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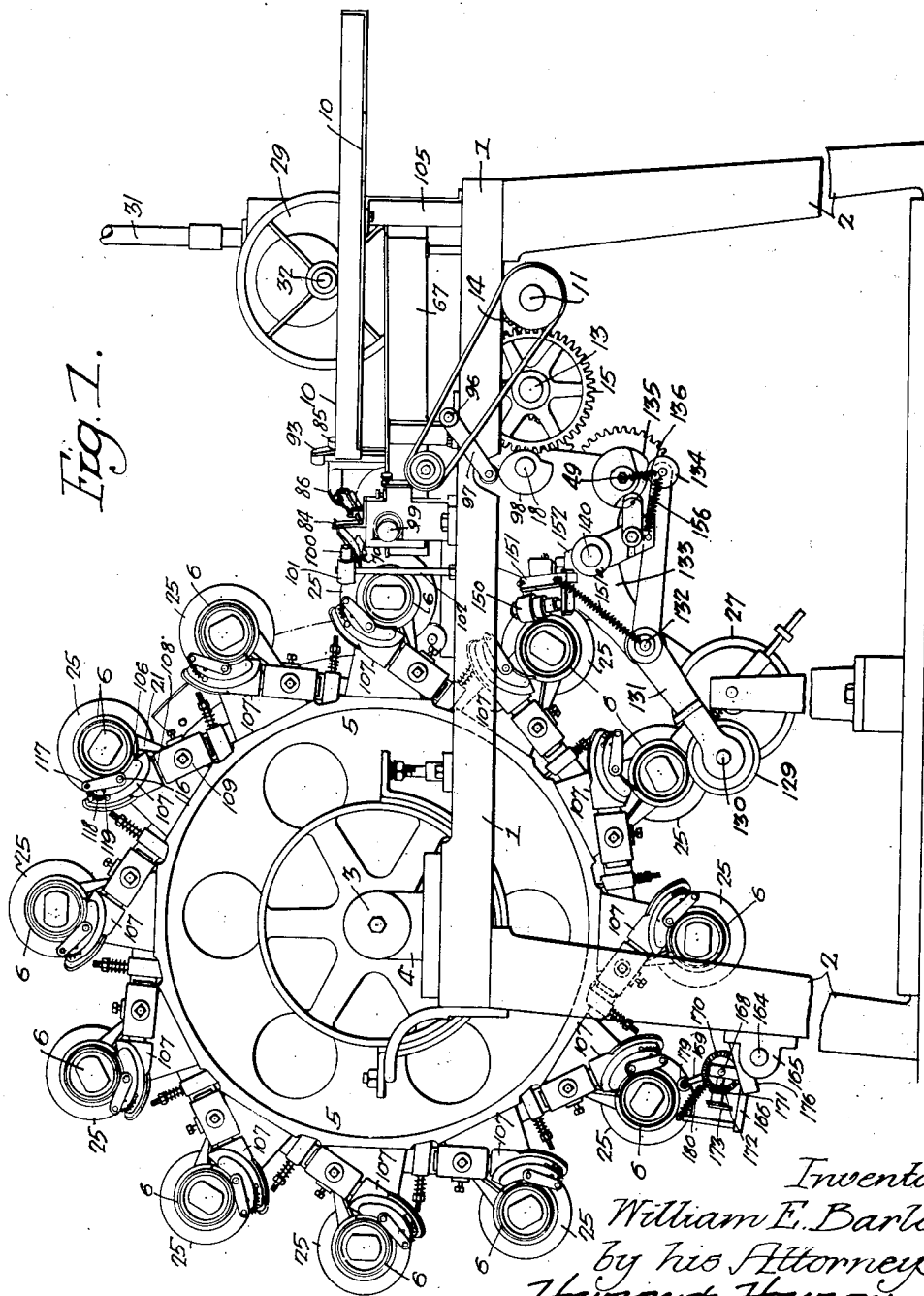
W. E. BARLOW

1,614,643

TUBE FORMING MACHINE

Filed March 12, 1925

15 Sheets-Sheet 1



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TUBE FORMING MACHINE

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15 Sheets-Sheet 2

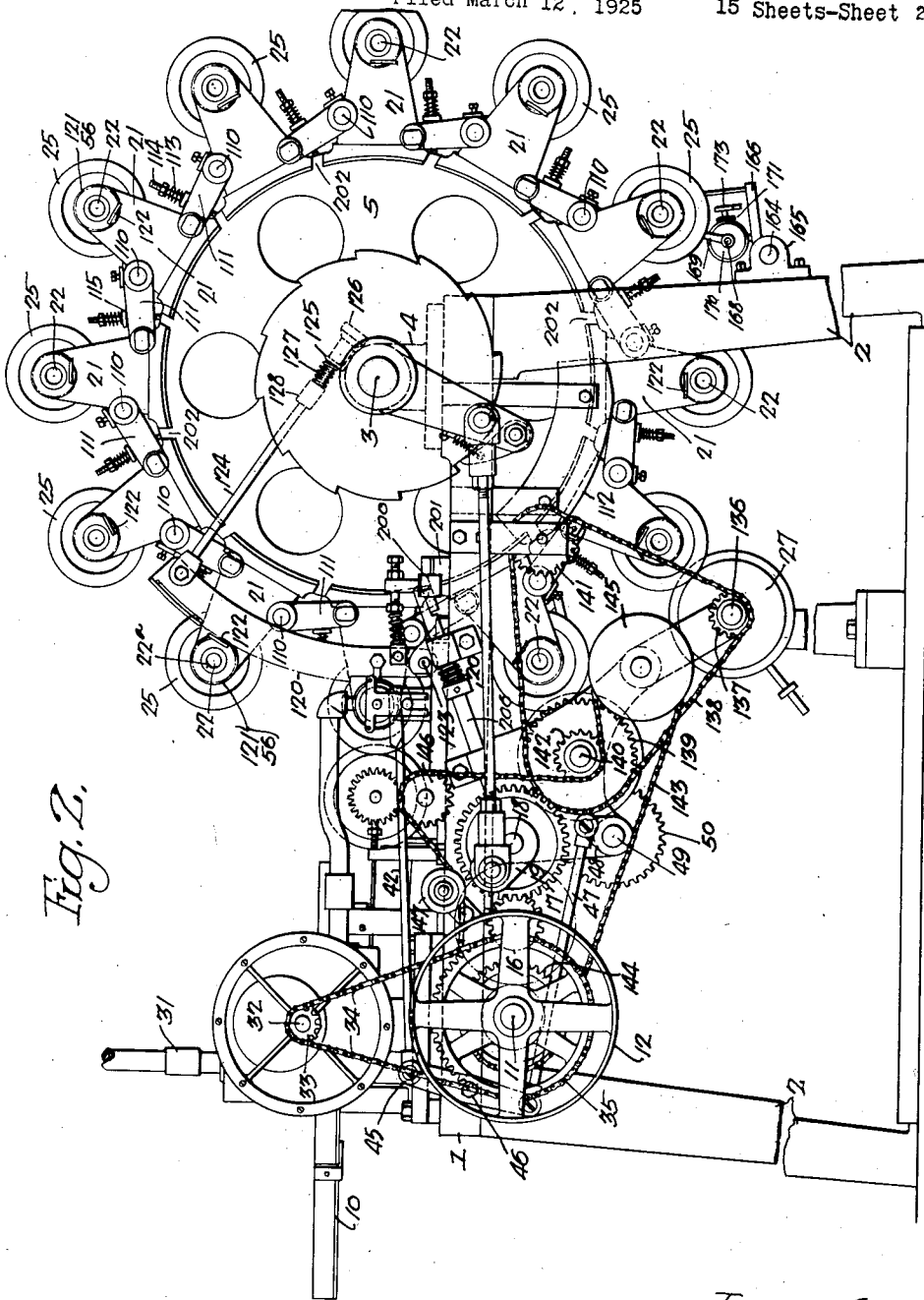


Fig. 2.

Inventor.-
William E. Barlow.
by his Attorneys.-
Howson & Howson

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W. E. BARLOW

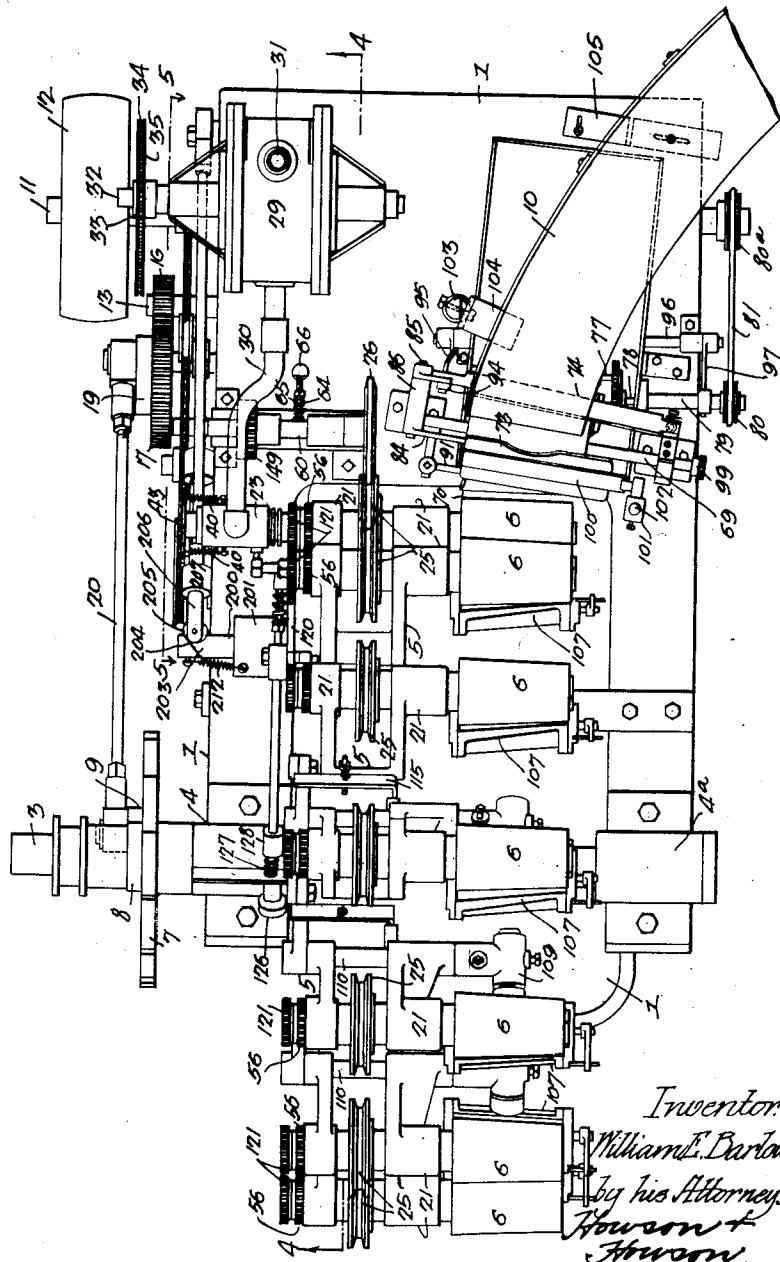
1,614,643

TUBE FORMING MACHINE

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15 Sheets-Sheet 3

Fig. 3.



Inventor:
William E. Barlow.
By his Attorneys
Hudson &
Hudson.

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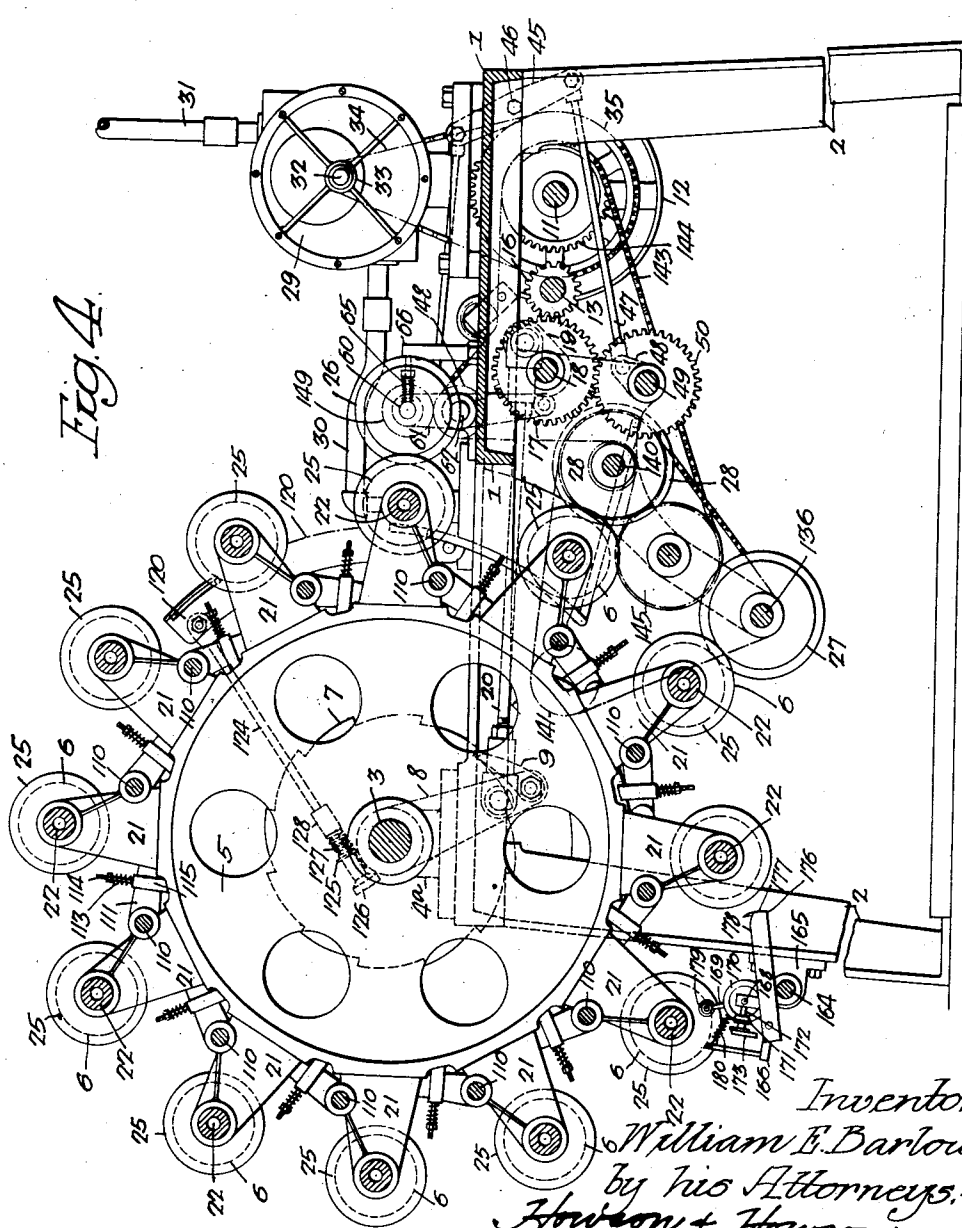
W. E. BARLOW

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15 Sheets-Sheet 4



Inventor:-
William E. Barlow.
by his Attorneys,-
Howson + Howson

Jan. 18, 1927.

W. E. BARLOW

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15 Sheets-Sheet 5

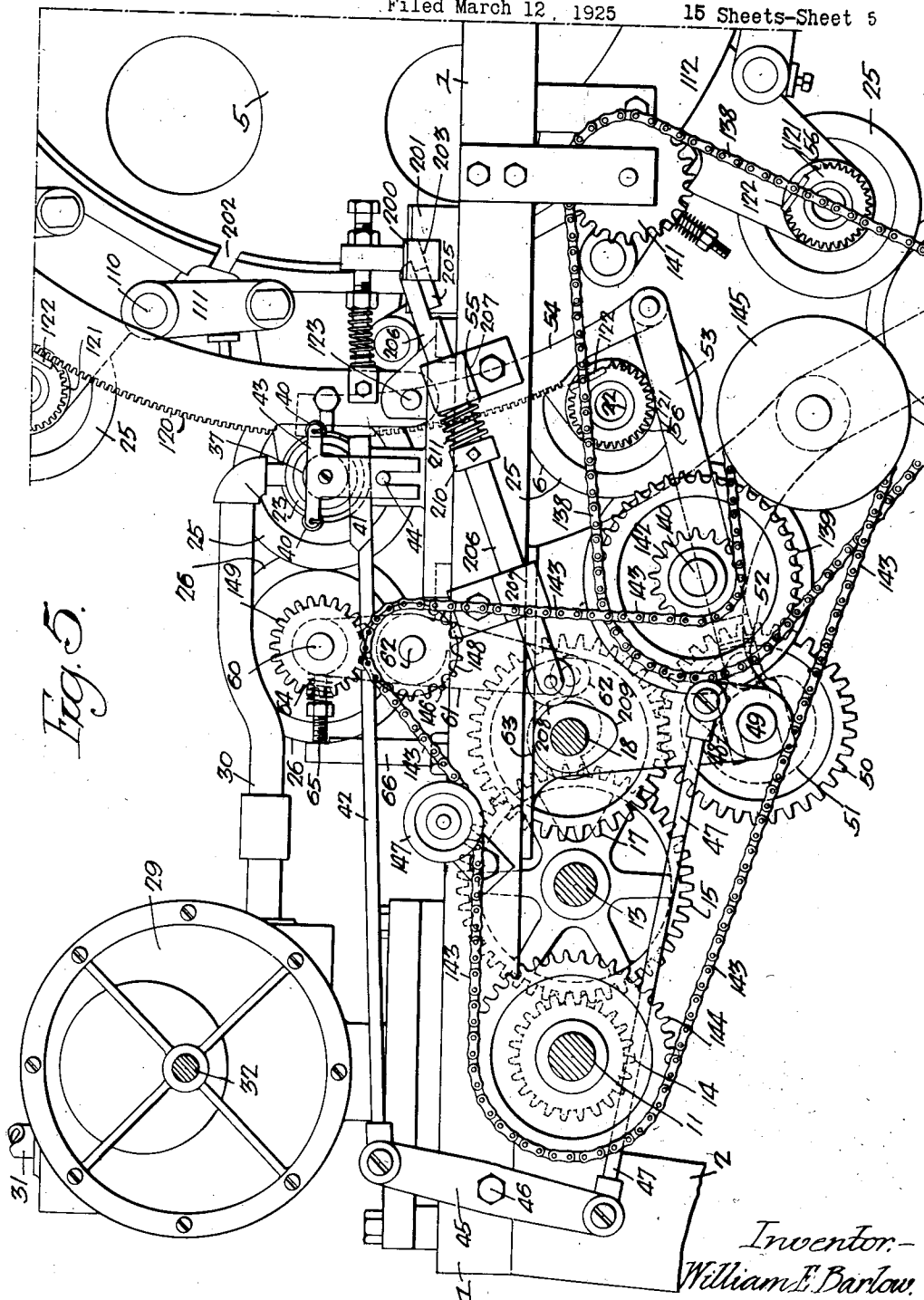


Fig. 5.

Inventor.-
William E. Barlow.

by his Attorneys.-
Howson & Howson

Jan. 18, 1927.

W. E. BARLOW

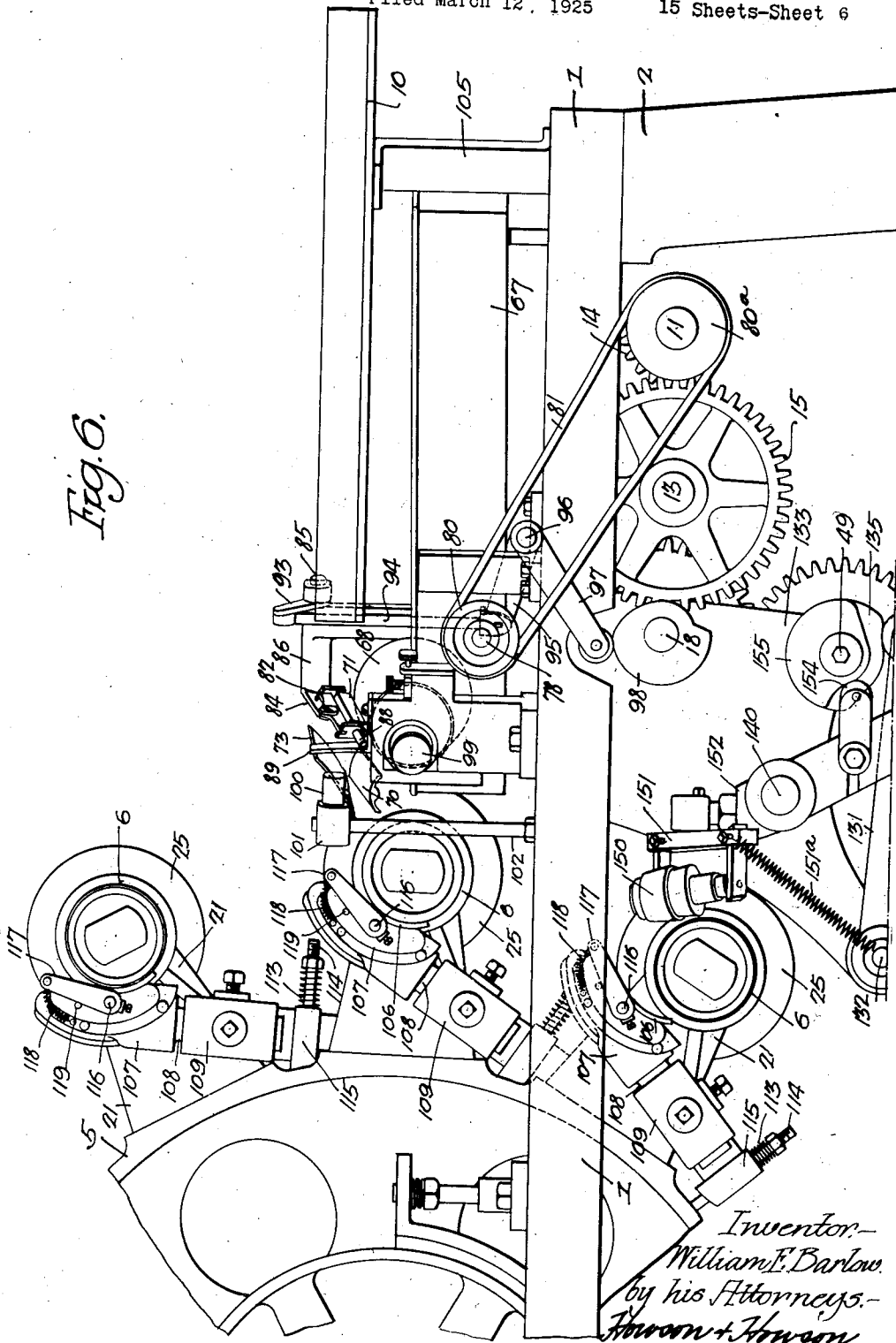
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Fig. 6.



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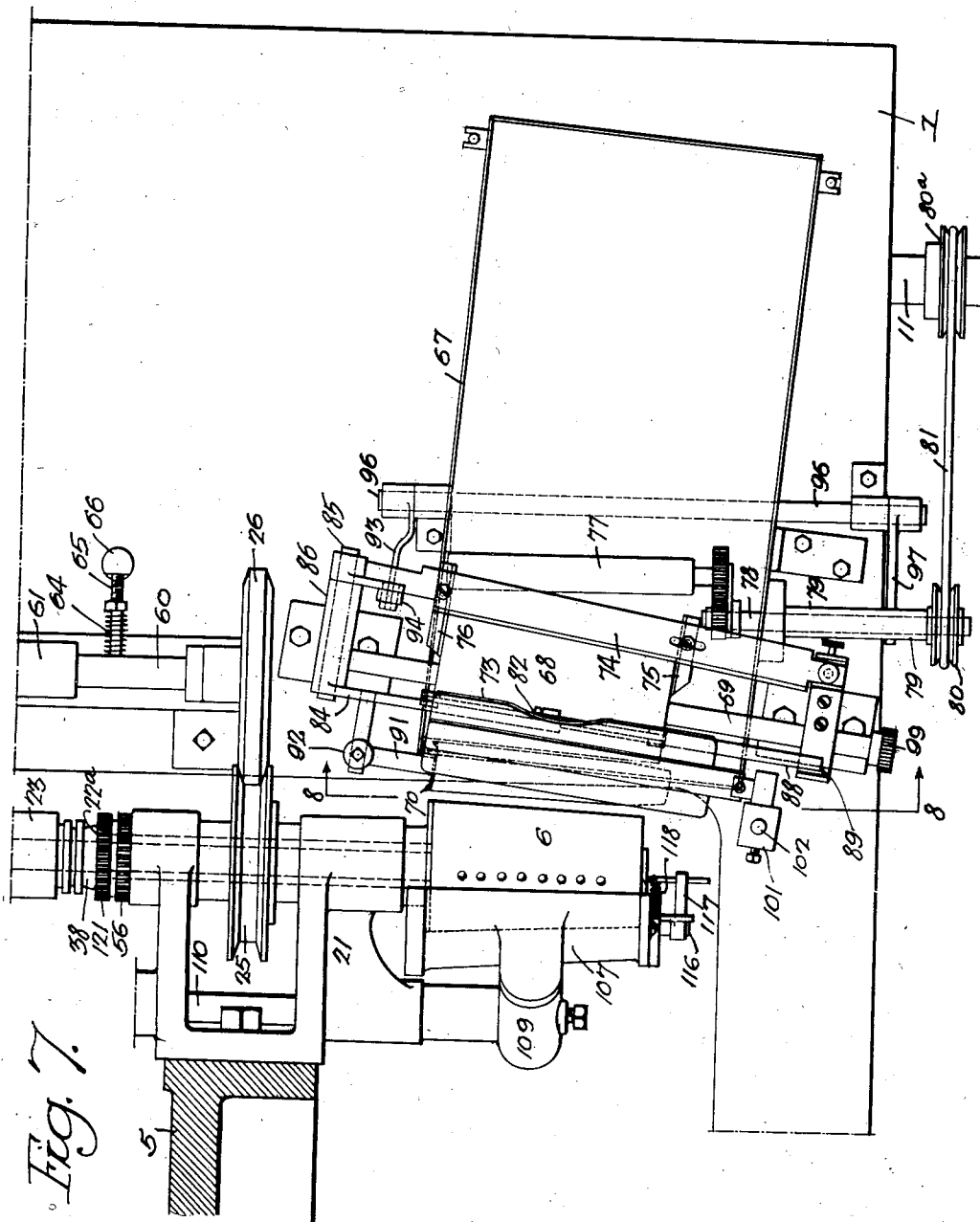
W. E. BARLOW

1,614,643

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15 Sheets-Sheet 7



Inventor.-
William E. Barlow
by his Attorneys.-
Howson & Howson

Jan. 18, 1927.

W. E. BARLOW

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TUBE FORMING MACHINE

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15 Sheets-Sheet 8

Fig. 27.

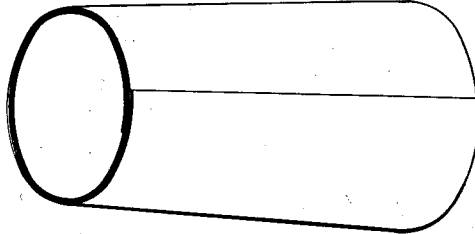


Fig. 8.

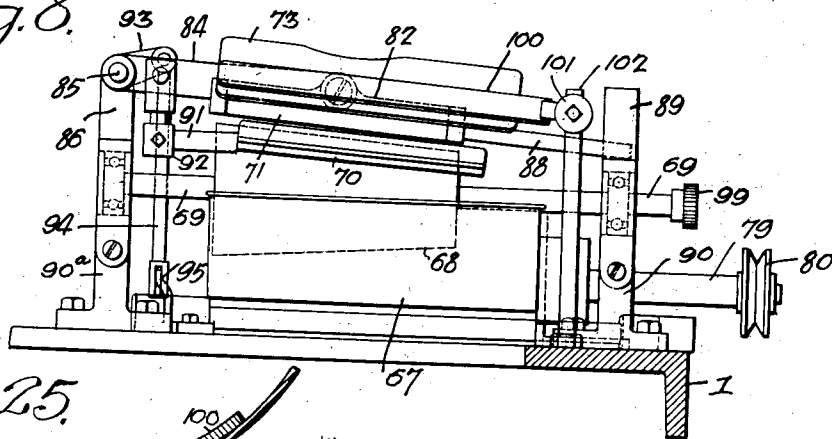


Fig. 25.

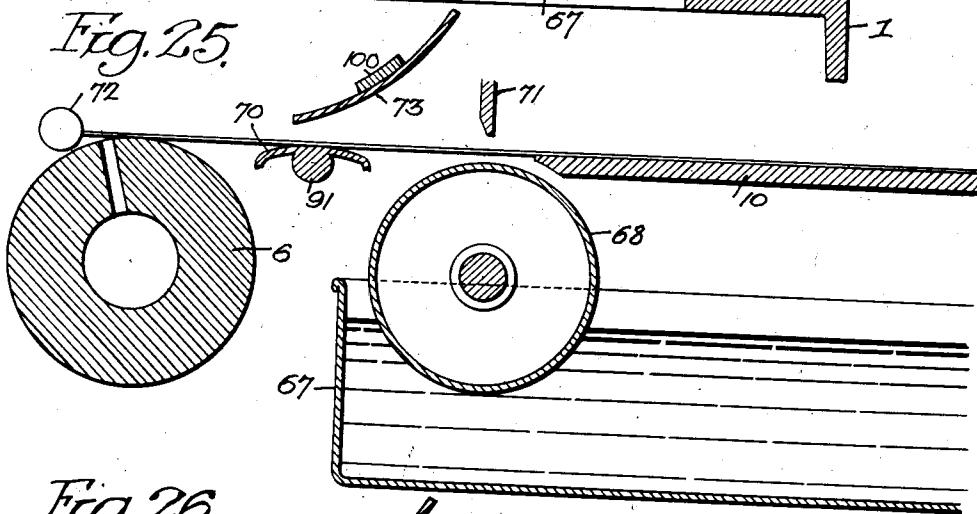
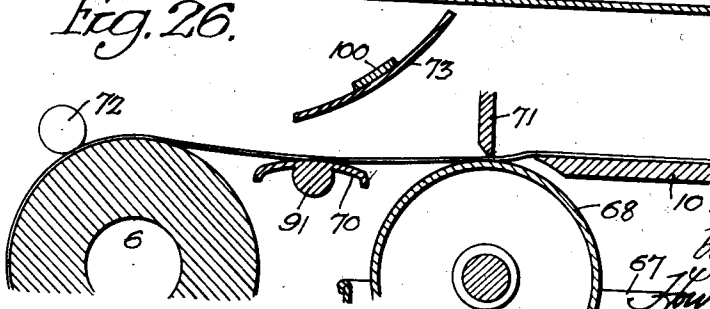


Fig. 26.



Inventor:-

William E. Barlow
by his Attorneys-
Johnson & Johnson

Jan. 18, 1927.

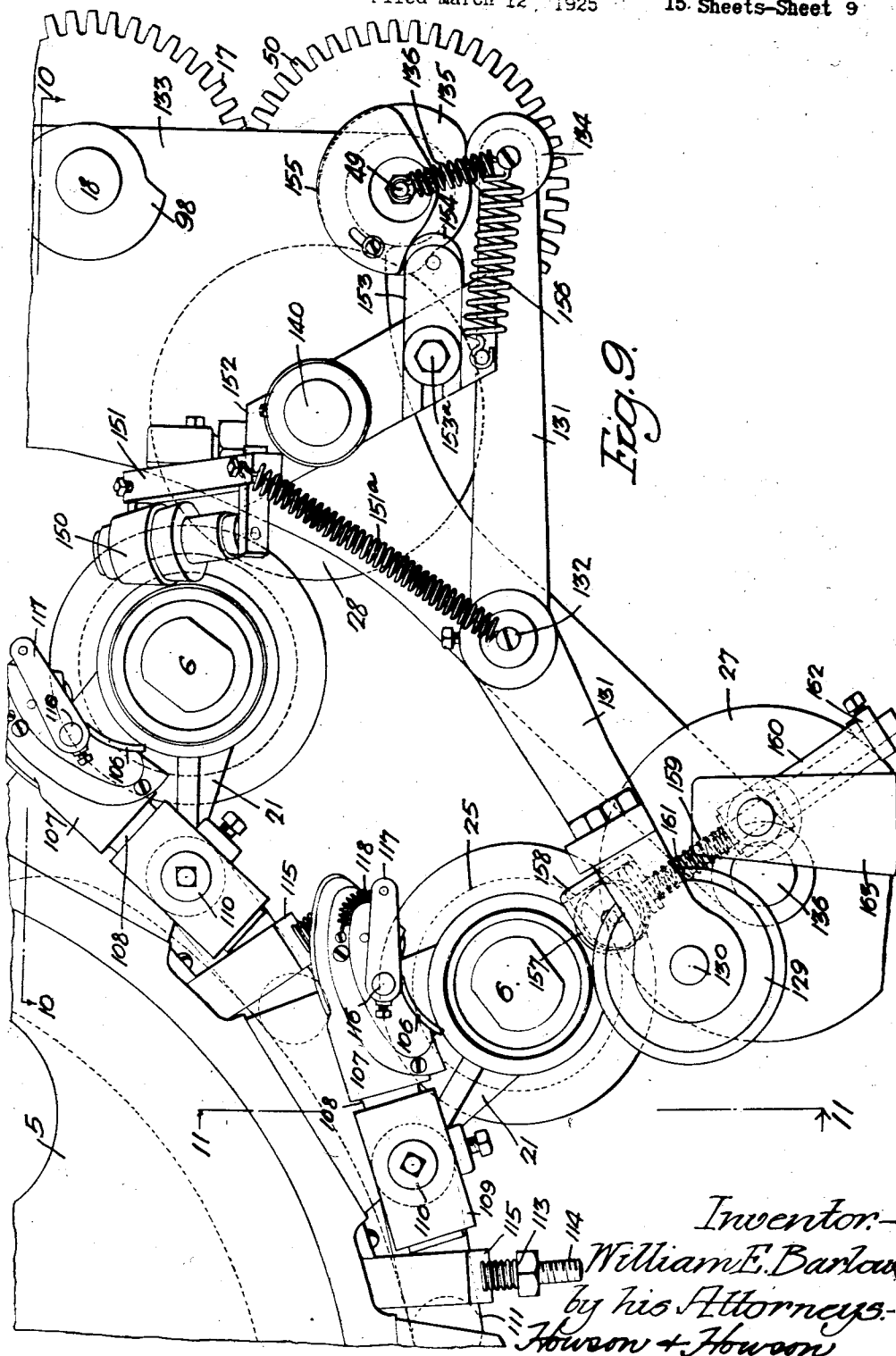
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TUBE FORMING MACHINE

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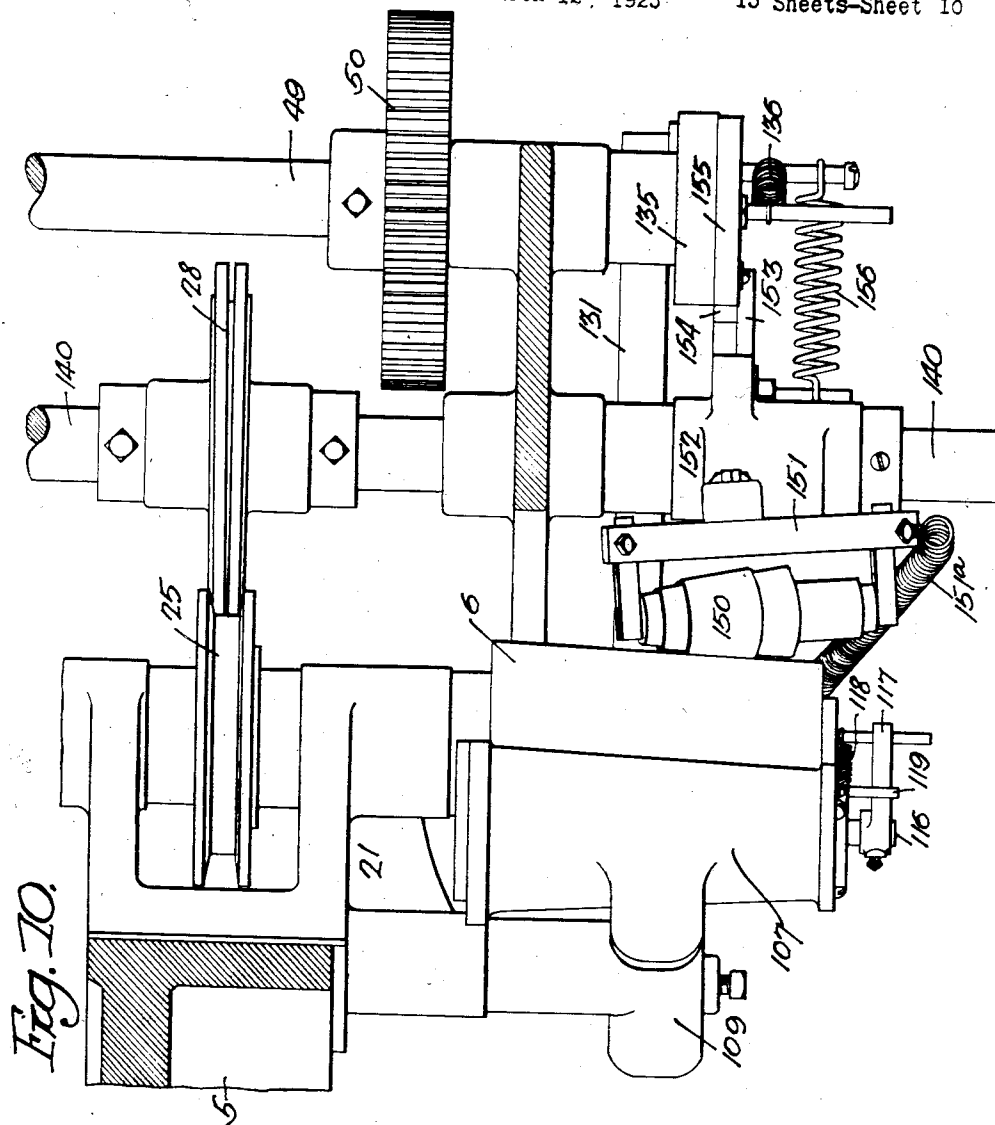
W. E. BARLOW

1,614,643

TUBE FORMING MACHINE

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15 Sheets-Sheet 10



Inventor:-
William E Barlow.
by his Attorneys:-
Howson & Howson

Jan. 18, 1927.

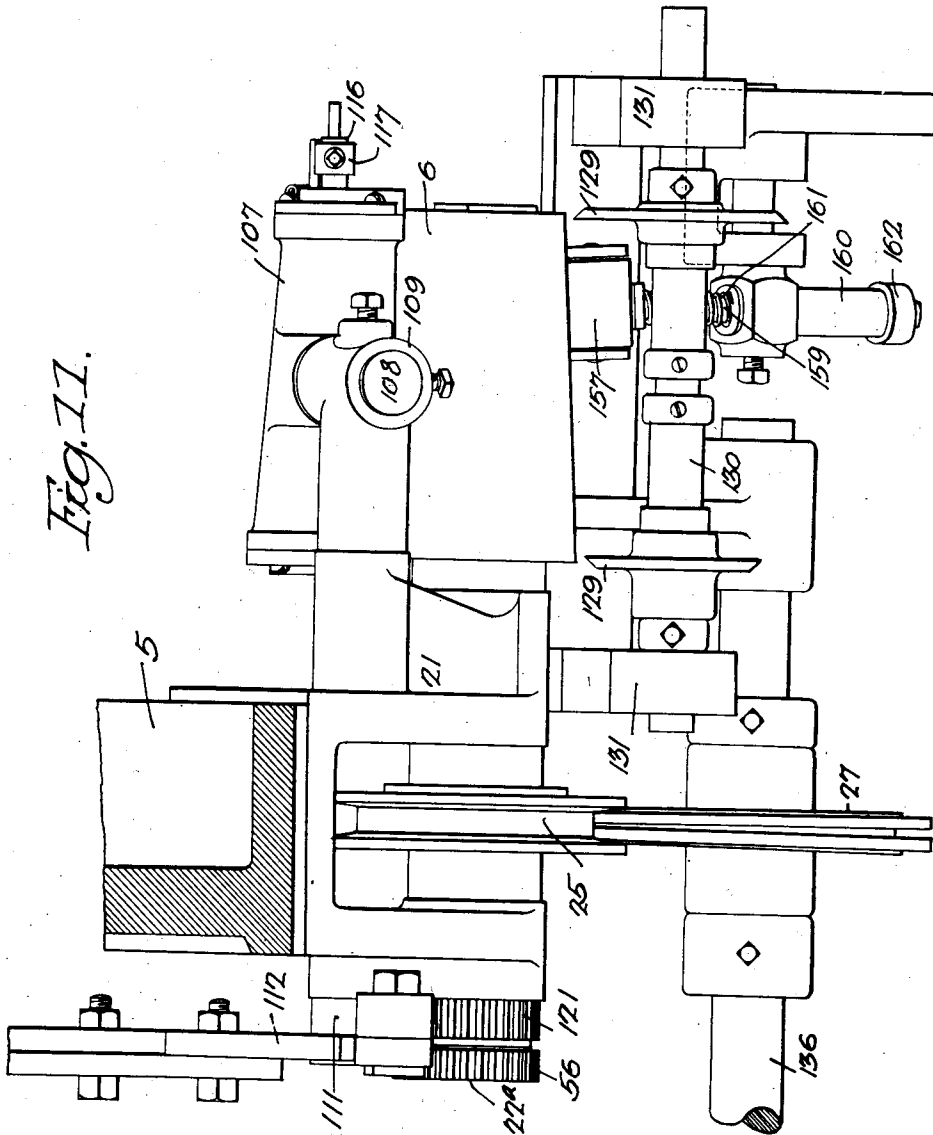
W. E. BARLOW

1,614,643

TUBE FORMING MACHINE

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15 Sheets-Sheet 11



*Inventor:-
William E. Barlow.
by his Attorneys:-
Howson + Howson*

Jan. 18, 1927.

1,614,643

W. E. BARLOW

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Fig. 12.

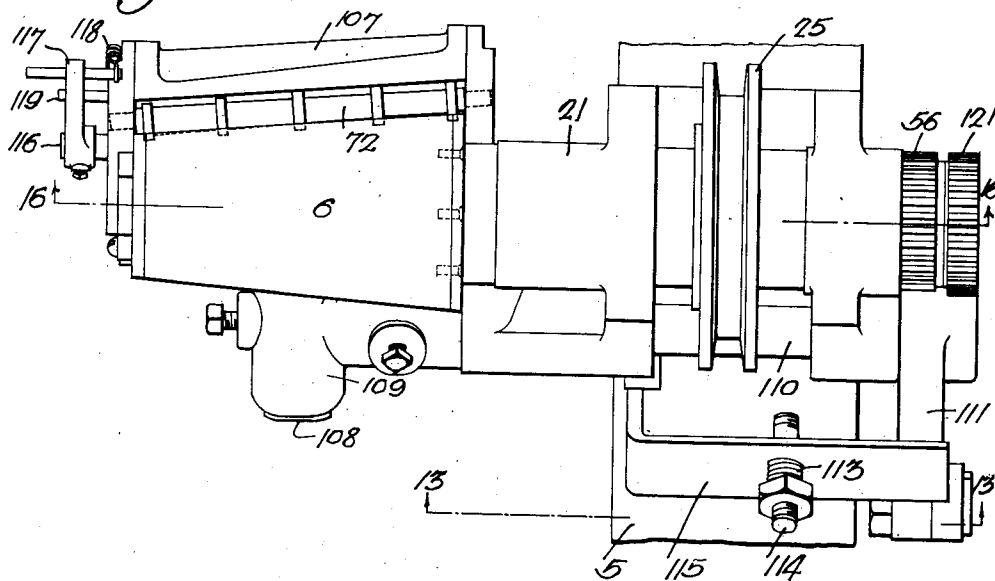
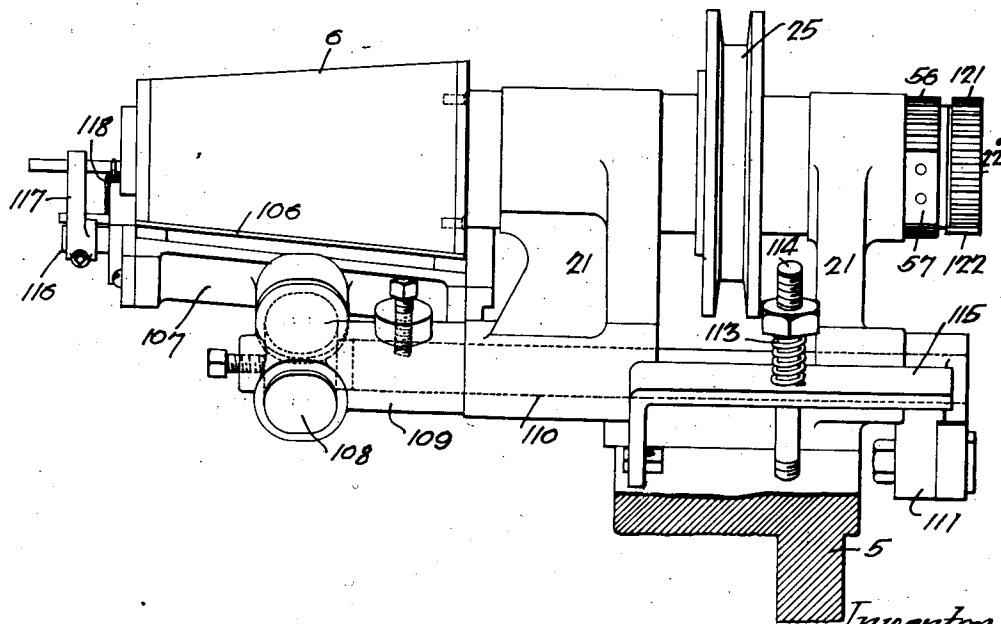


Fig. 13.



Inventor:
William E. Barlow.
by his Attorneys.
Hobson & Howson

Jan. 18, 1927.

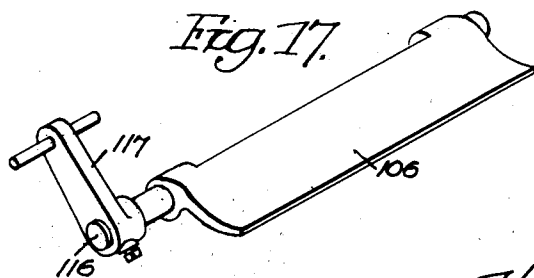
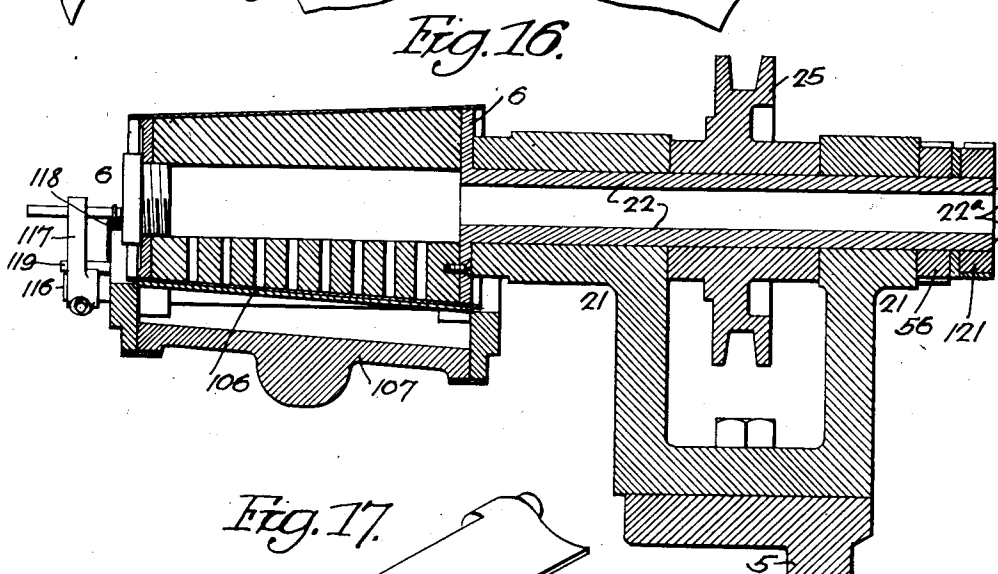
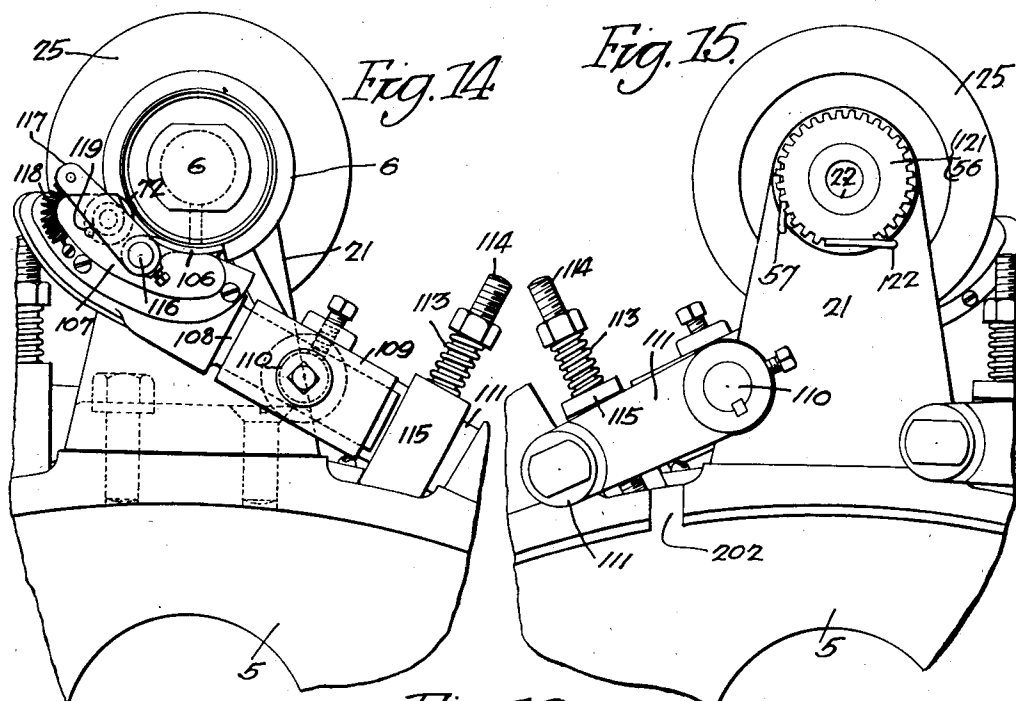
W. E. BARLOW

1,614,643

TUBE FORMING MACHINE

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15 Sheets-Sheet 13



Inventor.
William E. Barlow.
by his Attorneys.
Howson & Howson

Jan. 18, 1927.

W. E. BARLOW
TUBE FORMING MACHINE

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15 Sheets-Sheet 14

Fig. 18.

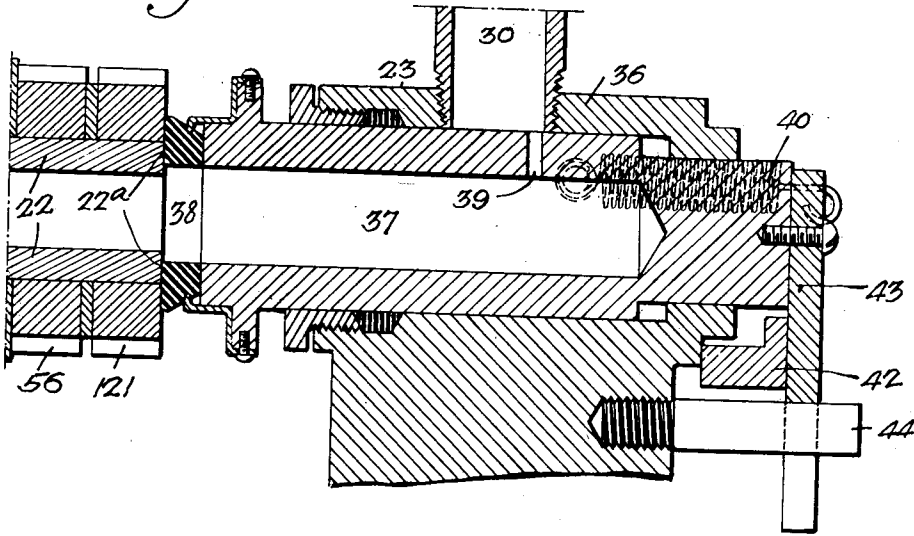


Fig. 19.

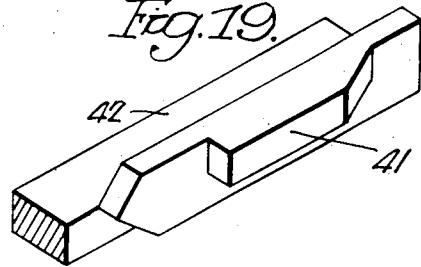


Fig. 20.

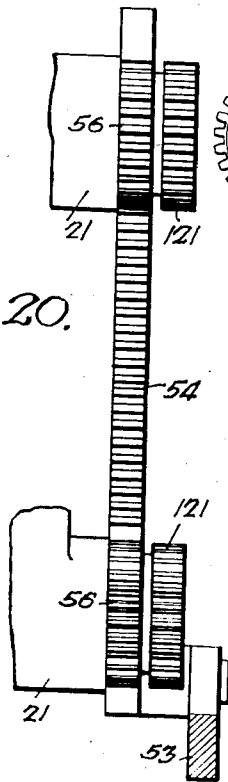
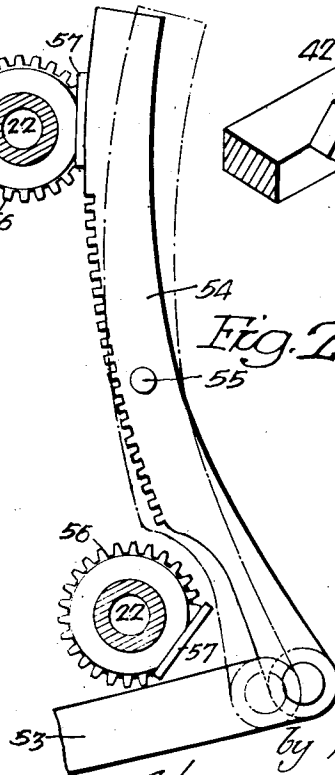


Fig. 21.



Inventor.
William E. Barlow
by his Attorneys.
Howson & Howson

Jan. 18, 1927.

W. E. BARLOW

1,614,643

TUBE FORMING MACHINE

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Fig. 22.

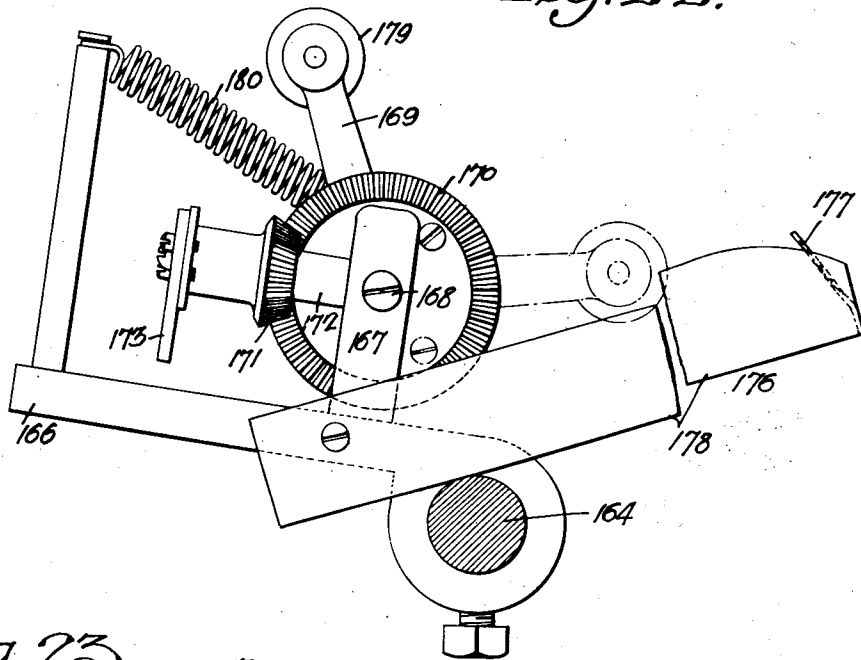


Fig. 23.

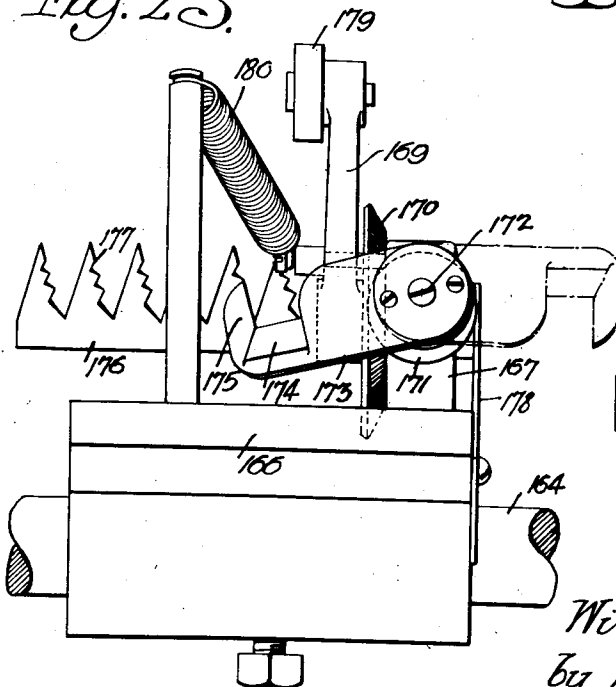
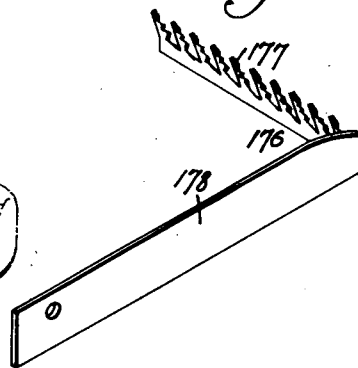


Fig. 24.



*Inventor—
William E. Barlow.
by his Attorneys—
Hudson & Hudson.*

UNITED STATES PATENT OFFICE.

WILLIAM E. BARLOW, OF TREVOSE, PENNSYLVANIA, ASSIGNOR TO DAIRY EQUIPMENT AND CONTAINER COMPANY, OF DOVER, DELAWARE, A CORPORATION OF DELAWARE.

TUBE-FORMING MACHINE.

Application filed March 12, 1925. Serial No. 14,990.

My invention relates to certain improvements in machines for making frusto-conical tubes of paper, or similar material, which are used, particularly, in the manufacture of paper containers. The bottom of the container is applied to the body thereof by another machine.

One object of the invention is to improve the construction of a machine for making frusto-conical tubes so that the paper blank can be fed to the machine, formed automatically into a tube, and delivered as a finished conical tube ready to receive the bottom section.

A further object of the invention is to provide means for holding the outer end of the formed blank while the adhesive material "sets," thus insuring a closed seam.

A still further object of the invention is to provide means for trimming the ends of the tubes after they have been formed and while they are on the mandrel.

The invention also relates to further details, which will be fully described hereinafter.

In the accompanying drawings:—

Fig. 1 is a front elevation of my improved tube forming machine;

Fig. 2 is a rear elevation;

Fig. 3 is a plan view;

Fig. 4 is a longitudinal sectional view on the line 4—4, Fig. 3;

Fig. 5 is an enlarged sectional view on the line 5—5, Fig. 3;

Fig. 6 is an enlarged front elevation of the feed end of the machine;

Fig. 7 is an enlarged plan view of the feed end of the machine with the feed table removed to illustrate the pasting mechanism;

Fig. 8 is a transverse sectional view on the line 8—8, Fig. 7;

Fig. 9 is an enlarged front elevation of part of the machine, illustrating the ejecting mechanism and the cutters;

Fig. 10 is a sectional plan view on the line 10—10, Fig. 9;

Fig. 11 is a transverse sectional view on the line 11—11, Fig. 9, illustrating the cutters for trimming the ends of the tubes;

Fig. 12 is a plan view of one of the mandrels;

Fig. 13 is a sectional elevation on the line 13—13, Fig. 12;

Fig. 14 is a front elevation illustrating one of the mandrels and the clamping shoe;

Fig. 15 is a rear elevation of the mechanism shown in Fig. 14;

Fig. 16 is a sectional view of the mandrel on the line 16—16, Fig. 12;

Fig. 17 is a detached perspective view of one of the shoes;

Fig. 18 is a sectional view of the suction head;

Fig. 19 is a perspective view of the end of the rod for operating the suction head;

Fig. 20 is a view of one of the mandrels, showing its relation to the positioning rack;

Fig. 21 is a side view of the mechanism illustrated in Fig. 20;

Fig. 22 is a face view of a portion of the machine for removing the cuttings;

Fig. 23 is a transverse elevation of the mechanism shown in Fig. 22;

Fig. 24 is a detached perspective view of the rake;

Fig. 25 is a diagrammatic view, showing the paper elevated clear of the pasting roller;

Fig. 26 is a view, similar to Fig. 25, showing the paper in contact with the pasting roller; and

Fig. 27 is a perspective view of the finished tube.

Referring, in the first instance, to Figs. 1 to 4, inclusive, the base of the machine 1 is supported by suitable legs 2. A shaft 3 is mounted in bearings 4, 4^a on the base. On the shaft 3 is secured a carrier in the form of a turret 5, on which the mandrels 6 are mounted. Secured to the shaft 3 is a ratchet wheel 7. Loosely mounted on the shaft is an arm 8, which carries a pawl 9 that engages the teeth of the ratchet wheel and moves the turret intermittently to bring one mandrel after another in position to receive the paper blank from the feed table 10. A lock is provided between the base 1 and the turret 5 by which said turret is maintained rigidly in certain definite positions to permit the proper successive operations of the mandrels. The lock will be more fully described hereinafter.

The main driving shaft 11 of the machine is mounted in hangers under the base 1, and has a pulley 12 by which it is driven. The shaft 11 is geared to an intermediate shaft by gears 14 and 15. On the intermediate shaft is a gear wheel 16, which meshes with a gear wheel 17 on a shaft 18.

The arm 8, which carries the pawl 9 that moves the turret, is reciprocated by the shaft 18, on which is a crank arm 19. This crank arm is connected to the pawl arm 8 by a rod 20, Figs. 2 and 3.

The gearing is so timed that the turret remains stationary while a paper blank is wrapped around a mandrel, and while a finished tube is being ejected from the machine.

Each mandrel 6 is hollow, and is secured to a hollow spindle 22, which is mounted to a bearing 21. The periphery of each mandrel is tapered and a series of perforations extend from the inside of the mandrel to the outer tapered surface, as shown in Fig. 16. The inner end of each hollow spindle 22 terminates in a flat end 22^a so as to fit against the end 38 of a suction head 23 that is located in a fixed position at the point where a paper blank is wrapped around a mandrel. When a paper blank is fed to a mandrel, the forward edge of the paper is sucked onto the mandrel and is held to the mandrel until the mandrel moves away from the suction head.

On the spindle 22 of each mandrel 6 is a grooved friction wheel 25. The spindles are so arranged that they frictionally engage the driving wheels 26, 27 and 28, Fig. 4. By this construction, the mandrels are driven only at the point where the paper blank is wrapped thereon, at the point where the cutters trim the tube, and at the point where the tube is ejected from the machine.

The suction head 23 is connected to the rotary suction pump 29 through a pipe 30, Figs. 3 and 4. This pump has an exhaust pipe 31. On the shaft 32 of the pump is a sprocket wheel 33, around which passes a chain 34, from a sprocket wheel 35 on the main shaft 11. The suction head is made as shown in Fig. 18. In the cylindrical shell 36 of the suction head is a hollow piston 37, which has a ring 38 of rubber, or other suitable flexible material to close against the end 22^a of the spindle of each mandrel 6.

In the hollow piston 37 is an air port 39, which is normally held out of alignment with the suction pipe 30 by a wedge-shaped end 41 of a rod 42 (Figs. 18 and 19), which is located between the end of the suction head and a plate 43. The plate is attached to the rear end of the piston 37, and is slotted, as shown in Fig. 5, to receive a pin 44 on the support for the suction head. This pin prevents the piston turning in the suction head.

Attached to the plate 43 are springs 40, which extend on each side of the suction head and are secured thereto, as illustrated in the drawings, so that, when the wedge is withdrawn, the springs 40 force the piston against the end of the spindle of a mandrel and also bring the port 39 in alignment with the suction pipe 30 so that, when a paper blank is fed to a mandrel, its inner edge is held to the mandrel by suction. When the wedge is moved, it withdraws the piston from the spindle at the same time the port is moved away from the suction pipe 30.

The rod 42 is connected to one arm of a lever 45, which is pivoted to the base at 46. The other arm of the lever 45 is connected by a rod 47 to a crank arm 48 on a shaft 49. The shaft 49 has a gear wheel 50, which meshes with a gear wheel 17, Fig. 5. On the shaft 49 is a cam 51, which engages a roller 52 on a bar 53 that is pivotally connected to the lower end of a positioning rack 54, Fig. 5. The rack is pivoted at 55 to the base of the machine, and is normally held out of the path of the gear wheels 56 on the spindles 22 of the mandrels. On each gear wheel 56 is a blank section 57, Fig. 13, which engages the rack 54 and slides thereon, after the gear wheel has been turned, so as to hold the perforations in the mandrel in such a position with respect to the paper blank feeding machine that the edge of the paper blank extends over the perforations and is held to the mandrel by suction, while the blank is being wrapped upon the mandrel to form a paper tube.

The driving friction wheel 26 for driving the mandrels is shaped as shown in Fig. 7 to enter the groove in the friction wheels 25 of a mandrel as one mandrel after another is moved into position to receive a paper blank. The wheel 26 is mounted on a shaft 60, which is carried by one arm of a lever 61 that is pivoted at 62, Fig. 5. The other arm of the lever 61 has a roller 62, which bears upon a cam 63 on the shaft 18. A spring 64 on a screw-threaded stud 65, carried by a post 66, holds the roller yieldingly against the cam and tends to hold the wheel 26 in frictional contact with the wheels 25 of the spindles as they come into position.

Under the table 10 is a paste reservoir 67. A paste roller 68, Figs. 7 and 8, is mounted on a shaft 69 adapted to bearings 90 and 90^a. The lower portion of this paste roller is in the reservoir 67. The upper surface of the paste roller is below the surface of the table 10 and also below the movable table 70 when elevated. The movable table is located between the paste roller and the mandrel so that the paper can be fed from the table 10 to the mandrel without receiving paste until slightly more than one revolution is made when the table 70 is lowered

and with it a presser bar 71, which presses the paper onto the paste roller so that the paper receives a definite amount of paste. The bar 71 holds the paper onto the paste roller until the predetermined extent of surface is supplied with paste, when the bar 71 and the table 70 are raised.

The paper is fed over the paste roller 68, movable table 70, and onto the mandrel, which has been brought in position to receive the paper, until it strikes a small roller 72 at the mandrel and the edge of the paper is over the suction holes in the mandrel. At this point, the suction device is connected to the mandrel, drawing the edge of the paper onto the mandrel. When the mandrel is rotated, the paper passes under the roller and under the shoe, which holds the seam until the paste sets.

The paper is prevented from rolling as it is fed to the mandrel by curved guards 73. The paste roller has an adjustable scraper blade 74. Carried by this blade are end blades 75 and 76 for scraping paste from the ends of the paste roll, thereby insuring the proper amount of fresh paste being transferred to the paper.

In the reservoir 67 in front of the paste roller is a flat paddle 77, which has trunnions that are mounted in suitable bearings. The paddle is geared to a shaft 78 extending through the side of the reservoir, Fig. 7. The shaft is supported by an elongated bearing 79. The paddle keeps the paste in proper condition.

On the end of the shaft 78 is a pulley 80, around which passes a belt 81 from a pulley 80^a on a shaft 11, Fig. 6. The presser bar 71 is carried by a frame 82, which is pivoted to an arm 84 that is secured to a shaft 85, mounted in a bearing 86, Fig. 7. A guide rod 88 extends from the frame 82 and slides against an upright guide 89 on the outer bearing 90 for the paste roller.

The table 70 is secured to a rod 91, which is mounted in an adjustable block 92 that carries the presser bar 71 so that the table 70 and the presser bar 71 are raised and lowered in unison.

On the shaft 85 is an arm 93, which is connected by a rod 94 to an arm 95 on a shaft 96, which extends under the paste reservoir and has, at its outer end, an arm 97 that carries a roller, which is in contact with a cam 98 on the shaft 18, Fig. 6.

The cam 98 is so set that the table 70 and the presser bar 71 are raised and lowered in time with the mandrel and its mechanism. The shaft 69 of the paste roller is preferably mounted in ball bearings in the bearings 90 and 90^a, Fig. 8, and has a knurled knob 99 by which it can be turned by an operator, when necessary. When the machine is in operation, the paste roller is turned by the forward movement of the pa-

per when in contact with the paste roller.

The curved guard 73 is mounted on a bar 100, which is adjustably mounted in a block 101, carried by an upright 102 that is secured to the base of the machine.

The table 10, from which the paper blanks are fed to the machine, is preferably made adjustable so that the curved paper blanks are fed to the mandrel at the proper angle. A post 103 projects from the base at one side of the paste reservoir, Fig. 3. A bracket 104, secured to the underside of the table 10 is adjustably attached to the post by a bolt. The outer edge of the table is mounted on a slotted bracket 105, which has a slotted foot, as shown in Figs. 1 and 3. A clamp screw passes through the table and another clamp screw passes through the slot in the foot of the bracket and into the base 1.

Each mandrel is turned to a given position by the pinion 56 engaging the pivoted rack 54 as it comes to the point opposite the table to receive a sheet and is held in this position by means of a flat portion on the pinion traveling over the face of the gears. When the mandrel is in the given position, the perforations in the mandrel are at one side of the vertical center line, as shown in the diagram, Fig. 25. As the paper is applied, the mandrel is turned by the friction wheel 26. The paper passes under the roller 72 and under a shoe 106, Fig. 14, and, when the blank is wound on the mandrel, the two ends of the blank are between the shoe and the mandrel, the shoe holding the edge until the paste has set.

The shoe 106 and the roller 72 are carried by a head 107 having a spindle 108, which extends through an opening in an annular block 109, secured to a shaft 110 that extends through an opening in the bearing 31. On the opposite end of the shaft 110 is an arm 111, carrying a roller, which is arranged to ride upon a slow raising cam 112, which is fixed to the frame, Fig. 2. This cam is so located that it moves each head 107 away from its mandrel at the point when the trimming takes place and holds the head until the paper tube is removed from the mandrel. The head is then released.

A spring 113 on a stud 114, projecting from the turret, returns the head to its normal position. The spring 113 rests upon a plate 115, which extends over the arm 111. This plate has a foot, which is secured to the turret, Figs. 14 and 15.

The shoe 106, associated with the mandrels, is mounted on a shaft 116 that is located in the head 107. On the shaft 116 is an arm 117 to which is attached one end of a coiled spring 118. The other end of the spring is secured to a pin on the head, Fig. 14. A stop pin 119 limits the movement of the arm 117 in one direction.

By this construction the shoe is held against a mandrel by the tension of the spring 118, and yields as the plies of paper are wound around a mandrel.

5 The roller 72 of each head 107 is mounted on a pin that is secured to the head. Each head is preferably ribbed, as shown in Fig. 12. To insure a mandrel stopping at the proper point in respect to its shoe, a rack 120 is so located above the point at which the paper is wrapped upon a mandrel that the pinion 121 on each mandrel engages the rack and is turned by it until the flat portion 122 on the pinion comes in contact with the face of the rack, as shown in Fig. 2, holding the mandrel in such position in respect to its shoe that the seam of the paper is under the shoe. The shoe and the mandrel retain this position until the paste sets and until the shoe is moved away to allow the formed tube to be cut and removed from the mandrel.

The rack 120 is pivoted at 123 at its lower end to the base of the machine. The upper end of the rack is connected to the bearing 4 by a rod 124, which extends through an opening in a plate 125, secured to the bearing 4. On the rod is a head 126, which limits the outward movement of the rack. A spring 127 in the head is located between the plate 125 on the bearing and a collar 128 on the rod. This spring allows the rack to yield, should the parts become clogged.

The mandrels and shoe retain the same relation during three-fourths of the revolution of the turret, at which time the head carrying the shoe is moved away from the mandrel by the cam 112. After the shoe has been moved away from a mandrel, the mandrel, with the paper tube thereon, passes to a position in line with the cutters 129, which trim both ends of a paper tube, as shown in Fig. 11. The outer ring cut from the tube falls off and away from the machine, while the inner ring is retained in the bearing of the mandrel and is removed therefrom by a suitable cutting device, described hereinafter.

The cutters 129 are mounted on a shaft 130, having its bearings in one arm of a lever 131, pivoted at 132 to a bracket 133, depending from the base 1. On the other arm of the lever 131 is a roller 134, which is in contact with a cam 135 on the shaft 49. A spring 136 holds the roller 134 in contact with the cam 135.

55 The mandrels are rotated when the cutters are moved into cutting position. The friction wheel 25 of each mandrel is moved into frictional contact with a friction wheel 27, Fig. 11, as the turret is rotated intermittently. The friction wheel 27 is mounted on a driven shaft 136 having a sprocket wheel 137, around which passes a drive chain 138 from a sprocket wheel 139 on a shaft 140. The chain also passes around an idler 141, Fig. 2.

On the shaft 140 is a small sprocket wheel 142, around which passes a drive chain 143, which passes around a sprocket wheel 144 on the shaft 11. The chain also passes around an idler wheel 145 and around a sprocket wheel 146 and under a take-up wheel 147.

The sprocket wheel 146 is on a line with the pivot 82 of the lever 61, which carries the friction wheel 26 and drives the wheel through gearing 148 and 149.

To insure the paper tube turning with the mandrel during the cutting operation, a spring-pressed roller 157 is set so as to press upon the paper tube and to turn with the tube and the mandrels.

The roller 157 is mounted in a head 158, which is carried by a stem 159 that passes through a long bearing 160. A coiled spring 161 is mounted between the head and the bearing, as shown in Fig. 9, and presses the roller against the tube on the mandrel when a mandrel is in position. A collar 162 limits the outward movement of the head 158 and its roller. In the present instance, the bearing is mounted on a standard 163.

After the ends of the paper tube have been trimmed by the cutters, the turret is moved to bring a mandrel, carrying a cut tube, into position to allow the ejector to force the tube from the mandrel. This ejector consists of a rubber-faced roller 150, which is set at an angle in respect to the mandrel and so driven as to cause the tube to move off of the mandrel, due to the frictional contact of the ejector.

The rubber-faced roller 150 is mounted in bearings on a frame 151. This frame is arranged at an angle in respect to a mandrel, as shown in Fig. 9. The frame 151 is pivoted to one arm of a lever 152, mounted loosely on the shaft 140. The other arm of the lever carries an adjustable bar 153, which is secured to the lever by a bolt 153^a that extends through a slot in the bar 153. This bar has a roller 154, which is held yieldingly against a cam 155 on the shaft 49 by a spring 156. A spring 151^a is attached to one end of the frame 151 and to a pin on the pivot 132, Fig. 9.

The friction wheel 28 is so located as to come into frictional contact with the wheel 25 of a mandrel when it is moved into alignment with the ejecting means. At this time, the cam 155 is so set as to release the lever and allow the spring 156 to force the ejecting roller 150 in contact with the tube, causing the tube to be withdrawn from the mandrel as the mandrel is rotating, which movement also rotates the ejecting roller. Each mandrel, after a tube has been removed, is moved into position to receive another paper blank.

In order to remove the ring that is cut from the paper tube, a slitting device is provided, which has a knife so operated as to engage the loose ring as it stops momentarily

at the device cutting the ring to allow it to fall clear of the machine. A rake is provided, which engages a cut ring and aids in removing the ring from the machine. Two or three rings may accumulate on the bearings of the mandrels without interfering with the operation of the machine.

Referring to Figs. 22, 23 and 24, a bar 164 is mounted in a bracket 165. Adjustably mounted on this bar is a plate 166 having bearings 167 for a stud 168, on which is an arm 169 and a bevel wheel 170, which meshes with a pinion 171 on a knife shaft 172. The knife blade 173 is made as shown in Fig. 23, and has a recess 174, which forms a hook 175. The edges of the recess and the hook are sharp so that, as the knife is rotated, the hook engages a ring cut from a tube and severs it. In some instances, the knife also removes the ring, but to insure the positive removal of a cut ring, a rake 176 is located in its path, the teeth of the rake engaging the ring and dragging it from the mandrel.

The teeth of the rake are preferably made as shown in Figs. 23 and 24. The tooth portion 177 of the rake is held at the rear of the cutting device and has an arm 178, which is attached to the plate 166.

The arm 169 has a roller 179, which is in the path of the mandrels as they move past the cutting device. The arm is moved forward by the mandrels turning the cutting blade from the position shown in full lines in Fig. 23 to that shown by dotted lines in said figure. A spring 180 retains the arm 169 in position as soon as it is released by a mandrel.

The lock between the turret 5 and the frame 1 comprises a bolt 200, slidably mounted in a bearing 201, secured to the frame, as illustrated in Figs. 3 and 5. One end of said bolt is adapted to enter one of a series of notches 202 in one side of the turret 5. The opposite end of the bolt 200 is provided with an angularly depressed groove 203, which has an angular side wall 204 that is adapted to be engaged by a roller 205, which is carried by one end of a bar 206, slidably mounted in bearings 207, secured to the base 1. The opposite end of the bar 206 is provided with a cam roller 208, which is adapted to be engaged by a cam 209 that is secured to the shaft 18. A collar 210 is secured to the bar 206, adjacent one of the bearings 207, and a spring 211 is positioned between said collar and said bearing for the purpose of maintaining operative engagement between the roller 208 and the cam 209. A spring 212, having one end secured to the bolt 200 and its opposite end secured to the bearing 201, tends to move the said bolt inwardly and maintains the bolt in one of the grooves 202. As the shaft 18 is rotated, the cam 209 moves the bar 206 longitudinally, the roller 205 thereon engaging the wall 204 of

the bolt 200, thereby withdrawing said bolt from the groove 202. As the cam 209 continues to rotate, the bar 206 recedes, and thereby releases the bolt 200 and permits the same to be moved inwardly by a spring 212 against the side of the moving turret 5. When the turret 5 completes its movement, the bolt 200 enters the aligned notch 202 therein, and locks the turret in a definite position.

The operation of the machine is as follows:—

The paper blanks are cut to the form desired and are placed on the feed table. The blanks are fed to the machine by hand. A blank is moved over the paste roller, but not in contact therewith, as it is held clear thereof by the elevated table 70. The edge of the paper is moved over the suction holes in a mandrel. This movement is stopped by the roller at the mandrel. The suction valve is opened, which causes the end of a paper blank to adhere to a mandrel, which is then turned, and when the paper is drawn over the paste roller to an extent equal to a little more than one revolution of the mandrel, the table 70 is lowered and with it the blade 71, which forces the paper in contact with the paste roller, applying paste to the balance of the paper with the exception of a narrow portion at the end of the blank, which is coated with the excess paste as the paper blank is wrapped around a mandrel. By this method, the escape of paste at either end of a blank is avoided.

When a blank has been wrapped around a mandrel, the suction device is withdrawn and the turret carrying the mandrels is moved intermittently to bring another mandrel in position. The mandrel with the paper wrapped thereon, is rotated until the seams of the formed paper tube are under the shoe. The parts are held in this position until the paste sets. The turret is moved intermittently, bringing one mandrel after another in position to receive a paper blank. When the turret has turned three-quarters of a revolution, the paste has set and the shoe can be withdrawn. The ends of the paper tube are trimmed and the mandrel is moved to the next position, where the tube is removed therefrom and discharged from the machine.

The mandrel is then moved into position to receive another paper blank and the operation is repeated.

I claim:

1. The combination in a machine for forming paper tubes, of a carrier; a series of mandrels on the carrier, each mandrel being hollow and having a series of longitudinal perforations; suction means arranged to communicate with each mandrel at the winding point; independent means for rotating each mandrel prior to its reaching the winding

point; means for holding the mandrels with perforations in a given position, so that the suction means will hold the paper blank onto the mandrel as it is being wrapped thereon; and means for supplying paste to a paper blank.

2. The combination in a machine for forming paper tubes, of a carrier; a series of mandrels on the carrier; means for supplying pasted paper to each mandrel; means for rotating each mandrel as the paper is applied; a head located at each mandrel; a shoe pivoted to the head; and means for holding the shoe yieldingly in contact with the paper being coiled by the tube; means for moving the head away from the mandrel at given points of rotation of the carrier; and means for discharging a tube from a mandrel.

3. The combination in a machine for forming tapered paper tubes, of a turret; a series of tapered mandrels on the turret; a shoe for each mandrel arranged to hold the outer end of the paper blank to the mandrel while the paste sets; means for rotating each mandrel while the paper blank is being wrapped thereon; cutters, acting with the mandrels, to trim the overhanging end of the tube from the body; and means for rotating each mandrel during the cutting operation.

4. The combination in a machine for forming paper tubes, of a turret; a series of mandrels carried by the turret; means for intermittently rotating the turret; a shoe located at each mandrel for holding the seam of a tube; means for rotating a mandrel to wrap a paper blank thereon, said mandrel being hollow and having a series of perforations; suction means arranged to communicate with each mandrel when it arrives at the winding point; a roller located in advance of each shoe; a paste reservoir; and means for applying paste to the paper blanks as they are fed to the mandrel, the roller limiting the inward movement of each paper blank, said roller acting also to press the sheet onto the mandrel as the mandrel is rotated.

5. The combination in a machine for forming paper tubes, of a turret; a series of mandrels on the turret, each mandrel being hollow and having a series of perforations; means for rotating the mandrels; a suction device located at the winding point; means for bringing said suction device into contact with a driven mandrel, so that when the paper blank is fed to the mandrel, its forward edge is held to the mandrel by suction; and means for supplying paste to the paper blank as it is being rolled upon the mandrel.

6. The combination in a machine for forming tubes, of a turret; a series of mandrels mounted thereon; means for applying pasted paper blanks to the mandrels to form tubes; means for rotating a mandrel one revolution

after the paper blank has been rolled thereon; means for retaining the mandrels in a fixed position the remainder of the movement; a shoe at each mandrel arranged to bear upon the seam of a tube while on a mandrel; means for removing a tube from a mandrel; and means for turning a mandrel as a tube is being removed.

7. The combination in a tube forming machine, of a turret having a series of bearings thereon; mandrels mounted at each bearing; a shoe at each mandrel for pressing upon the seam of a tube wrapped around a mandrel; means for applying a pasted paper blank to a mandrel; means for rotating a mandrel as a paper blank is applied; means for rotating a mandrel after a tube is formed and while it is being carried from one station to another; and means for removing a completed tube from a mandrel.

8. The combination of a turret; means for moving the turret intermittently step by step; a series of mandrels mounted on the turret; means for holding each mandrel in a given position after a tube is formed thereon and prior to the removal of a tube therefrom; a shoe arranged to bear upon a seam of a tube while it is being carried by a mandrel; means for applying a paper blank to the mandrel which has been previously pasted; means for rotating the mandrels; means for causing the mandrels to rotate after leaving the point at which the paper blanks are applied, said rotating means being stopped at a given point so that a shoe will bear upon a seam and will hold the seam closed during the remaining movement of the turret; and means for removing the finished tubes from the mandrels.

9. The combination of a turret; means for intermittently moving the turret step by step; a series of mandrels mounted on the turret; means for holding the mandrels in a given position as a tube is formed thereon; a shoe arranged to bear upon a seam of a tube while it is being carried by a mandrel; means for applying a paper blank to the mandrel, said paper blank having been previously pasted; means for rotating the mandrel; means for causing the mandrel to rotate after it leaves the point at which the paper is applied, said rotating means being stopped at a given point so that a shoe bears upon a seam and holds the seam closed during the remaining movement of the turret; means for trimming both ends of the tube; and means for rotating and removing the tube from the mandrel.

10. The combination in a tube forming machine, of a paste roller; a mandrel on which a tube is to be wound; means for actuating the paste roller and the mandrel; a table for holding a paper blank off the pasting roller during a portion of the movement

of the paper blank; and means for lowering the table to bring the paper blank in contact with the paste roller.

11. The combination in a paper tube forming machine, of a mandrel on which the tube is to be formed; means for actuating the mandrel; a paste roller in advance of the mandrel; means for holding the paper blank off of the paste roller during a portion of the movement of the paper blank towards the mandrel; and means for bringing the paper blank in contact with the paste roller to paste a given portion of the paper blank which is to form the tube.

12. The combination of a mandrel upon which a tube is to be formed; means for rotating the mandrel; a paste roller; and means for allowing the paper blank to come in contact with the paste roller at a given point beyond the complete revolution of the mandrel to allow the roller to apply paste to the remainder of the paper blank so that, when the paper blank is rolled upon the mandrel, the applied paste will not spread beyond the inner edge of the paper.

13. The combination in a tube forming machine, of a series of tapered mandrels; means for applying pasted paper blanks to the mandrels, each paper blank being wrapped on a mandrel so that the inner and outer edges overlap; a head at each mandrel; a yielding shoe carried by the head and arranged to clamp the paper blank onto the mandrel at the seams, and to hold the edges of the paper until the paste sets; and a roller on each head located in advance of the shoes for pressing the paper onto the mandrel, and also acting as a stop to limit the movement of the paper as it is being fed to the machine.

14. The combination of a mandrel having suction holes therein; means for rotating the mandrel; a roller bearing upon the mandrel; a roller for applying paste to a paper blank as it is fed to the mandrel; and means for pressing the paper blank onto the paste roller, said means being actuated after the edge of the paper passes the suction holes in the mandrel and after the mandrel commences to rotate.

15. The combination of a table; a paste roller; a mandrel; means for rotating the mandrel; means located in close proximity to the paste roller for holding the paper blank off of the paste roller during a portion of the movement of the blank; and means for allowing the paper blank to come in contact with the paste roller during the remainder of the movement of the paper blank.

16. The combination of a feed table; a paste roller; a mandrel on which a tube is to be formed; a table located between the paste roller and the mandrel for holding the paper blank away from the paste roller so that a given portion of the paper blank is free of paste; mechanism for moving the table to al-

low the paper blank to come in contact with the paste roller; and a bar above the paste roller connected so as to work in unison with the table to press the paper blank onto the paste roller.

17. The combination of a turret; a series of mandrels carried by the turret; means for turning the mandrels at different points; means for rotating each mandrel as it approaches the winding point to bring it in proper position; means for rotating each mandrel after the paper blank has been wound thereon to bring the seam of a tube under a shoe; and means for withdrawing the shoes to allow the tubes to be removed from the mandrels.

18. The combination in a tube forming machine, of a turret; a series of mandrels carried by the turret; means, at the paper blank feeding point, to drive the mandrels frictionally; a pivoted rack; a cam controlling the movement of the rack, and a pinion on each mandrel arranged to engage the rack and to turn the mandrel, each pinion having a flat portion to cause the pinion to slide on the rack to the feeding position, the cam withdrawing the rack to allow the mandrels to be turned.

19. The combination of a turret; a series of mandrels on the turret, each mandrel having suction openings; a shoe located at each mandrel; means for carrying the shoes; a cam for actuating the shoe-carrying means at a given point in the rotation of the turret; a suction device arranged to be coupled to a mandrel at the paper blank feeding point; means for rotating the mandrels; and two racks for positioning the mandrels, one for locating each mandrel so that its suction openings are in proper position prior to the feeding of the paper blank, the other rack turning each mandrel to a position in which the seam is covered by a shoe.

20. The combination of a carrier; a perforated mandrel mounted thereon; a tubular spindle for the mandrel; means for rotating the spindle; a suction head at one side of the machine in line with the mandrel when in position to receive a paper blank; a tubular piston in the suction head; and means for moving the piston in contact with the end of the tubular spindle of the mandrel, said piston in its movement opening and closing the suction pipe.

21. The combination in a machine for forming paper tubes, of a carrier; a perforated mandrel thereon; a hollow spindle for the mandrel; means for feeding a paper blank to the mandrel; a suction head at the feeding point, said head having a movable hollow piston provided with a cushion to fit the end of the hollow spindle of the mandrel; a spring for holding the piston yieldingly against the spindle; a cam bar for

withdrawing the piston; means for actuating the bar; and a suction pipe attached to the head, said pipe being opened and closed by the piston.

- 5 22. The combination in a machine for forming paper tubes, of a carrier; tapered mandrels on the carrier; means for applying a paper blank to a mandrel; means for holding the formed tube on the mandrel; 10 discharging means, in the form of a roller, arranged at an angle in respect to the mandrel; and means, at the discharge point, for rotating the mandrel, the roller being rotated in turn by the mandrel.
- 15 23. The combination of a turret; a series of mandrels on the turret; means for wrapping pasted paper blanks on the mandrels; means for holding the seams closed while the paste sets; means for trimming the ends 20 of the formed tubes, said means consisting of two rotary cutters; means for discharging the formed tubes from the mandrels, said means consisting of a spring-pressed angular roller having a rubber face; and 25 means for rotating each mandrel at the wrapping point, at the trimming point, and at the discharge point.

24. The combination in a machine for forming paper tubes, of a turret having

bearings; mandrels in the bearings; means 30 for applying a paper blank to each mandrel; means for trimming the ends of the formed tubes; and means for severing the rings cut from the inner ends of the tubes as they are suspended from the bearings 35 of the mandrels.

25. The combination of a turret; bearings thereon; a mandrel mounted in each bearing; means for applying a paper blank 40 to each mandrel; means for trimming the ends of the formed tubes; a rotating knife actuated by the turret and located to engage a ring cut from the inner end of the formed tube; and a rake for removing the cut ring from the machine. 45

26. The combination of a turret; mandrels mounted on the turret; means for applying a paper blank to each turret; means for trimming the ends of each formed tube; and means for severing the ring cut from 50 the inner end of each tube as it is carried by the turret, said means consisting of a hooked knife; and an arm geared to the knife and located in the path of the mandrels so as to be actuated by each mandrel 55 as it passes the cutter.

WILLIAM E. BARLOW.