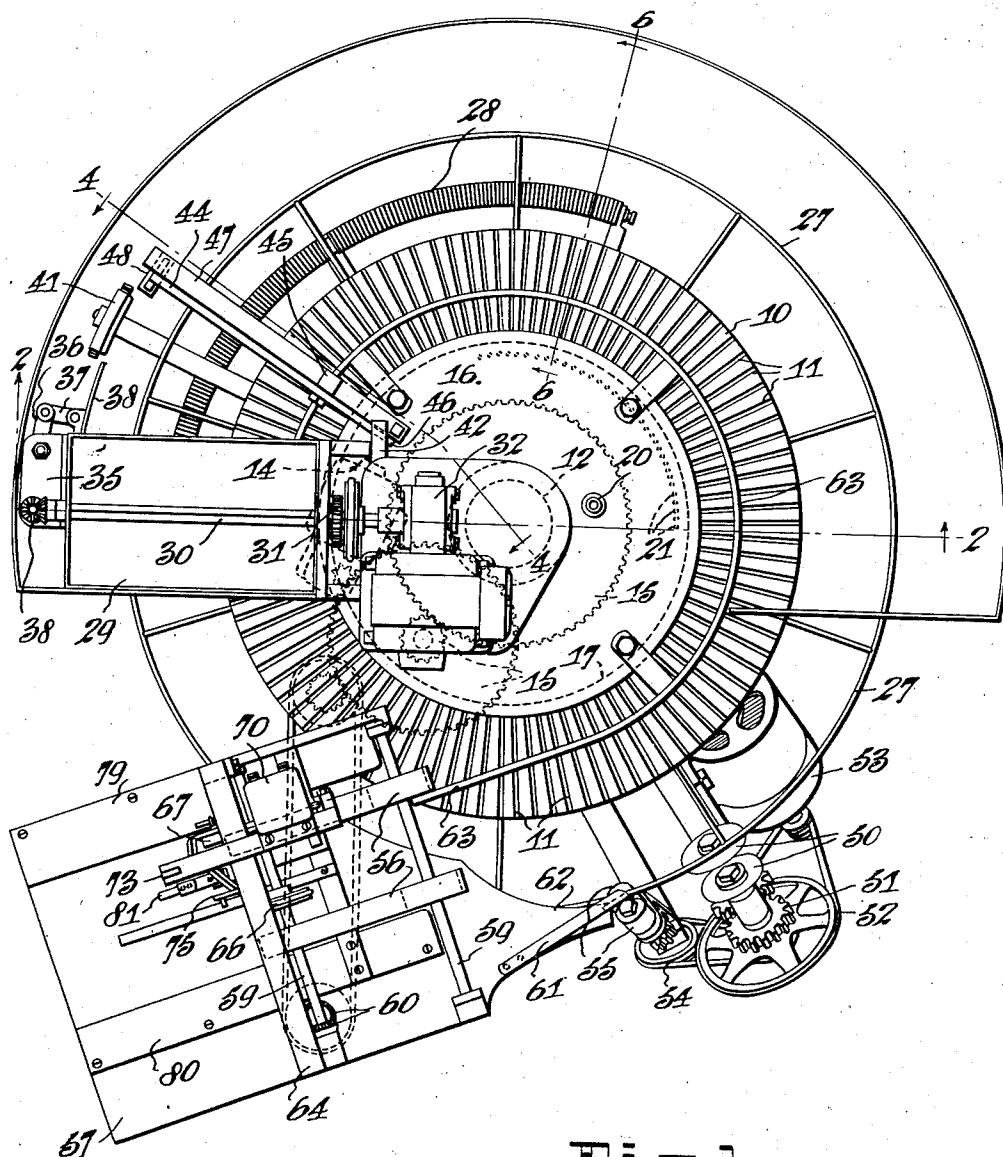
S. T. MALTBY

2,304,467

MACHINE FOR FORMING ANGULARLY BENT DRINKING TUBES

Filed April 11, 1940

6 Sheets-Sheet 1



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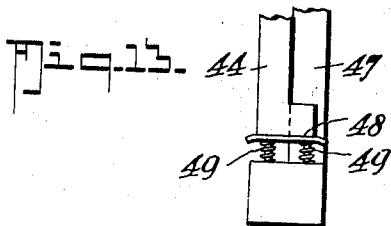
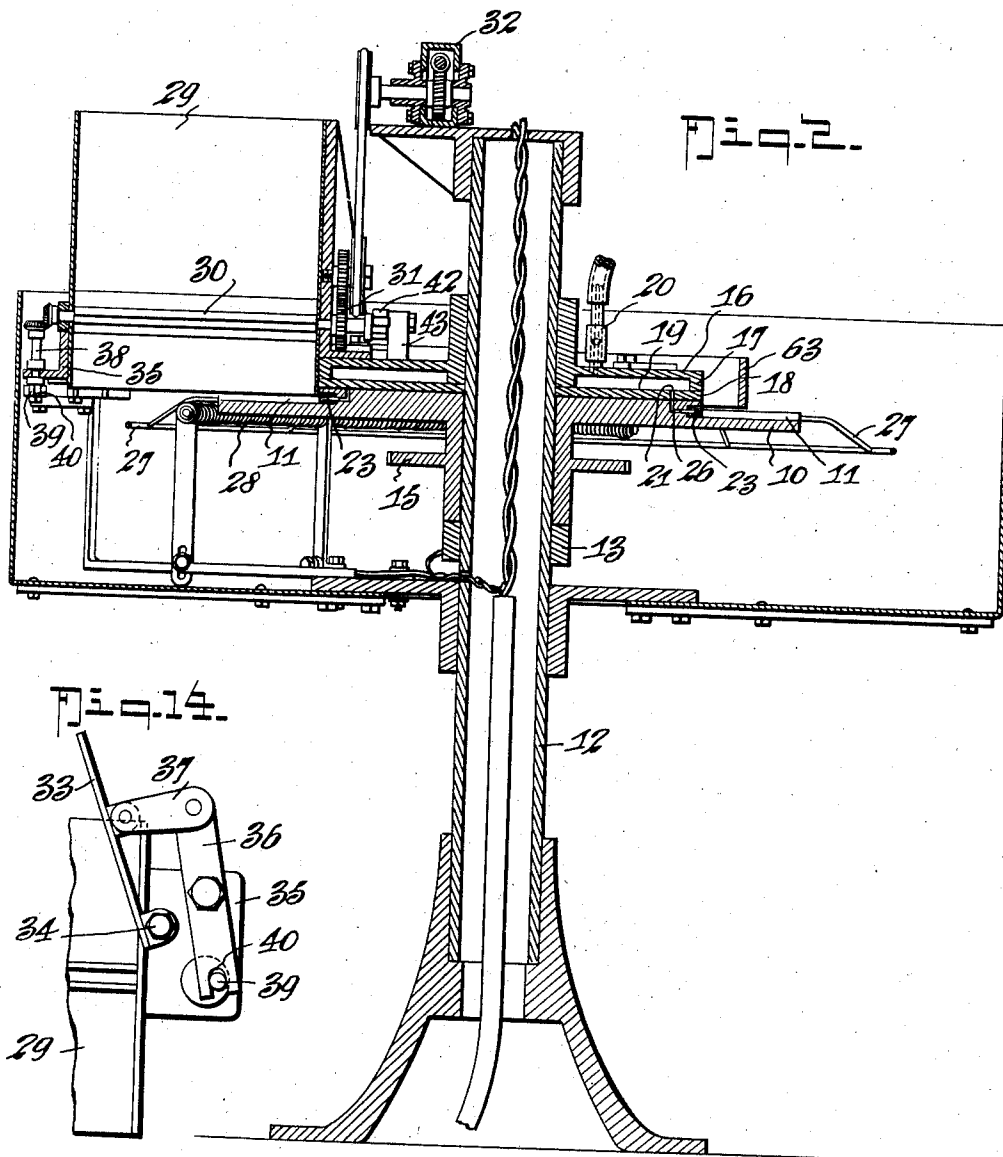
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MACHINE FOR FORMING ANGULARLY BENT DRINKING TUBES

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6 Sheets-Sheet 2



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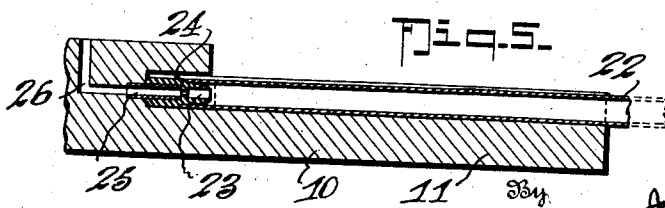
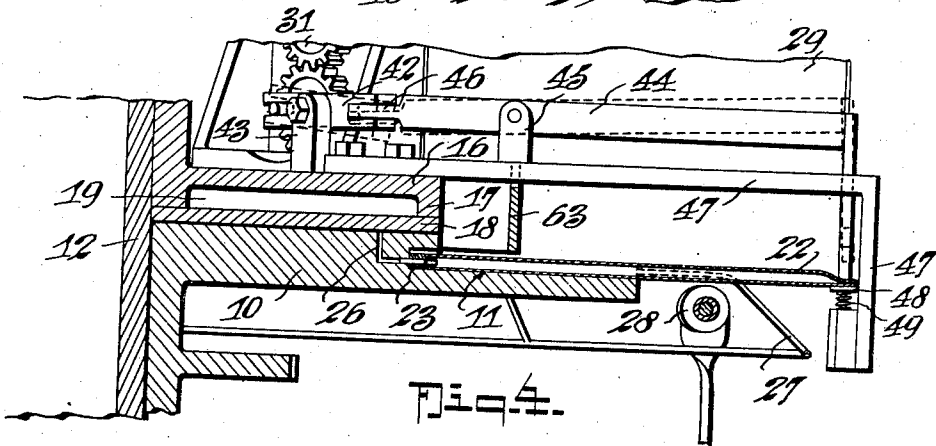
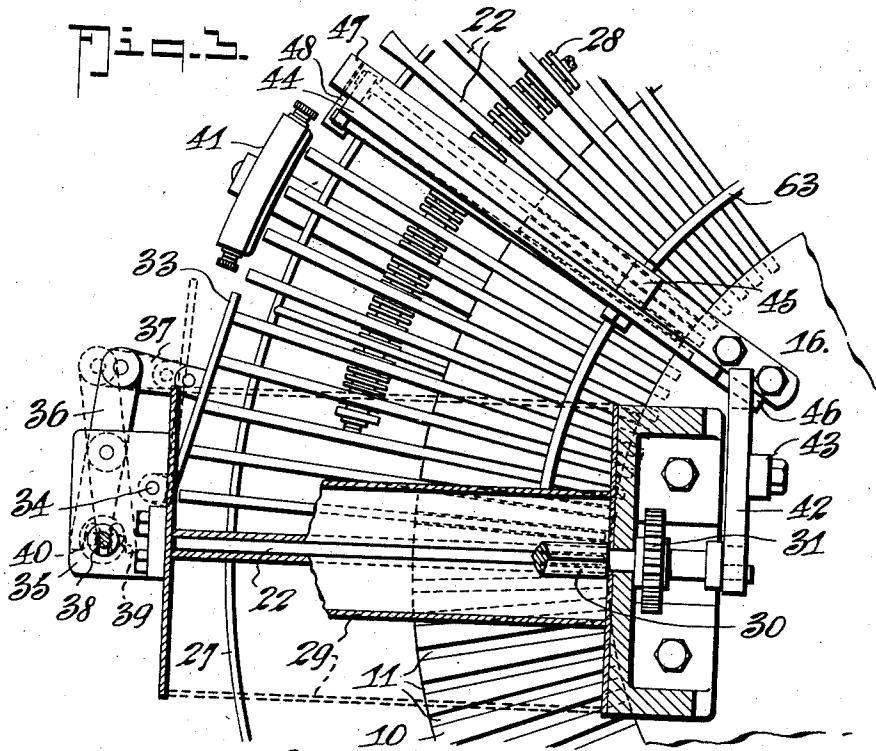
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MACHINE FOR FORMING ANGULARLY BENT DRINKING TUBES

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6 Sheets-Sheet 3



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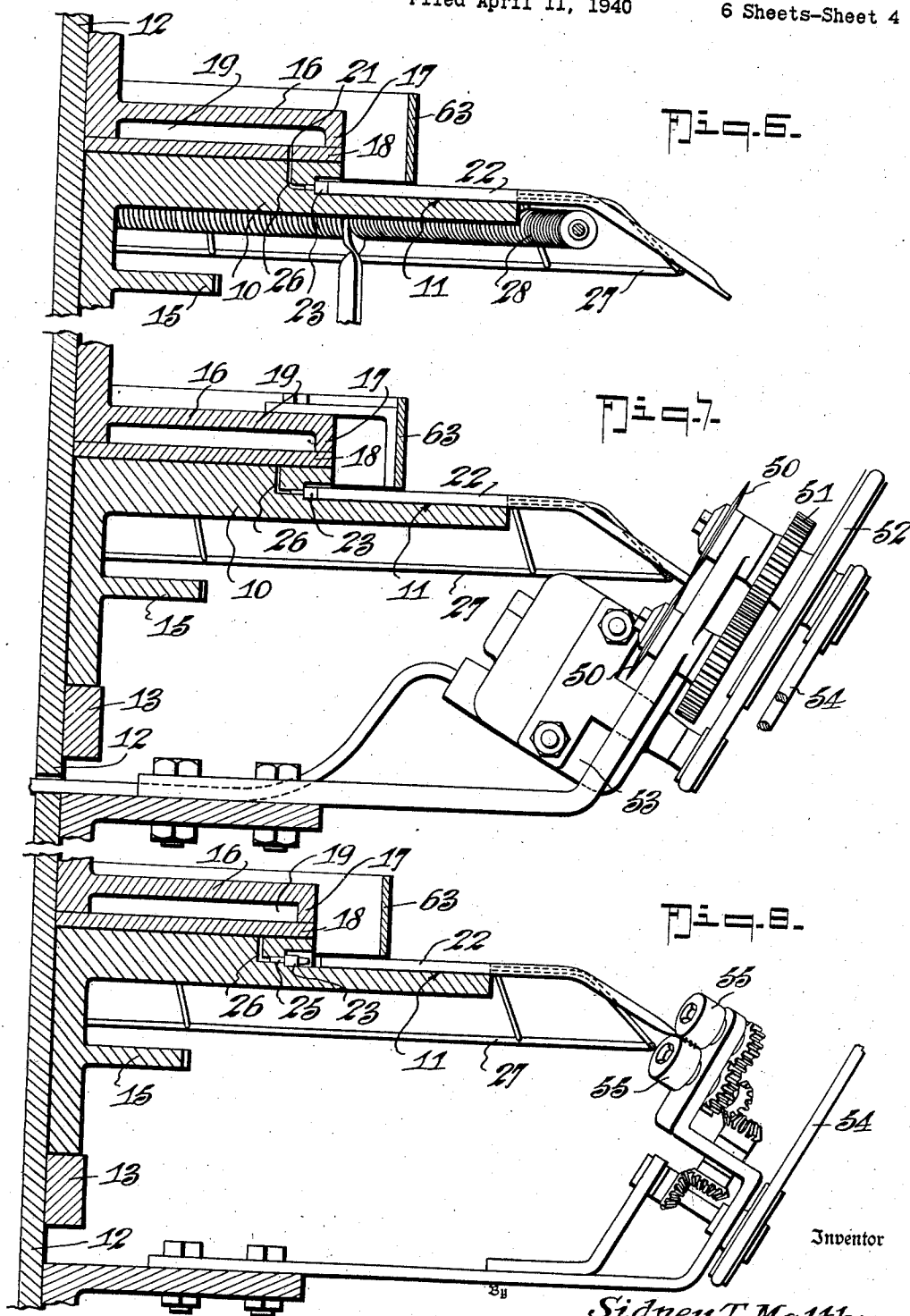
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MACHINE FOR FORMING ANGULARLY BENT DRINKING TUBES

Filed April 11, 1940

6 Sheets-Sheet 4



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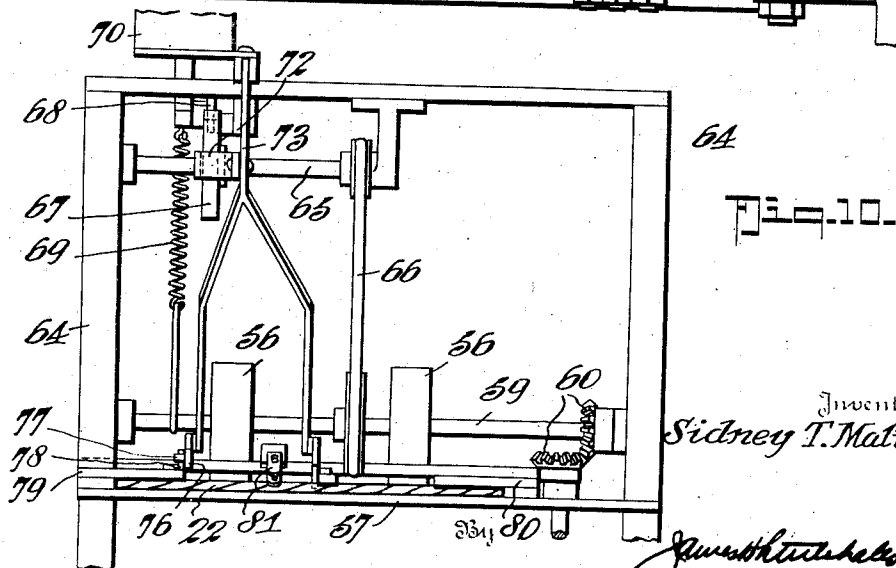
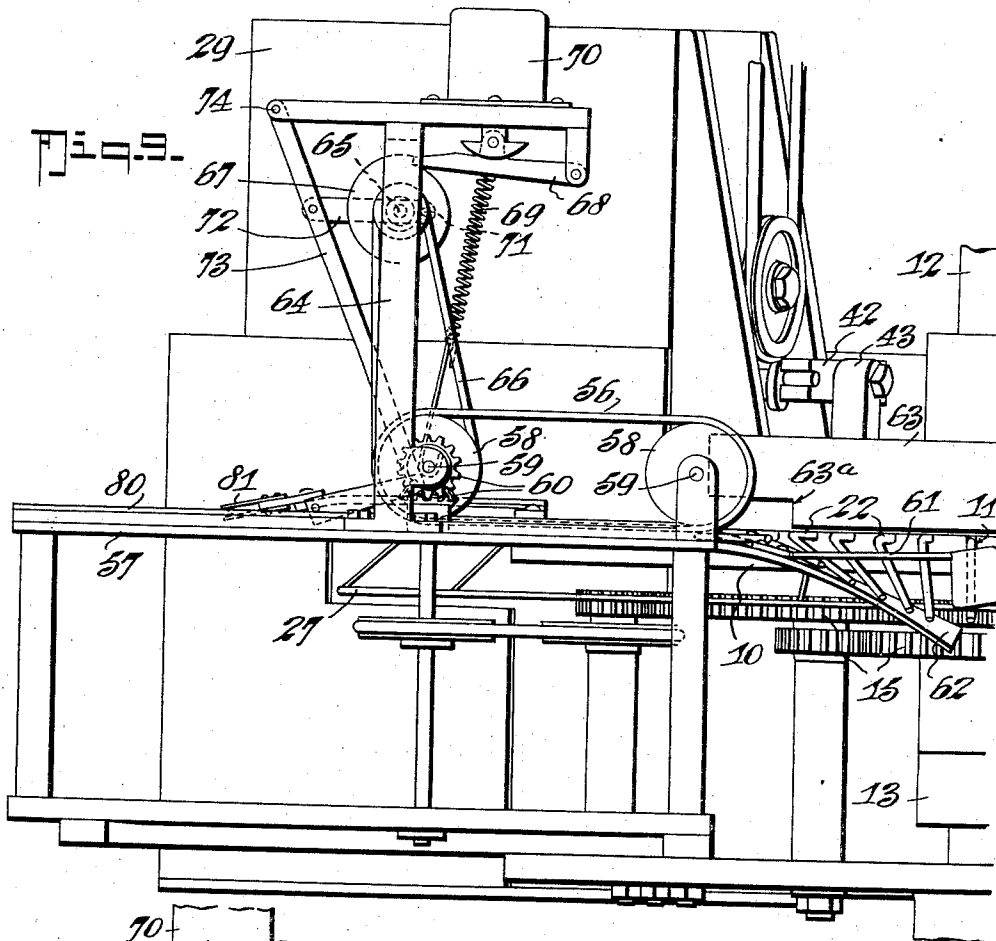
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MACHINE FOR FORMING ANGULARLY BENT DRINKING TUBES

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6 Sheets-Sheet 5



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MACHINE FOR FORMING ANGULARLY BENT DRINKING TUBES

Filed April 11, 1940

6 Sheets-Sheet 6

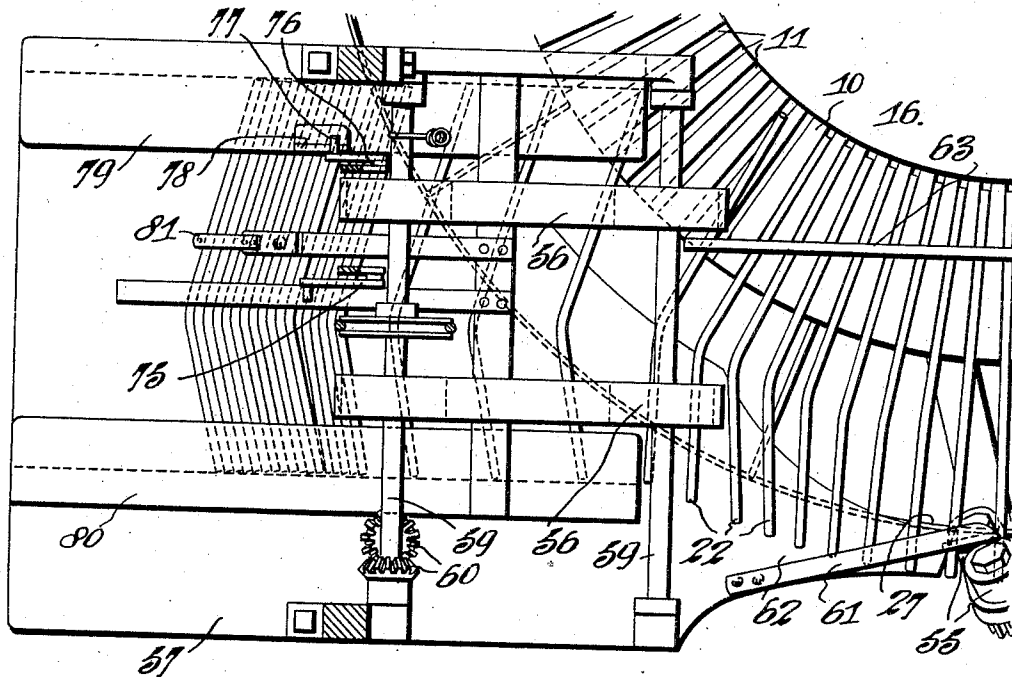


Fig. 11.

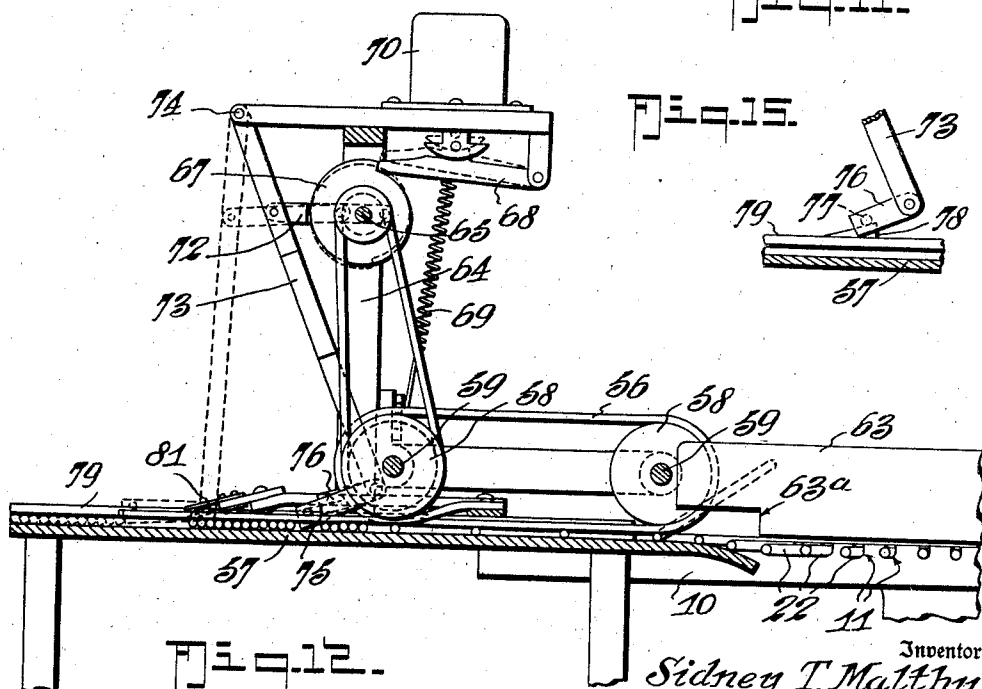


Fig. 12.

Fig. 15.

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UNITED STATES PATENT OFFICE

2,304,467

MACHINE FOR FORMING ANGULARLY
BENT DRINKING TUBES

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Application April 11, 1940, Serial No. 329,164

13 Claims. (Cl. 18—1)

This invention relates to a machine for forming angularly bent drinking tubes from straight lengths of heat softening tubular material, such as cellulose acetate or the like.

More specifically, the invention provides a machine in which successively fed tubes which are initially straight are heated intermediate their ends and are thereby softened and bent to angular shape, while at the same time they are supported internally so that the resulting tube will have a substantially uniform bore throughout and will not be buckled or restricted at the point of bend.

Angularly bent drinking tubes have heretofore been made of glass and have found extensive use in such institutions as hospitals, where the patients must be served in reclining position. Glass tubes, however, possess the disadvantage that they may break in the mouth of the user, causing severe injury. Moreover, because of their appreciable cost as compared to paper or amorphous cellulose tubes they cannot be economically discarded after a single use, yet they cannot be readily cleaned and sterilized for re-use.

The usual paper straws or sippers would be a desirable substitute for glass drinking tubes if it were not for the fact that they cannot be bent without their buckling and cutting off the flow of beverage. Since they are formed by winding overlapping plies of material on a mandrel from which the completed tube is stripped, it is not feasible to form them with an angular bend, for this would prevent their withdrawal from the mandrel.

The present invention achieves an economical manufacture of bent drinking tubes of cellulose acetate or other heat softening material, which are of substantially uniform bore throughout.

One object of the invention is to provide a machine in which straight lengths of tubing are heated and bent to angular shape while being supported internally, to obviate buckling or collapse of the tube wall.

Another object of the invention is to provide such a machine in which successively fed tubes are sealed at one end, and air is blown into them to subject them to internal air pressure during heating and bending, after which the sealed end is trimmed off, and the cooled and permanently bent tube is delivered from the machine.

Other and further objects will be apparent from the following description and drawings, in which

Figure 1 is a plan view of the machine.

Figure 2 is a vertical sectional view, taken along line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary plan view, partly in section, of the mechanism shown in the left of Figure 1.

Figure 4 is an enlarged detail view, partly in vertical section, along line 4—4 of Figure 1.

Figure 5 is an enlarged vertical sectional view of a tube before bending, received upon one of the air nozzles.

Figure 6 is a vertical sectional view taken along the line 6—6 of Figure 1.

Figure 7 is a view, partly in section, of the trimmer shown in the lower right of Figure 1.

Figure 8 is a view, partly in vertical section, of the stripper rolls, showing the manner of withdrawing a completed tube from the air nozzle.

Figure 9 is a side view of the delivery table and mechanism for counting the completed tubes.

Figure 10 is a front view of the delivery platform and counting mechanism.

Figure 11 is a top view of the delivery platform.

Figure 12 is a side view of the delivery platform, showing the manner of delivering counted groups of completed tubes.

Figure 13 is a detail view, taken from the end of the anvil and hammer members shown in the right of Figure 4.

Figure 14 is a bottom view, showing in detail the mechanism for operating the tamper.

Figure 15 is a side elevation of one of the pusher dogs of the delivery mechanism, and its associated cam raising means.

Referring more particularly to the drawings: A circular table 10, formed with radial grooves 11, is mounted for rotation on a standard 12 by means of a supporting thrust collar 13 (Figure 2), and is driven by motor 14 through suitable gearing 15.

Above the table 10 there is mounted a fixed circular casting 16 which has a peripheral flange 17 extending into contact with a plate 18, the casting and plate defining between them an air chamber 19. Air under pressure is admitted to the chamber through regulating valve 20 from a source not shown, and escapes from the chamber through an arcuate series of ports 21, shown in dotted lines, Figure 1.

The grooves 11 in the rotary table are of a shape to receive tubes 22 and to support them in spaced relation as the table rotates. The grooves extend inwardly from the periphery of the table, and at their ends mount soft rubber nozzles 23 which are tapered to enter the ends of the tubes slid into the grooves, and which are shouldered as at 24 to limit inward movement of the tubes.

The rubber nozzles fit upon tubular sleeves 25 in the bores of air passages 26 which extend to the upper surface of the rotary table and communicate with the discharge ports from the air chamber as the table rotates, thereby permitting air to blow through the nozzles in a selected region for the purpose to be presently described.

A circular wire frame 27 is attached to the table 10 and extends both out beyond its periphery and below its upper surface. This frame supports the outwardly projecting ends of the tubes which fall when they are softened by heat in their passage over an arcuate heater 28 mounted below the table and beyond its periphery. Preferably, the heater 28 is slightly off center with respect to the rotary table so that the tubes carried over it will be evenly heated throughout the region of their softening.

A hopper 29 is mounted on the casting 15 over the outer portion of the table 10 to deliver straight lengths of tubing one at a time into the radial grooves of the table as they pass under the hopper discharge opening.

An agitator 30, shown as an angular rod driven through gearing 31 from a motor 32, serves to keep the tubes from becoming jammed in the hopper discharge and to insure their uninterrupted delivery to the rotary table.

Also geared to the agitator shaft is the tamping mechanism shown in detail in Figure 3. This comprises a plate 33 which is pivoted at 34 to a bracket 35 on the side wall of the hopper. The tamber is actuated by a rocker arm 36, also carried by the bracket, and a connecting link 37. A driven shaft 38, which is journaled in the bracket, has an eccentric pin 39 (Figure 14) projecting from a disc carried thereby, such pin engaging in a slot 40 in the rocker arm. Thus, the straight tubes which are fed successively to the radial grooves in the rotary table are first tamped and driven onto the rubber nozzles at the inner ends of the grooves.

Next, the ends of the tubes are presented to a heater 41 which is in sufficiently close proximity thereto to soften and fuse them.

Following this, the softened ends of the tubes are sealed by a hammer and anvil mechanism, as shown in Figures 3 and 4. A rocker arm 42, pivotally mounted on lug 43, is driven by eccentric pin and slot arrangement shown in Figure 4, from gearing 31 connecting it to motor 32. The hammer element 44 is pivoted at 45 for vertical rocking movement, and it has a reduced end 46 which engages the bifurcated end of rocker arm 42. A bracket 47 carries the anvil 48 which has spaced pins 49 projecting from its under surface and guided in holes formed in the underlying part of the bracket. Springs are mounted on such pins, and are adapted to be compressed between the anvil and the bracket for cushioning the hammer impact.

Up to this point the tubes have been delivered to the table in succession and have been forced upon the air nozzles which, however, are not yet in communication with the air supply. The projecting ends of the tubes which overhang the edge of the table have been softened and sealed, while at the same time the intermediate portions of the tubes have begun to soften from the heat of the underlying heater 28.

As the table continues to rotate, communication with the air supply is established and the tubes are thus put under internal pressure as they soften and fall onto the wire frame 27, as shown in Figure 6. Thereafter, as they pass beyond the

heater 28 they cool and set, still under internal supporting pressure which prevents buckling and collapse at the point of bend.

After the table has rotated sufficiently to cut off communication between the air chamber and the tubes which are now bent, the sealed ends of the latter are trimmed off by rotary knives 50, driven in unison by gearing 51, through belt gearing 52 from motor 53.

Also, through belt gearing 54 from motor 53, the adjoining stripper rolls 55 are rotated. These are of soft rubber, set at an angle to pull each succeeding tube off of its respective rubber nozzle and into position to be received under the endless belts 56 moving along a discharge platform 57. The endless belts are driven by pulleys 58 on spaced shafts 59 which are rotated by gearing 60.

As the tubes are stripped from their associated air nozzles by the rolls 55 their ends are guided under a projecting spring strip 61 (Figure 11) from which they then pass in riding up the inclined apron 62 of the discharge platform as they continue to be carried along by their engagement with the grooves 11 in the rotating table.

The outer ends of the tubes so delivered pass successively under one of the endless belts 56 which by its speed partly rotates the tube to disengage it from its associated groove 11, as shown in dotted lines, Figure 12, and in full lines in Figure 11. The raised inner end of the tube is guided into position to be engaged by the other endless belt 56 by the cut-out portion 63a of a guard rail 63 which overlies the grooves of the rotating table and terminates adjacent the endless belts 56. Thus, both endless belts engage the tubes adjacent their opposite ends and feed them toward the discharge end of the platform 57.

Counting and delivery mechanism is carried by a frame 64 which bridges the discharge platform. A horizontal shaft 65 is journaled in the frame and carries a pulley driven by an endless belt 66. It also mounts a cam disc 67 against which a pivoted arm 68 is held by a spring 69, and which by abutting the shoulder of the cam prevents rotation thereof under the influence of the continuously moving belt 66 until it is raised to release the cam.

The pivoted arm 68 is raised by the armature of a solenoid 70 which is pivotally connected to it, but being immediately lowered again by the spring 69 it limits the cam rotation to 360 degrees.

An eccentric pin 71 projecting from the side face of the cam 67 pivotally supports a link 72 through which motion is transmitted to a pivoted lever 73, the latter being mounted to swing about a pivot 74. The lever 73 is bifurcated as shown in Figure 10 and at its ends mounts pusher dogs 75 and 76. Dog 76 carries a laterally projecting pin 77 which rides on the inclined cam surface of a bracket 78. The bracket 78 is mounted on the upper surface of a side strip 79 which extends longitudinally of the discharge platform and which overlies the ends of the tubes while a similar side strip 80 on the other side edge of the platform overlies the opposite ends of the tubes.

In the retracted position of the lever 73 as shown in Figures 9 and 12, the dog 75 has ridden over a group of tubes and is in position to thrust them forwardly. The dog 76, however, has ridden up the inclined cam surface of bracket 78

and is held out of contact with the tubes until the forward thrust has been initiated.

The tubes accumulate in advance of the pusher dogs until the leading one presses against the spring contacts 81 which are in the path of the advancing tubes, thereby closing the electric circuit through the solenoid 70 and causing the lever 73 to be swung forwardly, segregating the collected tubes and delivering them in a group for packaging. It will be appreciated that the number of tubes so selected and discharged may be varied at will, either by adjusting the throw of the lever 73, or by adjusting the position of the contacts 81 along the discharge platform.

In operation of the machine, straight tubes of some suitable heat softening material are fed from the hopper, singly, to the radial grooves in the underlying rotary table. They are then tamped into the grooves from the end and onto the rubber air jet nozzles. Next, the projecting ends of the tubes are softened by heat and at the following station they are pressed and sealed. Following this, the tubes are softened by heat applied to the region intermediate their length, and they thereby fall onto the surrounding wire guard or stop which limits the extent of their bending, while at the same time air under pressure is blown into the open ends of the tubes to hold the softened walls distended and to prevent their buckling.

At the succeeding stations the sealed ends of the tubes are clipped, after which the completed tubes are stripped from the rubber nozzles and delivered to a discharge platform where they are segregated automatically into groups of desired numbers and discharged for packaging.

From the foregoing, it will be apparent that the machine of my invention constitutes an automatic and efficient mechanism for transforming straight tubes into angularly bent drinking tubes of substantially uniform internal diameter throughout, and for delivering the completed tubes in groups to be packaged.

What I claim as my invention and desire to secure by Letters Patent is:

1. A machine for forming angularly bent drinking tubes, comprising a heater for softening one end of the tube, means for sealing such softened end, a source of air under pressure communicating with the open end of the tube, a heater exposed to an intermediate portion of said tube, and means for supplying air under pressure internally of the tube as it is softened by said second heater to prevent its buckling at the region of bend.

2. A machine for forming angularly bent drinking tubes, comprising a heater for softening one end of the tube, means for sealing such softened end, a source of air under pressure communicating with the open end of the tube, a second heater underlying an intermediate portion of said tube, a stop for limiting the degree of bend of such softened tube, means for supplying air under pressure internally of the tube as it is softened by said second heater, thereby to prevent its buckling at the region of bend and to maintain its internal diameter substantially uniform throughout.

3. A machine for forming angularly bent drinking tubes, comprising means for sealing the end of a straight tube, a source of air under pressure communicating with the opposite end of said tube, a heater to which a restricted intermediate portion of said tube is exposed to soften it and

permit it to bend while under internal air pressure, and mechanism for removing the sealed end of said tube after it is bent to shape.

4. A machine for forming angularly bent drinking tubes, comprising a heater for softening one end of the tube, means for sealing such softened end, a source of air under pressure communicating with the open end of the tube, a second heater to which an intermediate portion of said tube is exposed and is thereby softened while subjected to internal air pressure to keep its wall from collapse, a stop for limiting the angular bend of such softened tube, and a cutter for removing the sealed end of the tube after it is bent to shape.

5. A machine for forming angularly bent drinking tubes, comprising a rotary table having radial tube receiving grooves therein, tube receiving nozzles in the respective grooves communicating with a source of air under pressure, means for forcing tubes along said grooves and onto said nozzles, means for temporarily sealing the opposite ends of said tubes, means for softening said tubes at a region intermediate their ends while subjecting them internally to air pressure to prevent their collapse in bending, a cutter for removing the sealed ends of the tubes after they are bent to shape, and means for stripping said tubes from their associated nozzles for delivery from the machine.

6. A machine for forming angularly bent drinking tubes, comprising a rotary table having radial tube receiving grooves therein of less length than the tubes, tube receiving nozzles in the respective grooves communicating with a source of air under pressure, a tamper for forcing said tubes onto said nozzles, a heater for softening said tubes at their projecting ends, pinching and sealing means for the softened ends of the tubes, a second heater to which an intermediate projecting portion of each tube is exposed, a stop for limiting the angular bend of the tubes when in softened condition, a cutter for removing the sealed ends of the cooled tubes, and stripper rollers engageable with the projecting ends of the tubes to remove them from their associated nozzles.

7. A machine for forming angularly bent drinking tubes, comprising a rotary table formed with radial tube receiving grooves of less length than the tubes, hopper means for feeding straight lengths of tube singly to the grooves of said table, tube receiving nozzles in said grooves, a source of air under pressure communicating with said nozzles while the table passes through an arc of its rotation, a tamper for forcing said tubes onto said nozzles, a heater for softening the projecting ends of the tubes, pinching and sealing means for the softened ends of the tubes, a second heater to which an intermediate projecting portion of each tube is exposed in the continued rotation of the table, a stop upon which the projecting portions of the tubes fall when softened, to limit the degree of bending thereof, a cutter for removing the sealed ends of the tubes, and a pair of stripper rolls engageable with the projecting ends of the tubes to remove them from their associated nozzles.

8. A machine for forming angularly bent drinking tubes, comprising a rotary table formed with radial tube receiving grooves of a length less than the tubes to be received therein, a hopper for feeding straight lengths of tube singly to such radial grooves, tube receiving nozzles mounted in the grooves and communicating with

a source of air under pressure in certain positions of the table in its rotation, a tamper for forcing such tubes inwardly in their associated grooves and onto their respective air nozzles, means for sealing the outwardly projecting ends of the tubes, means for causing air to be admitted under pressure to the interior of the tubes, a heater to which a part of the projecting portion of each tube is exposed, thereby to soften it while under internal air pressure, a stop for limiting bending of the tubes when so softened, a cutter for removing the sealed ends of the tubes, a pair of cooperating stripper rolls engageable with the projecting ends of the tubes to strip them from their associated nozzles, a discharge platform having an inclined apron to which the tubes are delivered, a pair of endless belts moving over said platform, one of which engages the outer ends of the tubes in advance of the other belt engaging the inner ends thereof, thereby to roll each tube up and out of the groove in which it is supported, and an overlying guard to limit the extent of roll of the tube so that it will be engaged by said second endless belt and discharged from the machine.

9. A machine for forming angularly bent drinking tubes, comprising a rotary table formed with radial tube receiving grooves of a length less than the tubes to be received therein, a hopper for feeding straight lengths of tube singly to such radial grooves, tube receiving nozzles mounted in the grooves and communicating with a source of air under pressure in certain positions of the table in its rotation, a tamper for forcing such tubes inwardly in their associated grooves and onto their respective air nozzles, means for sealing the outwardly projecting ends of the tubes, means for causing air to be admitted under pressure to the interior of the tubes, a heater to which a part of the projecting portion of each tube is exposed, thereby to soften it while under internal air pressure, a stop for limiting bending of the tubes when so softened, a cutter for removing the sealed ends of the tubes, a pair of cooperating stripper rolls engageable with the projecting ends of the tubes to strip them from their associated nozzles, a discharge platform having an inclined apron to which the tubes are delivered, a pair of endless belts moving over said platform, one of which engages the outer ends of the tubes in advance of the other belt engaging the inner ends thereof, thereby to roll each tube up and out of the groove in which it is

supported, an overlying guard to limit the extent of roll of the tube so that it will be engaged by said second endless belt, and means for segregating and delivering predetermined numbers of completed tubes in groups for packaging.

10. In a machine of the class described, a rotary table having radial grooves therein for support of tubes bent in process with their projecting ends deflected downwardly, a discharge platform extending substantially tangentially of said table, a pair of endless belts for engaging opposite ends of such tubes, the arrangement of said belts being such that the one to which the outer ends of the tubes are presented grips the tubes in advance of the other, thereby rolling them upwardly and out of their associated grooves, and an overlying guard limiting the upward movement of the inner ends of the tubes so that they will be engaged by said second endless belt.

11. A machine for forming angularly bent drinking tubes, comprising a tube support, means for feeding tubes to said support to overhang the edge thereof, means for heating and softening the tubes in their overhanging portions, means for limiting the bending of such softened tubes, and a source of air under pressure communicating with the interiors of said tubes while the walls thereof are in softened condition to prevent their collapse at the region of bend.

12. A machine for forming angularly bent drinking tubes, comprising a grooved support, means for feeding tubes into such grooves to overhang the edge of said support, a heater for softening the tubes whereby their overhanging portions will bend, stop means for limiting the degree of bend, and a source of air under pressure communicating with the interiors of the softened tubes to prevent their collapse at the region of bend.

13. In a machine of the class described, a rotary table for supporting tubes to be bent to angular shape, said table having radial grooves therein of a length less than that of the tubes to be bent, a source of fluid pressure, a tubular sleeve in the inner end of each groove communicating with said pressure source and a rubber nozzle fitted upon each said tubular sleeve to project axially of its respective groove, each said nozzle being tapered outwardly and formed with a shoulder to limit seating of the tube thereon.

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