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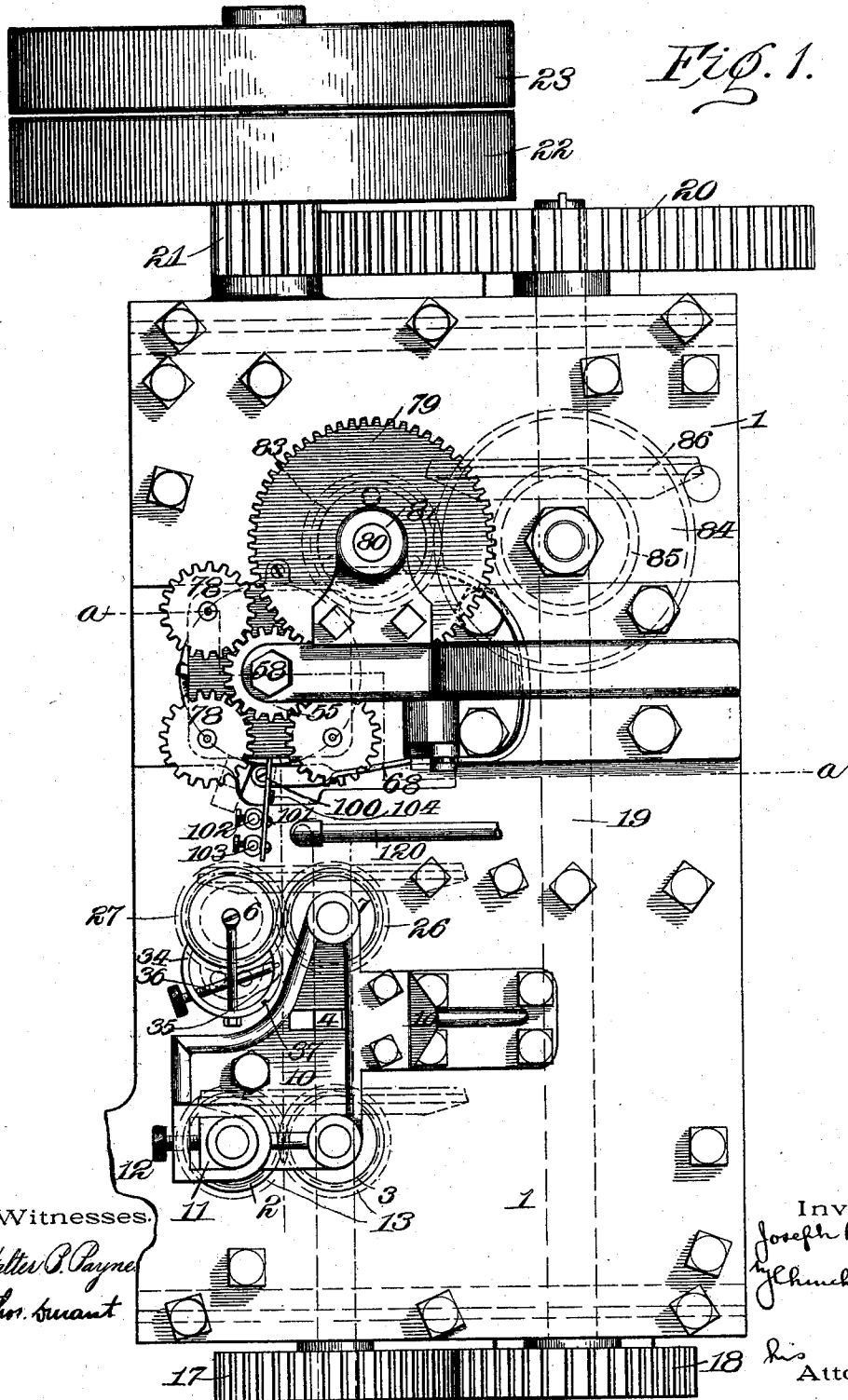
Patented Apr. 10, 1900.

J. B. MILLER.
PAPER TUBE MACHINE.

(Application filed July 24, 1899.)

(No Model.)

5 Sheets—Sheet 1.



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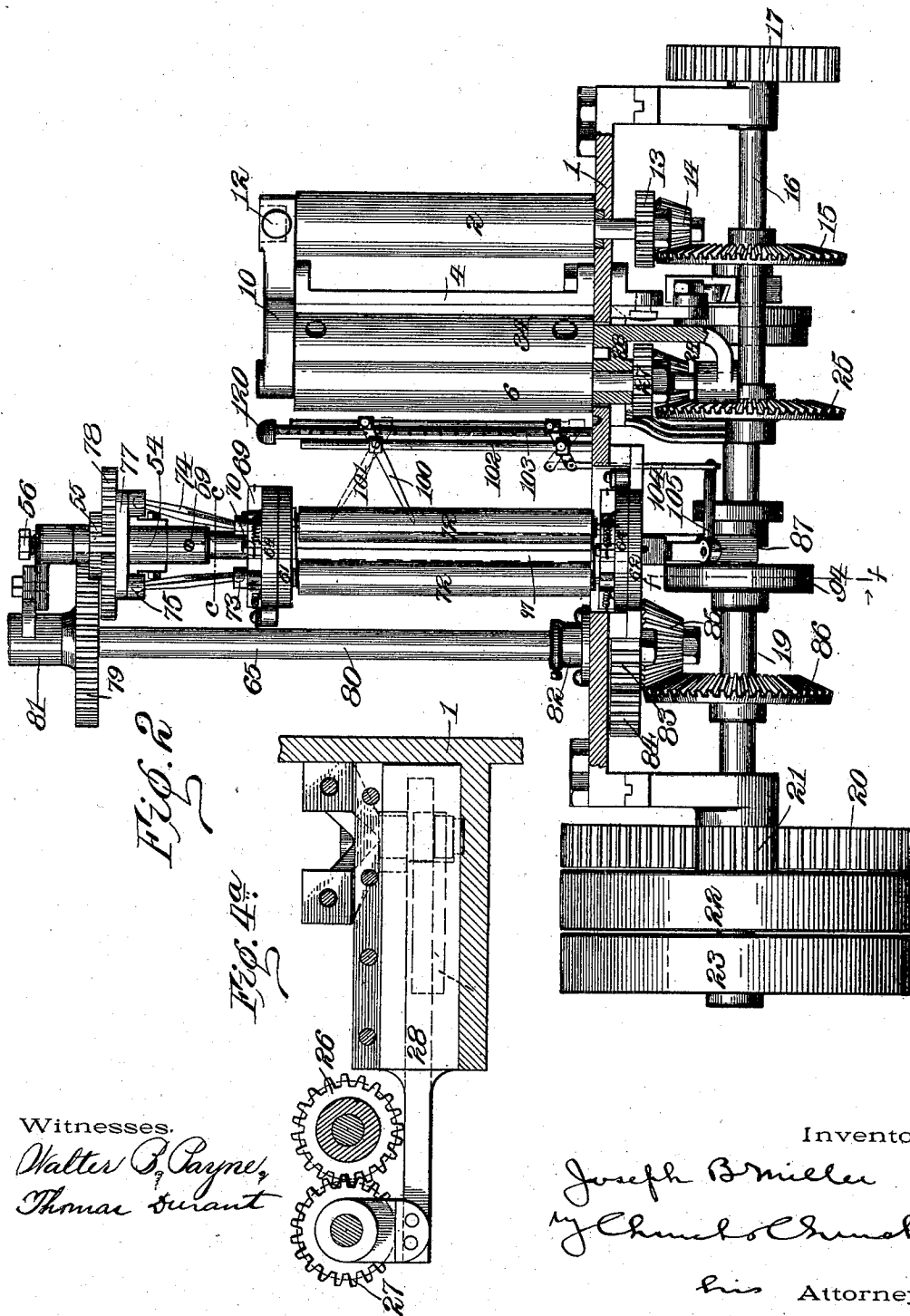
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Witnesses.

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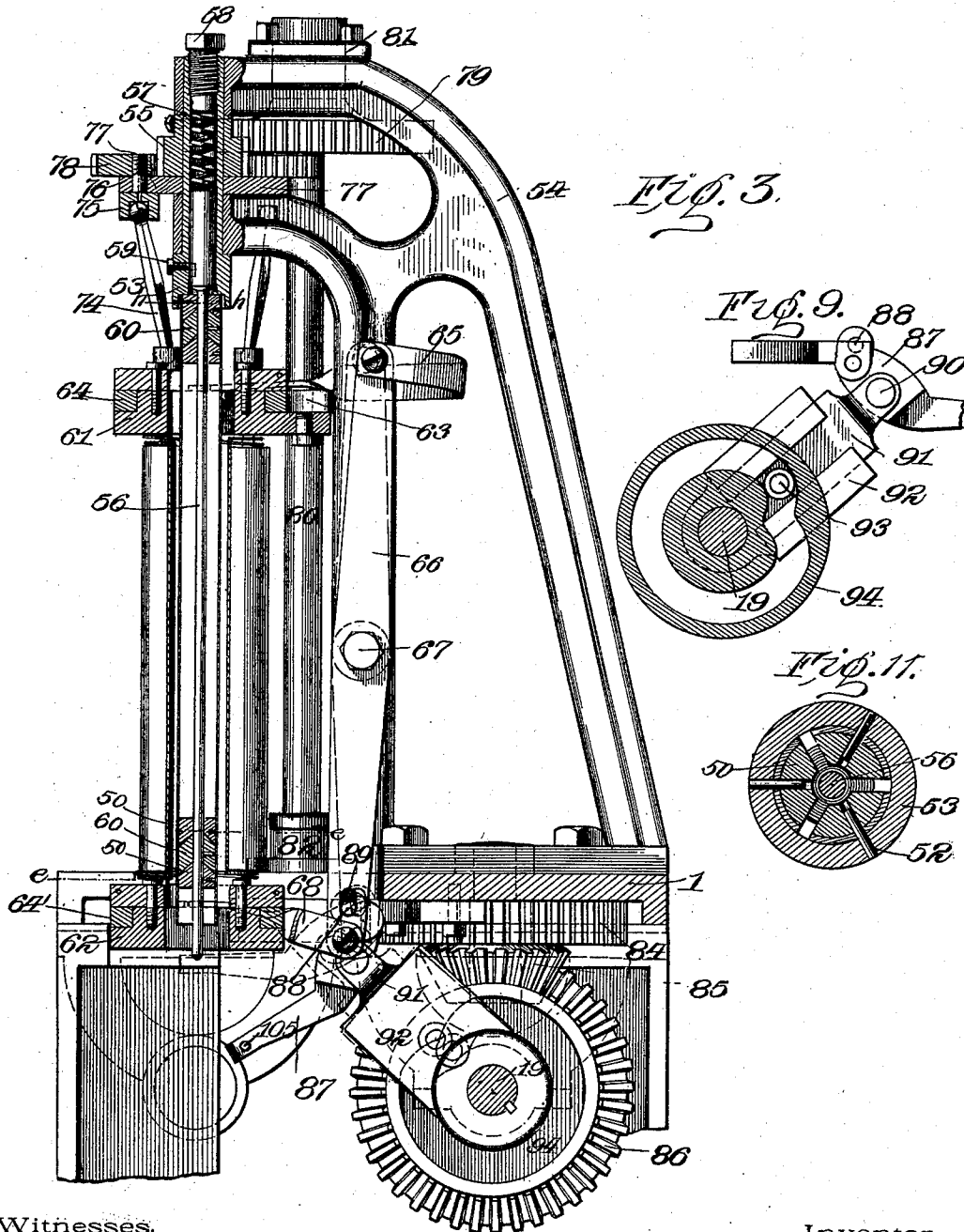
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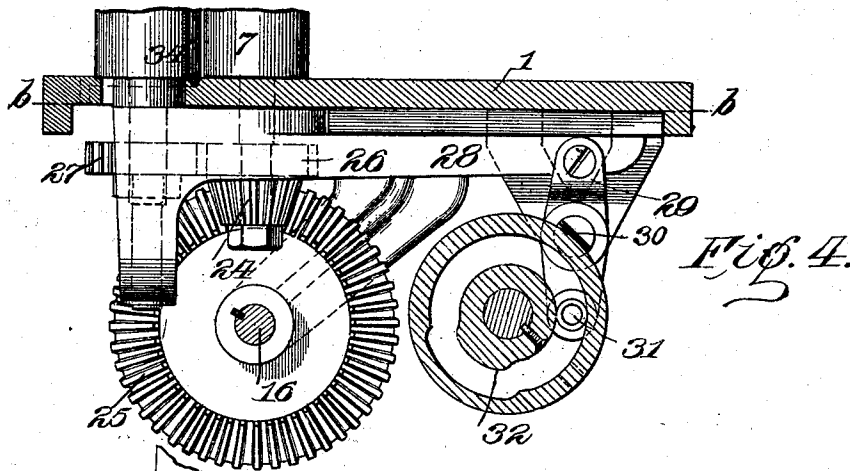
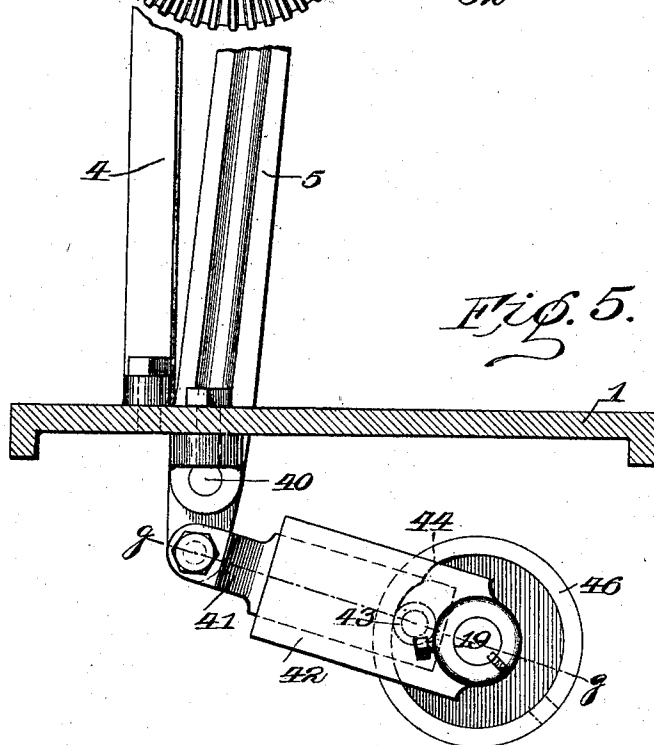
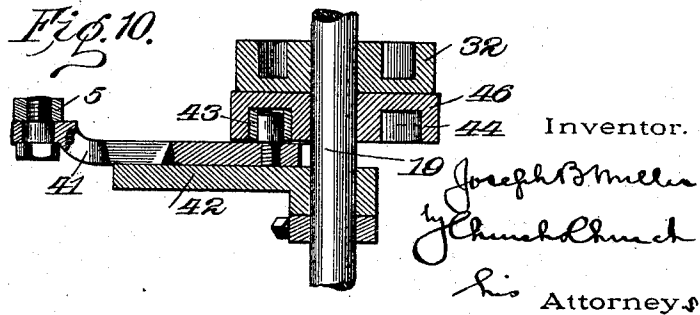
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5 Sheets—Sheet 4.



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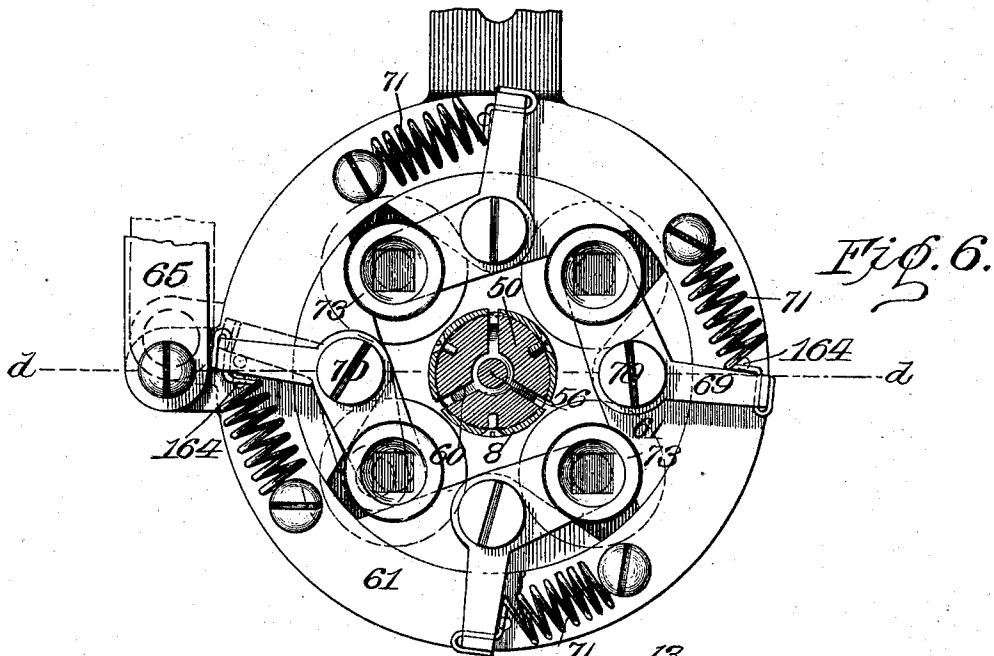
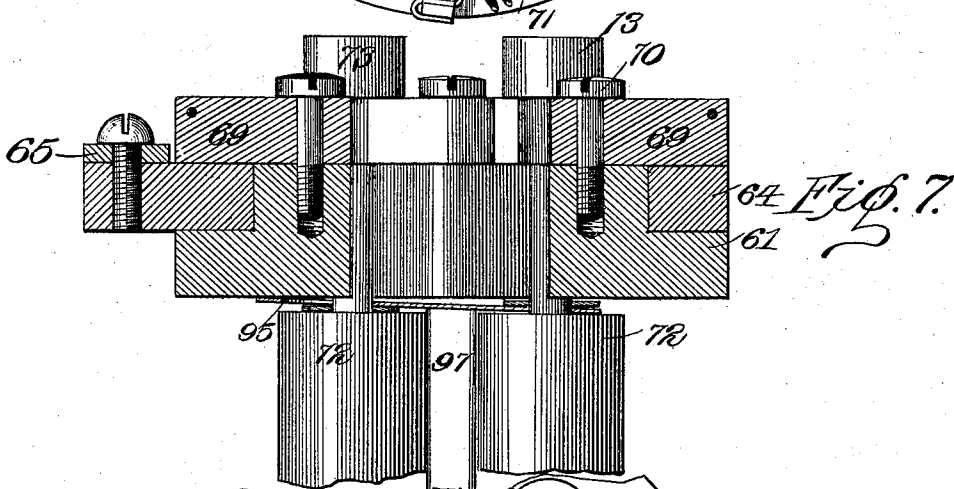
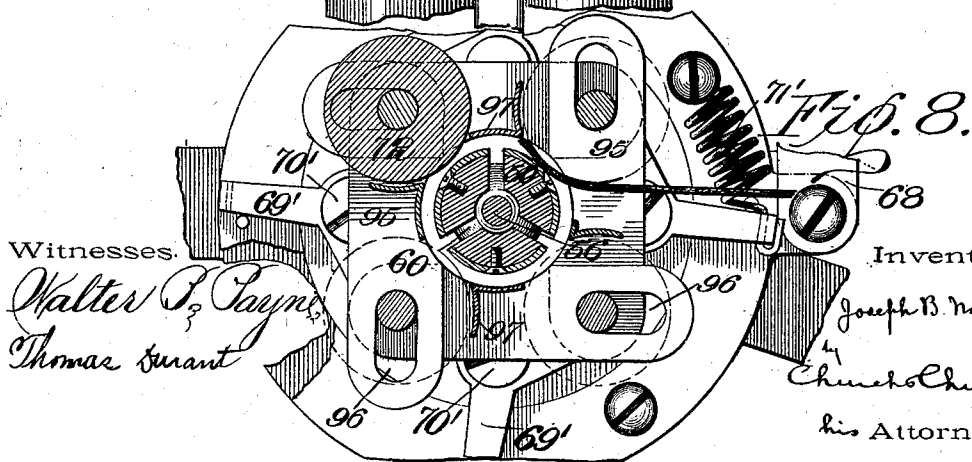
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5 Sheets—Sheet 5.



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UNITED STATES PATENT OFFICE.

JOSEPH B. MILLER, OF SENECA FALLS, NEW YORK.

PAPER-TUBE MACHINE.

SPECIFICATION forming part of Letters Patent No. 647,234, dated April 10, 1900.

Application filed July 24, 1899. Serial No. 724,974. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH B. MILLER, of Seneca Falls, in the county of Seneca and State of New York, have invented certain new and useful Improvements in Paper-Tube Machines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the reference-numerals marked thereon.

My present invention has for its object to provide an improved machine for manufacturing tubes composed of paper or similar material adapted to contain drawings or for use in the manufacture of fireworks, whereby said tubes may be expeditiously and cheaply constructed in quantity, the material, as cardboard, being fed to the machine from a continuous web or strip and the separate tubes rolled and pasted being delivered from the machine ready for use.

To these ends the invention consists in certain improvements hereinafter described, the novel features being pointed out in the claims at the end of this specification.

In the drawings, Figure 1 is a plan view of a machine constructed in accordance with my invention; Fig. 2, a side elevation of the same with a portion of the bed-plate broken away; Fig. 3, a vertical sectional view on the line *a a* of Fig. 1; Fig. 4, a similar view showing the devices for intermittently operating the pasting device; Fig. 4^a, a sectional view on the line *b b* of Fig. 4; Fig. 5, a vertical sectional view showing the means for operating the paper-severing device; Fig. 6, a horizontal sectional view taken on the line *c c* of Fig. 2; Fig. 7, a sectional view taken on the line *d d* of Fig. 6; Fig. 8, a sectional view taken on the line *e e* of Fig. 3; Fig. 9, a horizontal sectional view taken on the line *f f* of Fig. 2; Fig. 10, a sectional view taken on the line *g g* of Fig. 5; Fig. 11, a sectional view taken on the line *h h* of Fig. 3.

Similar reference-numerals in the different figures indicate similar parts.

The main frame of the machine embodies a suitable table or plate 1, supported upon suitable legs or otherwise and upon which all of the operating parts are secured, said operating parts embodying generally feeding

devices consisting in the present instance of two vertically-arranged rollers 2 and 3, between which the paper web passes, a suitable web-severing device in the present embodiment in the form of a stationary cutter-blade 4 and a movable operating shearing-blade 5, the paste-applying device embodying a pair of rollers 6 and 7, the former carrying the paste and the latter cooperating therewith, said rollers being preferably brought into contact with the paper to apply paste thereto intermittently, and lastly the tube-forming device, embodying a collapsible mandrel and rollers 72, arranged around it.

The feed-rollers 2 and 3 extend vertically from the bed-plate 1, their upper ends being supported in suitable bearings formed in an upwardly-extending bracket 10, and the roller 2 being preferably mounted in movable boxes 11, adjustable by set-screws 12. At the lower ends the rollers are provided with intermeshing gears 13, which cause them to be operated at the same surface speed. The roller 3 is also provided with a beveled pinion 14, meshing with a larger pinion 15 upon a shaft 16, supported beneath the base-plate. The shaft 16 is provided at its end with a gear 17, meshing with a corresponding gear 18 on a shaft 19, extending parallel with the shaft 16 and having at its opposite end a large gear 20, meshing with a pinion 21, secured to a belt-driving pulley 22, beside which latter is a loose pulley 23.

The devices for severing the web of paper or cardboard embody the stationary knife 4, secured at its lower end to the bed-plate 1 and at its upper end to the bracket 10, and the movable blade or knife 5, pivoted at 40 to a bracket arranged on the under side of the table 1 and pivoted at its lower end to a slide 41, operating in a guide 42, loosely sleeved upon the shaft 19, the inner end of the slide 41 being provided with a stud or roller 43, adapted to cooperate with a cam-surface 44, formed in the inner periphery of a wheel 46, secured to and rotating with the shaft 19. The construction of the cam and the slide is such that the blade 5 will be moved to cooperate with the blade 4 to sever the paper by a quick movement during the rotation of the wheel 46, the cooperating blades being held normally separated, as shown in Fig. 5, by the concentric portion of the cam-groove.

This construction of severing device gives a shear cut of such short duration as not to interfere with the proper operation of the machine; but it may be replaced by any suitable web-severing device, as will be understood by those skilled in the art.

The roller 7, with which the paste-applying roller 6 coöperates, is mounted near its lower end in a bearing formed in the base-plate 1 or beneath it, and its upper end is journaled in the bracket or frame 10, as shown in Fig. 1, and it is also provided with a beveled pinion 24, meshing with a gear 25, secured to the shaft 16, so as to be driven from the latter, and is further provided with a pinion 26, meshing with a corresponding pinion 27, arranged upon the arbor of the paste-roller 6, so as to drive the latter at the same surface speed. The lower end of the paste-roller 6 is journaled in the bracket 28, sliding laterally of the main frame and toward and from the roller 7, the lower end of said arbor being stepped in the bracket or frame 28, (shown in Fig. 2,) which slides in suitable ways in the under side of the base-plate 1 and is moved toward and from the roller 7 by means of a lever 29, pivoted at 30 and having at its lower end a small stud or roller 31, operating in a grooved cam-wheel 32, mounted on the shaft 19. (See Fig. 4.)

The groove in the cam-wheel embodies two parts, both preferably concentric with the shaft, but arranged at different distances from the latter, so that during the greater portion of the rotation of the cam the rollers 6 and 7 will be close together to apply paste to the paper and during a small portion of the time will be separated and be held apart to prevent contact with the paper for a purpose to be described. The paste-receptacle is supported upon and carried with the slide or bracket 28 and in the present instance embodies a segmental casing 34, having its edges in contact with the roller 6, the inner edge 35 being capable of adjustment by means of a screw 36 to regulate the amount of paste carried out of the receptacle by said roller 6. This movable edge 35 is preferably formed by cutting a groove 37 in the spring metal of which the paste-receptacle 34 is composed. The teeth upon the gears 26 and 27 on the rollers 7 and 6, respectively, are of sufficient length so that notwithstanding the fact that the rollers may be separated to prevent the application of paste to the paper moving between them said gears will not be out of mesh.

The object of causing the momentary separation of the paste-rollers is to prevent the application of paste to the end of the web of paper which is first wrapped around the forming-mandrel, so that the first one or two convolutions will not have paste applied to their surface, and thereby the paper will be prevented from sticking to the mandrel and thereby preventing the proper operation of the machine, and more particularly the removal of the completed tubes from the mandrel.

The tube-forming mandrel is composed of a series of segmental plates or sections 8, three being preferred, and each is provided near its ends with a pair of conical segmental blocks or sleeves 50 and the whole forming, in effect, a tube provided near each end with a pair of collars or sleeves, the adjacent surfaces of said collars being inclined in the same direction and the tubes and sleeves being divided longitudinally into three (or more) parts, which are movable radially toward and from the center of the mandrel thus formed to collapse or expand the latter. The upper ends of the mandrel-sections 8 are connected by radially-extending pins 52 with a sleeve or tubular arbor 53, journaled in the upper forked end of a bracket or frame 54, extending vertically from the table 1, (see Fig. 3,) a gear 55, located between the frame-fork and secured to the sleeve, preventing longitudinal movement in said frame.

56 indicates a spindle or rod extending longitudinally through the mandrel and having its upper end enlarged to fit in the arbor 53, and above said end is arranged a spring 57, operated upon by a screw or bolt 58, the downward movement caused by said spring being limited by a set-screw 59, passing through the side of the arbor and entering a slot formed in the end. Secured upon the spindle 56, and preferably near the ends, are conical collars or rings 60, arranged between the pairs of blocks 50 on the mandrel-sections, these parts being so constructed and arranged that a movement of the spindle downward caused by the spring 57 will contract or collapse the mandrel and a movement in the other direction will expand it, all as shown in Fig. 3.

61 62 indicate annular plates, the former surrounding the mandrel at its upper end and the latter at the lower end, but both having a space between the inner sides and said mandrel, the plate 61 being bolted to an arm 63, extending from the vertical bracket 54, and the plate 62 being secured to the under side of the bed-plate 1, as shown in Figs. 2 and 3. The upper portions of the plates 61 and 62 are fitted to receive rotary rings 64 64', sliding on the central boss thereof, as shown, the upper ring 64 being connected by a curved link or arm 65 to the upper end of a lever 66, pivoted at 67 on the main frame, while the lower end of the lever is connected by a curved link 68 with the lower ring 64'. The links 65 and 68 are arranged upon opposite sides of the rings, so that as the lever 66 is turned on its pivot the rings will be rotated in the same direction.

69 69' indicate arms or levers (four being shown in the present instance) pivoted by bolts 70 70' upon the central portion of the ring-supports 61 and 62 and connected at their outer ends by springs 71 71' with the movable rings 64 64'. (Shown particularly in Figs. 6, 7, and 8.) The rings are also provided with stop-pins 164, adapted to contact with the ends of the levers or arms 69, so that

as the rings are rotated in one direction the pins will move the levers positively, as in dotted lines in Fig. 6. Journaled in the inner ends of the arms or levers 69 69' are small rollers 72, (four being shown,) constituting an expansible former around the mandrel and adapted when the rings 64 64' are rotated by the links 65 and 68 in one direction to be moved away from the mandrel and when the rings are moved in the other direction to be moved by the springs and the levers toward the mandrel to compress the convolutions of the paper or cardboard upon the latter when it is rotated, and the springs will yield to compensate for the increase in the size of the paper tube. The upper ends of the rollers 72 are provided above the levers 69 with angular sockets 73, in which are arranged the heads of connecting-spindles 74, angular in cross-section, but rounded on the ends, the upper ends of said spindles being similar to the lower ends and operating in sockets 75, connected to bolts 76, journaled in a plate or disk 77, secured rigidly to the standard 54. These bolts 76 have secured upon their upper ends pinions 78, meshing with the gear 55 on the sleeve or arbor 53, the construction being such that as the arbor is rotated to wind the paper upon the mandrel the rollers 72 will also be rotated in the same direction and at approximately the same surface speed. The gimbal-joint connection between the pinions 78 and the rollers permits the movement of the rollers 72 radially of the mandrel without disconnection of the parts. The teeth of the gear 55 are broader than the pinions 78, and they are adapted to be engaged by a gear 79, mounted upon the upper end of a shaft 80, journaled in a bracket 81 on the standard 54 and also in a bracket 82, mounted on the bed-plate 1, the lower end of said shaft being provided with a pinion 83, meshing with a horizontally-rotating gear 84, provided with a connecting beveled pinion 85, meshing with the beveled pinion 86 on the shaft 19, as shown in Figs. 1, 2, and 3.

87 indicates an arm having a pin 88 at its upper end operating in a slot 89 in the lower end of the lever 66 and pivoted at 90 upon the end of a slide 91, operating in a box or guide 92, loosely sleeved upon the shaft 19, said slide being provided with a stud or roller 93, operating in the groove of a cam-wheel 94, rigidly secured on the shaft 19. The inwardly-projecting portion of the cam-groove operates to draw the slide 91 toward the shaft to the position shown in Fig. 3, thereby withdrawing the lower end of the arm 87 from contact with the spindle 56 in the mandrel, allowing the mandrel to be collapsed by the longitudinal movement of said spindle caused by the spring and at the same time turning the lever 66 to rotate the rings 64 and 64' to separate the pressing-rollers 72 from the mandrel. When the cam continues its rotation, the arm 87 is moved against the lower end of the spindle 56, centering the mandrel,

which is supported at one end only, and causing the expansion of the mandrel and through the means described permitting the rollers 72 to be moved by the springs 71 toward the mandrel to compress the convolutions of paper wound upon the latter and to yield as the size of the tube increases, as will be understood. At each end of each of the rollers 72 is provided a link or plate 95, having an aperture at one end through which the journal of the roller passes and at the other end an elongated slot 96, adapted to receive the arbor of the next adjacent roller, as shown particularly in Fig. 8. These plates 95 are connected in pairs by guide or guard plates 97, arranged between the rollers and having curved flanges concentric with the small rollers and also flanges extending concentric with the mandrel, one of the last-mentioned flanges being shortened between the rollers where the paper or cardboard is introduced to the mandrel, as shown in Fig. 8. When the rollers are moved toward the mandrel, the plates 95 and rollers form an inclosure for the paper and effectually prevent the edges or ends from projecting, insuring the tight rolling of the tubes.

Arranged at one side of the mandrel is a stripping device for removing the completed tube from the mandrel when the latter is completed, consisting in the present instance of a finger 100, pivoted at 101 to a standard 102 on the bed-plate and pivotally connected by a link 103 to a short parallel lever 200. The lever is connected by a link 104 and pin 105 with the movable arm 87 beneath the mandrel, so that as said arm occupies its normal position against the end of the spindle in the mandrel the finger will be elevated to the position in dotted lines, Fig. 2, and when the arm is moved down, as in full lines, Figs. 1 and 3, the finger will be moved down and its end engaging the tube on the mandrel will strip the latter therefrom, causing it to drop beneath the table or bed-plate. The finger 100 is inclined relative to the direction of feed of the paper web, so that it does not interfere with the proper entry of the paper to the mandrel.

In using the machine with paper or cardboard that is hard and stiff or more or less elastic or springy or such as is liable to warp unduly when the paste is applied I prefer to employ a means for dampening the rear or outer side of the paper opposite that to which the paste is applied, and for this purpose have shown in Fig. 1 a water-supply pipe 120, located between the pasting device and the mandrel, said pipe having small perforations in one side through which spray is applied to the paper.

The general operation of the machine will now be readily understood.

The normal position of the machine when at rest is shown in Figs. 2 and 3, the mandrel-sections being separated and the arm 87 down. The paper or cardboard to be formed into

tubes is preferably in the form of a continuous web, and the end is passed between the feed-rollers 2 and 3, the lower edge resting upon the bed-plate. These feed-rollers are rotated continuously by the mechanism described and feed the cardboard between the pasting-rollers until the end extends between the rollers 72 and enters one of the slots between the parts of the segmental mandrel, which is constantly rotating. The paste-rollers are held separated by the movable frame on which one of them is mounted, while the first end of the paper is moving between them, and therefore the end which is first wrapped around the mandrel is not pasted. When the paper enters one of the slots in the mandrel, the arm 87 is moved upwardly by its cam and engages the spindle 56, forcing the latter upward and through the conical collars, expanding the mandrel-sections outward, and at the same time the lever 66 is turned on its pivot to the position in dotted lines, Fig. 3, turning the rings 64 64' and allowing the springs 71 to force the rollers 72 inward tightly against the mandrel. As the mandrel rotates the rollers 72 are also positively rotated at the same surface speed and compress and wind the paper tightly upon the mandrel, and after the proper length has been fed the severing mechanism, Fig. 5, is operated, cutting the web, and when the loose end thus formed has been wound around the mandrel and compressed by the rollers the arm 87 is moved down, allowing the mandrel to collapse, leaving the tube thus formed loose thereon, so that it may drop off, or, if desired, be positively removed by the stripping-finger, the arc of movement of the ends of the latter just touching the paper tube and serving to start it downward or to remove it entirely, if desired. The paper web being fed continuously, as soon as one tube drops the end of the web passes into a slot in the mandrel, the arm 87 moves upward, and another tube is formed in the manner described, and so on continuously. The speed of the various parts and their co-operation may be timed and varied as desired by variations and adjustments of the gears and cams, as will readily occur to those skilled in the art.

Instead of the specific forms of pasting, severing, and feeding devices shown others could be readily employed, the central features of the machines aside from the general organization being the tube-forming mechanism and the operating parts thereof.

It is desirable that the rollers and mandrel be arranged in a vertical position, as shown, in order that the completed tube may be dropped from the machine; but said parts could, if desired, be arranged in a horizontal position and the stripper be relied upon to remove the tubes.

I claim as my invention—

1. In a paper-tube machine, the combination with a paper-web-feeding device, a web-severing device, and an intermittently-oper-

ating device for applying paste to portions of the web, of a collapsible mandrel, and an expansible former around it.

2. In a paper-tube machine, the combination with a paper-web-feeding device, a web-severing device and an intermittently-operating pasting device for applying paste to portions of the web, of a collapsible mandrel, and an expansible former around it, composed of positively-driven rollers.

3. In a paper-tube machine, the combination with a mandrel, of an intermittently-operating pasting device arranged to apply paste to a portion only of the sheet forming the tube.

4. In a paper-tube machine, the combination with a mandrel, of a paste-applying roller, and a cooperating roller, and means for causing their intermittent approach and separation to apply paste to portions only of the paper fed between them and wound on the mandrel.

5. In a paper-tube machine, the combination with a mandrel, of means for applying paste to the paper sheet, and means for dampening the opposite side of the sheet.

6. In a paper-tube machine, the combination with a mandrel, and a former surrounding it, composed of driven rollers, of means for applying paste to the paper sheet, and means for dampening the opposite side of the sheet.

7. In a paper-tube machine, the combination with a vertically-arranged collapsible mandrel free at one end, and an expansible former around it, of paper-feeding devices, means for applying paste to one side of the paper, and means for dampening the opposite side.

8. In an organized paper-tube machine, the combination with paper-web-feeding devices, a web-severing device, and a pasting device, of a contractible mandrel free at one end, a former composed of rollers yieldingly held in contact with the mandrel, and means for simultaneously separating the rollers and contracting the mandrel.

9. In a paper-tube machine, the combination of a web-feeding device, a paper-severing device, a pasting device for intermittently applying paste to the paper web, and a tube-rolling device embodying a mandrel and rollers cooperating therewith.

10. In a paper-tube machine, the combination with a collapsible rotary mandrel, of a series of positively-driven rollers arranged around it.

11. In a tube-machine, the combination with a rotary collapsible mandrel, and means for expanding it, of an expansible former extending around the mandrel.

12. In a tube-machine, the combination with a rotary collapsible mandrel, and means for expanding it, of an expansible former extending around the mandrel and composed of rollers.

13. In a tube-machine, the combination with a rotary collapsible mandrel, and means for

expanding it, of an expansible former extending around the mandrel and composed of positively-driven rollers.

14. In a tube-machine, the combination with
5 a rotary collapsible mandrel, and means for expanding it, a former arranged around the mandrel and composed of rollers, and means engaging the opposite ends of the rollers for causing their movement toward and from the
10 mandrel.

15. In a tube-machine, the combination with a rotary collapsible mandrel, and means for expanding it, of a plurality of forming-rollers arranged around the mandrel, means for
15 separating the rollers from the mandrel, and means for holding them yielding against it.

16. In a tube-machine, the combination with a rotary collapsible mandrel, and means for expanding it, of a plurality of rollers arranged
20 around the mandrel, spring devices for pressing the rollers toward the mandrel, and means operating simultaneously on the ends of the rollers for separating them from the mandrel.

17. In a tube-machine, the combination with
25 a rotary mandrel supported at one end and free at the other, of a plurality of forming-rollers around it, means for holding the rollers in yielding contact with the mandrel, and means for separating the rollers and moving
30 them out of contact with the material on the mandrel.

18. In a tube-machine, the combination with a rotary mandrel supported at one end and free at the other, of a plurality of positively-driven forming-rollers around it, means for
35 holding the rollers in yielding contact with the mandrel, and means for separating the rollers and moving them out of contact with the material on the mandrel.

19. In a tube-machine, the combination with the rotary collapsible mandrel, of an expansible former around the mandrel, and means for simultaneously collapsing the mandrel and
40 expanding the former.

20. In a tube-machine, the combination with the rotary collapsible mandrel, of a plurality of forming-rollers around the mandrel and movable radially thereof, and means for simultaneously collapsing the mandrel and separating the rollers therefrom.
50

21. In a tube-machine, the combination with a rotary collapsible mandrel, of a plurality of positively-driven forming-rollers around the mandrel, and movable radially thereof, and means for simultaneously collapsing the mandrel and separating the rollers therefrom.
55

22. In a tube-machine, the combination with a rotary collapsible mandrel, of a plurality of forming-rollers around the mandrel and held
60 yielding against it, and means for moving the rollers away from the mandrel and at the same time collapsing the latter.

23. In a tube-machine, the combination with a rotary collapsible mandrel, having the longitudinally-movable spindle for expanding and collapsing it, of an expansible former around the mandrel, a movable arm adapted

to engage the mandrel-spindle to operate it, and connections between said arm and the former for expanding it.

24. In a tube-machine, the combination with a collapsible mandrel, the longitudinally-movable spindle therein, and the spring for operating it in one direction, of the movable arm adapted to be moved into and out of engagement with said spindle.
70 75

25. In a tube-machine, the combination with a rotary collapsible mandrel supported at one end only, the longitudinally-movable spindle therein, and the spring for operating it in one direction, of the movable arm adapted to be moved into and out of contact with the spindle to expand the mandrel and center it during its rotation.
80

26. In a tube-machine, the combination with a vertically-arranged rotary, collapsible mandrel supported at its upper end and free at its lower end, a longitudinally-movable spindle for controlling the expansion and collapse of the mandrel, and a movable arm adapted to cooperate with the lower end of the spindle.
85 90

27. In a tube-machine, the combination with a vertically-arranged rotary collapsible mandrel supported at its upper end and free at its lower end, and a longitudinally-movable spindle for controlling the expansion and collapse of the mandrel, of an expansible former around the mandrel, means for expanding it, a movable arm cooperating with the free end of the spindle and controlling the movement of the former, and a stripper for removing the tube from the mandrel.
95 100

28. In a tube-machine, the combination with a rotary mandrel, of a plurality of forming-rollers around it, the arms carrying the rollers, and the rotatable rings cooperating with the arms to move the rollers toward and from the mandrel.
105

29. In a tube-machine, the combination with a rotary mandrel, of a plurality of forming-rollers arranged around it, the arms in which the rollers are mounted, the rings engaging the arms, and springs connected to the arms and rings.
110

30. In a tube-machine, the combination with the rotary mandrel, of a plurality of forming-rollers arranged around it, the rings, connections between said rings and arms for operating the former, and the lever connected to said rings for simultaneously operating the latter to move the rollers.
115 120

31. In a tube-machine, the combination with the rotary mandrel, of a plurality of forming-rollers around it, the rings, connections between the rings and arms, springs interposed in said connections, and means for operating said rings simultaneously to cause the approach and separation of the rollers.
125

32. In a tube-machine, the combination with a rotary mandrel, of a plurality of forming-rollers arranged around the mandrel, the gears, one for each roller, flexible connections between the rollers and gears, and means for separating the rollers from the mandrel.
130

33. In a tube-machine, the combination with the rotary collapsible mandrel, of a plurality of forming-rollers arranged around the mandrel, the gears, one for each roller, flexible connections between the rollers and gears, supports for the ends of the rollers, and means for moving the rollers toward and from the mandrel.
34. In a tube-machine, an expansible mandrel embodying a plurality of tubular sections, each having the segmental conical blocks thereon, the central spindle having the conical collars arranged to cooperate with the blocks, and means for operating the spindle longitudinally relatively to the tubular sections.
35. In a tube-machine, the combination with a rotary mandrel free at one end, of a pivoted arm cooperating therewith, a support for the arm, a shaft having a cam thereon, a guide sleeved loosely on the shaft, the slide operating in the guide and operated upon by the cam, and pivotal connections between the slide and arm.
36. The combination with the rotary shaft, and the cam thereon, of the guide loosely sleeved on the shaft, the slide operating therein and engaging the cam, a movable arm connected to the slide and an expansible mandrel and arranged to be controlled by the arm.
37. In a paper-tube machine, the combination with the roller in stationary bearings, of the carriage having the paste-receptacle, and the paste-roller operating therein, and means for operating the carriage toward and from the first-mentioned roller.
38. In a paper-tube machine, the combination with the roller mounted in stationary bearings, having the gear, of the sliding carriage, the paste-receptacle thereon, the roller in the receptacle meshing with the gear on the first-mentioned roller, and means for operating said carriage intermittently.

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Witnesses:

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