No. 679,011. Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1.

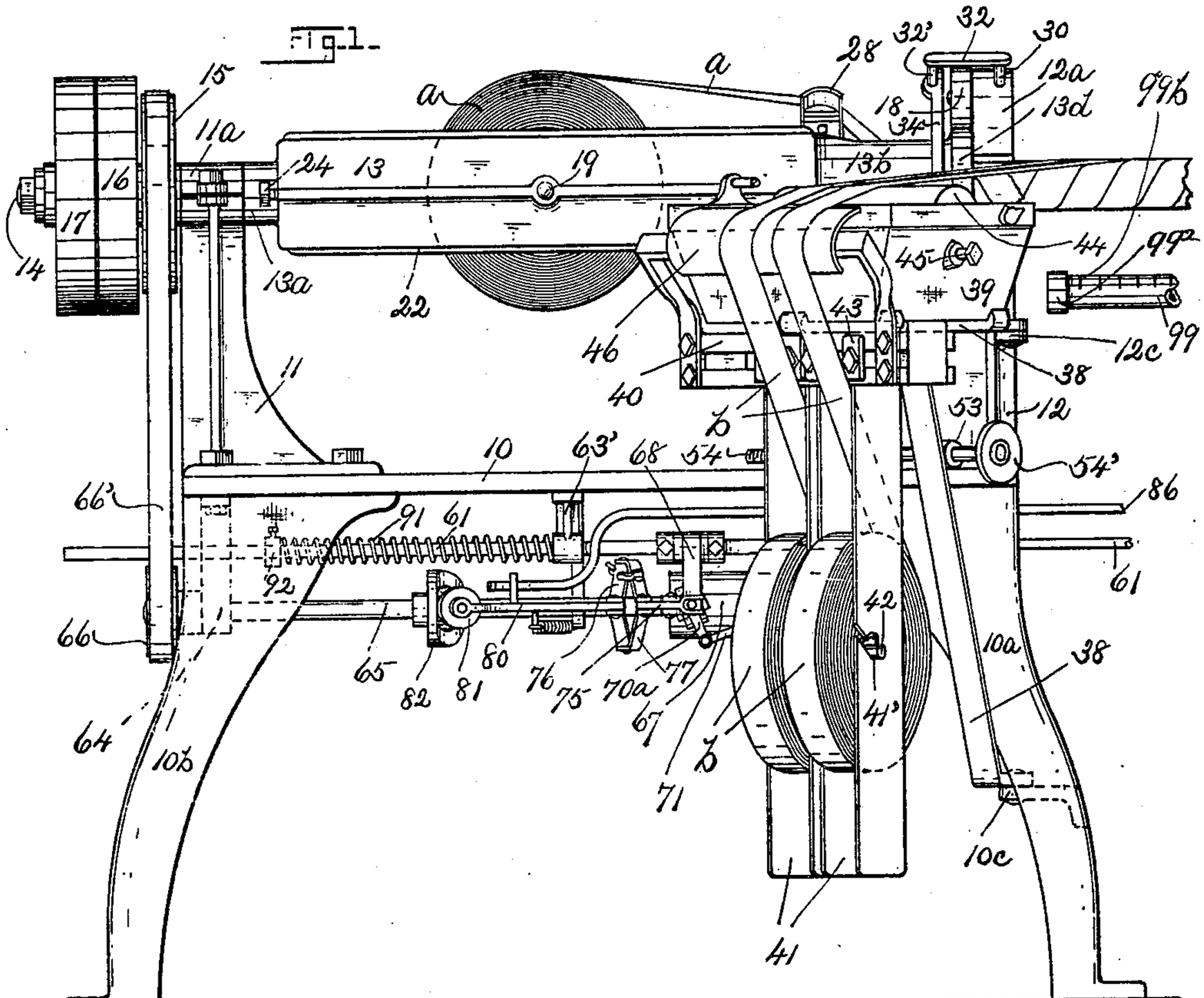
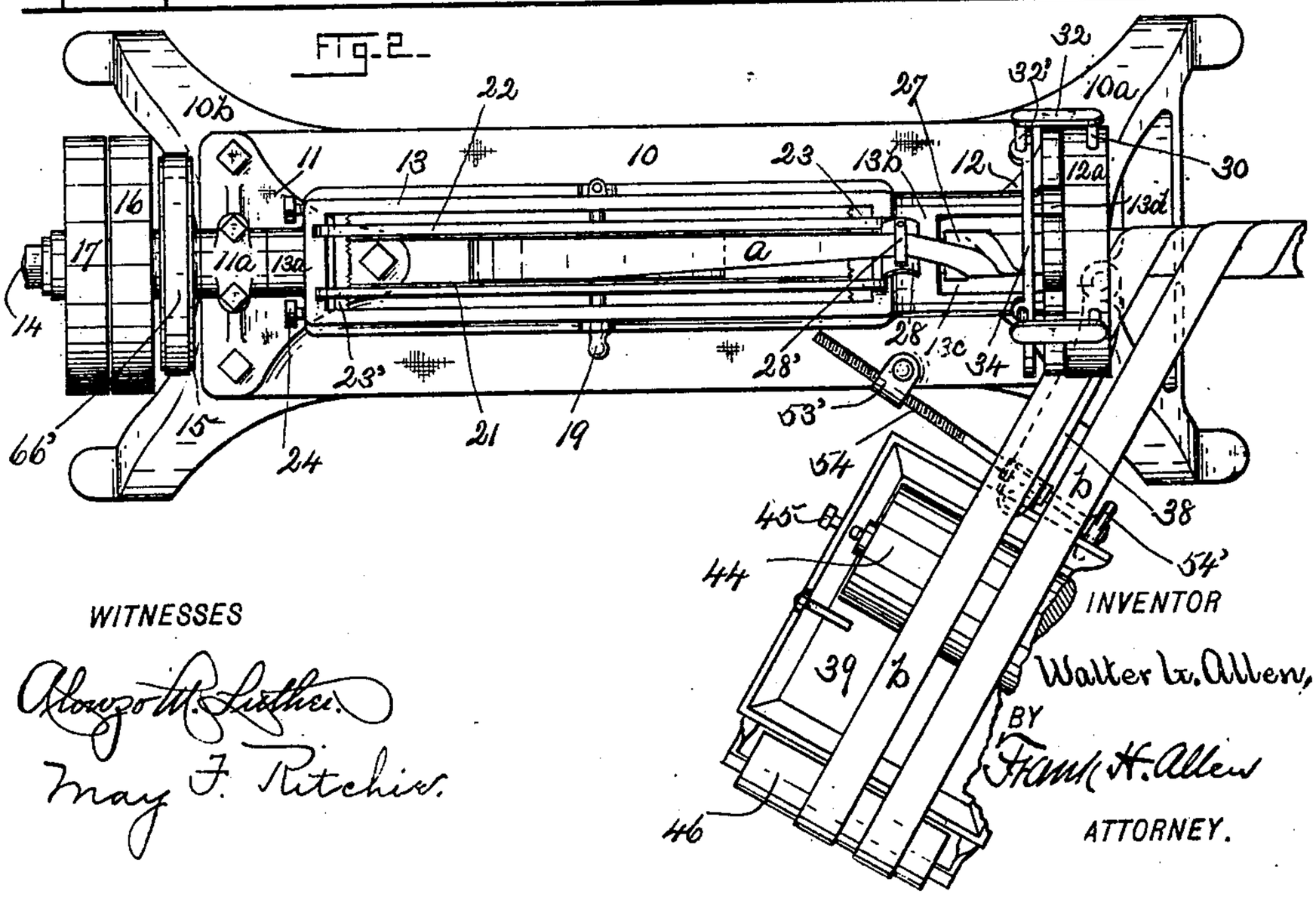


Fig. 2.



WITNESSES

Alonzo W. Lusther.

May F. Ritchie.

INVENTOR

Walter L. Allen,

BY

Frank H. Allen

ATTORNEY.

No. 679,011. Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.)

(No Model.) 7 Sheets- Sheet 2.

Fig. 3.

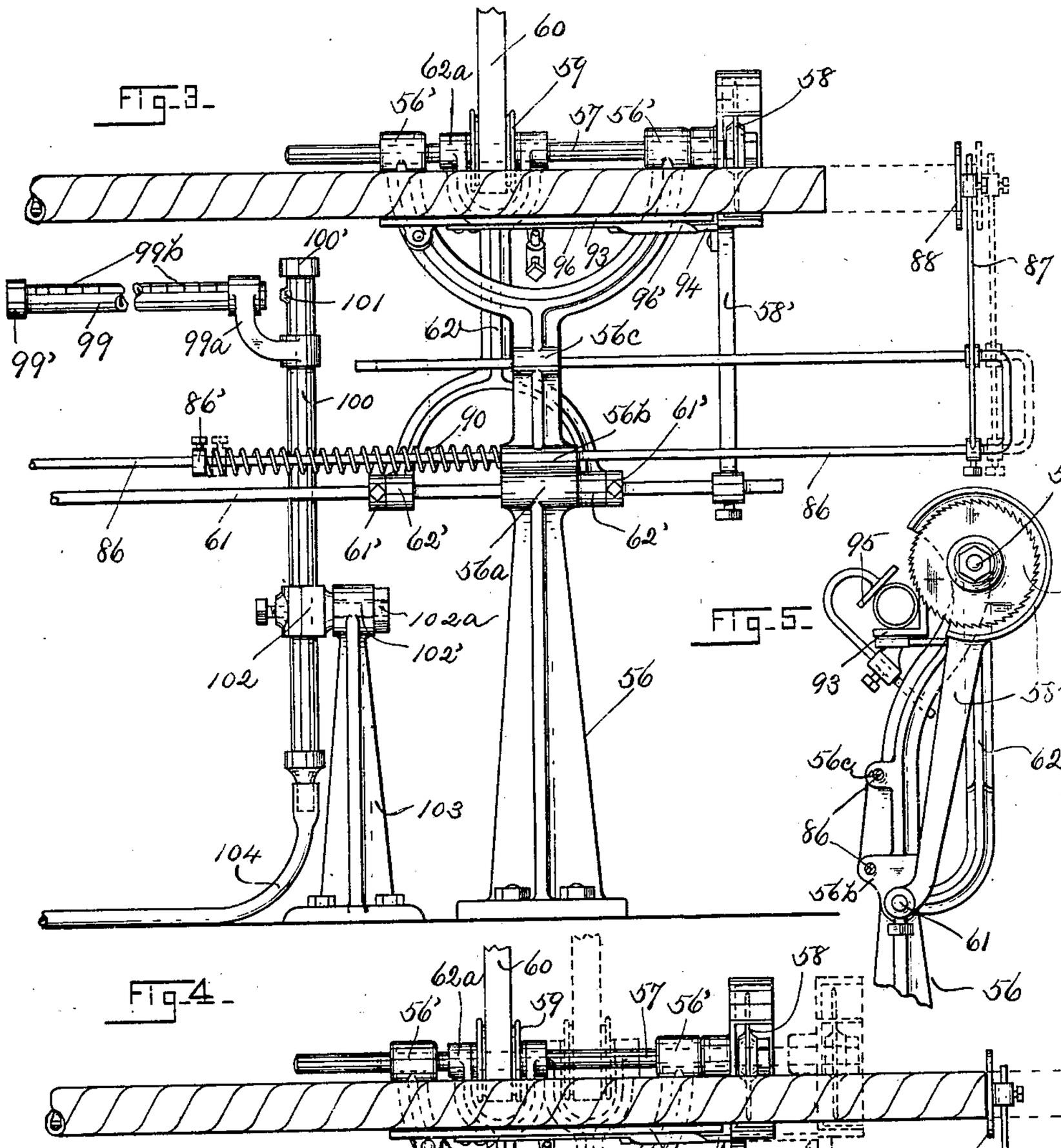
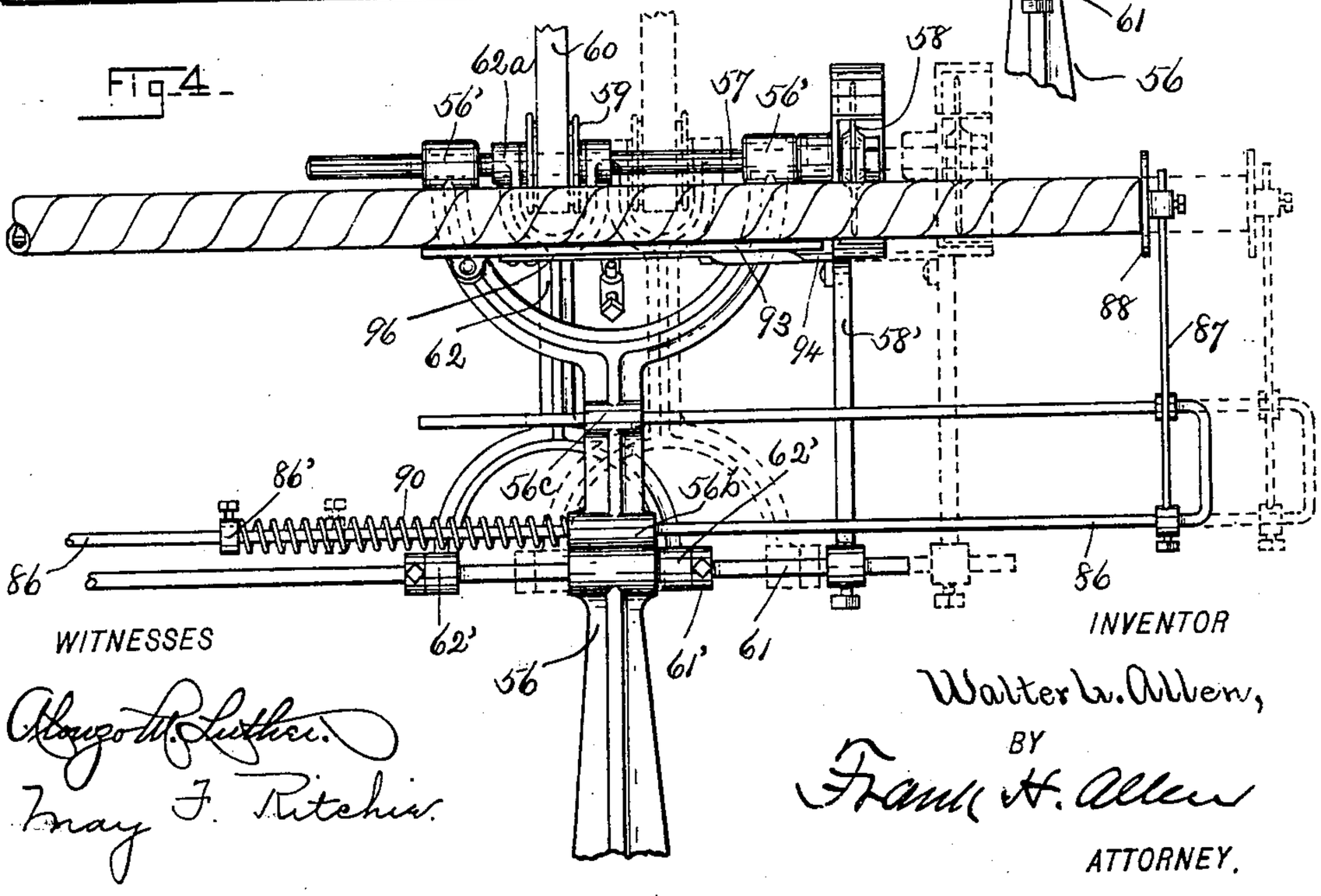


Fig. 5.

Fig. 4.



WITNESSES

Thos. W. Luthier.

Tracy F. Ritchie.

INVENTOR

Walter L. Allen,

BY

Frank H. Allen

ATTORNEY.

No. 679,011. Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.

(No Model.) 7 Sheets—Sheet 3.

Fig. 6.

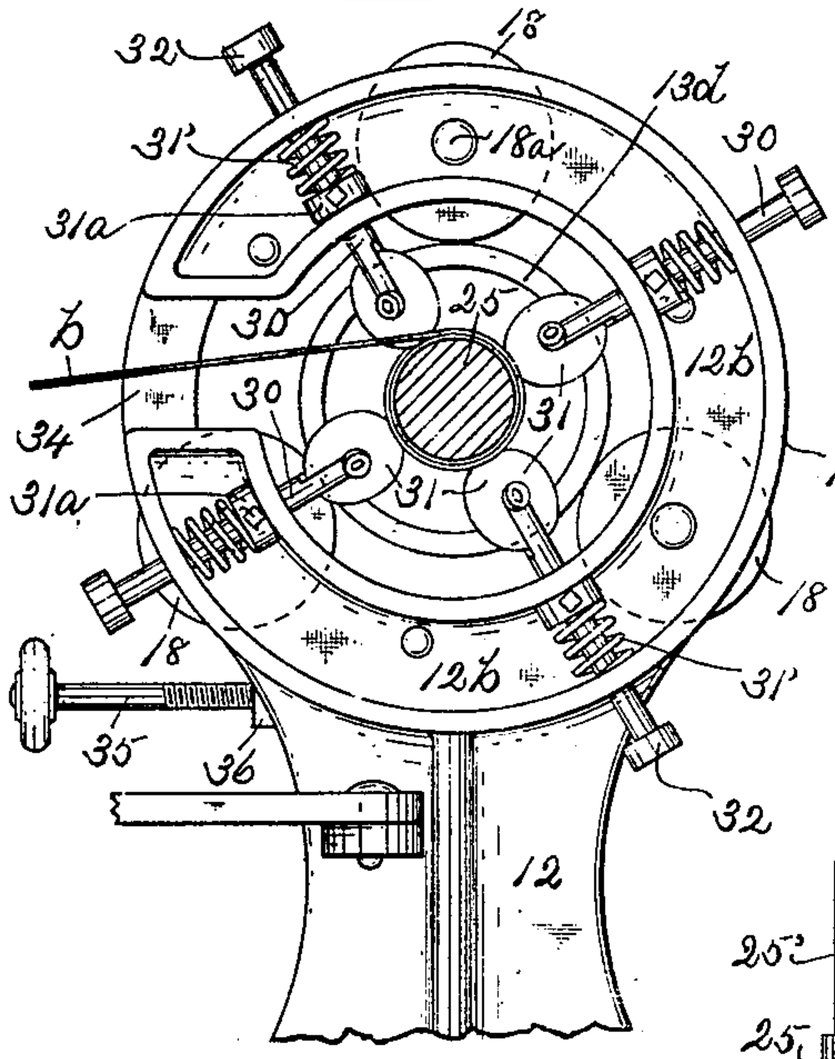


Fig. 7.

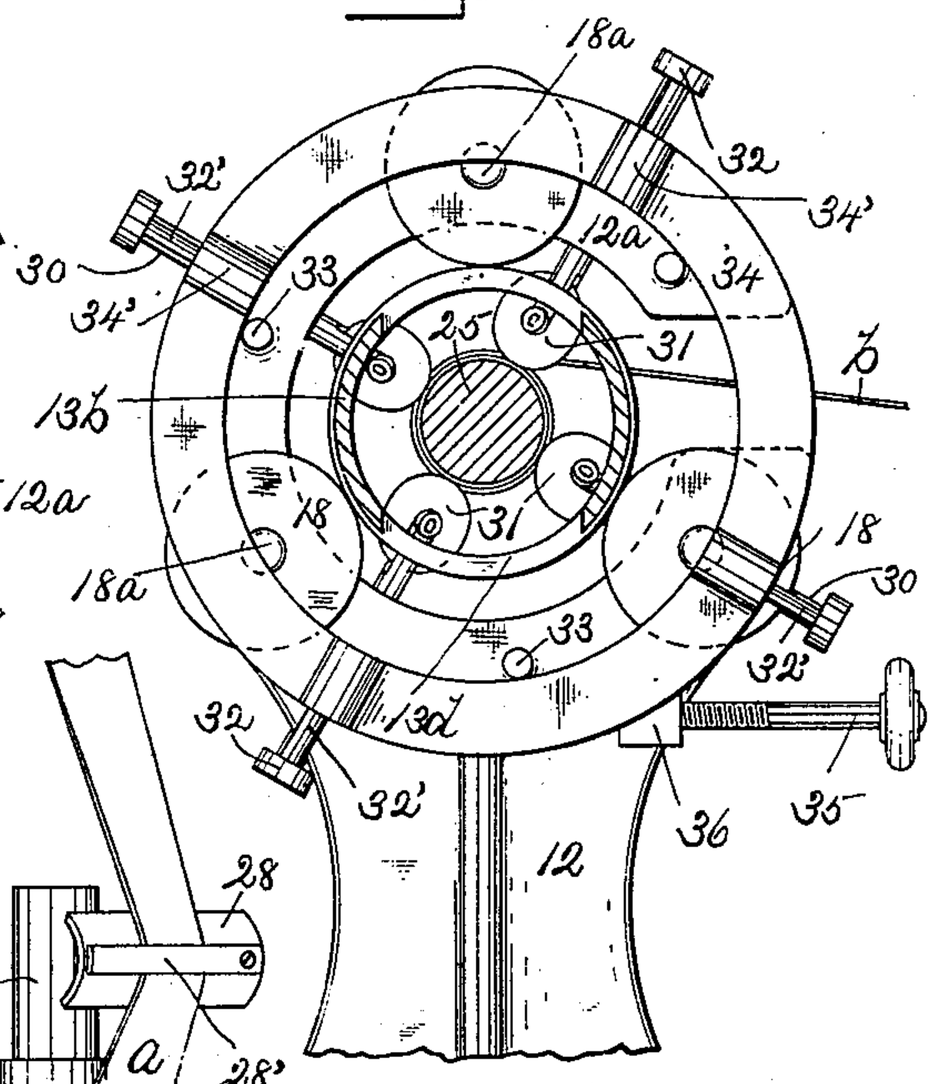


Fig. 8.

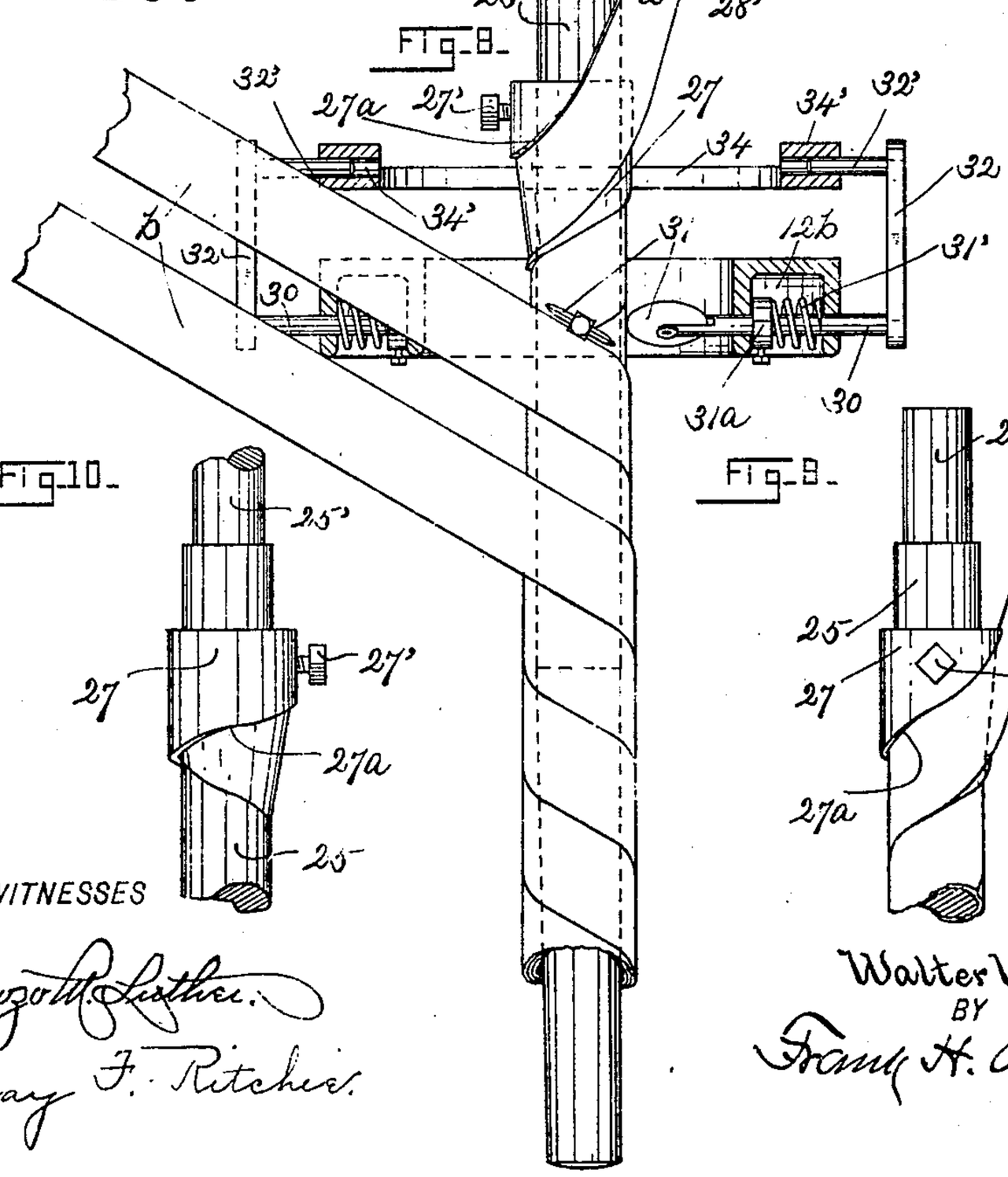


Fig. 10.

Fig. 9.

WITNESSES

Abbozoth Lothrop.

Mary F. Ritchie.

INVENTOR

Walter L. Allen,

BY

Frank H. Allen

ATTORNEY.

No. 679,011.

Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.)

(No Model.)

7 Sheets—Sheet 4.

Fig. 11.

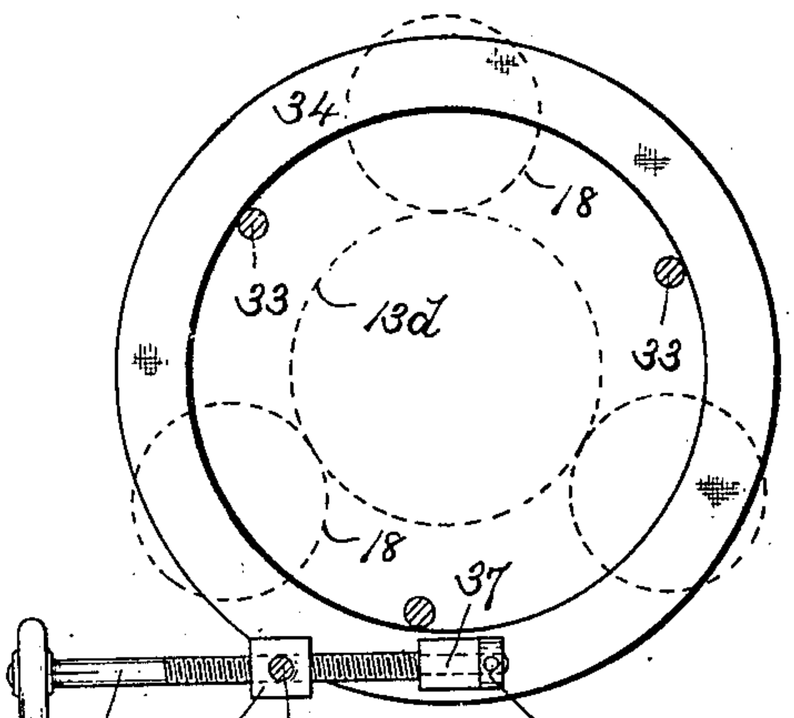


Fig. 12.

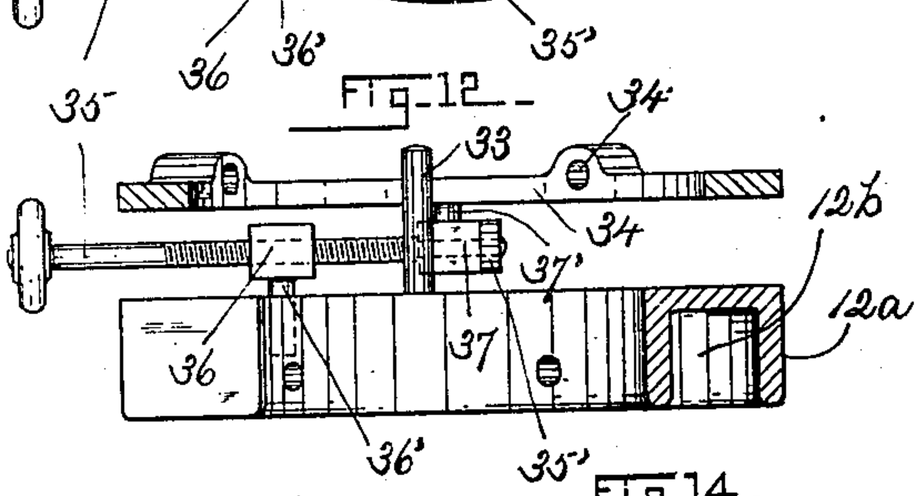
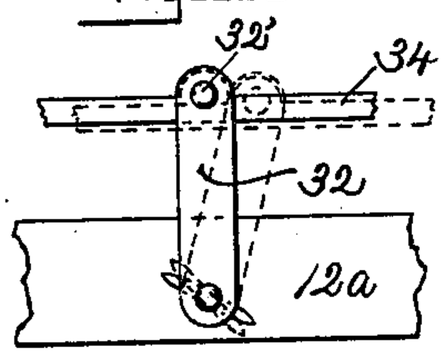


Fig. 13.



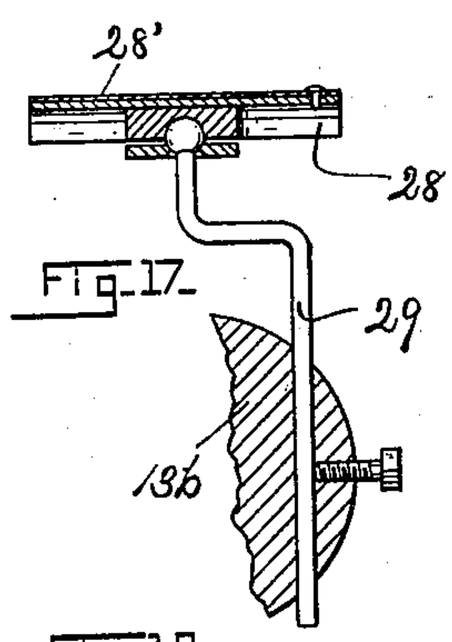


Fig. 17.

Fig. 18.

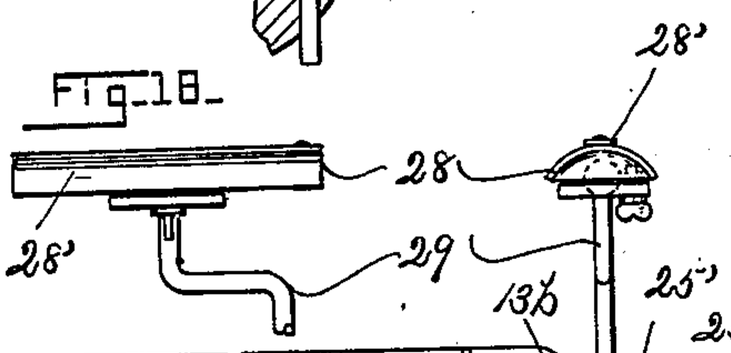


Fig. 14.

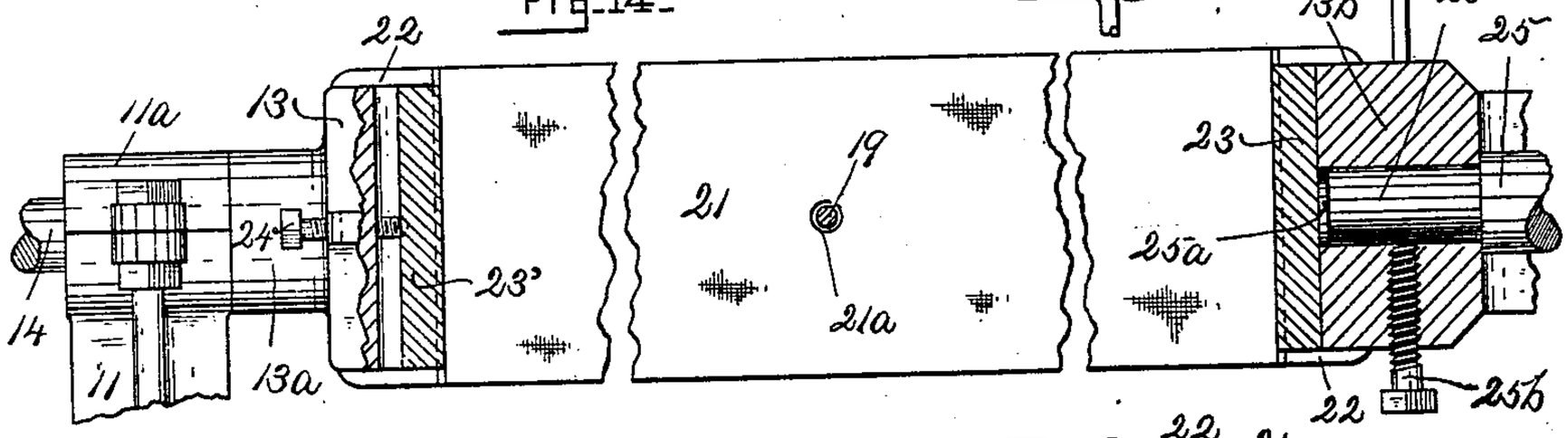


Fig. 15.

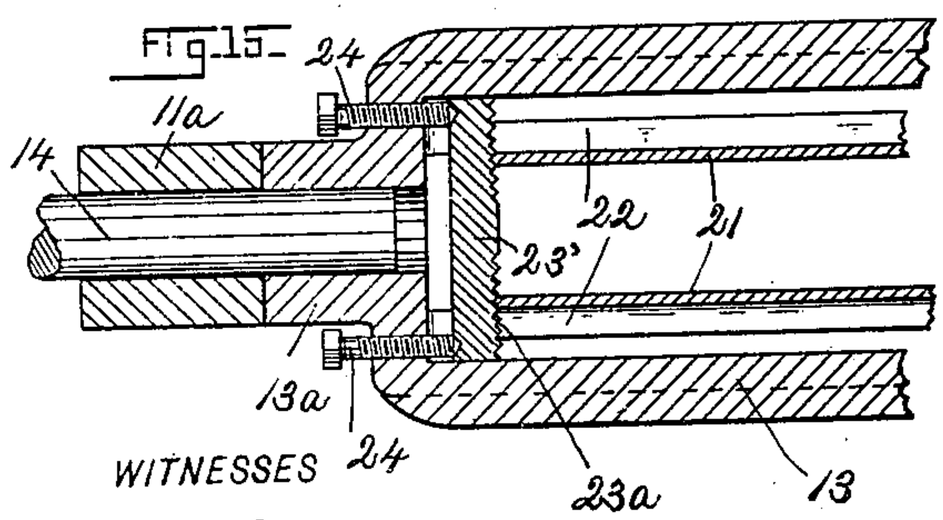
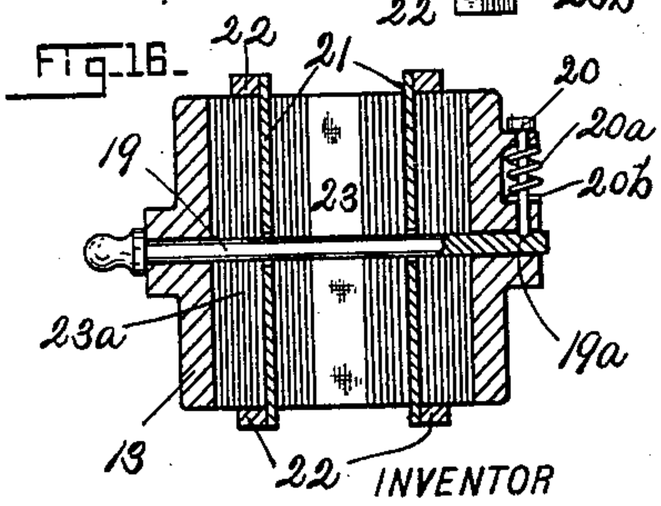


Fig. 16.



INVENTOR

Witnesses

Abouzoth R. Luther.

May F. Ritchie.

Walter L. Allen,

BY

Frank H. Allen

ATTORNEY.

No. 679,011. Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.)

(No Model.) 7 Sheets—Sheet 5.

Fig. 19.

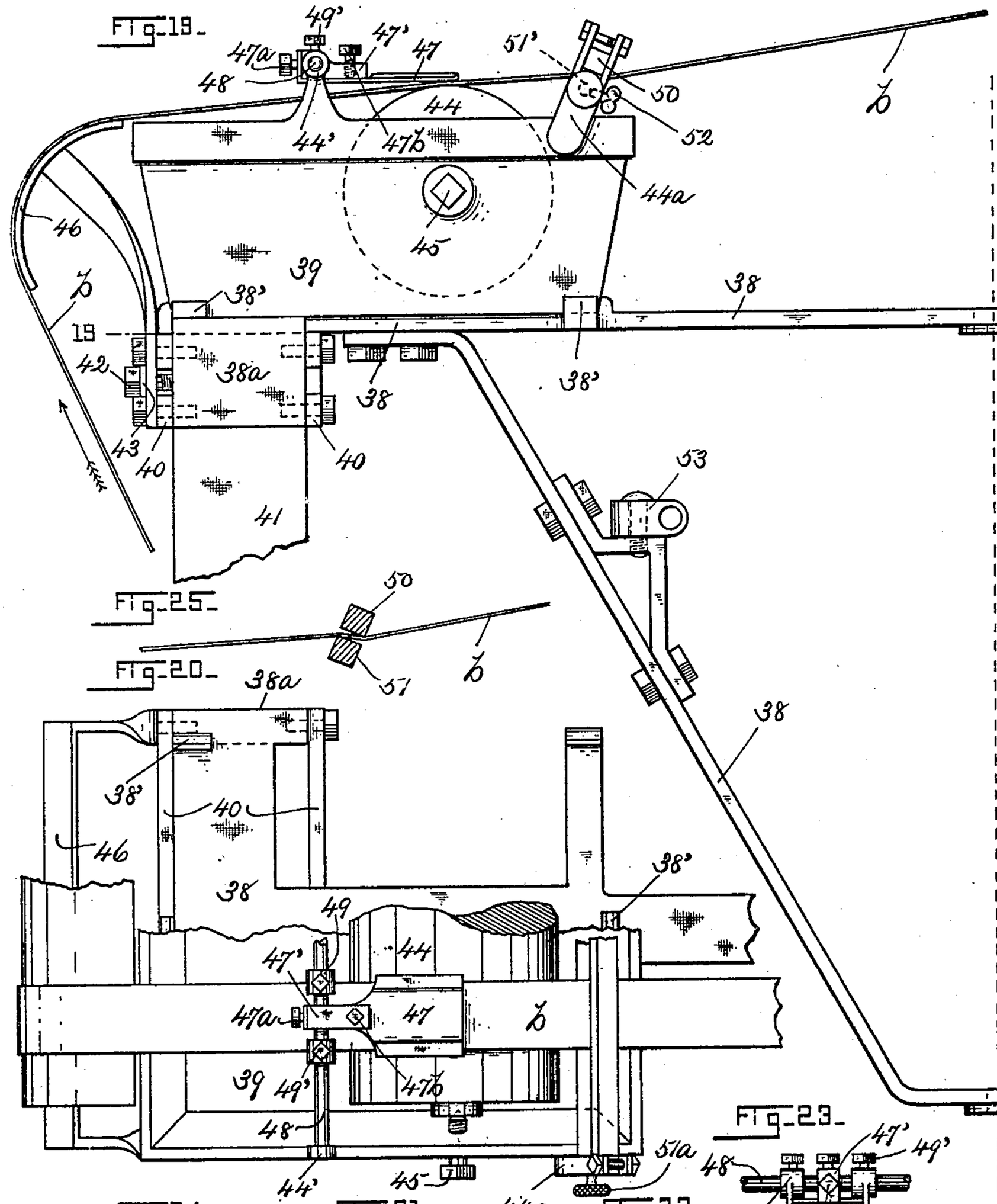


Fig. 25.

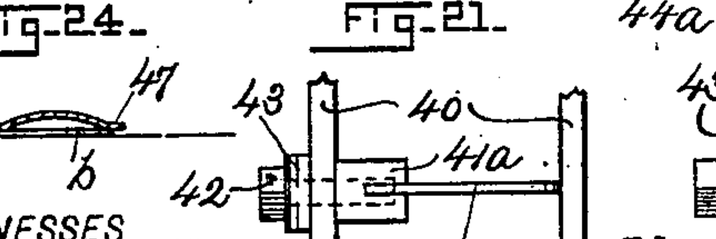


Fig. 20.

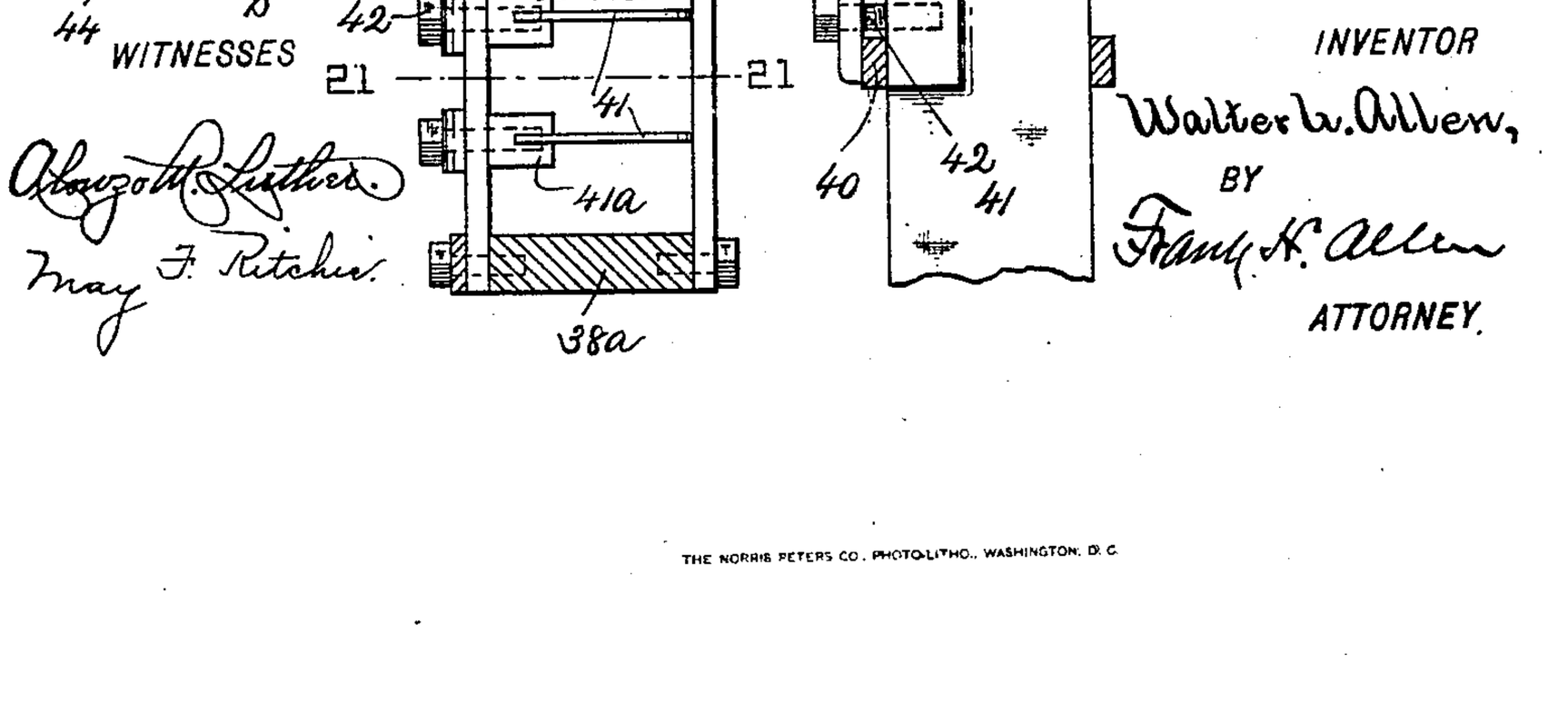


Fig. 23.

Fig. 24.

Fig. 21.

Fig. 22.

WITNESSES

Abayzo M. Luther.

May F. Ritchie.

INVENTOR

Walter L. Allen,

BY

Frank K. Allen

ATTORNEY.

No. 679,011. Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.)

(No Model.) 7 Sheets—Sheet 6.

Fig. 26.

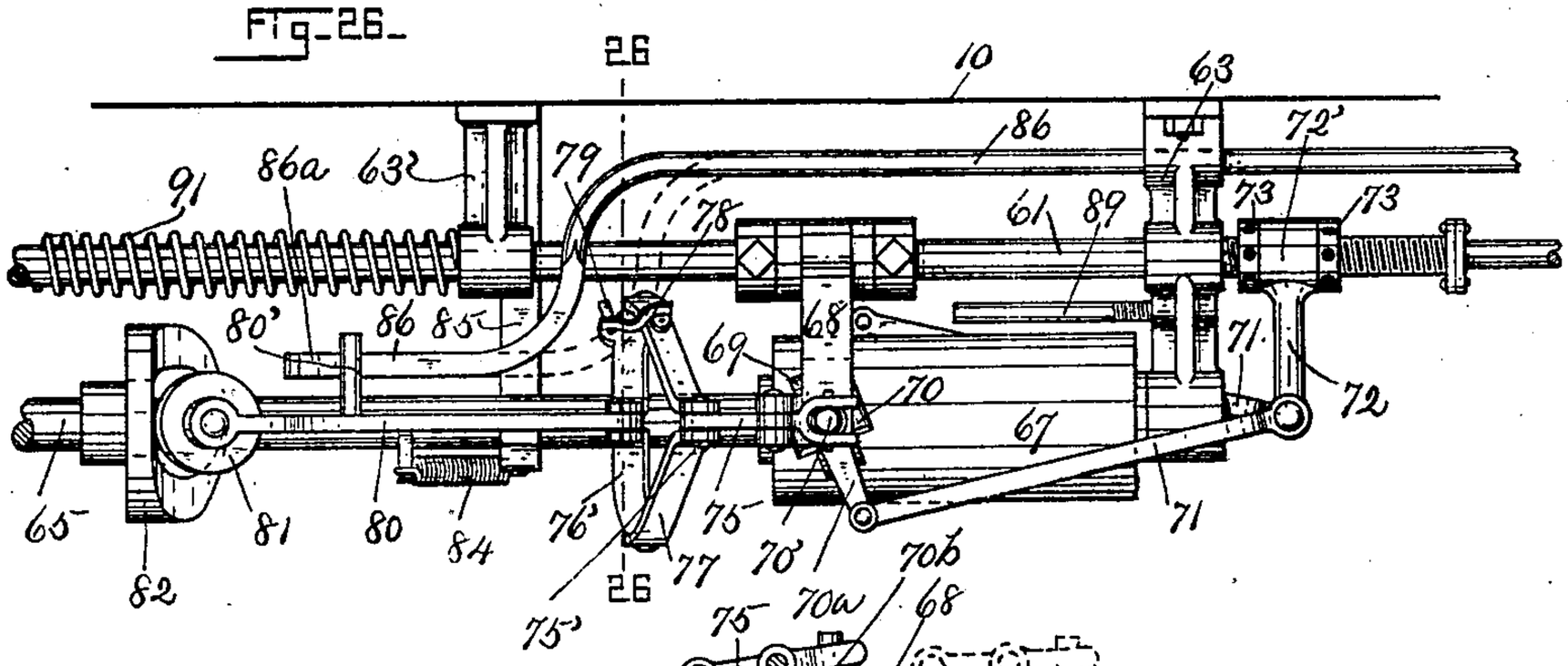


Fig. 27.

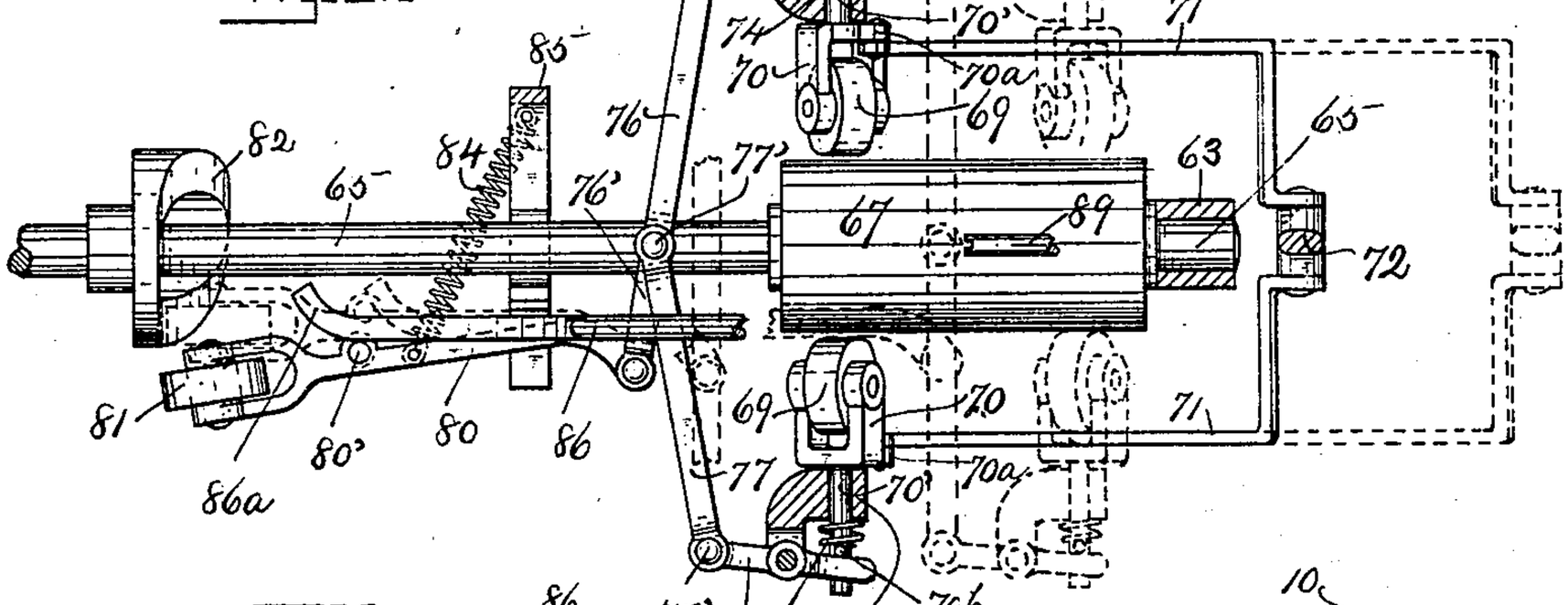


Fig. 28.

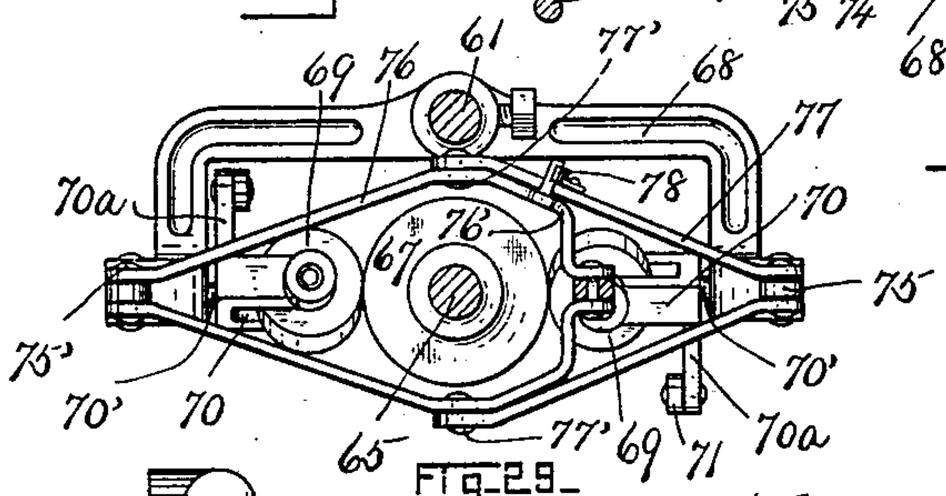


Fig. 29.

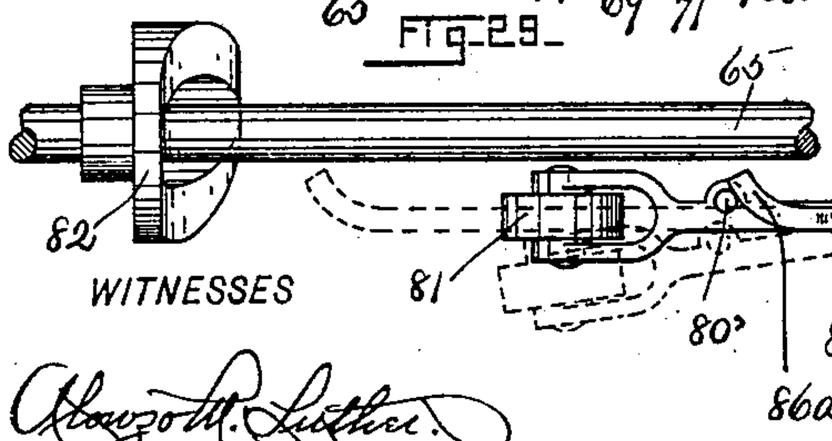


Fig. 31.

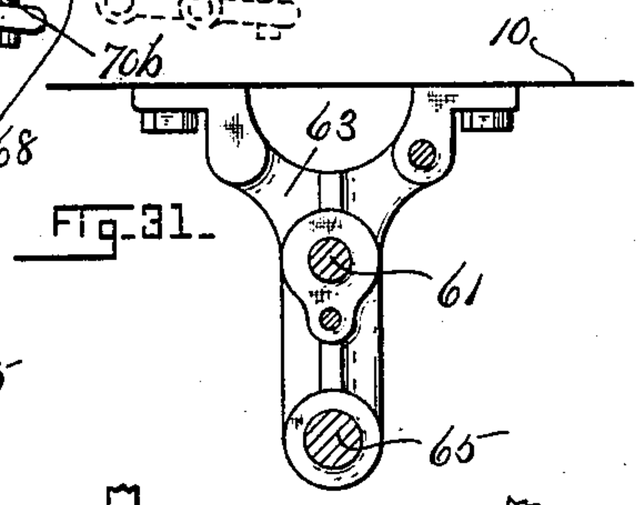
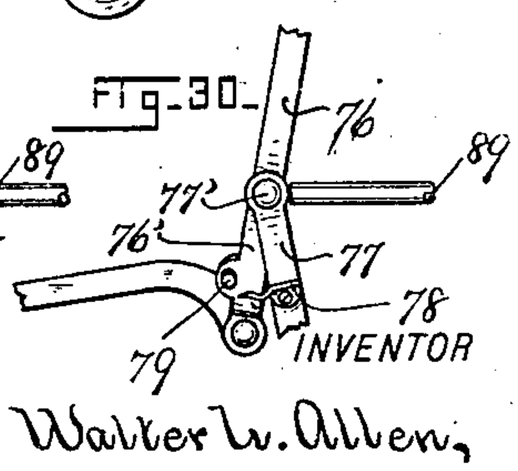


Fig. 30.



WITNESSES

Alwyn H. Luther.

Mary F. Ritchie.

INVENTOR

Walter L. Allen,

BY

Frank H. Allen

ATTORNEY.

No. 679,011. Patented July 23, 1901.

W. L. ALLEN.

PAPER TUBE MACHINE.

(Application filed July 31, 1899.)

(No Model.) 7 Sheets—Sheet 7.

Fig. 33.

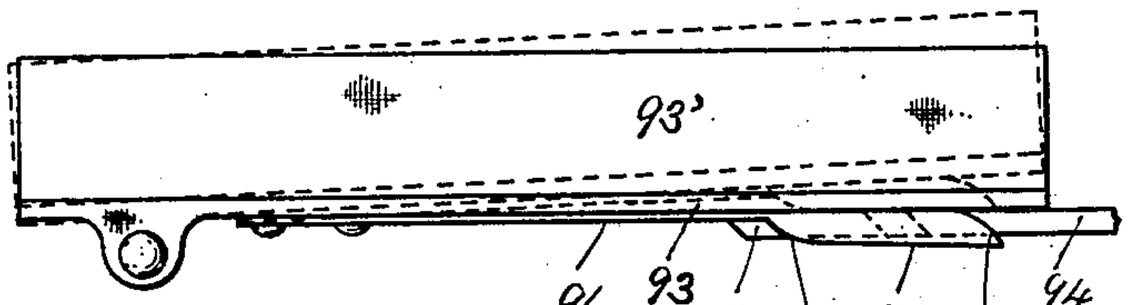


Fig. 32.

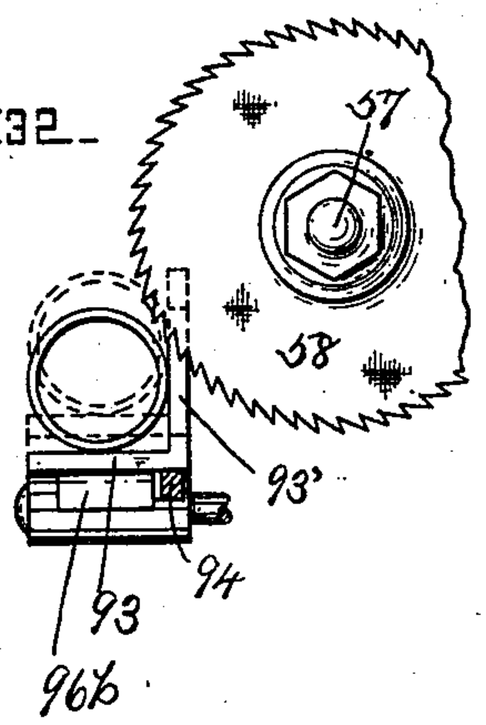


Fig. 34.

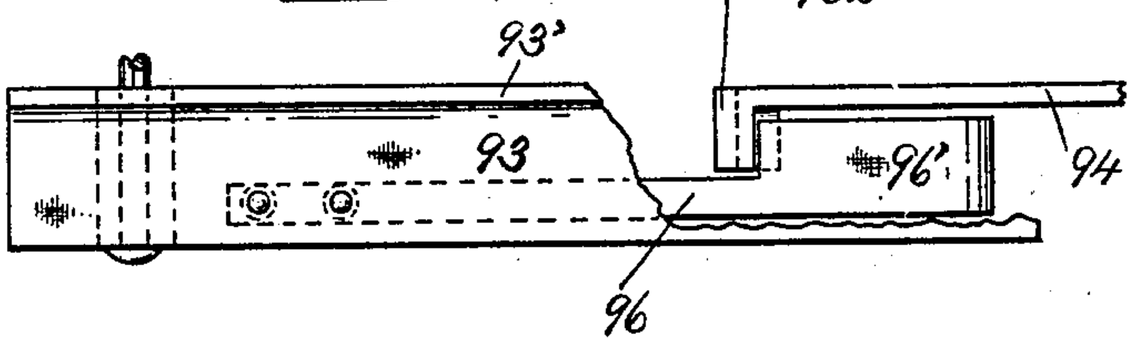


Fig. 35.

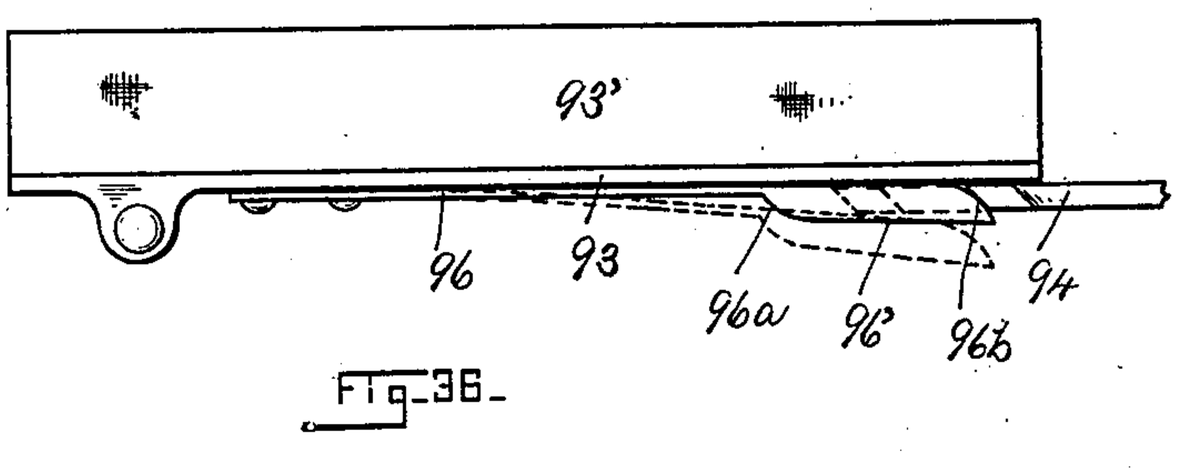
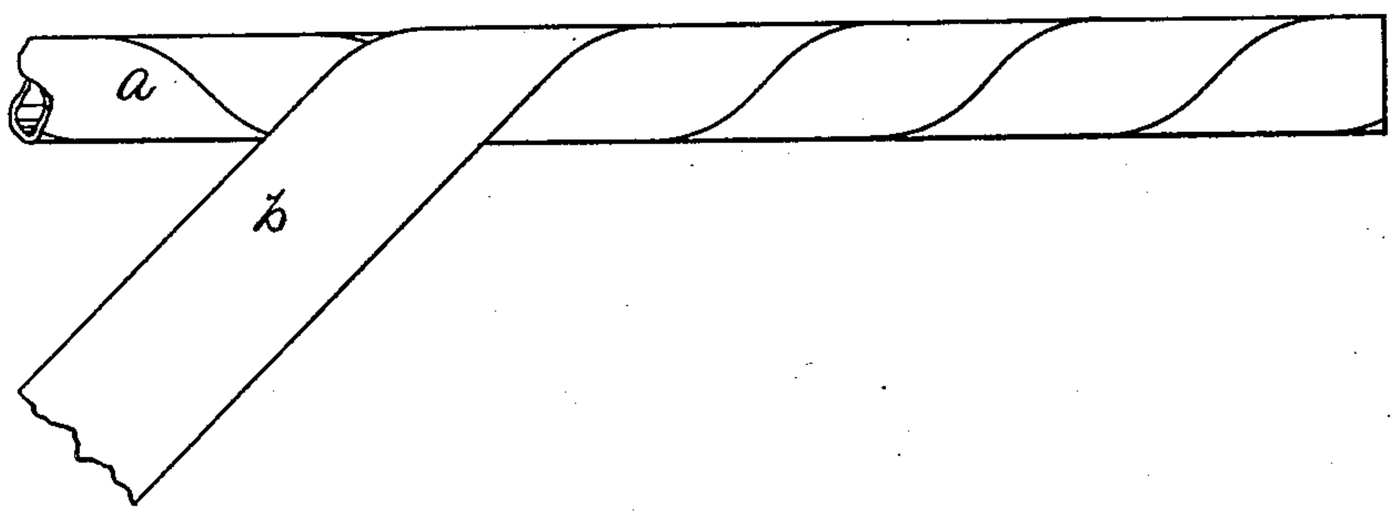


Fig. 36.



WITNESSES

Alwyn M. Luther.

Mary F. Ritcher.

INVENTOR

Walter L. Allen,

BY

Frank H. Allen

ATTORNEY.

UNITED STATES PATENT OFFICE.

WALTER L. ALLEN, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE THOMPSON & NORRIS COMPANY, OF SAME PLACE.

PAPER-TUBE MACHINE.

SPECIFICATION forming part of Letters Patent No. 679,011, dated July 23, 1901.

Application filed July 31, 1899. Serial No. 725,675. (No model.)

To all whom it may concern:

Be it known that I, WALTER L. ALLEN, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Automatic Paper-Tube Machinery, of which the following is a full, clear, and exact description.

This invention is in paper-tube-manufacturing machinery, my purpose being to provide comparatively simple mechanism (that may be operated by a single attendant) by means of which so-called "mailing-tubes" may be automatically and rapidly made and cut into desired lengths. The tubes thus made are of the class that have a spirally-wound core and one or more oppositely-coiled wrappers, the several strips of which the core and wrappers are formed being wound, pasted, and dried by the machine, as I shall describe in detail.

Incidentally my invention also consists in devices for readily adjusting the various elements of the said machine, to the end that tubes of various diameters and lengths may be produced, and these adjusting devices are in most instances so planned and constructed that they may be brought into use while the machine is in operative action, thus saving a deal of time and defective tubes that have been unavoidable heretofore in machines that must be stopped whenever it is necessary to vary the pitch of the coiled strips or to change the tension under which the said strips are delivered or to reduce or increase the speed at which the tubes are coiled and fed forward, &c.

With a view to explaining clearly the construction of my machine I have provided the accompanying seven sheets of drawings, illustrating not only the complete machine, but also its various elements.

Figure 1 of these drawings is an elevation of said machine as viewed from the side from which the strips of pasted paper are introduced to the winding mechanism. Fig. 2 is a plan view of the same. Fig. 3 shows in elevation a part of the cutting-off mechanism of my machine and also the drying apparatus connected therewith. Fig. 4 is a view very similar to Fig. 3. Fig. 5 is a side elevation of certain parts of the cutting-off mechanism shown in Fig. 3. Fig. 6 shows in elevation a portion of one end of the tube-machine proper. Fig. 7 is an elevation of the reverse side of the portion of the machine shown in Fig. 6. Fig. 8 illustrates the manner in which the winding of the core and cover strips is accomplished and shows, principally in section, mechanism immediately related to the winding devices. Fig. 9 is a view of a portion of the mandrel, showing a certain device mounted thereon over which the core-strip is drawn to aid in the winding of said core-strip. Fig. 10 is a view similar to Fig. 9 with the said core-strip omitted. Fig. 11 shows in elevation a portion of the mechanism for regulating the feeding of the tubing. Fig. 12 illustrates said mechanism partly in plan and partly in horizontal cross-section. Fig. 13 illustrates a certain detail of construction of the said tube-feeding mechanism. Fig. 14 shows, principally in vertical central section, a certain rectangular frame forming an element of my machine. Fig. 15 is a horizontal central sectional view of the said rectangular frame. Fig. 16 is a vertical cross-sectional view of the said rectangular frame, taken at approximately midway its length. Fig. 17 illustrates, principally in section, a certain guide for the core-strip and shows how the same is adjustably supported. Fig. 18 shows the said guide in elevation detached. Fig. 19 is an elevation of the pasting mechanism of the machine. Fig. 20 illustrates said pasting mechanism in plan. Fig. 21 is a sectional view, taken on the line 19 of Fig. 19, of means provided for the support of the rolls of cover-strips. Fig. 22 is a sectional view taken on the line 21 21 of Fig. 21. Fig. 23 shows in elevation a guide provided for the cover-strips. Fig. 24 illustrates in cross-section means provided to retain the cover-strips in close contact with the paste-roll of the machine. Fig. 25 is a cross-sectional view of a certain element of the pasting mechanism. Fig. 26 shows in elevation parts of the cutting-off mechanism, and Fig. 27 is a plan view of the same. Fig. 28 is a cross-sectional view taken on the line 26 26 of Fig. 26. Fig. 29 is a plan view of a portion of the said cutting-off mechanism. Fig. 30 is a

detail view of the levers 76 77 and connected parts. Fig. 31 is an elevation of a hanger employed in the support of the cutting-off mechanism. Fig. 32 shows in end elevation the manner in which the tube is introduced to the saw by means of which the cutting off of the tube is accomplished. Fig. 33 is a front elevation of a hinged shelf provided to support the tube near the point at which the latter is cut by the saw. Fig. 34 is a plan view of the said shelf. Fig. 35 is a view similar to Fig. 33. Fig. 36 shows a tube in the process of construction.

Referring to the drawings, the number 10 denotes the top or bed of a stand, which has mounted thereon or suspended thereunder the various mechanisms of my machine. The table-bed 10, as here shown, is of rectangular shape and is provided near each end with legs 10^a 10^b. Mounted upon the bed 10, near each end thereof, are stands, which stands are denoted, respectively, by the reference-numbers 11 and 12. These stands serve to support horizontally a frame or box 13, of rectangular shape and substantially square in cross-section, as is best shown in Fig. 16. Projecting from the end wall of the box 13, adjacent the stand 11, is a hub 13′, within which is secured a short shaft or stud 14, which latter is received in and supported by a bearing 11^a, provided at the upper end of the stand 11. The stud 14 projects through the bearing 11^a sufficiently to receive a pulley 15, from which motion is transmitted to the cutting-off mechanism, as hereinafter described, and said stud 14 has also mounted thereon fast and loose pulleys 16 and 17, which pulleys are adapted to receive the main driving-belt of the machine. The opposite end of the box 13 is formed with a hub-like extension 13^b, which is bored centrally, as at 13^c, and has upon its end a ring 13^d, whose center is in alinement with the axial center of the stud 14. The ring 13^d is revolubly supported by three rolls 18, located equidistant from each other on the rear face of a circular frame 12^a, that forms the upper portion of the stand 12, and the center of said rings is in horizontal alinement with the axial center of the bearing 11^a. The rolls 18 are mounted and adapted to revolve upon pins 18^a, projecting horizontally from the rear face of the said circular frame 12^a.

It will now be seen that the rectangular frame 13, supported as just described, may be freely rotated upon its points of support when motion is imparted to the fast pulley 16, the said points of support being, respectively, the bearing 11^a, which receives the stud 14, and the rolls 18, that receive the ring 13^d, said rolls providing a roller-bearing for the end of the box 13 adjacent the stand 12.

The rectangular frame 13 is adapted to receive and support the roll of paper from which the core of the tube is constructed, and such roll, as well as the strip rendering therefrom, is denoted by the reference-letter *a*. The roll *a* is supported axially between the side walls of the frame 13 and rotates with the said frame, and in addition to such movement the roll is also free to rotate upon its own axial support to allow the paper to be drawn from the roll as fast as utilized in the construction of the tube.

The axial support for the roll *a* consists of a pin 19, located in the side walls of the box 13, the said pin 19 passing centrally through the roll *a*. To guard against the accidental displacement of the pin 19, a bolt 20, that is supported in suitable bearings on one side of the casing 13, is provided, and said bolt has mounted thereon a spiral spring 20^a, that seeks to force the end of the bolt 20 adjacent the pin 19 into a recess 19^a in said pin, and thus prevent accidental endwise displacement of the latter, as is best shown in Fig. 16.

The side walls of the frame 13 are sufficiently far apart to receive rolls *a* of considerable width, and to prevent the sidewise travel of narrower rolls upon the supporting-pin 19 movable walls 21 are provided within the frame 13, which said walls 21 are adapted to be adjusted to retain the roll *a* approximately centrally between the walls of the frame 13 and at such a distance apart as to prevent any sidewise travel of the said roll *a*.

The walls 21 consist of thin metallic plates somewhat less in length than the interior length of the frame 13 and of slightly greater width than the walls of said frame to permit the opposite edges of the plates 21 to be secured to rods 22, whose ends project somewhat beyond the end walls of the frame 13, thus preventing the removal of the plates 21 from the said frame, but interfering in no way with their adjustment.

The frame 13 has located therein at opposite ends plates 23 23′, of which the plate 23 is rigidly secured to the end wall of the frame 13, but the plate 23′ is adjustably secured in position. The confronting faces of the plates 23 23′ are grooved, as at 23^a, to receive the adjacent ends of the plates 21, and the rear face of the plate 23′ abuts the ends of adjusting-screws 24, located in the frame 13. The adjusting-screws 24 when turned home force the plate 23′ before them, and thus effect the clamping of the plates 21 between the said plates 23 23′ after the plates 21 have been properly adjusted. Upon easing back the screws 24, however, the plate 23′ may be moved rearward sufficiently to allow the plates 21 to be disengaged from the grooves 23^a, thus permitting the ready adjustment of the said plates 21. The plates 21 are provided with holes 21^a, through which the pin 19 passes, as shown in Fig. 14.

Referring now to Sheets 1, 3, and 4 of the drawings, the number 25 denotes the mandrel, upon which the tubing is wound. The said mandrel is secured to and rotates with the rectangular frame 13, and its central axial line is the same as that of the said frame.

The end of the mandrel 25, which is secured to the frame 13, is provided with a shouldered-down portion 25′, to receive which the end wall of the recess 13^c is bored, as at 25^a, and after having been placed in position the mandrel is secured by a screw 25^b. The mandrel 25 extends centrally through the recess 13^c and the ring 13^d and projects for a considerable distance beyond said ring, the major portion of such projecting portion tapering very slightly to the outer end of the mandrel (see Fig. 8) for a reason hereinafter explained.

Mounted upon the mandrel 25 near its inner end and within the chamber 13^c is a collar 27, secured by a set-screw 27′ and having cut therein a spiral groove 27^a. The groove 27^a is of proper width to allow the core-strip *a* to be drawn therethrough and onto the mandrel 25, the said groove leading the strip *a* onto the mandrel at the angle required to produce with such strip a tube of given diameter, the spirals of which tube shall be "close-laid," as previously explained.

In leading the strip *a* from its roll in the frame 13 to the collar 27 said strip is drawn over a circular plate 28, which is supported by a rod 29 and is capable of universal adjustment by reason of a ball-joint that serves to secure the plate 28 to the upper end of the rod 29. (See Figs. 14, 17, and 18.) A flat spring 28′ is secured to the upper face of the said plate 28, and the strip *a* is drawn beneath the said spring, the latter producing a considerable degree of tension upon said strip when the machine is in operation. The rod 29 is adjustably secured in the hub portion 13^b of the frame 13, as shown in Figs. 14 and 17. The plate 28, being supported as just described, may be readily adjusted at such an angle that the strip *a* may be led thereover and to the collar 27 within the chamber 13^c, the said angle being such that when the strip *a* is in motion it has no tendency to travel sidewise or off the end of the plate 28. To still further assist in leading the strip *a* onto the mandrel, the bottom of the groove 27^a (at the point of the introduction of the strip *a*) may be at a slight angle to the axial center of the mandrel, such angle becoming gradually less pronounced as the point is approached where the strip passes from the groove onto the mandrel, this last feature being best shown in Figs. 8, 9, and 10 of the drawings. Near the collar 27 the wound portion of the strip *a* is engaged by certain mechanism which acts to force said wound portion forward upon the mandrel, this action serving to draw the strip *a* through the groove 27^a of the collar 27, thus winding new tubing upon the mandrel to take the place of that fed forward as fast as such action takes place.

In the mechanism for feeding the tubing upon the mandrel, as just mentioned, particular reference is called to Sheets 1, 3, and 4, illustrating this mechanism.

The circular frame 12^a, which forms the upper portion of the stand 12, is recessed, as at 12^b, and the concentric walls of said recess are drilled to provide bearings for radially-extending bolts 30, several of which are provided, (preferably four, as shown in the drawings,) and each of which bears on its inner end a small wheel 31. The wheels 31 are adapted to engage the wound portion of the core-strip at a point adjacent the collar 27 and are held in such engagement by means of spiral springs 31′, so mounted upon the bolts 30 that their opposite ends abut, respectively, the outer wall of the recess 12^b, and a collar 31^a, so located on the bolt 30 as to be forced into contact with the inner wall of the recess by the said spring 31′ when the wheels 31 properly engage the core-strip *a*. The collars 31^a are adjustably secured to their respective bolts 30 to enable the latter to be readily adjusted to permit the sliding of the bolts toward or away from the axial center of the mandrel to accommodate tubing of different sizes. The wheels 31 are set at an angle relatively to the mandrel 25, and the circumferential edge of each of said wheels is sufficiently sharp to prevent the core-strip *a* from slipping beneath the wheels when the wound portion of the latter is in engagement with said wheels. The wound portion of the core-strip *a*, revolving with the mandrel 25 and engaged by the wheels 31, serves to rotate the wheels 31 and cause them to seek to travel upon the core. The wheels 31, however, being stationary, so far as any forward travel of the same is concerned, cannot move, and as a result the wound portion of the core is itself forced forward upon the mandrel in the direction the reverse to that in which it seeks to cause the wheels 31 to travel. The rate of travel of the wound core upon the mandrel relatively to the rate of rotation of the mandrel and the core is of course dependent upon the angle at which the wheels 31 engage the said core, it being readily seen that said wheels 31 would fail to cause the tube to travel if set at right angles to the axial center of the mandrel, but that the rate of travel would be increased proportionately with the deviation of the wheels 31 from said last-named position until an angle is reached in which the plane in which the wheels 31 revolve would become so nearly parallel with the axial center of the mandrel as to prevent the free rotation of the core thereon.

From the foregoing description it will be understood that the roll of core-paper *a* rotates with and within the frame 13 and the mandrel 25, and it will also be understood that the rotation of said frame and mandrel does not in itself effect the winding of the core, but such winding is produced by feeding the core-strip *a* forward on the madrel, said strip drawing through the groove 27^a of the collar 27 and being wound around the mandrel, as explained. The speed at which the core may be wound is therefore dependent upon its rate of travel upon the mandrel, such rate of travel being determined by the

angle at which the feed-wheels 31 are set, and said angle is in turn determined by the width of cover-strip *b* which is employed in the construction of the tube, it being apparent that with a given width of strip *b* introduced at the proper angle to the core (approximately the same angle at which the wheels 31 are set) the said core must travel forward to receive the cover-strip at such a rate that the cover-strip *b* will be wound thereon in close-laid spirals. In the tubing shown in the various figures of the drawings the cover-strips *b* are of the same width as the core-strips *a;* but from the foregoing explanation it will be seen that this is not essential to the successful working of my machine.

The cover-strip *b* is introduced to the wound core-strip at a point adjacent the wheels 31, with its pasted side in engagement with said core, the paste causing the cover strip or strips to adhere to the core, and thus the tubing is retained in its wound condition.

In connection with the feed-wheels 31 mechanism is provided whereby the adjustment of all of said wheels simultaneously may be readily attained and controlled.

To accomplish the result just stated, the following-described mechanism is provided: Each of the bolts 30 bears on its outer end an arm 32, to whose opposite end there is secured a pin 32′, extending parallel with the bolts 30. Projecting from the rear face of the circular frame 12^a and extending parallel with the pins 18, already described, are three or more pins 33, which serve to support a ring 34, arranged concentrically with the axial center of the frame 13 and the mandrel 25. The ring 34 is provided with bearings 34′, corresponding in number with the pins 32′ and adapted to receive the latter, said pins being capable of both rotary and endwise movement in the bearings 34′. It will now be seen that should the ring 34 be rotated, carrying with it the pins 32′, the rocking of the arms 32 in unison will be effected and also the rotation of the bolts 30, carrying the feed-wheels 31, thus making it possible to adjust the latter to any angle within the limits of the rotation of the ring 34. (See dotted lines, Fig. 13.) It will also be seen that the ring 34 when thus rotated will move slightly toward or away from the circular frame 12^a, in accordance with the direction of such rotation; but its means of support permit said movement of the ring, as will be readily understood.

The reference-number 35 denotes a screw mounted in a tapped sleeve 36, having a stem 36′, which is supported on the rear face of the stand 12. The inner end of the screw 35 is shouldered down and is received in a sleeve 37, having a stem 37′ projecting therefrom, which stem is received in the ring 34. The shouldered-down end of the screw 35 bears a collar 35′, thus preventing endwise movement of the screw in the bearing 37, but interfering in no way with its rotation. It will now be seen that upon the rotation of the screw 35 said screw will travel in the sleeve 36 and carry with it the sleeve 37, thus effecting the rotation of the ring 34, the direction of such rotation being of course dependent upon the direction of rotation of the screw 35. To permit the ring 34 to travel toward or away from the stand 12, the stem 36′ of the threaded sleeve 36 is capable of longitudinal movement in its bearing in the said stand.

Describing now the pasting mechanism and the means for supporting the roll or rolls of cover-paper *b*, attention is called in connection with such description to Sheets 1 and 5 of the drawings. The portion of the tube-machine now under consideration is supported upon a bracket, (denoted as a whole by the reference-number 38.) The bracket 38 is pivotally supported at the point 12^c on the stand 12 and at the point 10^c on the legs 10^a, the said points 12^c and 10^c being in vertical alinement with each other to permit the horizontal swinging of the bracket. The upper portion of the bracket 38 is formed as a framework on which the paste-box 39 of the machine is mounted. The paste-box is of sufficient weight to make it unnecessary to secure the same to the frame upon which it rests; but to guard against its accidental displacement the frame has formed thereon a number of lugs 38′, between which the box is set. The described manner of mounting the paste-box enables the latter to be readily removed from the machine when it is desired to clean or fill the same. Depending from the opposite sides of the portion of the bracket upon which the paste-box is received are two plates 38^a, which are connected by rods 40, thus providing a rectangular framework whose sides are each composed of a pair of the rods 40 and whose ends are formed of the depending bracket portions 38^a. The rolls of cover-strip paper *b* are each supported between a pair of thin metallic strips 41, which are notched, as at 41′, to receive pins 42, upon which the said rolls revolve, and said plates 41 serve not only to support the rolls of paper *b*, but also to prevent their lateral displacement.

As the number of cover-strips employed vary and as the width of such strips also varies with the style of tubing produced it is necessary to provide means for adjustably securing the strips in position, and in order to accomplish this end the plates 41 are of such width that their upper ends may be introduced into and supported by the described rectangular frame provided by the depending bracket portions 38^a and the rods 40. At their said upper ends the plates 41 are provided with a thickened or block portion 41^a, which is tapped to receive a screw 42, which latter is adapted to be introduced through a plate 43, located on the side of the rods 40 opposite the blocks 41^a, said screw being passed between the said rods in order that it

may enter the tapped hole in the said block 41ª, after which the turning home of the screw 42 serves to clamp the plate 43 and block 41ª upon the said rods 40, and thus secure the plates 41 in position. Upon slightly easing up upon the screw 42 the plates 41 may be moved in the rectangular frame in which they are secured, and thus said plates may be readily set to any desired position, and rolls of cover-strips *b* of varying widths may be readily inserted in or removed from the said frame.

The paste-box 39 is shown in the drawings as approximately square in plan view, with flaring sides, but the exact shape of said box is of course not essential. The paste-roll is denoted by the number 44, and in order that said roll may revolve very freely it is hung upon the pointed ends of screws 45, projecting through the sides of the box 39. The strips of cover-paper *b* are led from their respective rolls upward to and around a circular plate 46, that is supported upon the bracket 38, and from said circular plate 46 the cover-strips pass into engagement with the upper portion of the paste-roll 44. Said strips engage the paste-roll 44 with a sufficient degree of frictional contact to effect the revolving of the roll when traveling over it, the lower portion of the roll revolving meanwhile in the paste with which the box is partly filled. Thus a supply of paste is deposited upon the said strips *b* and carried forward to insure their adhesion to the core-strip and to each other when wound in the construction of the tubing.

To insure sufficient frictional engagement of the paste-roll 44 by the cover-strips *b* to effect the revolution of the latter, said strips are each engaged on their upper face by plate 47, which presses the strip into close contact with the surface of the paste-roll. The plate 47 is supported by means of a rod 48, secured in bosses 44′, formed on the upper edges of the sides of the paste-box, the latter being bridged by the rod 48, parallel with the paste-roll 44. The plate 47 is not secured directly to the rod 48, but to a block 47′, mounted upon the rod 48 and secured thereto by set-screw 47ª. The said block also has located therein a set-screw 47ᵇ, which so engages the plate 47 that the manipulation of the screw will serve to increase or diminish the degree of frictional contact of the plate 47 with the roll 44, this feature being clearly shown in Figs. 19 and 20. The plate 47 is preferably slightly concave in cross-section, as seen in Fig. 24, so that the edges only of the strip *b* are forced into close contact with the paste-roll, it being unnecessary to coat the strip with paste its entire width. In addition to the block 47′ the rod 48 has mounted thereon certain guides for the cover-strips, such guides being simply collars 49, adjustably secured to the rod 48 by set-screws 49′ and having downwardly-projecting arms 49ª. The said guides are properly set on the rod 48 to cause the cover-strip to travel between a pair of the arms 49ª. (See Fig. 23.)

In order that the cover-strips *b* may not have too great a supply of paste thereon when wound upon the core, a scraper is provided therefor consisting of two parallel rods 50 and 51, which extend across the paste-box in close proximity to and parallel with each other and the paste-roll. The rods 50 and 51 are substantially square in cross-section and the opposite ends are supported in upwardly-extending portions 44ª of the paste-box 44. The said rod 50 is clamped rigidly between the said paste-box portions 44ª; but the rod 51 may be rotated between its points of support, and in order that such rotation may be readily performed the opposite ends of rod 51 are formed as journals 51′, which extend through the supports 44ª of said rods and one of which bears a small wheel 51ª, by means of which the rod 51 may be readily rotated. The cover-strips *b* enter between the rods 50 51, as best seen in Fig. 25, the corner of the rod 51 which engages the strip serving as a scraper and the rod 50 serving to retain the said strip in contact with said corner, and by reference to said Fig. 25 it will also be seen that the cover-strip *b* makes a considerable angle in passing from engagement with the rod 51 to the rod 50. Upon the slight rotation of the rod 51 the portion thereof which engages the strip *b* is raised or lowerd, thereby increasing or diminishing the angle in the strip and causing the latter to draw with a corresponding degree of friction over the rod 51, it being understood that the greater such frictional contact the more completely will the paste be scraped from the strips *b*. When the rod 51 is rotated to a desired position, it may be secured against displacement by a set-screw 52, located in one of the supports 44ª and engaging the journal portion 51′ of said rod.

In order that the bracket 38 may be very finely adjusted in the desired position to cause the cover-strips to be introduced to the core at the proper angle and in order that said bracket may be retained in such adjusted position, the following mechanism is provided: Swiveled to the said bracket 38 is a threaded block 53 and to the machine-table 10 a similar block 53′, which said blocks are drilled and tapped to receive a screw 54, provided with a hand-wheel 54′. Upon the rotation of the screw 54 the bracket 38 may be swung toward or away from the table 10, in accordance with the direction of such rotation, and when adjusted to the desired angle relative thereto will be locked in such position until the screw 54 is again rotated.

Assuming that a machine fitted up as thus far described is provided and it is desired to utilize the same in the manufacture of tubing, a mandrel 25 of the proper diameter is placed in position, having thereon a collar 27, whose groove 27ª is of proper width to receive the strip of core-paper *a*, a roll of which latter is

mounted in the frame 13. The roll or rolls of core-strip *b* to be utilized are properly located in their means of support on the bracket 38 and the paste-box 44 is supplied with paste. The operator draws the end of the core-strip from its roll over the guide 28 and through the groove 27′ of the collar 27; and winds said strip one or more turns around the mandrel. The feed-wheels 31 are now brought into engagement with the wound core to hold the strip upon the mandrel 25. The bracket 38 is adjusted to the angle demanded to secure the proper winding of the cover-strips upon the wound core. The said cover-strips are then brought into engagement with said core after having been led over the plate 46 and brought into contact with the paste-roll and scraper and are wound around the core one or more times, in which position the strip portions upon the mandrel are held until the paste sets and retains them therein. The feed-wheels 31 are then set at the proper angle (approximately the same as the angle of the cover-strips to the mandrel) to feed the core forward at the speed demanded to secure the proper winding of the cover-strips, after which the machine is set in operation and the winding of the strips is accomplished automatically. As fast as the tubing is thus wound it passes over certain drying apparatus to effect the drying of the paste, as before explained; but such feature is fully explained hereinafter. It has already been stated that the mandrel 25 tapers from a point near where the winding of the tube occurs to the free end thereof. This feature reduces greatly the frictional resistance which would otherwise be caused by the feeding forward of the tubing upon the said mandrel.

Having now described that portion of the mechanism of my machine that relates to the manufacture of the tubing and having described also the operation of such mechanism, I will proceed to describe the cutting-off mechanism. (Illustrated on Sheets 1, 2, 6, and 7 of the drawings.)

The cutting up of the tubing is performed by means of a circular saw, and as it is desirable to locate said saw at a considerable distance from the point where the tubing is wound a separate frame or stand is preferably provided for the support of the same. This construction is, however, for convenience in the manufacture of my machine, as it can be built much more cheaply than would be possible if a single elongated frame were provided for the support of the saw and its connected mechanisms; but it will be obvious that the last-described construction could be followed, if desired. The stand for supporting the saw is shown on Sheet 2 and is denoted as a whole by the reference-number 56. The upper portion of the stand 56 is provided with a pair of bearings 56′, which receive and support horizontally the saw-arbor 57, which latter bears the saw 58 upon one end. It has already been stated that the cutting up of the tubing is performed while the latter is in motion, and to accomplish this end mechanism is provided whereby the saw is caused to travel with the tubing when at work. It will therefore be seen that the saw-arbor 57, carrying the said saw 58, must be capable of endwise as well as rotary motion in the bearings 56′. The saw-arbor 57 has a pulley 59 mounted thereon between the bearings 56′, which pulley receives a belt 60, by means of which the arbor and saw are driven.

The reference-number 61 denotes a horizontal rod extending parallel with the saw-arbor 57, whose end adjacent the stand 56 is received in a bearing 56ª in said stand. The rod 61 under certain conditions (hereinafter explained) is capable of endwise reciprocal movement in its bearings, which movement through a frame 62 is imparted to the saw-arbor to cause the latter to travel in unison therewith. The frame 62 is bifurcated at each end, such bifurcated portions straddling, respectively, the stand 56 and the driving-pulley 59, and the said frame 62 is secured to the rod 61 and the saw-arbor by means of bearings 62′ 62ª, through which the said rod and saw-arbor respectively pass. To cause the frame 62 to travel with the rod 61, collars 61′ are located thereon, which engage the bearings 62′. The bearings 62ª engage, respectively, the opposite ends of the hub of the pulley 59, and thus the frame 62 causes the said saw and its arbor 57 to travel in unison with the rod 61.

To actuate the rod 61 to cause it to travel automatically in the manner just stated, the following mechanism is provided: The end of the rod 61 opposite that supported by the bearing 56ª of the stand 56 is received in and supported by bearings provided therefor in hangers 63, 63′, and 64, depending from the top 10 of the machine-frame. The hangers 63 and 64 are also provided with bearings, in which a shaft 65 is horizontally supported, which said shaft 65 might be termed the "initial" or "driving" shaft of the cutting-off mechanism. The reference-number 66 denotes a pulley mounted on the shaft 65 in alinement with the pulley 15, already mentioned, pulley 66 being belted to pulley 15 by the belt 66′, thus effecting the driving of the shaft 65 and the cutting-off mechanism simultaneously with the operation of the tube-producing mechanism. Located upon the shaft 65 adjacent to the hanger 62 is a roll 67, of considerable length, and secured to the rod 61 at a point over the said roll is a frame 68, which straddles the roll 67 in the manner best shown in Fig. 28. The frame 68 serves to support a wheel 69 on each side of the roll 67, which wheels under certain conditions are adapted to engage the roll 67 at points approximately diametrically opposed. The wheels 69 are not supported directly by the frame 68, but each is mounted in a small frame 70, having a stem or pintle 70′, which is received in the frame 68 and is capable of

both rotary and endwise movement in said frame. Each frame 70 has also formed thereon an arm 70^a, whose free ends are connected by links 71 to an arm 72, adjustably mounted on and depending from the rod 61. In order to adjustably secure the arm 72 to the rod 61, the said arm is formed with an enlargement or collar 72', through which the rod 61 passes, and the latter at that point is threaded and has nuts 73 mounted thereon, adapted to engage the opposite ends of the collar 72'. It will now be seen that by the adjustment of nuts 73 and of the arm 72 such adjustment, through the links 71, connecting the said arm to the arms 70^a of the frames 70, will effect the rocking of the latter upon their supporting-stems 70', and thus make it possible to set the wheels 69 at any desired angle to the roll 67. As already stated, the wheels 69 are under certain conditions introduced to the roll 67, and it will now be seen that when the said wheels are in contact with roll 67 and are set at an angle thereto the rotary motion of the roll 67 when imparted to the wheels 69 will cause the latter to travel upon the said roll. The just-described feature of the cutting-off mechanism corresponds closely to the tube-feeding mechanism first above described, excepting that in the tube-making mechanism the revolving core engaged by the wheels 31 is caused to travel, while in the cutting-off mechanism the revolving object is stationary so far as endwise travel is concerned and traveling motion is imparted to its engaging wheels. When the wheels 69 travel upon the roll 67, as just mentioned, they carry the frame 68 with them, and said frame being secured to the rod 61 imparts longitudinal movement to the latter.

The wheels 69 are held normally from engagement with the roll 67, and to accomplish this end a spiral spring 74 is mounted upon each stem 70', outside the frame 68, which spring is confined between said frame and a pin 70^b, located in the stem 70'. The frame 68 has pivotally secured thereto, near each stem 70', a short lever 75, one end of each of which levers is bifurcated to receive the outer end of the stem 70'. The opposite ends of the levers 75 have pivotally secured thereto at 75' a link or preferably a pair of links, (denoted, respectively, by the numbers 76 and 77,) and the links 76 77 are in turn pivotally secured together at the point 77'. The links 76 and 77 form a knuckle-joint or spreader, as is best shown in Figs. 26 and 28. When the central point 77' is brought into alinement with the points 75' of the said knuckle-joint, the last-named points are forced apart and the levers 75 are caused to engage the pins 70^b on the stems 70' of frames 70, and thus carry the latter inward against the force of the springs 74, resulting in moving the wheels 69 into engagement with the roll 67. The wheels 69 begin at once to travel upon the roll 67, imparting corresponding movement to the frame 68 and the said knuckle-joint, which latter straddles the roll, as best shown in Fig. 28. When the knuckle-joint formed by the arms 76 77 is in the position last named—that is to say, when the arms 76 77 are in alinement—it may be locked by means of a small notched spring 78, located on one of the arms 77 and adapted to engage a pin 79, located on an extension 76' of the arm 76. The ends of the extensions 76' of the arms 76 have pivotally secured between them one end of a link 80, whose opposite end bears a roll 81, which is adapted to be actuated by a cam 82, located on the shaft 65. The said roll 81 is for the greater part of the time held out of contact with the cam 82; but when allowed to be engaged by said cam the latter acts to force roll 81 and its link 80 forward, the latter in turn rocking the links 76 of the knuckle-joint to carry the central pivotal point 77' thereof into alinement with the points 75', and thus force the wheels 69 into engagement with the roll 67.

The reference-number 84 denotes a spring whose opposite ends are secured, respectively, to the link 80 and a bracket 85, depending from the machine-stand 10, which said spring seeks constantly to draw the link 80 into such position that its roll may engage the cam 82. The action of the spring 84 is, however, controlled by a rod 86, which under certain conditions is adapted to engage a pin 80', located on the link 80, to hold the latter in an outwardly-locked position. The rod 86 is supported in bearings in the hanger 63 and also in bearings 56^b in the stand 56, and to prevent the rotation of the rod 86 the latter is doubled upon itself adjacent the stand 56, and the end portion thereof is received in a bearing 56^c in the said stand 56. The doubled portion of the rod 86 has adjustably secured thereon an arm 87, which in turn has a disk 88 adjustably located thereon. The arm 87 is set in such position upon the rod 86 that the paper tubing in traveling forward will engage the disk 88 just previous to the time that it is desired to commence the operation of cutting off said tubing. Upon the engagement of the tubing with the disk 88 the latter is forced forward, carrying with it the rod 86, such travel being continued until the end of the rod adjacent the cam 82 has been drawn from engagement with the pin 80' on the link 80, as shown in dotted lines in Fig. 27, during which time the arm 87 has traveled into the position shown in dotted lines in Fig. 3. The spring 84 now draws the said link into position to cause the roll 81 to be engaged by the cam 82, which latter forces the link 80 forward and effects the locking of the knuckle-joint to cause the wheels 69 to engage the roll 67. The said wheels having been set at the proper angle to cause their travel upon the roll at an equal speed with the tubing, at once begin such travel and the same is continued until the central joint 77' of the knuckle-joint comes in contact with an adjustable stop

89, located on the hanger 63, the wheels 69 and frame 68 having now reached the position shown in dotted lines in Fig. 27. When the tubing engaging the plate 88 on arm 87 has forced the latter and the rod 86 into the position shown in dotted lines in Fig. 4, the end of the said rod 86 adjacent the link 80 reaches approximately the position shown in Fig. 29, at which time the link 80 is in the position also shown in said figure, the said link having been carried forward by the rod 61, which travels with the frame 68, carrying the wheels 69, as above set forth, until said link assumes the position shown in Fig. 29. Just before the central portion of the knuckle-joint travels into contact with the stop 89 the cutting of the tubing is completed and the cut section falls, after which a spring 90, which is mounted upon the rod 86 and confined between a collar 86′, mounted thereon, and the bearing 56^b of the stand 56, and which spring is contracted by the forward movement of the rod 86, at once expands and returns the rod 86 to its starting position. The end of rod 86 adjacent the cam 82 is curved, as at 86^a, and in the return travel of the rod 86 said curved end 86^a engages the pin 80′ on the link 80 and rocks said link outward, as shown in dotted lines in Fig. 29 and in full lines in Fig. 27. The wheels 69 continue to travel upon the roll 67 until the knuckle-joint is engaged by the stop 89 sufficiently to cause the breaking of said joint, as shown in Fig. 30, when the springs 70′ at once act to withdraw the wheels 69 from contact with the roll 67. During its forward travel the rod 61 has been drawing against the force of a spring 91, mounted thereon and confined between a collar 92 and the hanger 63′, and as soon as the wheels 69 are released from the roll 67 said spring 91 at once acts to return the several elements to their starting positions, as shown in Fig. 27, the pin 80′ on link 80 during such return movement traveling against the side of the rod 86.

The bracket 85, if desired, may be of such shape as to assist in the support of the link 80.

When the cutting mechanism is not in operation, the tubing travels in close proximity to the saw; but when the latter is at work said tubing is raised sufficiently to allow the saw to cut through the several wound strips composing the shell of the tubing, and the latter is held in such elevated position during at least one revolution of itself, thus allowing the saw to completely sever a portion of the tube.

To accomplish the raising of the tubing, I have provided the mechanism shown in Sheets 2 and 7 of the drawings. Describing this mechanism, the reference-number 93 denotes a plate hinged near one end to the stand 56 and having its opposite end supported by an arm 94, which is secured to a shield 58′, provided for and traveling with the saw 58, the lower portion of said shield being preferably secured to the rod 61, as shown in Fig. 3. The plate 93 receives the tubing, the latter being adapted to revolve thereon, and said plate has secured thereto at its back side a similar upright plate 93′ to retain the tubing in position on the plate 93. The plate 93 may have secured thereto also, if desired, an adjustable clamp or guide 95, as shown in Fig. 5, thus supporting the tubing at three points—viz, the plates 93 93′ and the clamp 95—but within which points it is free to rotate. The plate 93 has secured to its under side a flat spring 96, whose free end is thickened and widened, as at 96′, and the opposite ends of which portion 96′ are beveled, as at 96^a 96^b. While the cutting-off mechanism is stationary the end of the arm 94 is adjacent to the beveled end 96^a of the spring portion 96. When, however, the rod 61 is operated to start the travel of the saw, the end of the arm 94 engages the beveled end 96^a of the spring portion 96, and as the arm travels forward (carried by the saw-shield 58′) the end of the arm 94 travels beneath the spring portion 96′ and gradually raises the plate 93. (See Fig. 33.) The raising of plate 93 moves the tubing carried thereon into contact with the saw 58, as shown in Fig. 32, such movement of the tubing being sufficient to permit the saw to cut through the shell, as above mentioned. The plate 93 and the tubing thereon remain elevated sufficiently long to permit the tubing to make at least one revolution before the arm 94 travels from beneath the spring portion 96′, and after the arm reaches the position just mentioned (see Fig. 35) the plate at once reassumes the position of Fig. 33. Upon the return movement of the saw 58 the arm 94 engages the beveled end 96^b of the spring 93, forcing the latter downward and riding upon the upper face thereof until the arm returns to its starting position. It will be noticed that during the said return movement of the saw the position of the plate 93 is not changed, and therefore the tubing in its forward travel during such time does not come in contact with the saw.

It will now be readily seen that after setting the cutting-off mechanism to travel at a uniform speed with the tubing the tubing may be automatically cut into desired lengths.

The drying apparatus above mentioned is adapted to act upon the tubing midway the winding mechanism and the cutting-off mechanism. Said drying mechanism consists of a horizontal pipe 99, located beneath the tubing and having one end thereof closed by the cap 99′. The opposite end of pipe 99 is open and is secured by an arm 99^a to a vertical pipe 100, whose upper end is closed by a cap 100′. In line with the open end of the pipe 99, however, the said pipe 100 has a small outlet 101. The pipe 100 is adjustably secured in a sleeve 102, which latter has a stem 102′, that is journaled in a bearing in the upper end of a stand 103. By means of a nut 102^a, mounted on the end of stem 102′, the said drying apparatus may be locked in any position to which it may

be adjusted. The reference-number 104 denotes a flexible gas-supply pipe secured to the end of the pipe 100. It will now be seen that when a supply of gas is introduced into the pipe 100 said gas will escape with considerable force through the opening 101 and enter the pipe 99, carrying with it by suction a considerable quantity of air, such suction being increased by the consumption of the gas upon lighting of the same at the slots 99^b, provided in the pipe 99. The described drying apparatus is set beneath the tubing, and as the latter travels over it the heat from the burning gas serves to dry the said tubing, which latter then passes to the saw 58 completely dried.

My machine as a whole is not of complicated construction, may be operated by a single attendant, and produces very rapidly and in desired lengths tubing of the class described.

Having thus described my invention, I claim—

1. In combination, in a tube-machine, a journaled frame with projecting mandrel, as set forth; a core-paper-supporting shaft extending transversely through said frame, and means for centering and supporting the roll of core-paper consisting of plates 21 adjustably secured within said frame, substantially as specified.

2. In combination, a journaled frame with projecting mandrel as set forth, a paper-roll support consisting of a shaft 19 extending transversely through said frame, a guide for the core-strip consisting of a friction-plate 28 carried by the said frame, and means for adjusting the said plate to vary the delivery-angle of the said strip.

3. In combination, a journaled frame with projecting mandrel, a paper-roll support consisting of a shaft extending transversely through said frame, a plate 28 for controlling the delivery-angle of the core-strip, and a spiral guide 27^a fixed upon the said mandrel, substantially as specified.

4. In combination, a journaled frame with projecting mandrel, a paper-roll-supporting shaft located transversely in said frame, suitable guides for controlling the delivery of the core-strip to the mandrel, and tube-feeding mechanism consisting of frictionally-acting wheels 31 whose axes are arranged at an angle to the axial center of the said mandrel.

5. In combination, a revoluble mandrel, means for supporting a core-strip and for guiding the same to the said mandrel, and tube-feeding mechanism consisting of wheels 31 located around and acting frictionally upon the tube, substantially as set forth.

6. In combination, a revoluble mandrel, means for delivering a strip of core-paper to said mandrel, tube-feeding mechanism consisting of wheels whose axes are arranged at an angle to the axial center of the mandrel and whose perimeters are in frictional contact with the tube, and means for changing the angle of the said feed-wheels.

7. In combination, a revoluble mandrel, tube-feeding mechanism consisting of frictionally-acting wheels arranged around said mandrel, each wheel being journaled in a pintle that is mounted in a suitable supporting-frame, and means consisting of an adjusting-screw 35, and connections between said screw and the said pintles, whereby the several feed-wheels may be moved in unison, all being substantially as specified.

8. In combination, a revoluble mandrel, means for supporting a core-strip and for guiding the same to the mandrel, tube-feeding mechanism consisting of wheels 31 acting frictionally upon the tube, pasting mechanism adjacent to said mandrel, and devices substantially as specified for supporting and separating rolls of cover-paper.

9. In combination, a revoluble mandrel, means for supporting a core-strip and for guiding the same to the mandrel, tube-feeding mechanism consisting of wheels 31 acting frictionally upon the tube, pasting mechanism having attached thereto devices for supporting and separating rolls of cover-paper, and mechanism for adjusting the said pasting mechanism and cover-paper relatively to the mandrel to vary the angle at which the cover-paper is coiled upon the core of the tube.

10. In combination with tube-forming mechanism, tube-cutting mechanism consisting of a saw mounted to travel with the said tubing during the operation of cutting, a support for the said tubing, and mechanism for moving the said support to force the tubing into engagement with the saw.

11. In combination, in tube-cutting machinery, a driving-shaft 65 having fixed thereon a cam 82 and drum 67, rolls 69 located adjacent to, and adapted to be moved into engagement with, the said drum, and mechanism intermediate the said rolls and cam for forcing the rolls into engagement with the drum, for the purpose specified.

12. In combination, in tube-cutting machinery, a driving-shaft having fixed thereon a cam and drum as set forth, rolls 69 adapted to engage, and travel upon, the said drum, levers 75 and links 76 77 for forcing said rolls into engagement with the drum, lever 80 connected at one end with the link 76 and bearing in its other end a roll 81, and mechanism substantially as specified for moving the said roll 81 into the path of the cam to start the tube-cutting mechanism into action.

13. In combination, in tube-cutting machinery, a constantly-revolving drum, rolls 69, whose axes are at an angle to the axial center of the said drum, means consisting of levers 75 and links 76 77 for forcing the rolls into engagement with the drum, means for

locking the said links in alinement, and means consisting of a stop 89 for unlocking the said links; all substantially as specified.

14. In a tube-cutting machine, in combination, a longitudinally-movable saw-arbor and saw, a constantly-revolving drum, rolls 69 whose axes are at an angle to the axial center of the drum, mechanism for forcing the said rolls into engagement with the said drum, and mechanism connecting the rolls 69 and the saw-arbor whereby the said rolls and arbor are caused to move in unison.

15. In a tube-cutting machine, in combination, a longitudinally-movable saw-arbor and saw, a hinged shelf for supporting the tubing adjacent to the saw, a spring 96, having a head 96′ and inclined portions 96^a 96^b secured to said shelf, and an arm carried by the saw-arbor frame and adapted to engage the said inclined portions 96^a 96^b, for the purpose specified.

16. In a machine for making paper tubes, a journaled frame, a projecting mandrel carried thereby, a shaft arranged transversely in said frame and supporting a roll of paper, plates adjustable on said shaft and disposed on the respective sides of the roll of paper, and means for retaining said plates in their adjustment, substantially as described.

Signed at Brooklyn, New York, this 13th day of July, 1899.

WALTER L. ALLEN.

Witnesses:
FRANK H. ALLEN,
MARTIN H. DAY.