(No Model.) 7 Sheets—Sheet 1.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

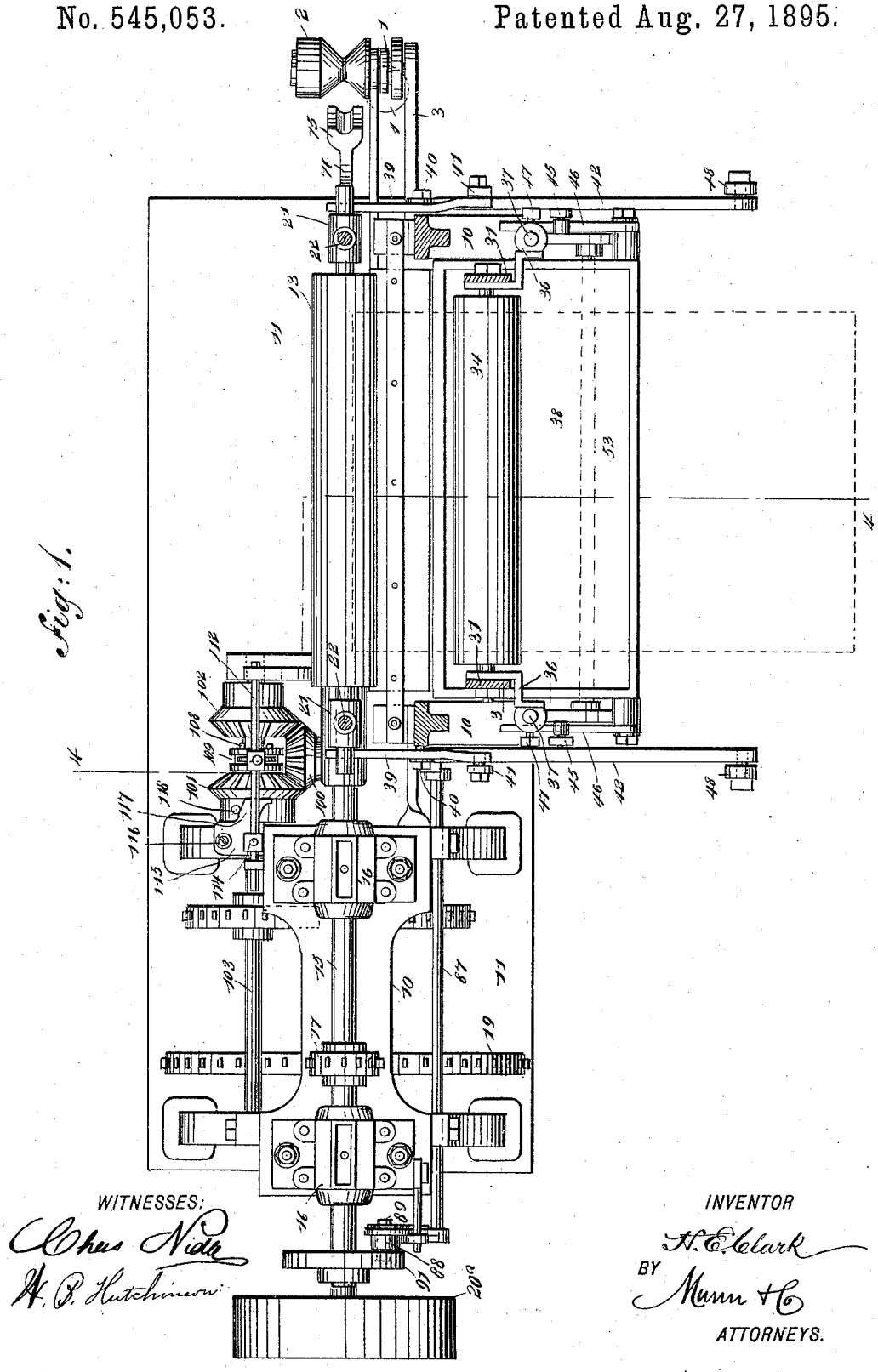


Fig. 1.

WITNESSES:

Chas. Nida

H. B. Hutchinson

INVENTOR

H. E. Clark

BY Munn & Co

ATTORNEYS.

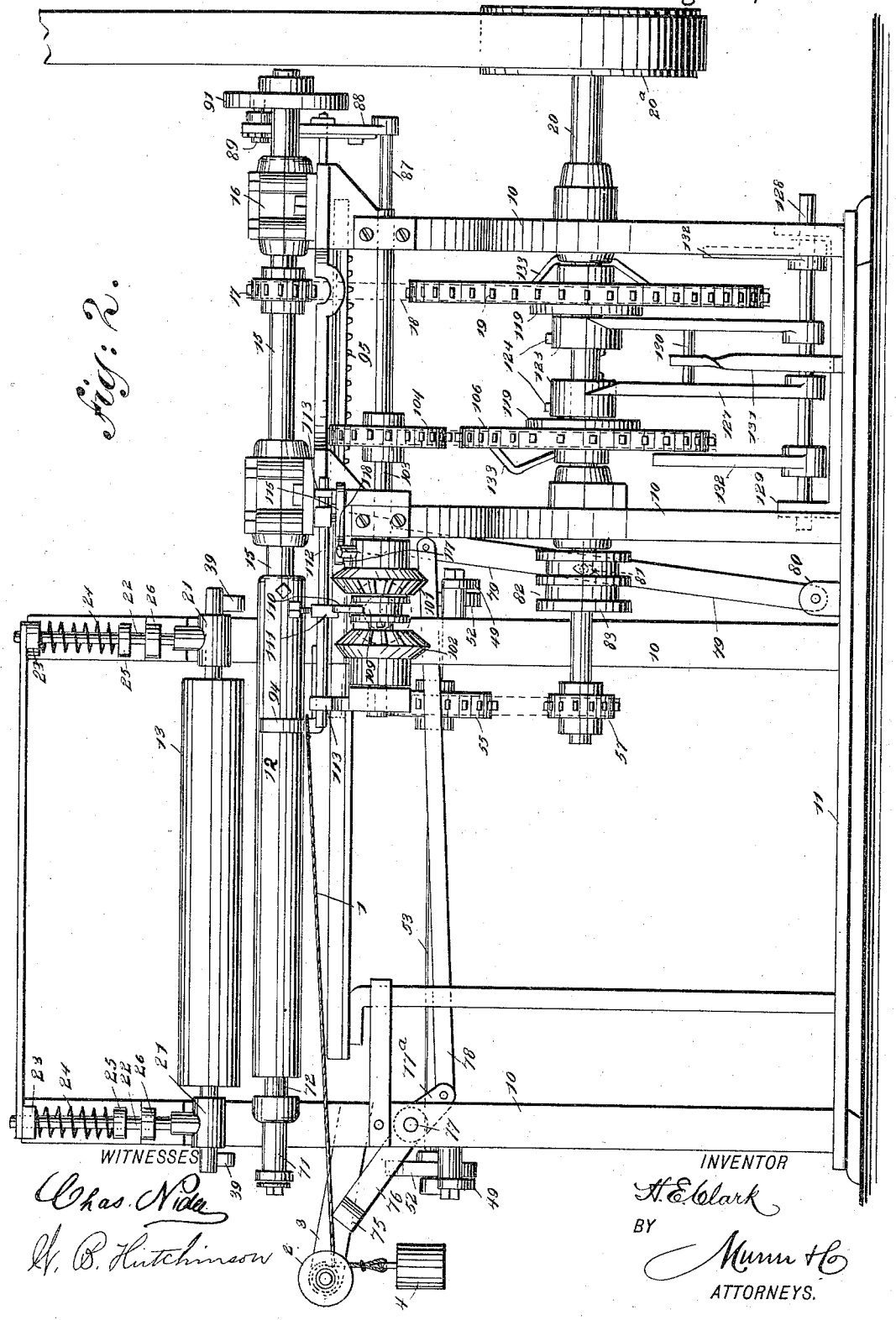
(No Model.) 7 Sheets—Sheet 2.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

Fig. 2.



WITNESSES

Chas. Nida

H. B. Hutchinson

INVENTOR

H. E. Clark

BY

Munn & Co

ATTORNEYS.

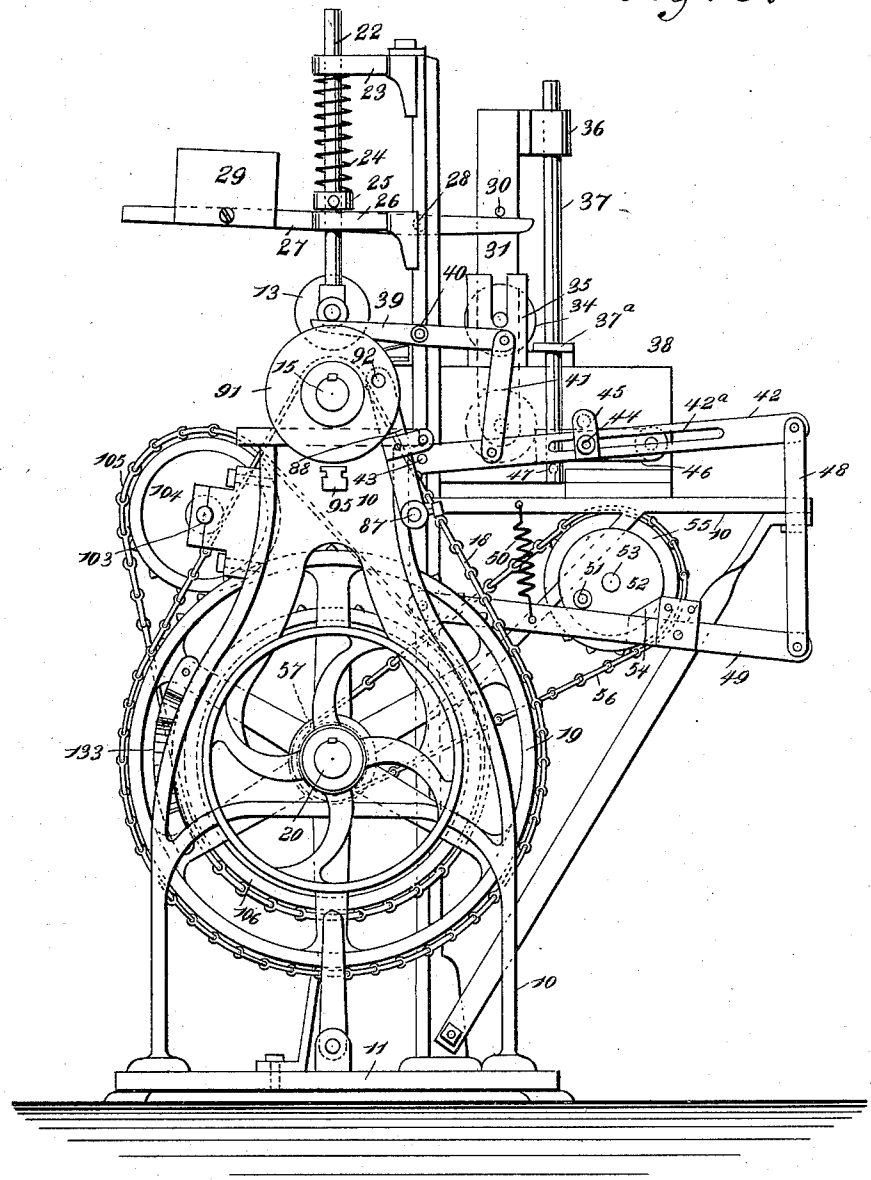
(No Model.) 7 Sheets—Sheet 3.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

Fig: 3.



WITNESSES:

Chas. Nida

W. B. Hutchinson

INVENTOR

H. E. Clark

BY Munn & Co

ATTORNEYS.

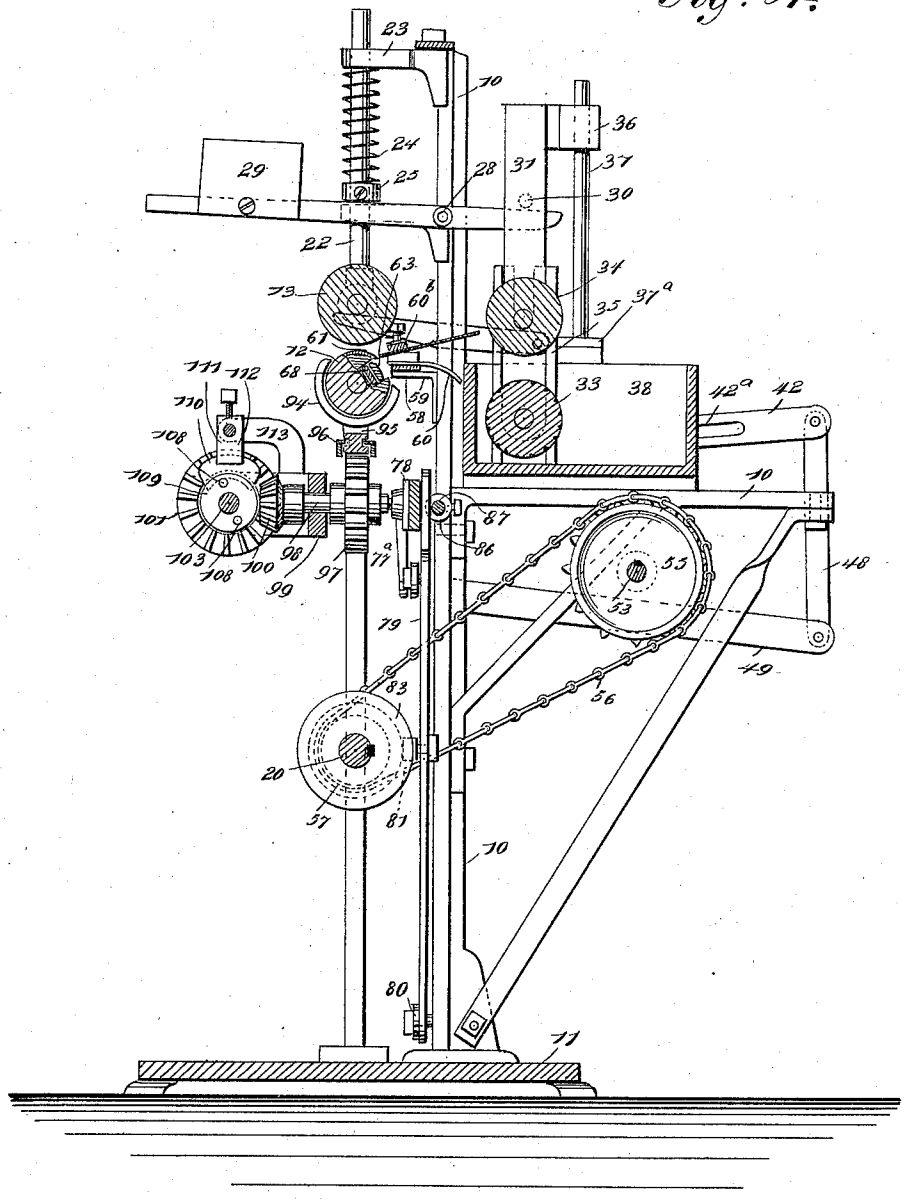
(No Model.) 7 Sheets—Sheet 4.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

Fig: 4.



WITNESSES:

Chas Nida

N. B. Hutchinson

INVENTOR

H. E. Clark

BY

Munn & Co

ATTORNEYS.

(No Model.) 7 Sheets—Sheet 5.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

Fig: 5.

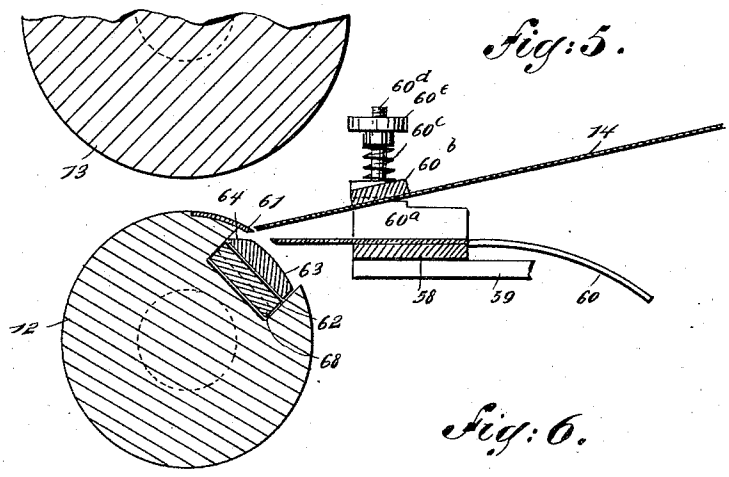


Fig: 6.

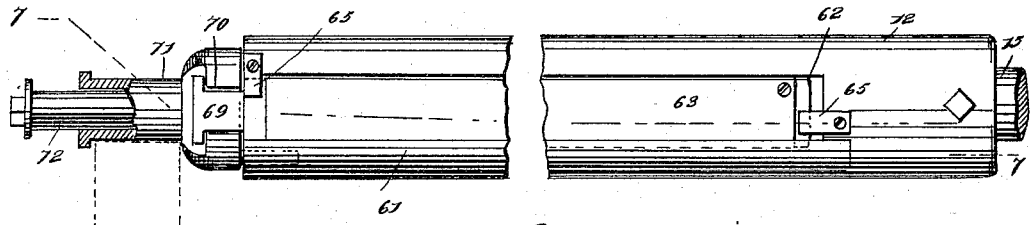


Fig: 7.

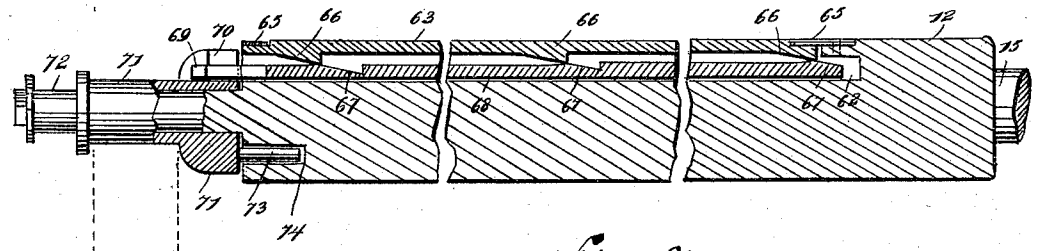
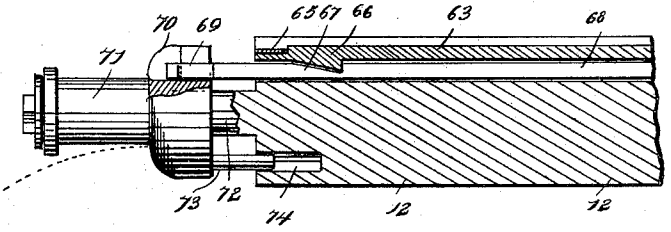
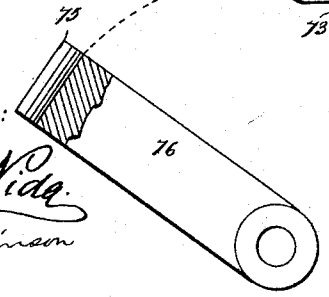


Fig: 8





WITNESSES:

Chas. Nida.

W. B. Hutchinson

INVENTOR

H. E. Clark

BY Munn & Co

ATTORNEYS.

(No Model.)

7 Sheets—Sheet 6.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

Fig. 9a.

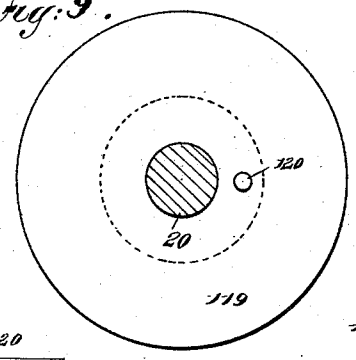


Fig. 9.

Fig. 11.

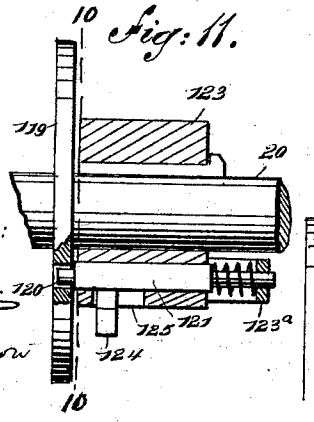
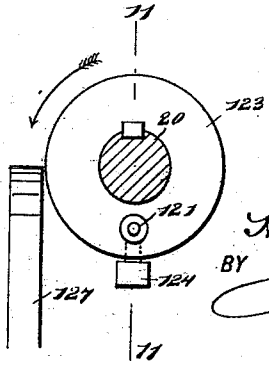


Fig. 10.



WITNESSES:

Chas. Nida.

W. B. Hutchinson

INVENTOR

H. E. Clark

BY

Munn & Co

ATTORNEYS.

(No Model.) 7 Sheets—Sheet 7.

H. E. CLARK.

TUBE FORMING MACHINE.

No. 545,053. Patented Aug. 27, 1895.

Fig: 12.

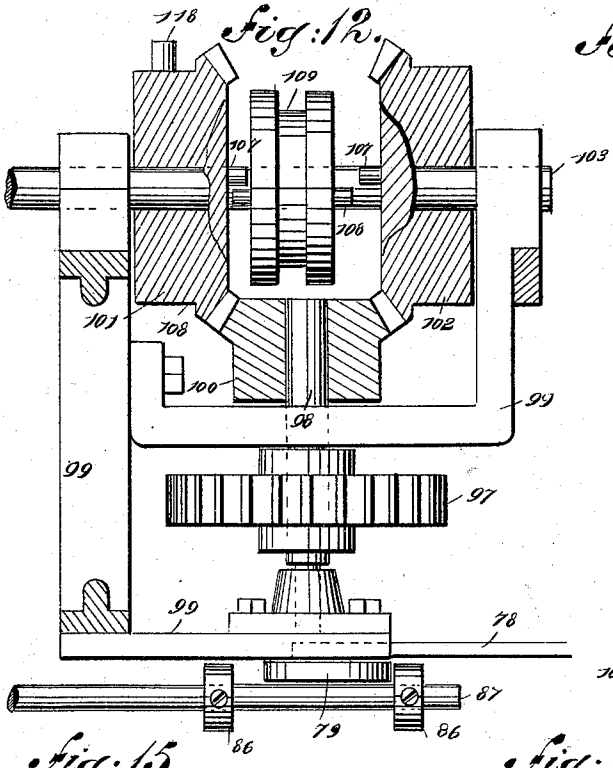


Fig: 13.

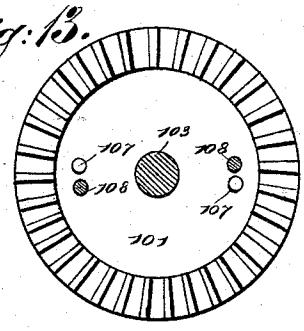


Fig: 14.

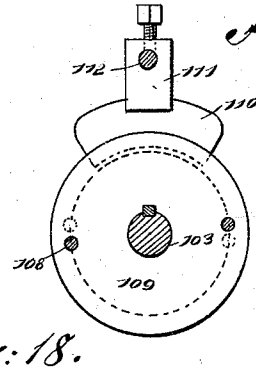


Fig: 16.

Fig: 15.

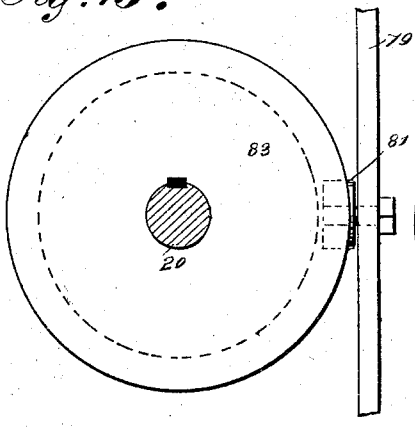
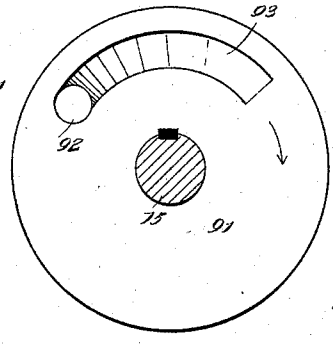
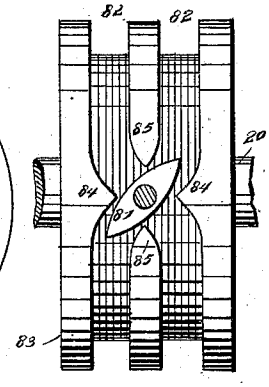


Fig: 18.





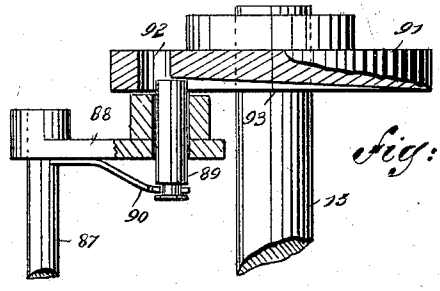


Fig: 17.

WITNESSES:

Chas. Nida.

W. B. Hutchinson

INVENTOR

H. E. Clark

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

HERBERT E. CLARK, OF NEW YORK, N. Y., ASSIGNOR TO THE UNION PAPER COMPANY, OF SAME PLACE.

TUBE-FORMING MACHINE.

SPECIFICATION forming part of Letters Patent No. 545,053, dated August 27, 1895.

Application filed September 8, 1894. Serial No. 522,459. (No model.)

To all whom it may concern:

Be it known that I, HERBERT E. CLARK, of New York city, in the county and State of New York, have invented a new and Improved Tube-Forming Machine, of which the following is a full, clear, and exact description.

My invention relates to improvements in that class of machines which are adapted for use in rolling and making tubes from paper, pasteboard, or other suitable material; and the object of my invention is to produce a practical machine which is adapted to operate very rapidly and easily, and which is arranged to take successive sheets of paper, form each sheet into a perfect roll, paste the same so that it cannot separate, and then eject automatically the formed roll from its roller.

A further object of my invention is to produce positively-working mechanism for operating the several rollers of the machine, for stopping the parts instantaneously at the right time, and for performing all the functions necessary in making a roll.

To these ends my invention consists of certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a sectional plan of the machine embodying my invention. Fig. 2 is a rear elevation of the same. Fig. 3 is an end view of the machine. Fig. 4 is a vertical cross-section on the line 4 4 of Fig. 1. Fig. 5 is a detail sectional view showing the position of the tube-forming rollers as a sheet of paper is fed to the machine. Fig. 6 is a broken plan view of the lower roller. Fig. 7 is a longitudinal section on the line 7 7 of Fig. 6, and shows the clamping mechanism for holding the paper or other material to the roller, the upper wedge-bar of the clamp being shown in a raised position. Fig. 8 is a broken detail longitudinal section of the lower roller with the clamping or wedge bars in their lowest position and with the locking-arm removed from the sleeve at the end of the roller. Fig. 9 is an enlarged detail sectional view of certain clutches on the driving-shaft which are adapted to throw the tube forming and ejecting mechanism into and out of gear. Fig. 9ª is a detail cross-section showing in elevation one of the disks of the aforesaid clutches on the driving-shaft. Fig. 10 is a cross-section on the line 10 10 of Fig. 11, and shows the arrangement of one of the clutches on the driving-shaft. Fig. 11 is a detail longitudinal section on the line 11 11 of Fig. 10. Fig. 12 is a detail sectional plan of the automatic clutch and shifting mechanism for working the tube-ejector. Fig. 13 is a cross-section showing the face of one of the gears of the clutch illustrated in Fig. 12, and showing also the interlocking pins of the said clutch. Fig. 14 is a cross-section showing the connection between the ejecting-clutch and the ejecting-rod which it operates. Fig. 15 is a detail sectional view of the cam mechanism for working the locking-arm used in connection with the tube-forming rollers. Fig. 16 is a detail sectional view showing the face of the cam-wheel and the cam illustrated in Fig. 15. Fig. 17 is a detail plan, partly in section, of the locking mechanism for stopping the tube forming and carrying roller; and Fig. 18 is a cross-section showing the face of the locking-disk shown in Fig. 17.

The machine is provided with a suitable frame 10, which is mounted on a base 11, and it is also provided with tube-forming rollers 12 and 13, arranged one beneath the other, the roller 12 being the roller to which power is applied, and to this end it is secured to a shaft 15, which is journaled in suitable bearings 16 on the machine-frame, and the shaft is driven by a sprocket-wheel 17 and chain 18, which chain connects with a sprocket-wheel 19 on the main driving-shaft 20, the connection being by means of a clutch, which will be hereinafter described. The driving-shaft is provided with a driving-pulley 20ª or with an equivalent driving device.

The upper roller 13 has its ends journaled in boxes 21, which are secured to vertically-sliding rods 22, which move in guide-arms 23, secured to the main frame, and the roller and its supporting-shafts are normally pressed downward by spiral springs 24, which are coiled around the shafts 22, beneath the arms

23, and above the collars 25, which are secured to the shafts. The shaft 22 also moves in guide-arms 26, and arranged transversely near the arms are levers 27, which are fulcrumed near the center, as shown at 28 in Figs. 3 and 4, and are provided with weights 29, which normally raise the inner ends of the levers against the pins 30 on the slide-bars 31, which carry the paste-roller 33, (see Fig. 4,) which is arranged beneath the upper paste-roller 34 and is adapted to move up and down in the paste-box 38, this being arranged in front of the tube-forming rollers 12 and 13. The slide-bars 31 move in suitable slideways 35, which are secured to the paste-box 38, and the slide-bars are connected by arms 36 with the vertically-movable posts 37, which move in guides 37^a, and which are lifted in the manner hereinafter described.

The ends of the upper roller 13 ride on tilting levers 39, (see Fig. 3,) which are fulcrumed near the center, as shown at 40, and which at their opposite ends are connected by links 41 with the vertically-swinging levers 42, which are pivoted on the machine-frame and the rise and fall of which tilt the levers 39, and when the levers 39 are pulled down at their pivoted ends the roller 13 is raised against the tension of the springs 24, and on the opposite movement of the levers the springs 24 push down the roller. The levers 42 are longitudinally slotted, as shown at 42^a, and these slots receive the pins 44, which are connected to the flanges 45 of the short arms 46, which are fulcrumed at the ends of the paste-box 38 and engage pins 47 on the sliding posts 37. It will thus be seen that when the levers 42 are raised they tilt the levers 39, so as to permit the roller 13 to be pressed into contact with the roller 12, and the levers 27 are tilted at the same time by the weights 29, so as to raise the lower paste-roller 33, and thus bring the paste against the material which is gripped by the rollers 13 and 12 and is drawn between the rollers 33 and 34. Thus it follows that the rollers 13 and 33 are simultaneously but oppositely moved, so that the paste is applied at the right time and the paste-roller is dropped when the roller 13 is raised, so that no paste is misapplied. The material to be formed into tubes is drawn between the paste-rollers 33 and 34, and as the paste-roller 33 is frequently dipped into the paste of the paste-fountain it raises sufficient pasts to smear the under side of the material, so that when the latter is rolled on the roller 12 it is stuck together to form the tube. When the lower paste-roller is raised, the counterbalances 29 hold it up. On the reverse movement of the levers 42 the posts 37 are pulled down and the levers 39 and 27 actuated, so as to again raise the roller 13, which movement occurs at the completion of a tube. The movement of the levers 42 is effected by means of the connecting-rods 48, which are pivoted to their outer ends, and the vertically-moving levers 49, which are fulcrumed on the machine-frame beneath the levers 42, and are also pivoted to the connecting-rods 48. The levers 49 are normally raised by springs 50, (see Fig. 3,) and they are moved against the springs by rollers 51 on the disks 52, which are secured to the shaft 53, this being journaled on the frame beneath the paste-box; and in order that the rollers 51 may depress the levers 49 at the proper moment the said levers are provided with cam-blocks 54 to engage the said rollers. The shaft 53 is provided with a sprocket-wheel 55, which is driven by a chain 56, connecting with a sprocket-wheel 57 on the driving-shaft 20. It will thus be seen that each rotation of the shaft 53 will actuate the lever mechanism above described and raise and lower the rollers 13 and 33.

The paper is fed to the upper roller through a guide, (shown best in Fig. 5,) which has a bottom plate 58, supported on brackets 59, and is provided with a bottom guide-plate 60. This plate has upturned flanges 60^a at the ends, and above the plate is an inclined top plate 60^b, which is pressed downward by spiral springs 60^c, coiled around the studs 60^d on the ends of the plate 60^b, which studs move through suitable guides 60^e. The top plate 60^b carries a broad guide-plate 14, and the springs 60^c, which press downward on the top plate, are light and permit the top plate to rock slightly, so as to fit nicely against the material which is fed beneath it. Any other suitable guide may be used, however, without departing from the principle of the invention.

The paper when fed to the roller 12 is held beneath a clamping-plate 61, which overlaps a longitudinal recess 62 on the roller, (see Figs. 5 to 8,) and the paper is clamped between the said plate 61 and the beveled edge 64 of the outer clamping-bar 63, which is normally pressed inward by flat springs 65, which are secured to the roller and overlap the clamping-bar, and the bar has on its inner side a series of wedges 66, which engage similar wedges 67 on the inner clamping or wedge bar 68, which is arranged in the recess 62 parallel with the bar 63, and the inner clamping-bar projects from one end of the roller 12 and terminates in a head 69, which is held in a recess 70 of the sleeve 71, which sleeve slides on the reduced end 72 of the roller 12 and is provided with a guide-pin 73, which enters a hole 74 in the end of the roller.

The sleeve 71 is actuated by the socketed end 75 of the bearing-arm 76, and when this arm is thrown upward into engagement with the sleeve it pushes the sleeve inward, and the latter pushes in the clamping-bar 68, the wedges 67 of which, acting on the wedges 66 of the outer clamping-bar 63, force the latter outward and cause it to impinge on the paper which is thrust between it and the plate 61, and the paper is thus bound firmly between the bar and the plate. When the bearing-arm 76 is thrown into the position described,

it also serves as a support for the end of the roller 12. The bearing-arm 76 is provided with a pivot-pin 77, which is journaled on the frame 10, (see Fig. 2,) and the pivot-pin has a crank 77^a, which connects with a rod 78, extending longitudinally beneath the machine, and the rod is pivoted to the upper end of a lever 79, which is arranged vertically and is pivoted at the bottom, as shown at 80.

The lever 79 has pivoted on it a cam 81, which is pointed at the ends, as shown in Fig. 16, and this cam enters the cam-grooves 82 of the cam-wheel 83, and the outer walls of these grooves are curved inward at opposite points, as shown in the figure referred to, while the middle wall between the grooves is at this place broken, as shown at 85, and thus the cam following the walls of the grooves is made to enter first one and then the other, so that in this way the lever 79 is operated, the connecting-rod 78 reciprocated, and the bearing-arm 76 moved back and forth, as already described.

The upper end of the lever 79 projects between collars 86 on the rod 87, which is preferably movable and slides in suitable supports, this rod having at one end an arm 88, (see Figs. 2, 3, and 17,) and in this arm is a sliding pin 89, which is pressed by a spring 90 against a disk 91 on the shaft 15, which carries the tube-forming roller 12, and in this disk is a groove 93, adapted to register with the pin 89 and merging in a hole 92 to receive the pin, so that when the pin enters the hole the disk 91, shaft 15, and tube-forming roller 12 are instantly stopped, which stoppage occurs at the instant that the tube is formed. The return stroke of the lever 79 removes the pin 89 and permits the turning of the shaft 15. The pin 89 is intended merely to stop the shaft 15 from turning by inertia, as the shaft is thrown out of gear at the same instant the pin 89 engages the disk, as will appear from the description to follow.

After each tube is formed and the bearing-arm 76 is thrown down to the position shown in Fig. 2 the tube is pushed endwise from the roller 12 by a fork 94, which has a shank in the form of a rack-bar 95, (see Fig. 4,) which rack-bar slides in a suitable guideway 96 and is reciprocated by a gear-wheel 97, which is carried by a shaft 98, journaled in a bracket 99 and having at one end a beveled pinion 100, by which it is driven. The pinion 100 meshes with pinions 101 and 102, both being loose on the shaft and being alternately thrown into gear, as will presently appear.

The shaft 103 is provided with a sprocket-wheel 104, driven by a chain 105, connecting with a sprocket-wheel 106 on the main driving-shaft 20. The pinions 101 and 102 have each on their inner sides and diametrically opposite one another pins 107, which are adapted to interlock with pins 108 on a clutch-sleeve 109, which is keyed to the shaft 103, but is slidable thereon, and when the pins of the clutch-sleeve engage the pins of the pinion 101 the pinion 100, gear-wheel 97, rack-bar 95, and ejecting-fork 94 are moved in one direction, and when the pins of the clutch-sleeve are in engagement with the pin of the pinion 102 the aforesaid parts are turned in the opposite direction, being moved by the pinion 102, and so by shifting the clutch-sleeve the rack-bar 95 and fork 94 are reciprocated. The clutch-sleeve 109 is moved by a shipping-blade 110, which has a shank 111 fastened to a slide-rod 112; which is parallel with the shaft 103 and slides in supports 113. The slide-rod 112 is connected by a slide 114 with the lever-plate 115, which lies flatwise on a suitable support and is pivoted, as shown at 116 in Fig. 1, and this lever-plate has a laterally-projecting curved arm 117, which extends into the path of a stud 118 on the hub of the gear-wheel 101. It will be seen, then, that when the gear-wheel 101 revolves the stud 118, striking the arm 117, will shift the plate 115 in one direction, and thus slide the rod 112, move the sleeve 109, and throw the sleeve into gear with the pinion 102, thus reversing the direction of the pinion 100, and at the next revolution of the pinion 101 it moves in the reverse direction and strikes the arm 117, so as to move it and the lever-plate back, so as to move the clutch-sleeve again into engagement with the pinion 101, and in this way the pinions are alternately thrown into and out of gear and the rack-bar 95 reciprocated, so as to move the ejecting-fork 94, as indicated.

Attached to the ejecting-fork 94 is a cable 1, which extends nearly parallel with the tube-forming roller 12 and beyond one end of the roller, this cable being mounted upon the hub of a grooved roller 2, which is journaled on a bracket 3 at the end of the machine and is arranged horizontally, while the free end of the cable has attached to it a weight 4. The weight takes up the slack of the cable 1 when the ejecting-fork is moved forward to push a tube off the roller 12, and when the fork moves back it pulls on the cable 1 and turns the roller 2 outwardly, so that the tube which is ejected from the roller 12 is caught by the roller 2 and carried out of the way.

The main sprocket-wheels 19 and 106 on the driving-shaft 20, which, as has been already described, drive, respectively, the tube-forming roller 12 and the ejecting mechanism of the roller, are loose on the driving-shaft, and each is provided with a disk 119, (see Figs. 2 and 9,) which disk has a hole 120 in it adapted to engage the slide-bolt 121, which is pressed into engagement with the said disk by a spring 122, which is arranged between the pulley 123 which carries the spring-bolt and a bracket 123^a on one end of the pulley. Each pulley 123 is rigidly secured to the shaft 20, and consequently when the spring-bolt in the pulley enters the disk 119 it locks the disk and its sprocket-wheel to the shaft.

Each spring-bolt is provided with a contact-block 124, which is secured to it and extends outward through a slot 125 in the pulley 123

and into the path of the inclined upper end 126 of a shipping-arm 127, which is secured to a slip-shaft 128, held in a suitable support 129, as shown clearly in Fig. 9. The two shipping-arms 127 are connected by a rod 130, which moves in a guide 131, and the slip-rod has near opposite ends upwardly-extending arms 132, which are adapted to be struck by the cams 133 on the sprocket-wheels 19 and 106. It will be seen, then, that the clutch arrangement just described provides for alternately moving the tube-forming roller and the ejecting mechanism. This will be understood by reference to Fig. 9, which shows one slide-bolt 121 in engagement with the disk 119 of the sprocket-wheel 106. As this wheel continues to revolve the inclined end 136 of one of the shipper-arms 127 engages the block 124 and releases the spring-bolt 121, while the opposite spring-bolt will move into engagement with the disk 119 of the sprocket-wheel 19, and the cam 133 of the said sprocket-wheel 19 will strike one of the arms 132 and move the shipping-arms 127, so as to move one of the said arms into the path of the block 124 of the second spring-bolt, and when the sprocket-wheel 19 has made a revolution the above action is repeated, but in the reverse direction, and the shipper is moved by the cam 133 of the sprocket-wheel 106 striking against the arm 132 of the shipper.

In operating the machine a sheet of paper or other material is fed between the rollers 33 and 34, over the guide-plate 58, and against the roller 12. The inner edge of the paper is clutched by the clamping mechanism on the roller 12, as already described, and as the roller rotates it winds the paper about it, while at the time the first turn is made the pasting-rollers will bear against the paper so as to apply the paste thereto, and the continuation of the process causes the parts of the paper to stick together so as to form a tube. At this point the rollers will be separated in the manner already described in detail, the roller 12 will be stopped short by the stopping mechanism illustrated in Fig. 7 and already described, while the locking-arm 76 will be thrown down, as specified, and the fork 94 will be thrown forward so as to push the tube from the roller. The parts are all returned to position, as clearly described above, and the machine is ready for another operation.

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

1. A tube-forming machine, comprising oppositely arranged tube-forming rollers, one having a clamping device thereon, a pair of pasting rollers adjacent to the tube-forming rollers, and mechanism for automatically separating the pairs of rollers, substantially as described.

2. A tube forming machine, comprising a tube forming roller, having a clamping device thereon, a bearing roller opposite the tube forming roller, spring-pressed arms carrying the boxes of the bearing roller, a lever mechanism for automatically raising the arms, a pair of separable pasting rollers arranged opposite the tube-forming and bearing rollers, weighted levers to move one of the pasting rollers in its bearings, and an operative connection between the weighted levers and the bearing roller shifting mechanism whereby the movable bearing roller and the movable pasting roller are simultaneously but oppositely moved, substantially as described.

3. A tube-forming machine, comprising a revoluble tube roller, a clamping device thereon, a second roller opposite the tube roller and moving in relation thereto, a guide in front of the tube roller, pasting rollers movable in relation to each other and arranged in front of the guide, and a lever mechanism for moving each pair of rollers in relation to each other, substantially as described.

4. The combination, with the tube roller, of the bearing roller above it, the pasting rollers one mounted in stationary and the other in vertically movable bearings, the spring-pressed shafts carrying the bearing tube roller, slide bars carrying the journals of the pasting roller, and levers and counterbalances for simultaneously moving the bearing roller and one of the pasting rollers, substantially as described.

5. In a tube-forming machine, the combination with the longitudinally recessed tube roller having a plate overlapping the said recess, of a clamping bar held in the recess and provided at intervals throughout its entire length with wedges, a second bar held behind the clamping bar and provided with wedges to engage those of the clamping bar, and means for longitudinally moving the inner bar, substantially as described.

6. The combination, with the tube roller having a longitudinal recess therein and the plate or jaw overlapping the said recess, of the spring-pressed clamping bar adapted to impinge on the jaw or plate and provided with wedges on its inner side, a second clamping bar arranged behind the first and provided with wedges to engage those of the outer clamping bar, and a sleeve slidable on a reduced end of the roller and adapted to engage the inner clamping bar, substantially as described.

7. The combination, with the tube roller, having a longitudinal recess, a reduced end and a plate or jaw overlapping the recess, of the outer and inner clamping bars in the said recess, means for forcing the bars outward by the longitudinal movement of the inner bar, the sleeve on the reduced end of the roller, the said sleeve being connected with the inner bar, and the swinging bearing arm adapted to engage the sleeve, substantially as described.

8. The combination with the tube roller and the clamping device and ejecting mechanism thereon, of the swinging bearing arm ar-

ranged near the end of the roller to work the clamping device, the double grooved cam wheel on the driving shaft of the machine, the cam lever having a cam arranged to alternately enter the grooves of the cam wheel, and an operative connection between the cam lever and the bearing arm, substantially as described.

9. The combination, with the tube roller and its ejecting mechanism, of a second roller near the end of the tube roller journaled at right angles to the tube roller, and means for rotating the second roller by the movement of the ejecting mechanism, substantially as described.

10. The combination with the tube roller and the ejecting fork, of the rack bar forming the shank of the fork, the gear wheel meshing into the rack bar, and an automatically reversing clutch controlling the movement of the gear wheel, substantially as described.

11. The combination, with the ejecting fork and its rack bar, of the pinion geared to the rack bar, a countershaft, oppositely arranged pinions loose on the countershaft and geared to the shaft of the first pinion, a clutch sleeve keyed to the countershaft to slide between the pinions, interlocking pins on the clutch sleeve and the pinions on the countershaft, and automatic mechanism for shifting the clutch sleeve at each revolution of the countershaft, substantially as described.

12. The combination, with the ejecting fork and its rack bar, of the pinion geared to the rack bar, the countershaft, the oppositely arranged pinions loose on the countershaft and geared to the shaft of the first pinion, a clutch sleeve slidable on the countershaft, interlocking pins on the clutch sleeve and the pinions near it, a slide rod connected with the clutch sleeve, a movable lever plate to move the slide rod, and a stud on one of the pinions of the countershaft to engage the lever plate, substantially as described.

13. The combination, with the tube-forming roller, the ejecting mechanism and the driving shaft, of sprocket wheels loose on the driving shaft and connected respectively with the tube-forming roller and the ejecting mechanism, a clutch device to lock the sprocket wheels to the driving shaft, a shipper to release the clutches, and cams on the sprocket wheel to work the shipper, substantially as described.

14. The combination, with the tube-forming and ejecting mechanisms, of the driving-shaft, the sprocket wheels loose on the shaft and connected respectively with the said mechanisms, pulleys rigid on the driving shaft, slide bolts mounted in the pulleys to engage the sprocket wheels, a shipper having arms to engage and release the slide bolts and striking arms to move it, and cams on the sprocket wheels to engage the striking arms of the shipper, substantially as described.

HERBERT E. CLARK.

Witnesses:
LEWIS L. PIERCE,
CHAS. G. DALE.