(No Model.) 7 Sheets—Sheet 1.

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PAPER FOLDING MACHINE.

No. 497,745. Patented May 16, 1893.

Fig. 1.

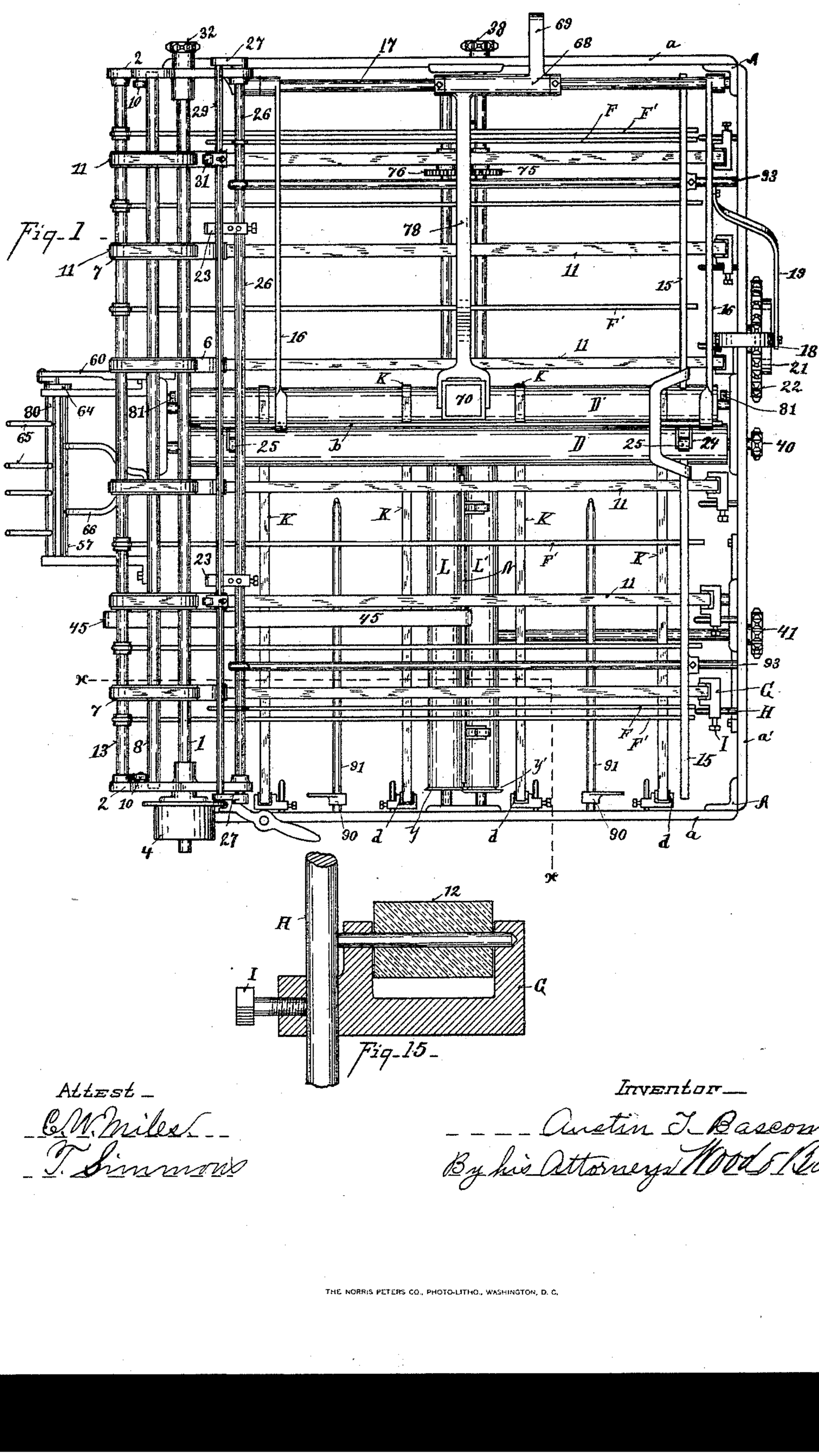

Fig. 15.

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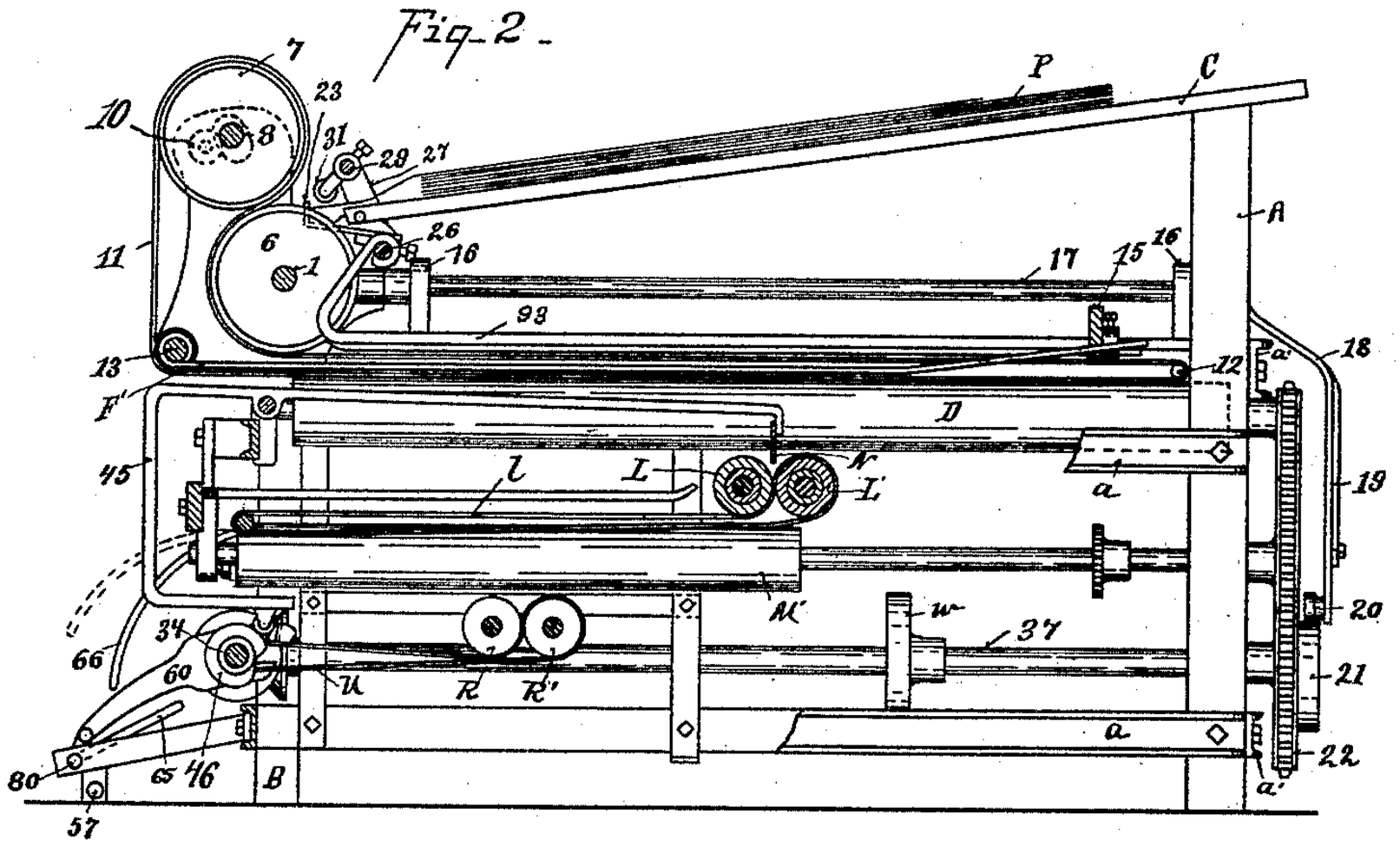
Fig. 2.



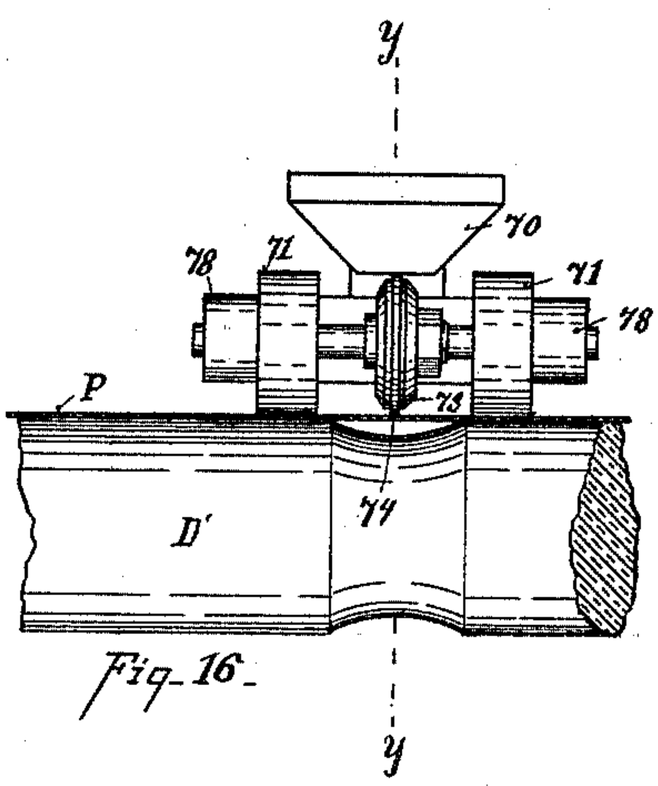


Fig. 16.

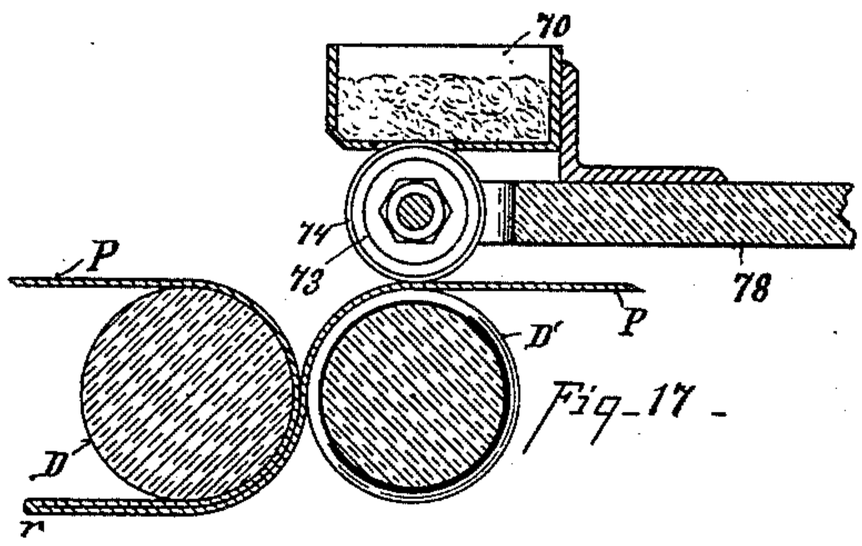


Fig. 17.

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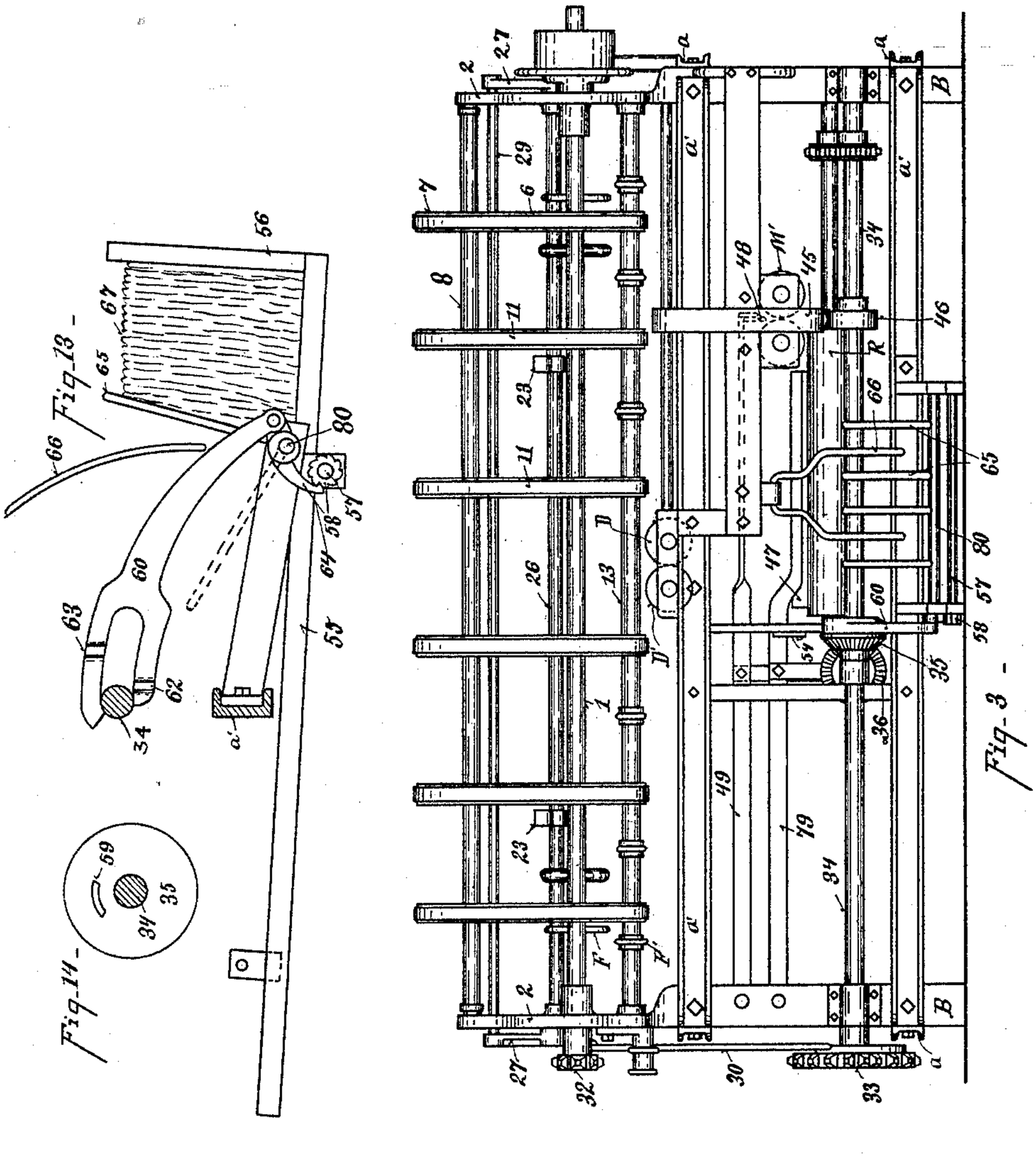

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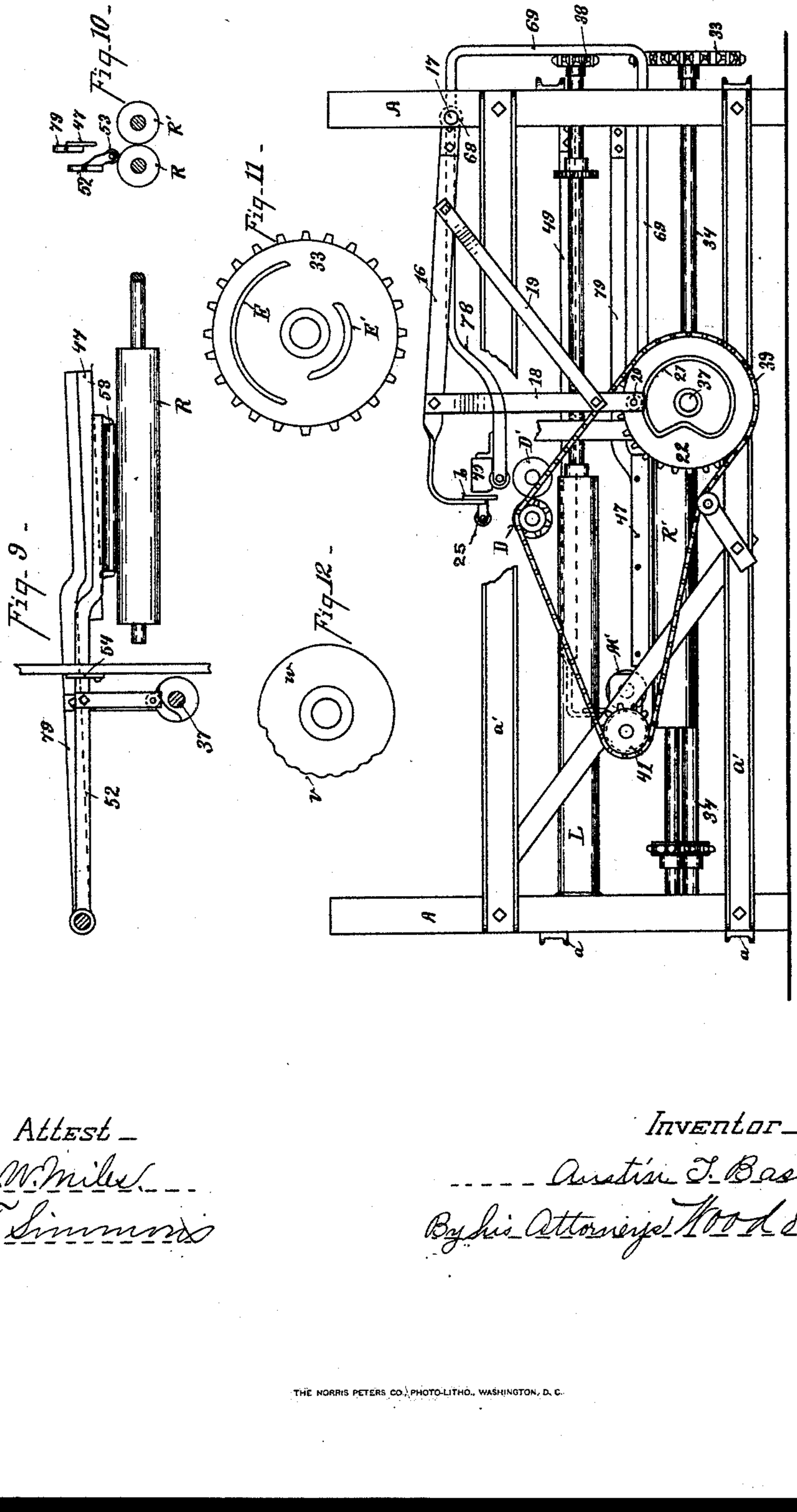

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Fig. 5.

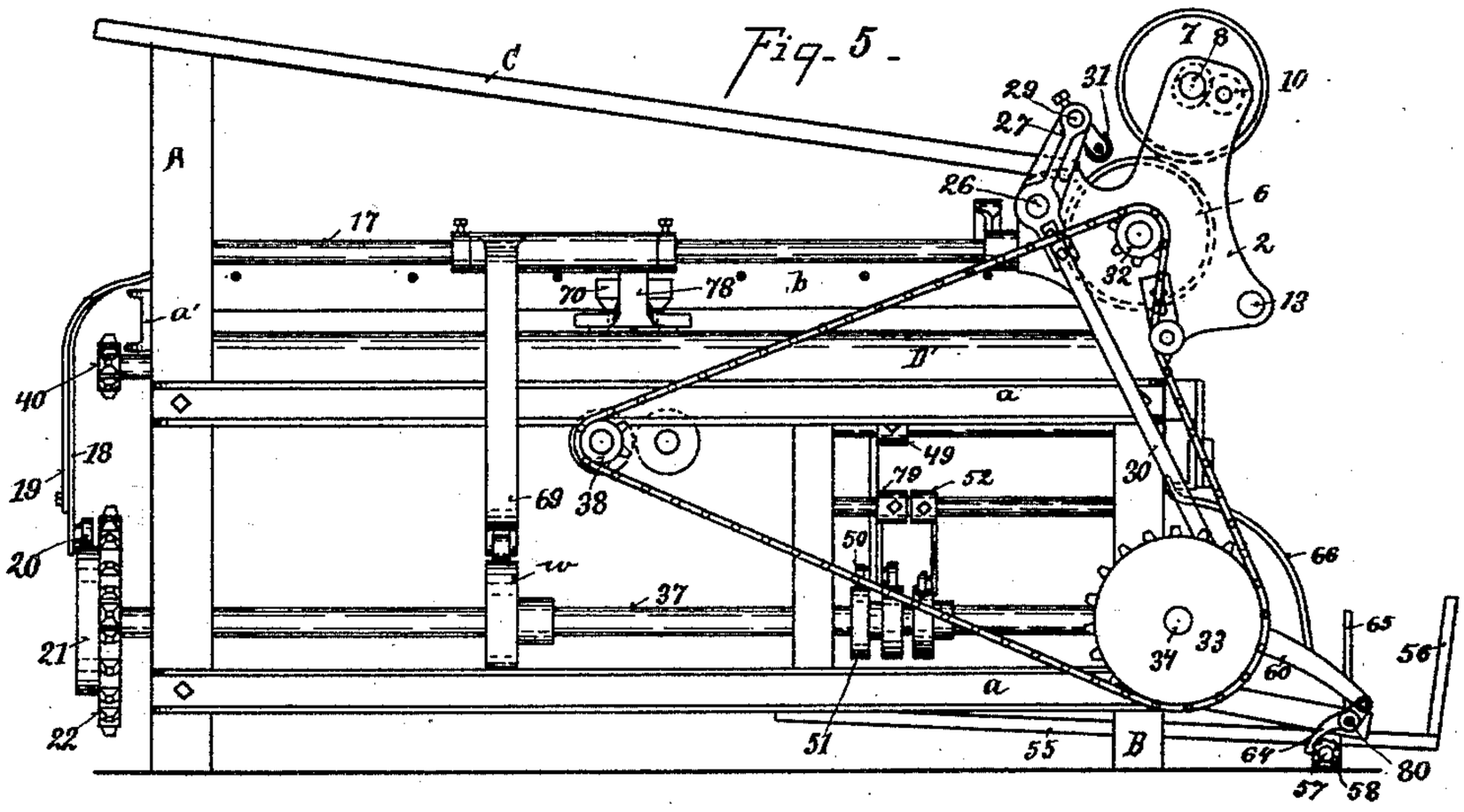


Fig. 6.

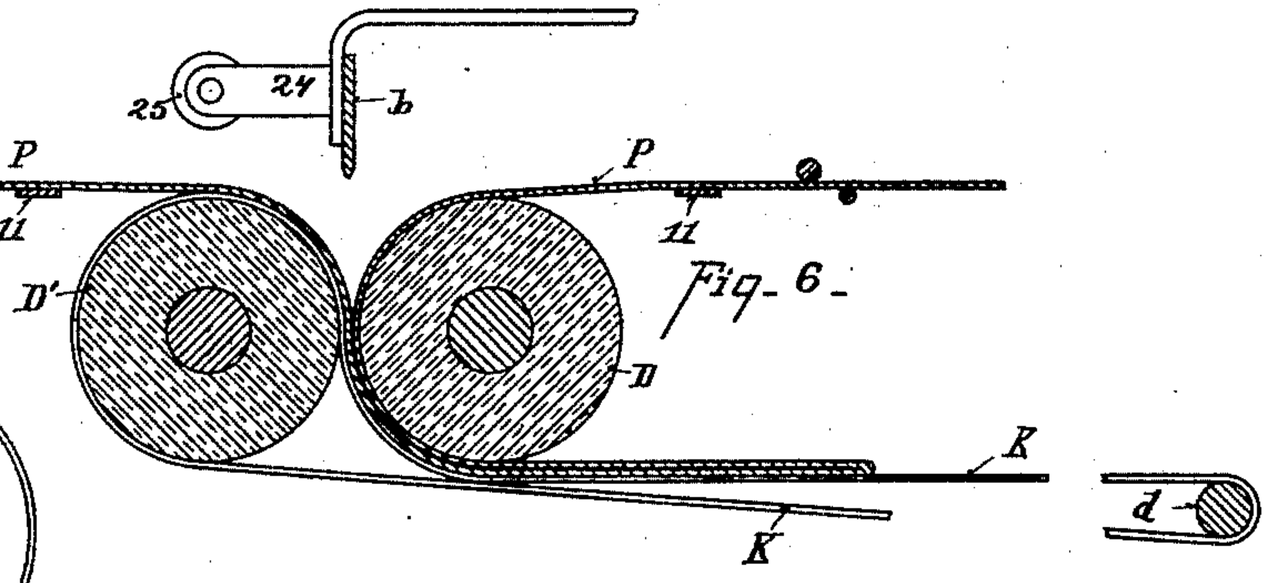


Fig. 7.

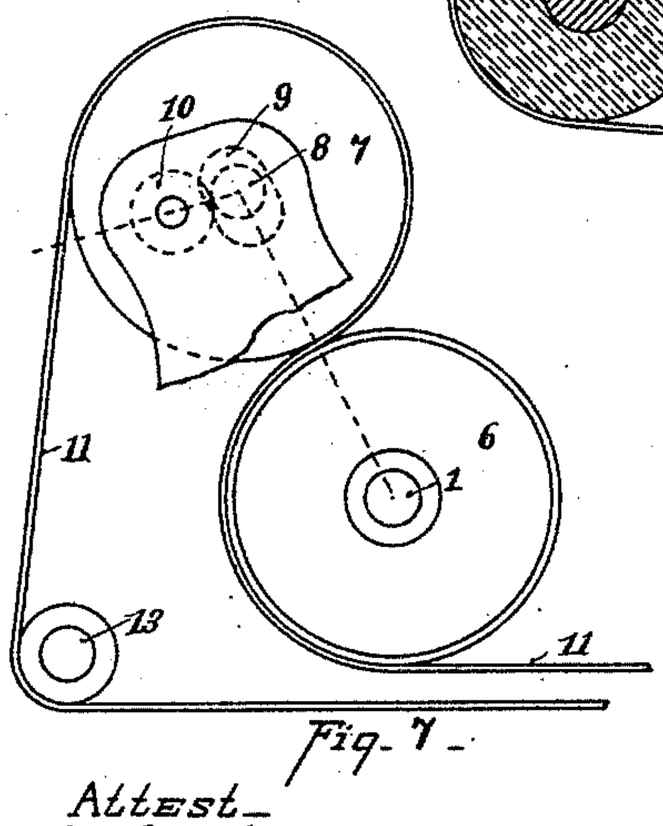
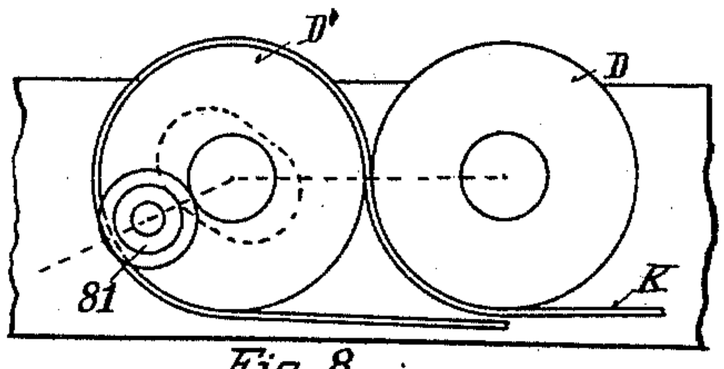


Fig. 8.



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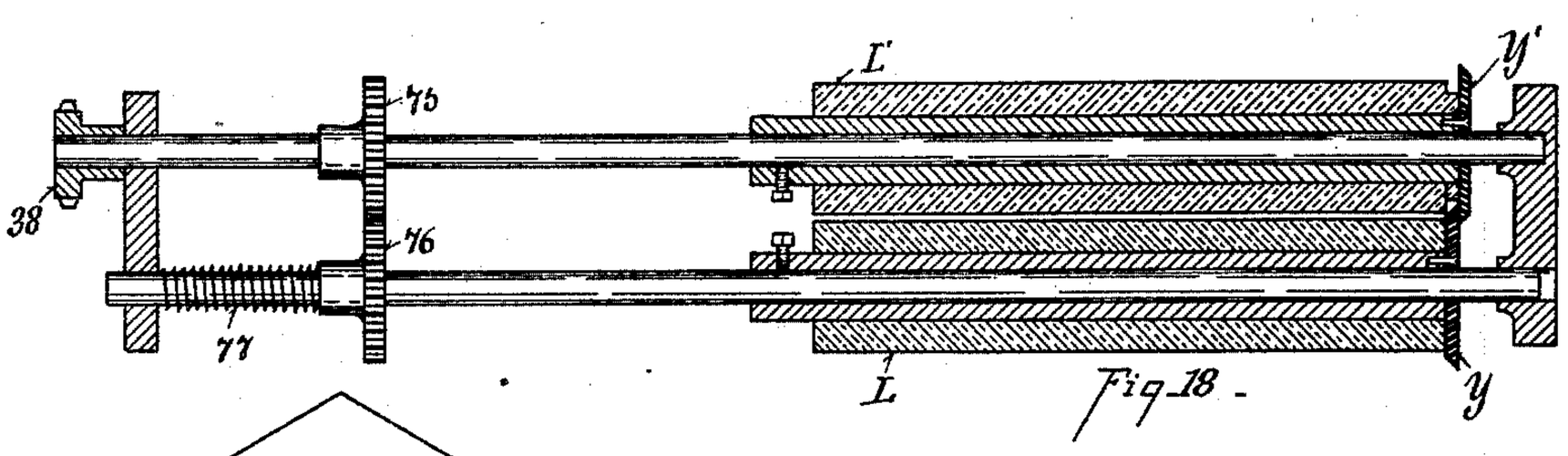


Fig. 18.

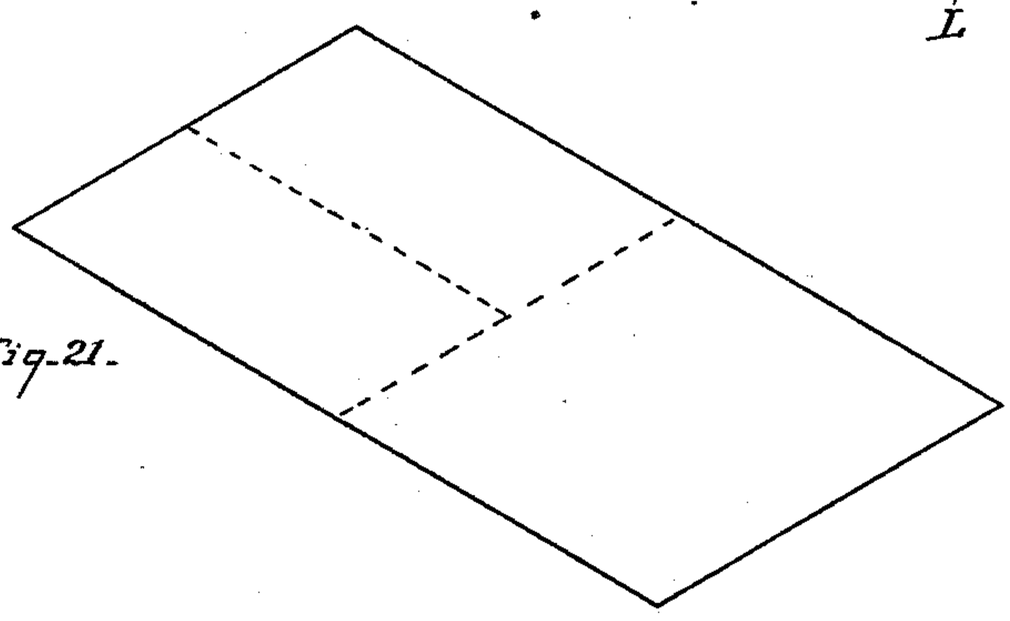


Fig. 21.

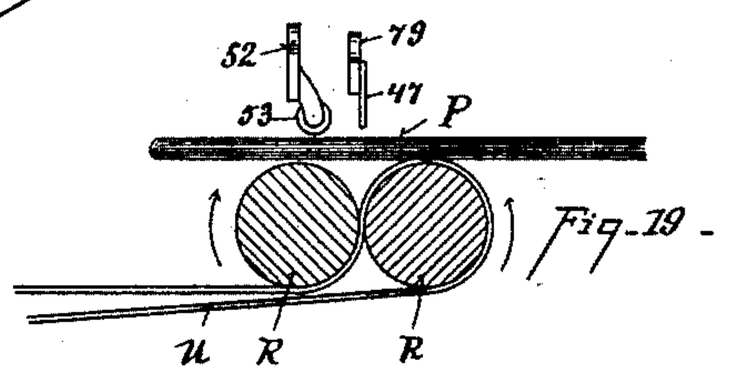
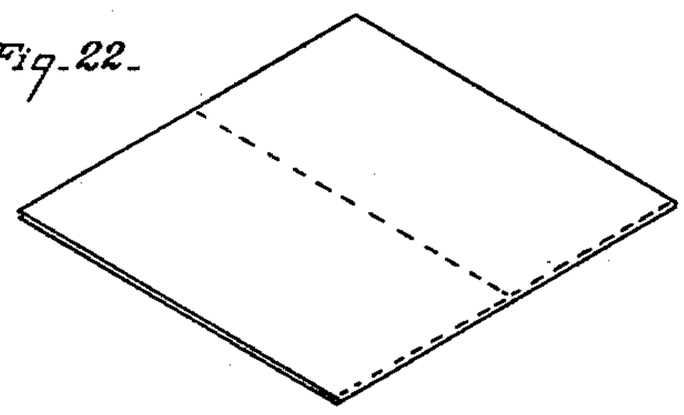


Fig. 19.

Fig. 22.



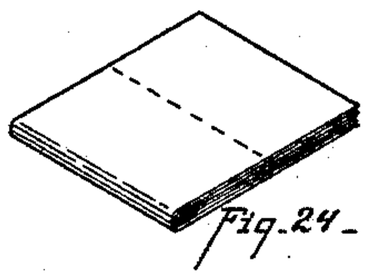


Fig. 24.

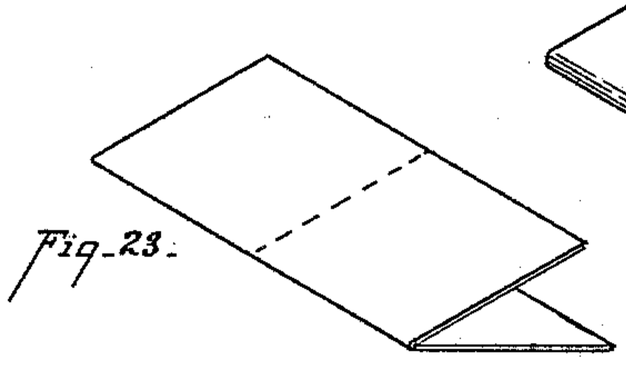


Fig. 23.

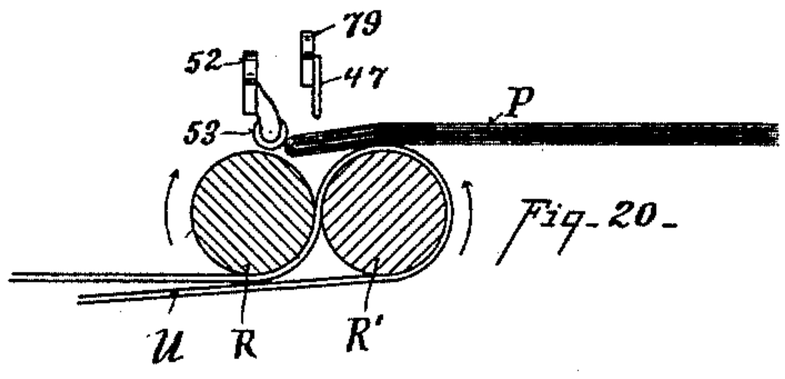


Fig. 20.

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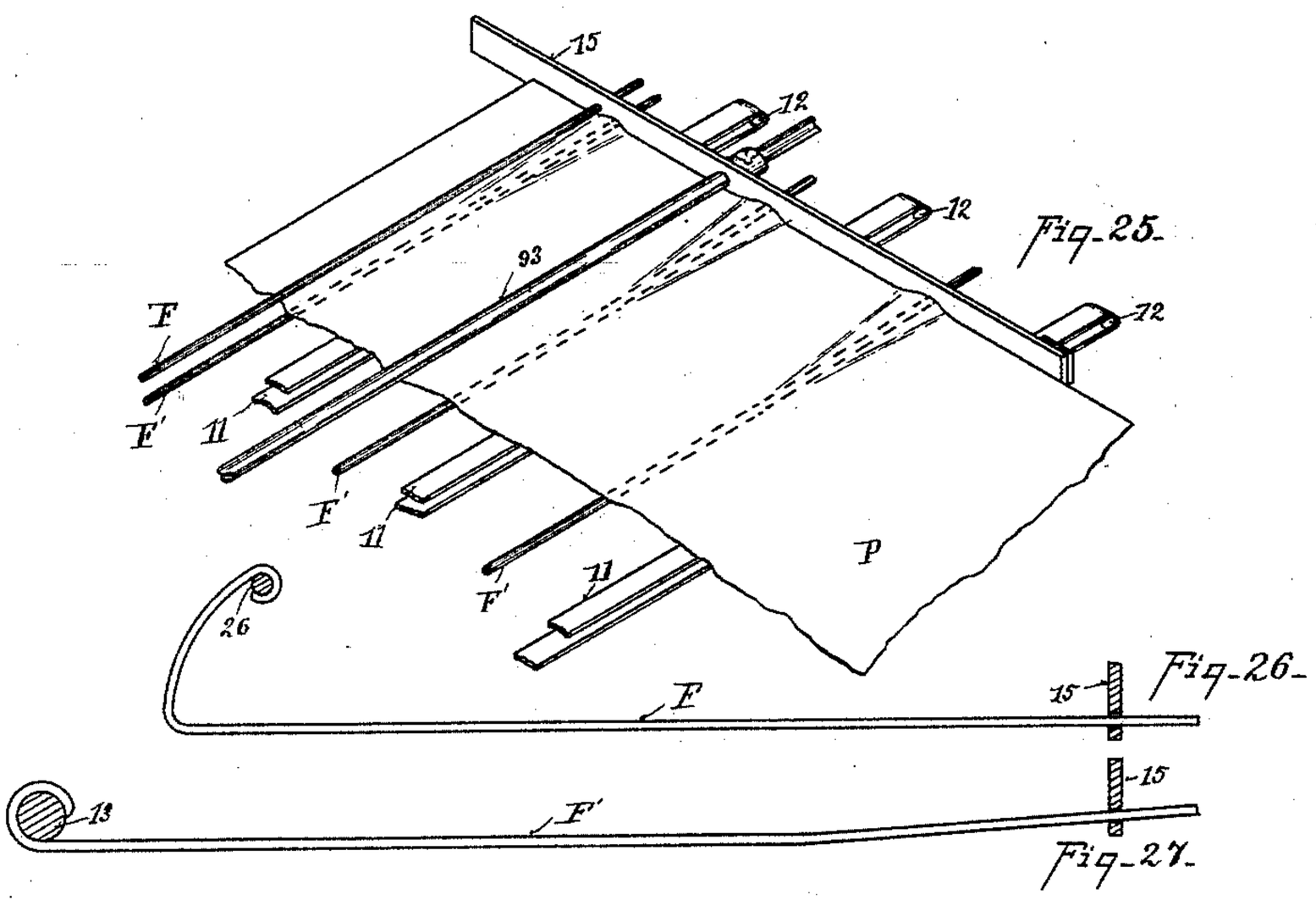

Fig-25-

Fig-26-

Fig-27-

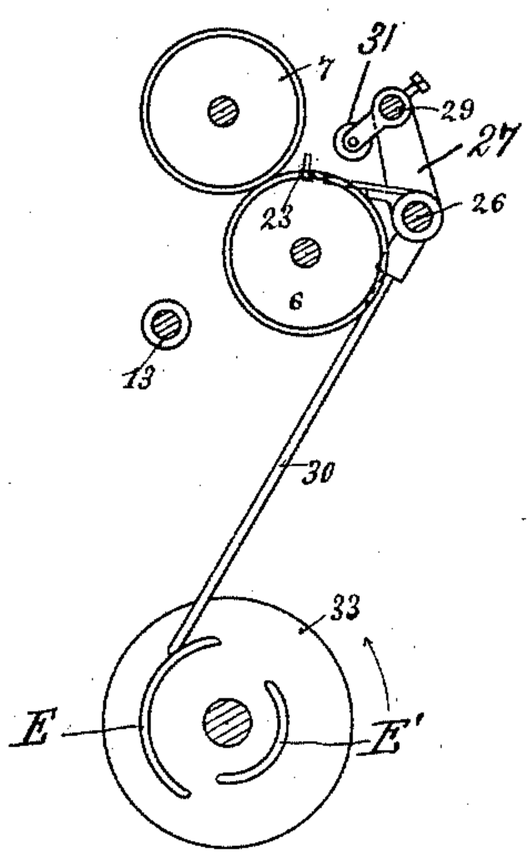

Fig-28-

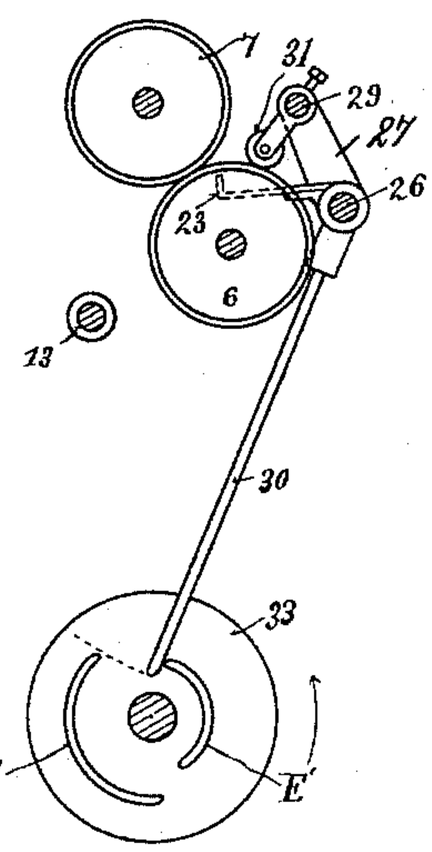

Fig-29-

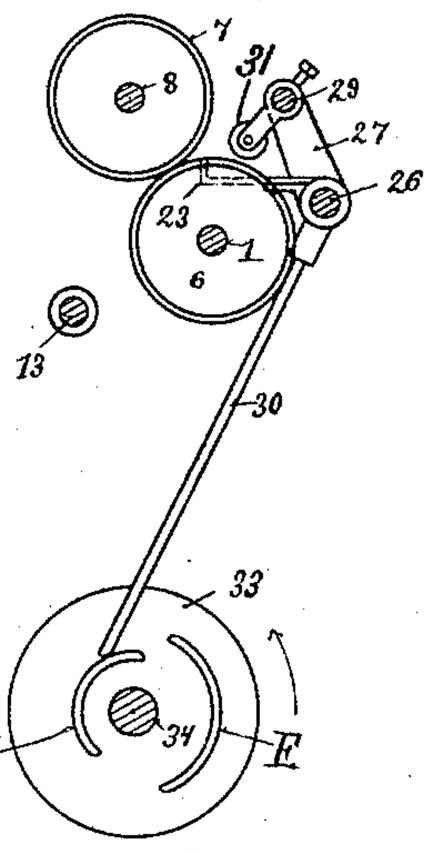

Fig-30-

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UNITED STATES PATENT OFFICE.

AUSTIN T. BASCOM, OF SIDNEY, OHIO, ASSIGNOR OF ONE-HALF TO J. K. CUMMINS, OF SAME PLACE.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 497,745, dated May 16, 1893.

Application filed December 22, 1891. Serial No. 415,871. (No model.)

To all whom it may concern:

Be it known that I, AUSTIN T. BASCOM, a citizen of the United States, residing at Sidney, in the county of Shelby and State of Ohio, have invented certain new and useful Improvements in Paper-Folding Machines, of which the following is a specification.

One of the objects of my invention is to provide a paper folding, pasting and cutting machine by means of which the papers can be folded three or four times, as occasion requires, either with the use of the pasting apparatus, or without it.

Another object of my invention is to provide mechanism by which three folds can be made, and the fourth dispensed with.

Another object of my invention is to facilitate the feeding so that only one sheet will be fed into the apparatus at a time.

Other objects of my invention relate to the details of construction of the apparatus whereby its operations are rendered simple and positive.

The various features of my invention are fully set forth in the description of the accompanying drawings making a part of this specification, in which—

Figure 1 is a top plan view of the machine showing only the two upper sets of folding rolls. Fig. 2 is a sectional elevation on line *x*, *x*, Fig. 1. Fig. 3 is a front elevation. Fig. 4 is a rear elevation. Fig. 5 is an end elevation of my improvement. Fig. 6 is a sectional elevation of a pair of folding rolls in the act of folding a paper. Fig. 7 is an end elevation of the feeding roll. Fig. 8 is an end elevation of a pair of folding rolls. Fig. 9 is a side elevation of the lower set of the folding rolls and tapping mechanism. Fig. 10 is an end view of the same. Fig. 11 is a plan view of a cam on one of the driving wheels. Fig. 12 is a plan view of the paster. Fig. 13 is a side elevation of receiving rack, and mechanism for depositing the papers therein. Fig. 14 is a plan of the disk for operating the same. Fig. 15 is a section of the tape belt sheave. Fig. 16 is a front elevation of the pasting device. Fig. 17 is a section on line *y*, *y*, Fig. 16. Fig. 18 is a central horizontal section of the second pair of folding rolls. Figs. 19 and 20 are details showing the manner of making three instead of four folds. Figs. 21, 22, 23 and 24, are diagrams representing the successive stages in the operation of folding the paper. Fig. 25 is a perspective view of the feeding tapes, stop and supporting fingers for delivering the paper to the first set of folders. Fig. 26 is a detail view of the upper supporting rod, and Fig. 27 is a detail view of the lower supporting rod. Figs. 28, 29, 30, are diagrams representing the initial feeding mechanism in different positions.

The folding machine shown in the accompanying drawings is composed of the following mechanism: First, a set of feeding pulleys and tape belt carrying mechanism, second, initial folding rollers D D′ with accompanying mechanism and tape belt carrier, succeeded by a second set of folding rolls L L′ and accompanying tape belt carriers, and tapping mechanism; a third set of folding rolls M M′ with the concomitant tape belt carriers and mechanism; a fourth set of folding rolls R R′ and tape carriers, starting mechanism and an auxiliary mechanism which may be brought into operation for stopping the fourth fold if desired; sixth, pasting mechanism preferably used in connection with the first set of folding rolls; and lastly, the receiving rack and mechanism for delivering the papers thereto in proper position.

My invention relates partly to the method of combining and operating said mechanisms which are arranged to work consecutively in the following order: first, the feeding rolls or pulleys with improved feeding mechanism to take the papers and deliver them to the initial folders: these folding rolls deliver the papers to the second folding rollers and they in turn to the third, and so on. These parts are driven in appropriate time movements in the following manner: 1 represents the main driving shaft, 4 the driving pulley; 32 a transmitter on the opposite end of said shaft 1, which is shown as a chain wheel, Fig. 5, transmitting motion to shaft 34, and a second set of folding rolls. Shaft 34 is provided with a beveled gear 35 meshing with bevel 36 on the shaft 37, upon the rear end of which is mounted a chain gear wheel 22; this transmits motion to the folding rollers D and M, see Fig. 4. These several shafts and gears

carry the appropriate cam mechanism for performing the various operations in time movements as will be hereinafter explained.

The machine is preferably constructed in the following manner:

A represents the rear posts of the machine; B the front posts; C the table; *a*, *a*, the side rails bolted to the front and rear posts.

a' a' represent the front and rear rails fastened to the front and rear posts respectively.

The main shaft is journaled to the head blocks 2, which are preferably made integral with posts B.

4 represents the driving pulley.

6 represents a series of pulleys fixed on the shaft 1.

7 represents a series of auxiliary feeding pulleys mounted upon the shaft 8 which shaft is loosely supported in the gains or elongated recesses 9 in the head blocks 2, as shown in Figs. 2, 5 and 7, so that the peripheries of the pulleys 7, rest upon the peripheries of the pulleys 6, which support the said pulleys 7 in a vertical direction.

10 represents friction rollers journaled to the head blocks 2 at one side of the gains or elongated recesses 9, and bear against the pulleys 6 whereby the said pulleys are supported in a lateral direction. I provide this means so that the auxiliary feeding pulleys may be permitted to move slightly in a vertical and lateral direction upon the entrance of the paper to be folded, being retained in operative relation to the pulleys 6 by the tension of the carrying belts.

11 represents a series of tape belts supported at their rear end by idler pulleys 12 and at their front end by the sleeve shaft 13; said tape belts are passed over the feed roll 7 and between the rolls 6 and 7 in the manner shown in Fig. 7. This method of mounting the feeding pulley 7 upon the periphery of pulley 6 clutches the tape belt 11 between said pulleys, so as to hold the paper P between the tape belt 11 and the feeding pulleys 6, and carry it around said pulley and around on top of the tape belts. The tape supports the papers and carries them forward until they rest against the rear stop 15, centrally over the first set of feeding rolls D D', and between the fingers F F'. The fingers F hold the paper down on the belts and prevent it from soaring and the lower fingers F' prevent the rebound of the paper, and prevent the ends of the paper from dropping down between the tape belts.

The paper is doubled and folded by the rolls D D', in the following manner: *b* represents a tapper or starting finger which pushes the paper down between the rolls at the appropriate time; this tapper or starting finger is operated as follows: 16 represents arms rigidly connected to rock shaft 17, see Fig. 1; these arms overhang the rolls D D' and support the tapper finger *b* in the central position, as shown in Figs. 4 and 6. 18 represents a pendent arm secured near the front end of arm 16. 19 represents a brace arm connecting arm 16 and arm 18. 20 represents a frictional roller on the free end of arm 18 which rests and travels upon the cam 21, preferably formed on the face of gear wheel 22. At the appropriate time the friction roller 20 drops into the depression of cam 21 and brings the tapper finger down upon the central line of the paper and thrusts it between the folding rolls D D'. In order to arrest this tapper finger at the proper time and prevent it being drawn into the rolls I provide yoke arms 24 carrying friction rollers 25, which strike the folding roll D and arrest the downward movement of the finger; the tapper makes a quick motion and is lifted up by the cam 21 as soon as the folded paper is thrust between the feeding rolls. The papers rest upon the table C and are fed at appropriate intervals to the feeding rolls 6 and 7. Stop mechanism is provided to prevent the papers being fed except at intervals which will be hereinafter explained. The papers are carried by the tape belt 11 around the rolls 6 and between the fingers F F' above the folding rolls D D', where they are arrested by the stop 15. They are pressed down by the tapper finger *b* between the rolls D D', and a second paper is started just as this initial folding commences, so that one paper is fed forward by the feeding rolls or pulleys 6 and 7, while the initial rolls D D' are operating upon the first paper.

In order that the papers may be fed one at a time and in the appropriate time movements I provide the following mechanism which is shown by diagram in Figs. 28, 29 and 30: 23 represents stops or guards which are placed at one side of the feed rolls or pulleys 6 the end of the finger projecting above the same, as shown in Fig. 28; this forward projection prevents the paper from being accidentally fed forward between the rolls. These guards are mounted upon the rock shaft 26; said rock shaft is provided with the series of crank arms 27, upon which is mounted a rod 29; upon this rod 29 is mounted a series of friction rollers 31. The rock shaft 26 is operated by means of the pendent arm 30 resting upon the cams E E'. When the parts are in position shown in Fig. 28, the guard holds the papers from being fed; at the appropriate time the fingers 23 have come into the position shown in Fig. 29, which allows the paper to be fed forward. These guards are depressed a sufficient time to allow the paper to pass through the feeders 6 and 7; the paper is caught between the friction roll 31 and the feeders 6; as soon as the paper has been caught between the tapes and rolls 6, roll 31 commences to rise and comes into the position shown in Fig. 30, and from thence, it passes to position shown in Fig. 28, so that the papers are easily and appropriately delivered to the feeders 6 and 7. This assists the operator in proper time movements and prevents accidental feeding.

I have shown four sets of folding roll mech-

anism, each of which is mounted in substantially the same manner; the first set of folding rolls D D′ is at right angles to the feeding pulleys 6 and 7; the first fold of the paper is performed by these folding rolls D D′, and the paper is delivered horizontally on to the second set of tape belts K which are driven by the feeding roll D′ supported at the opposite end by idler rollers *d*, which are of the same construction as the idler rollers 12 supporting the upper tape belt 11. In order to tighten these tape belts each spool or roller *d* or 12 is mounted in brackets G. The stems of said brackets G are pierced to receive the rod or stud H and is held in position by the set screw I so that the slack in the tape belts can be readily taken up or the belts loosened as occasion requires.

Positive motion is transmitted to the feeding roll D, only, the feeding roll D′, which carries the tape belts K, being loosely supported in an elongated recess in one of the side rails, as best shown in Fig. 8, and its periphery resting against the periphery of the roll D.

81, represents friction rolls journaled at one side of the bearing of the roll D′, and supporting the said roll D′ in one direction. By this means the roll D′ is permitted to yield in the same manner and for the same purpose as the auxiliary feed pulleys 7. As the paper is folded it drops upon the tape belt by which it is carried to a position above the second set of feed rolls L L′, and resting against stops corresponding to stop 15 above rolls D D′. Above these secondary feed rolls L L′ is supported a secondary tapping finger N, which is mounted on the overhanging rock arm 45. This arm is operated in appropriate time movements by means of the cam 46 on the shaft 34, which cam is similar in construction to the cam 21 operating the tapper finger on the first set of feed rolls. The feed roll L′ supports and draws the tape belt 1 and delivers the paper to the third set of folding rolls M M′. The axis of these rolls are parallel to the first set D D′, see Fig. 2, and they are provided with a tape mechanism operated in the same manner as the tape belts 1 and K.

48 represents a tapper finger supported vertically over the contact point of rolls M, M′; it is operated by the arm 49 which is provided with the friction roller 50 working on the face of cam 51. This mechanism operates the tapper 48 in appropriate time movements. Below is the fourth set of folding rolls R R′, the roll R′ being loosely journaled and supported, as shown for the folding roll D′ and it carries a fifth set of tape belts U, by means of which belts the folded papers are delivered to the receiving rack.

It is sometimes desirable to fold papers only three times and simply use the fourth set of folding rolls as an idler; when this operation is performed I provide a secondary arm 52, see Fig. 9, which is parallel to the arm 79 supporting the tapping finger 47, and is armed with the friction roller 53 which may be allowed to rest upon the roll R on one side of the tapping finger and it feeds the paper laterally off the roll R on to roll R′. See Figs. 19 and 20. The tapping finger 47 catches the end of the paper and feeds it to the rolls R R′, without folding it. In order that this may be accomplished it is necessary that the paper shall have passed so far over the rolls R, R′, that its end will be over bite of the said rolls at the time the tapper 47 descends, and this is effected by reason of the fact that when the roller 53 is let down in contact with the paper, such paper will travel at a greater speed than when said roller 53 is elevated out of operation, and if the travel of the paper is so rapid that otherwise it would have passed entirely off the roll R′, it is stopped by the stops 90; and the tape belts slip under the paper, and as tapper 47 descends it forces the paper end first into the bite of the rolls R, R′, and it is then carried out unfolded by said rolls by the tape belts. When it is desired to throw this side moving roll 53 out of the way the arm 52 is supported upon catch 54 out of the way, and the fourth fold will be made by the folding rolls R R′, and tapper 47.

The receiving rack is constructed and operated as follows: 55 represents an arm on which the rack board 56 is mounted; it is supported upon a friction roller or shaft 57 which carries a ratchet wheel 58. 59 represents a cam lug on the face of the bevel gear 35. 60 represents a fork arm supported on the idler shaft 34. One of said forks is provided with the lug 62, the other fork with the lug 63. In Figs. 13, 14, this rack moving mechanism is shown with the fork in position but the bevel gear 35 is turned round so that the cam 59 is shown upon the face of the disk. Cam 59 strikes against the lug 63 and forces the rack forward one notch by the engagement of the hook pawl 64, with the ratchet wheel 58, and brings the rack and parts into the position shown in Fig. 13. Cam 59 in the opposite plane of its revolution strikes against the lug 62 and draws the arm 63 back, drops the ratchet arm 64 one notch and moves the fly or finger 65 back into the position shown in dotted lines, Fig. 13.

66 represents fenders which catch the bundle of papers 67 and hold them from going backward with the follower fly 65, when the tape belt mechanism of the fourth set of rolls feeds another paper down upon the fly 65, as the arm 60 is fed forward by the striking of cam 59 against the lug 63; the ratchet wheel moves one notch and said fly being mounted on the shaft 80 they are thrown forward in position shown in full lines Fig. 13; the fender fingers 66 being raised as shown in dotted lines, Fig. 2, by the paper resting on the fly; so as to allow the papers to pass and compress by the fly into position as shown in Fig. 13. Thus the papers are folded and delivered in a convenient bundle for packing from which

they are readily removable by the operator from time to time.

When it is desired to paste and cut the papers I provide the following mechanism: 78, Fig. 1, represents a rocker arm supported on the sleeve 68. 69 represents a yoke arm attached to said sleeve and projecting around and forward under the frame. The free end of the lower fork of said yoke arm is armed with a friction roller and rides upon the face of cam *w*, Fig. 12; when the yoke-arm is in contact with the serrated portion *v* it gives the arm a slight jolting or oscillation to assist in delivering the paste, which is contained in the hopper 70 mounted on the forward end of arm 78. 71 represents friction rollers journaled in the forked end of said arm and they are brought in contact with the face of the friction roll D′. I have shown the paper P supported on said roll in the act of being pasted; this is accomplished by means of the paste wheel 73, which is formed of two disks between which is clamped a felt disk 74 that projects into a slot in the bottom of the box, so as to take paste and transmit it to the paper P; the friction rollers 71 hold the paper in position to receive the paste and convey rotary motion to the pasting disk 74; when the paper is folded between the rolls D D′ the rolls squeeze the pasted papers together and fold them in the middle at *r;* this compression sticks the parts together. As the paper is folded it may be desirable to cut or trim off the folded edge and this is accomplished by means of rotary cutters Y Y′; one of which is upon the axis of the fixed roll L and the other upon the axis of the abutting roller L′. In order to hold these knives in contact and to revolve them both I provide gear wheels 75, 76, mounted on the axis of the rolls L L′; the knives are held in contact by means of the coil spring 77; the shaft or axis of the folding roll L′ being allowed to move freely laterally; these knives cut off one folded edge of the paper. 90 represents a series of stops fixed to the supporting rod 91, see Fig. 1; they are made adjustable to the line of the paper and width of margin. The rollers L L′ are likewise laterally adjustable on their shafts, as shown in Fig. 18. As the center line of the paper upon each of the set of rolls must always be vertically under the tapper it is necessary to adjust the cutters to different sizes of papers folded; this is done by loosening the set screws of the rolls L L′ and moving them longitudinally on their shafts.

There are several advantages derived from the use of the above described folding machine: first, a feeding table is supported over the folder and may be used as an ordinary table as the papers are carried round by the feeding pulleys directly under the table where the first folding operation is performed. I have shown pulleys 6 and 7 to perform the initial feeding to the first set of folding mechanism; cylinders or drums could be used in place of these pulleys, and are the equivalent thereof; so, also, a series of pulleys might be used to form the folding if but little space was employed, but I prefer the cylindrical form of folding rolls.

The folder is made very compact by having the several folding rolls placed vertically one above the other, the second set at right angles with the first, and the third at right angles with the second, &c. By having one of the folding rolls loosely journaled and held by its weight in frictional contact with the other a very important advantage is derived; this loose roll is journaled upon frictional rollers 81, see Fig. 8, and upon one side of said rolls, so that the weight of the loose rolls, say D′, holds it against the roll D and properly drives the tape belts, which are grasped between these rolls without unduly stretching the tapes, which merely carry the paper forward to be folded. The tape belts when driven this way will perform their work without being drawn so taut as where they are driven by the friction of a single roller; they will wear much longer and do not have to be tightened so often and all the tapes are driven at the same speed, because of the grasp of the folding rolls, and hence, the papers are carried squarely across on the tape belts, always delivered at the proper angle to the succeeding folding roll. This result cannot be accomplished when the journals of both rolls are fixed.

Great difficulty has been experienced hitherto in the use of initial tapper finger or starter for large papers, because suspended upon a long arm they rebound or tremble; as shown in Fig. 4, I obviate this difficulty by bracing the arm 16 upon the outside of the machine and taking the motion from cam 22 and the pendent arm secured nearly to the forward end of the arm 16.

Another advantage is obtained in my folding machine by having the guard friction rolls 25 on the tapper which arrest the downward movement and prevent all danger of its being caught by the folding rolls and not necessitating so quick a lifting motion, hence, by this means avoiding the tendency to rebound or jerking motions.

I am enabled to place my cutters directly upon the end of one set of the folding rolls, either the second or fourth, preferred; this is accomplished by having one of the rolls moving laterally on its axis and held in position by a retractile spring, which is of sufficient force to perform the cutting and yet allow a yielding to undue strains. I am also enabled to employ the folding rolls to assist in pasting, and thus in this compact machine, paste, fold, cut and deliver, the papers in an appropriate rack without undue complication; the character of the mechanism and its adjustment being such that it can be worked at great rapidity, which is a very important consideration in a folding machine.

The guard or stop 15 is shown adjustable upon the supporting rods 93; they may be, how-

ever, supported upon either of the rods F or F′, and may be adjustable thereon if desired. The center of said stop or guard 15 is broken away over the rolls D D′, the ends being connected together by an over-yoke in order to permit of the operation of the tapper. For the remaining set of folder rolls, the stops 90 are supported in a similar manner and are individual instead of being joined together, as is the case with the guard or stop 15.

Having described my invention, what I claim is—

1. In a folding machine, the combination with a driving shaft 1, carrying a series of feed pulleys, of a shaft 8, supported in elongated recesses in the machine frame and carrying a series of feed pulleys in frictional contact with the feed pulleys on the driving shaft, friction rolls carried by the machine frame and bearing against the shaft 8, and tape belts passing around said feed pulleys and driven by the frictional contact thereof, substantially as described.

2. In a folding roll the combination with feed rolls, of two folding rolls, one of said rolls supported in journals and positively driven by suitable mechanism, the other of said rolls yieldingly supported in slotted bearings in the machine frame, friction rolls carried by the machine frame and bearing against said yieldingly supported folding roll, and tape belts passing around the yieldingly supported roll and driven by the frictional contact of said rolls, substantially as described.

3. In combination with the folding rolls R R′, the friction roll 53 for moving the paper laterally over the roll R′ and mounted upon an adjustable arm 52, whereby the said roll 53 is brought in or thrown out of operation to make three or four folds of the paper as occasion requires, substantially as specified.

4. The combination with the rack, 55, 56, resting on the shaft 57 of a rock shaft 80, ratchet 58, pawl 64 bifurcated arm 60, shaft 34, a cam carried thereby, and projections on the bifurcated arm 60 for engaging said cam, substantially as described.

5. The combination with the arm 55, means for intermittently moving the same and a rack board 56, mounted on said arm, of a rock-shaft 80, a follower finger 65 mounted on said shaft, and mechanism for intermittently moving the follower finger backward to receive a paper and then forward to deposit it in the rack, substantially as described.

6. The mechanism for automatically moving the rack arm 55, consisting substantially of the cam 59, the fork arm 60, the lugs 62 and 63, the rock shaft 80, ratchet 58, the pawl 64, driven by the disk 35 in appropriate time movements, substantially as specified.

7. The pasting mechanism supported upon the yoke arm 78, one fork of which is in contact with the cam *w*, having a portion of its face irregular for giving an undulatory motion to the supporting arm 78, substantially as specified.

In testimony whereof I have hereunto set my hand.

AUSTIN T. BASCOM.

Witnesses:
G. E. ALLINGER,
S. J. HATFIELD.