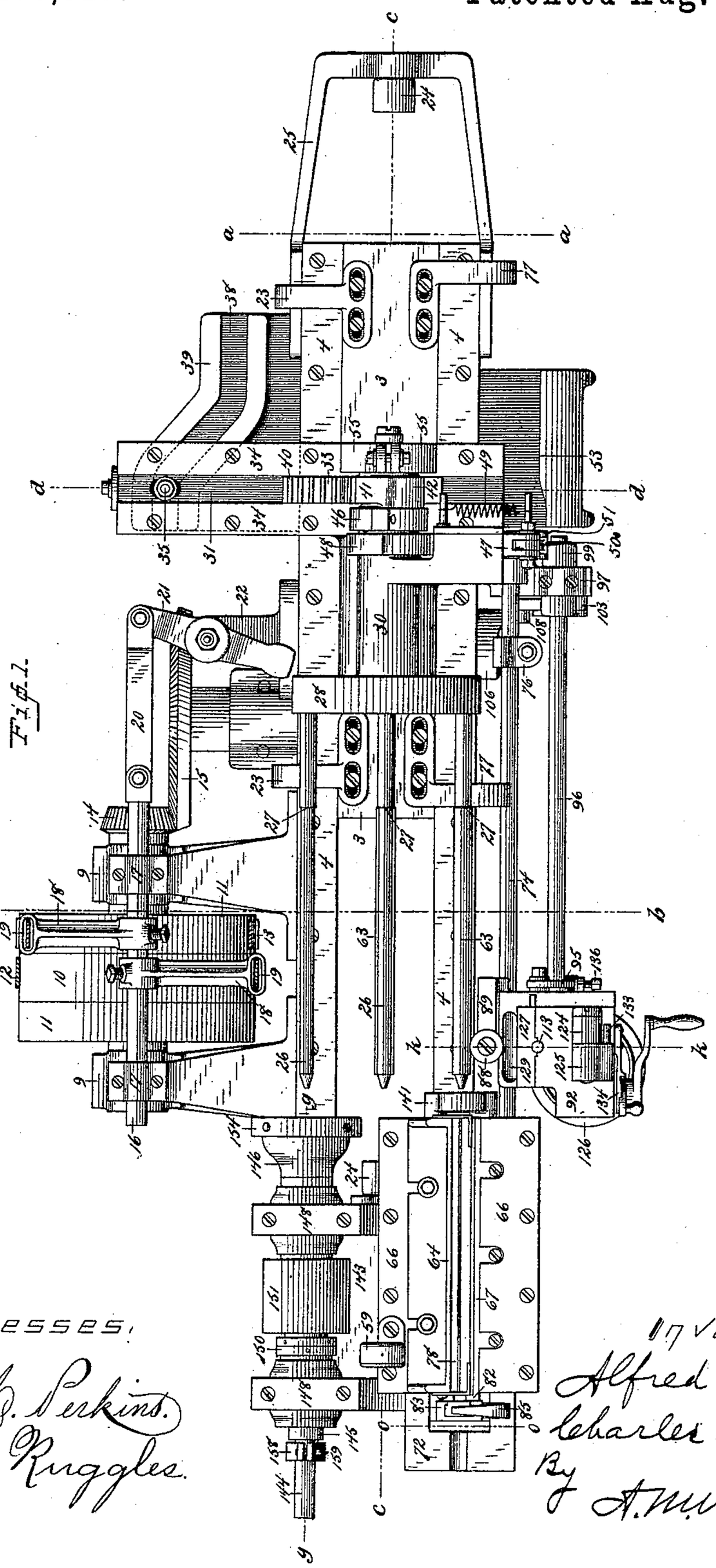
(No Model.) 11 Sheets—Sheet 1.

A. C. HOBBS & C. R. RICHARDS.

MACHINE FOR SIZING AND POLISHING PAPER TUBES.

No. 480,017. Patented Aug. 2, 1892.



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(No Model.) 11 Sheets—Sheet 2.

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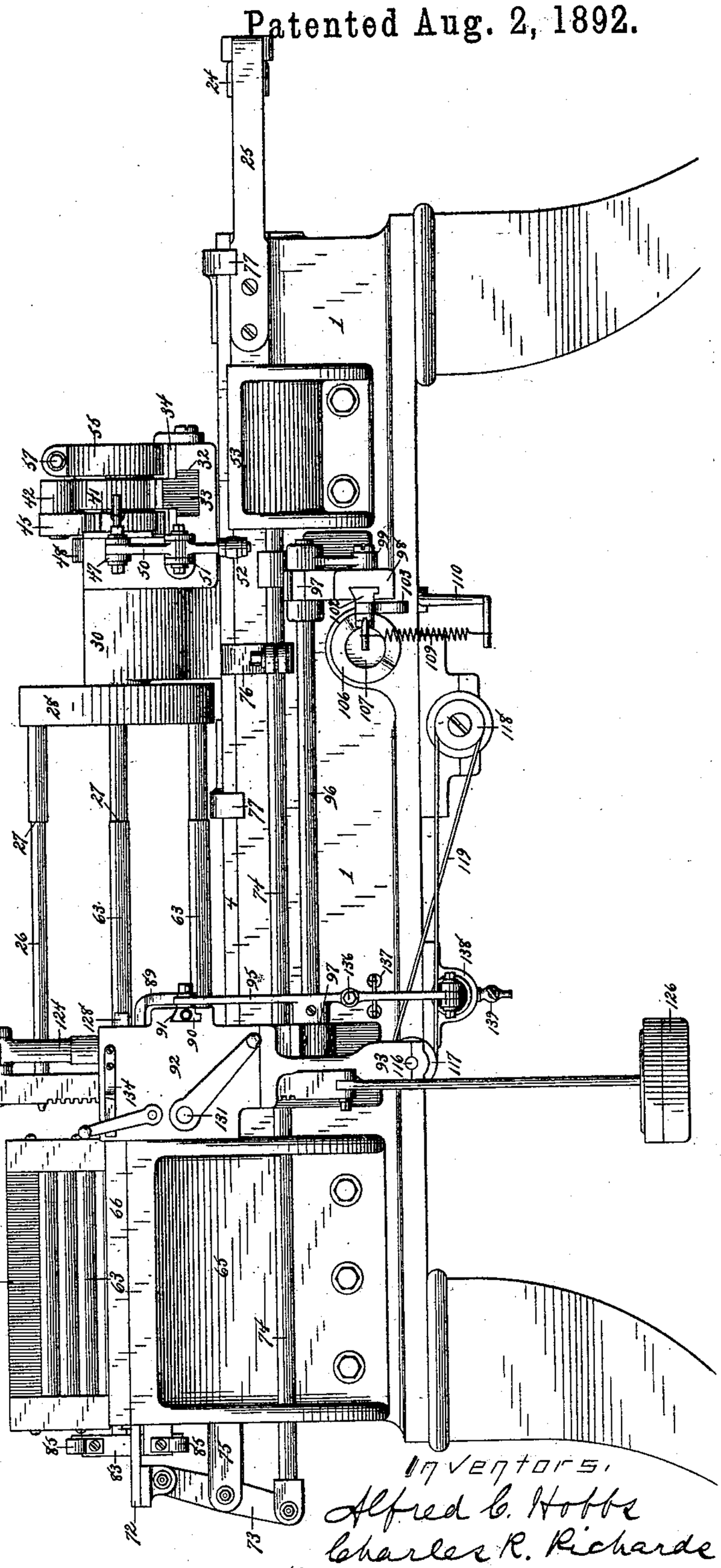
Fig. 2.



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(No Model.) 11 Sheets—Sheet 3.

A. C. HOBBS & C. R. RICHARDS.

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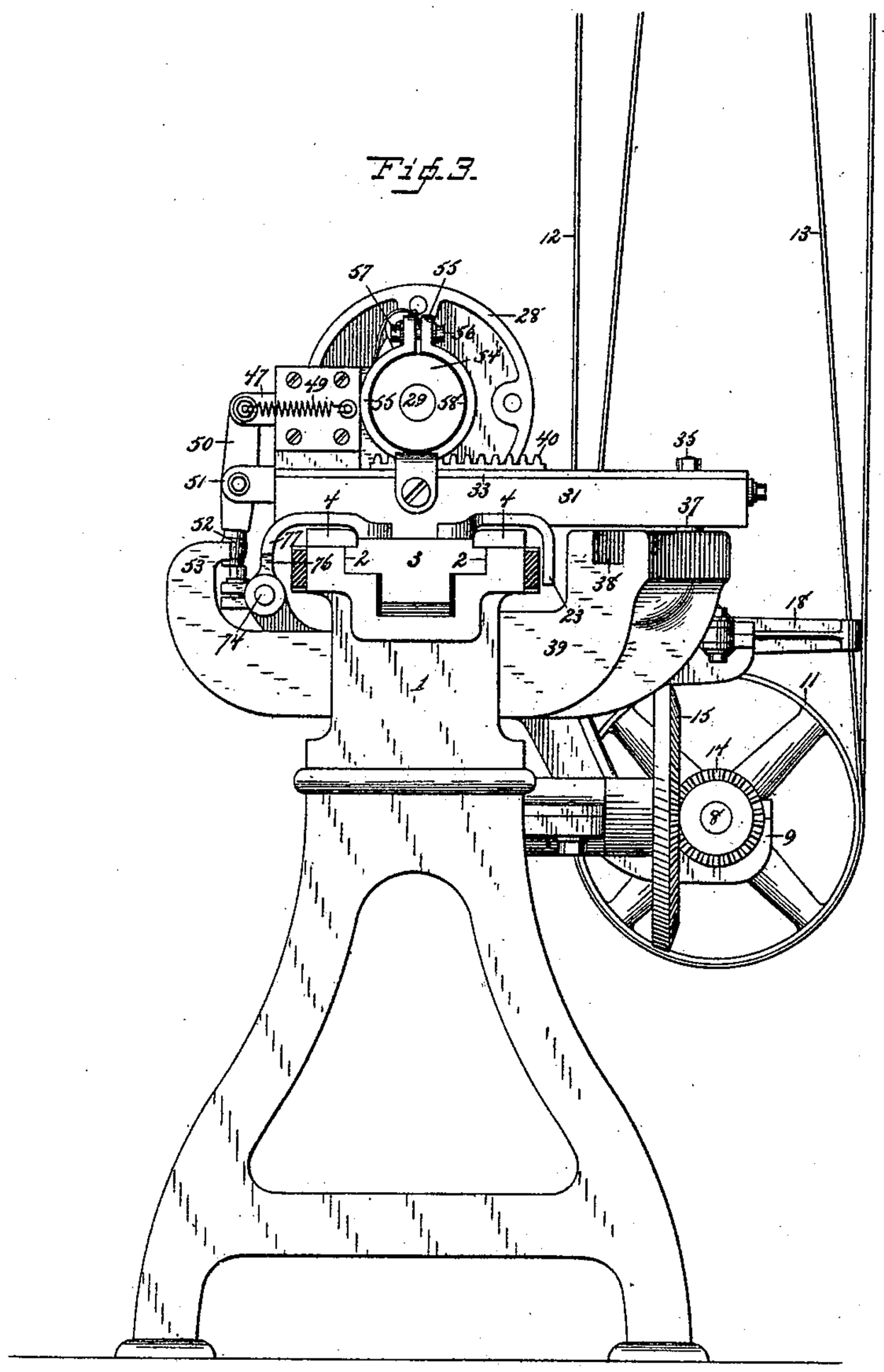
Fig. 3.



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(No Model.) 11 Sheets—Sheet 4.

A. C. HOBBS & C. R. RICHARDS.

MACHINE FOR SIZING AND POLISHING PAPER TUBES.

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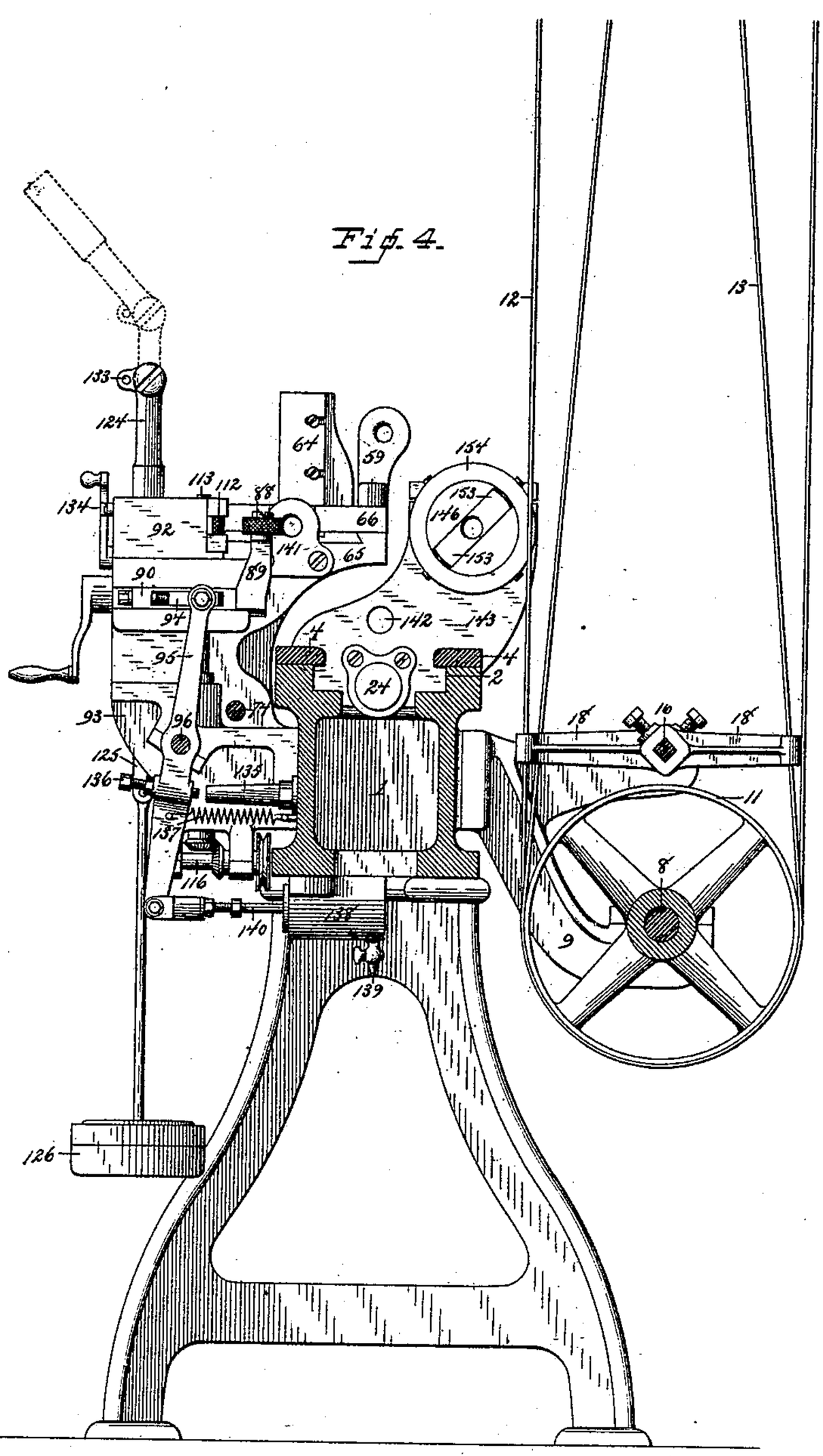
Fig. 4.



Witnesses,
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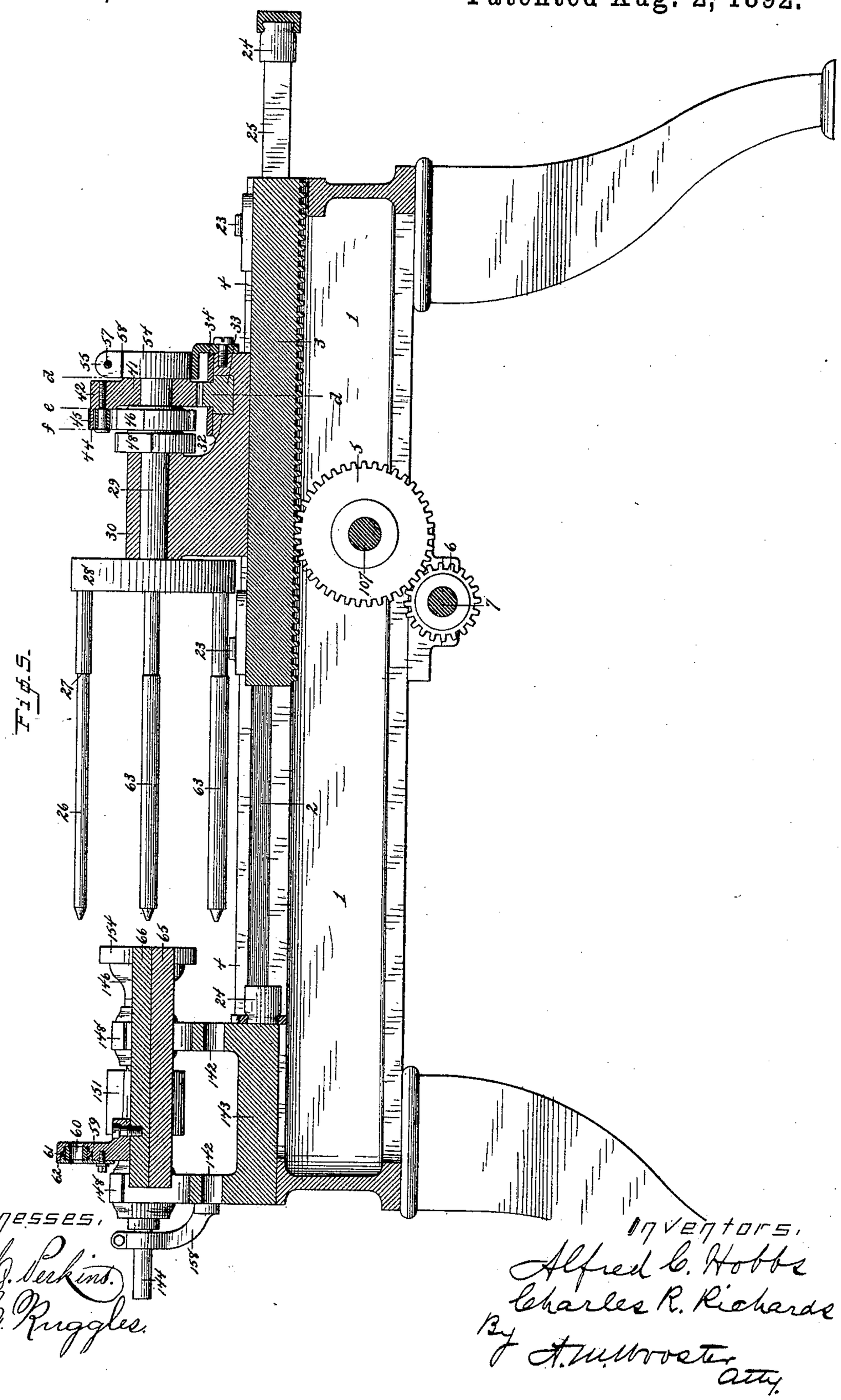

Fig. 5.

Witnesses,
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(No Model.) 11 Sheets—Sheet 6.

A. C. HOBBS & C. R. RICHARDS.

MACHINE FOR SIZING AND POLISHING PAPER TUBES.

No. 480,017. Patented Aug. 2, 1892.

Fig 8.

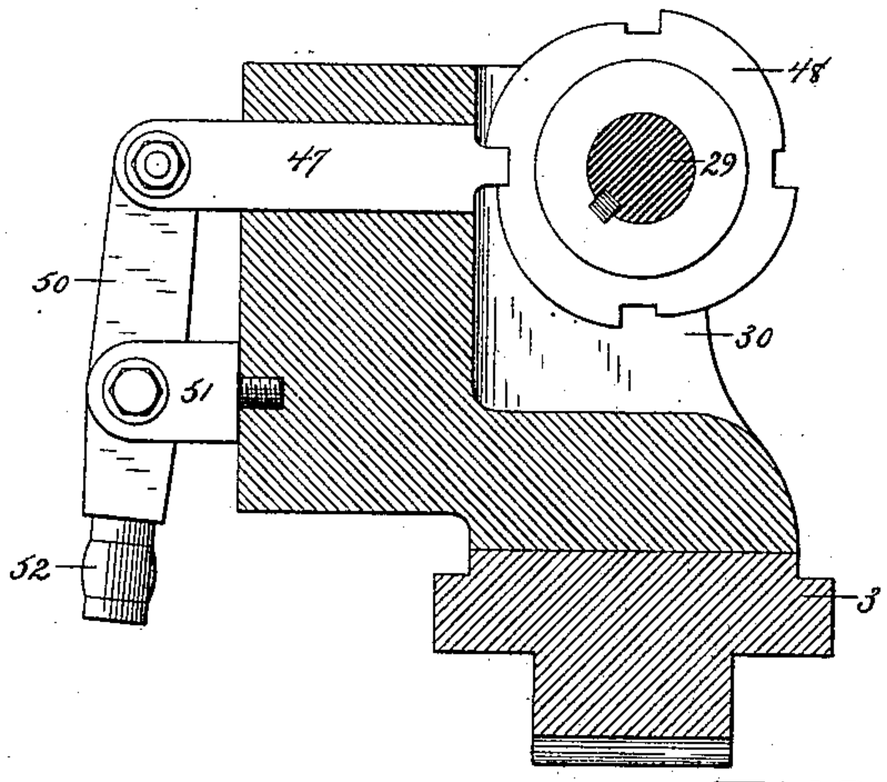

Fig 7.

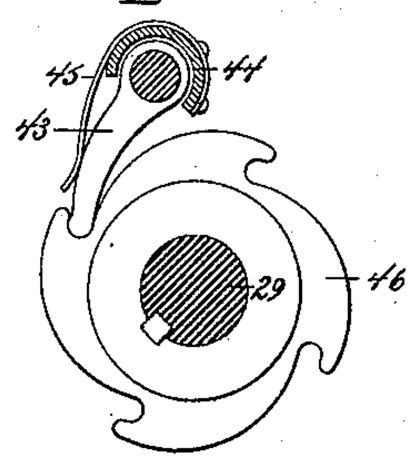

Fig 6.

Witnesses,
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MACHINE FOR SIZING AND POLISHING PAPER TUBES.

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Fig. 9.

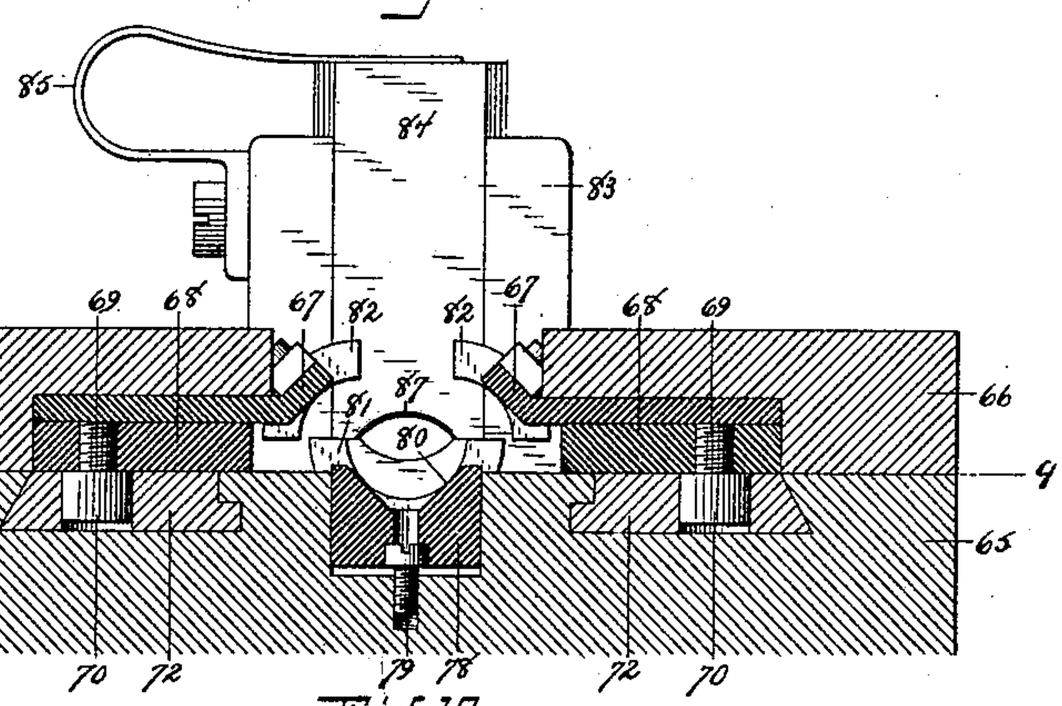

Fig. 10.

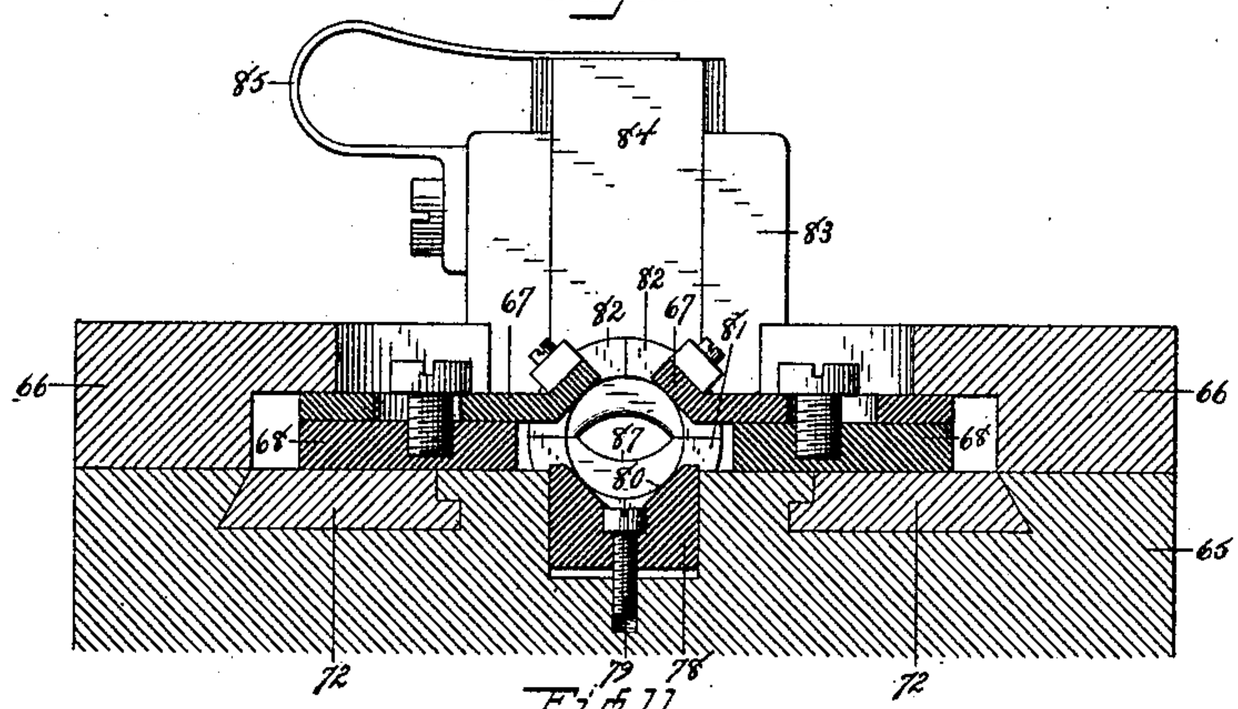

Fig. 11.

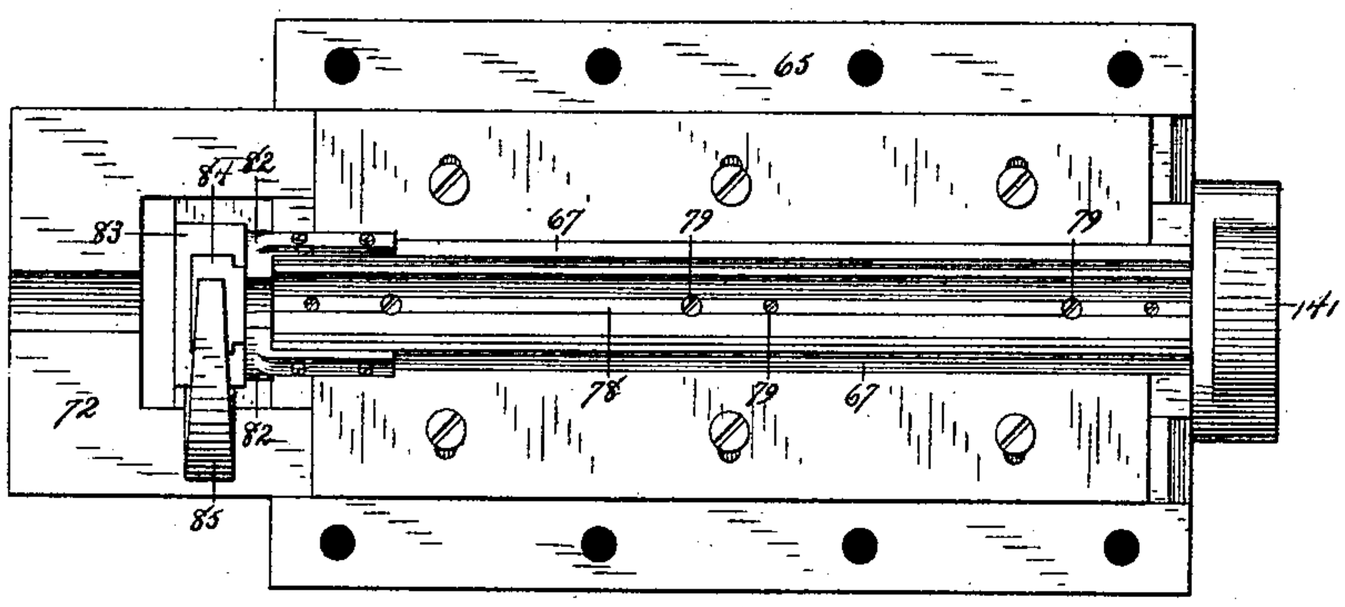

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Fig. 12.

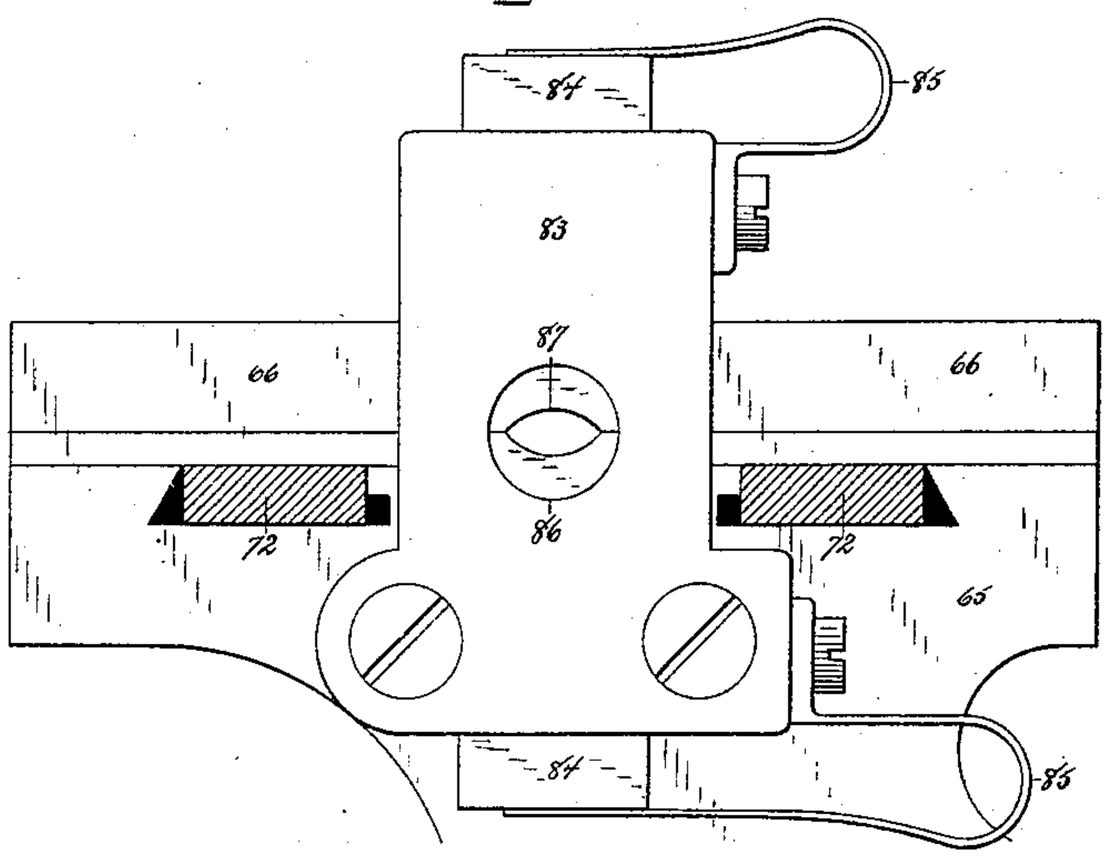


Fig. 13.

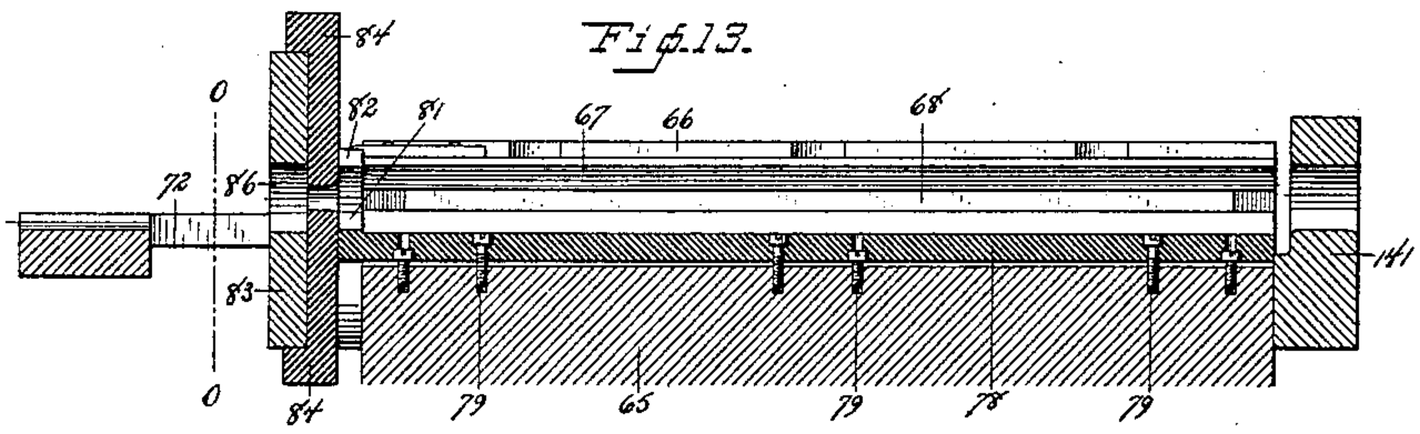
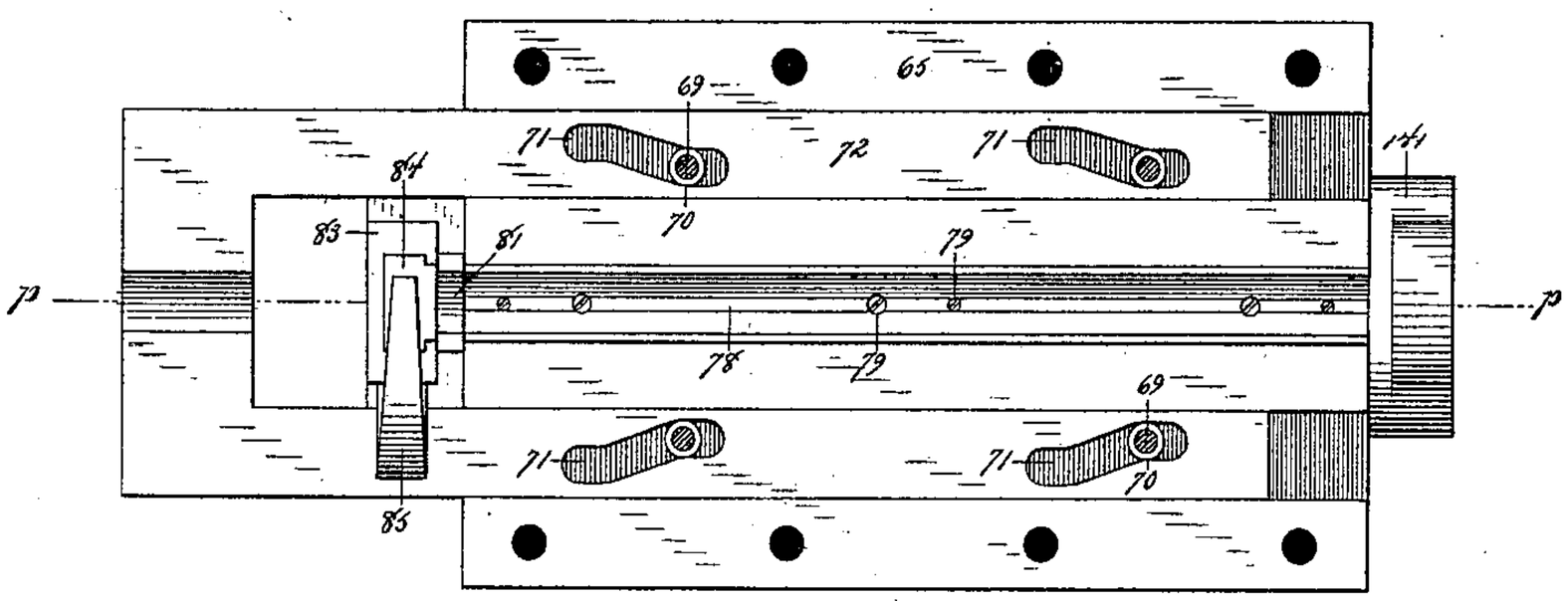


Fig. 14.



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MACHINE FOR SIZING AND POLISHING PAPER TUBES.

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Fig. 15.

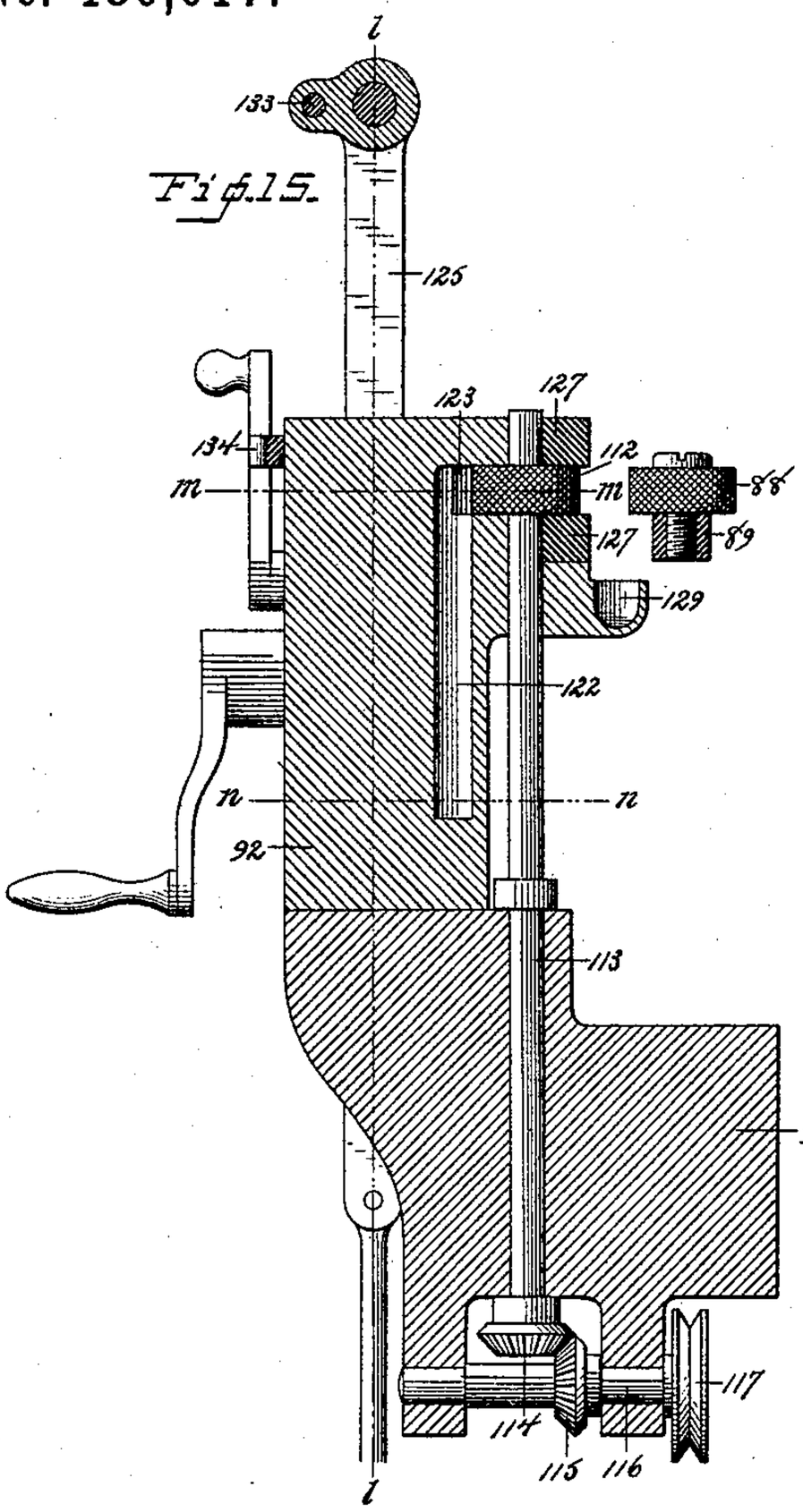


Fig. 16.

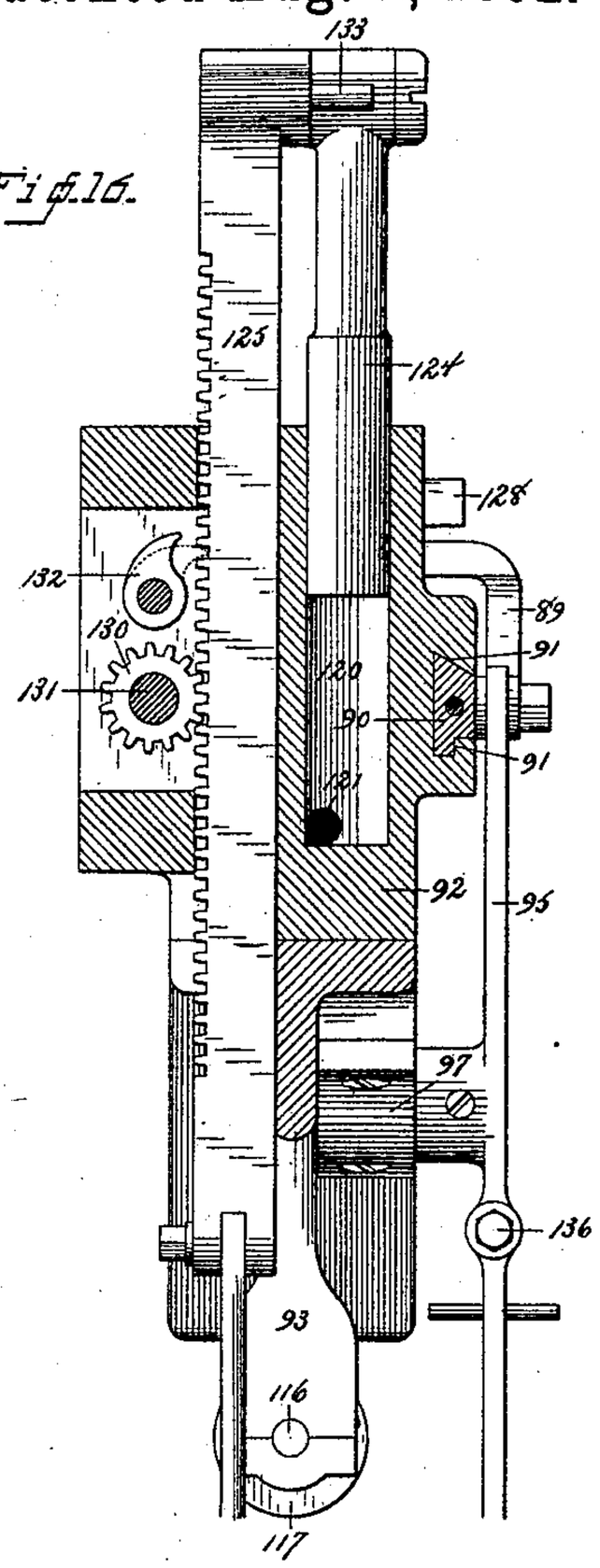
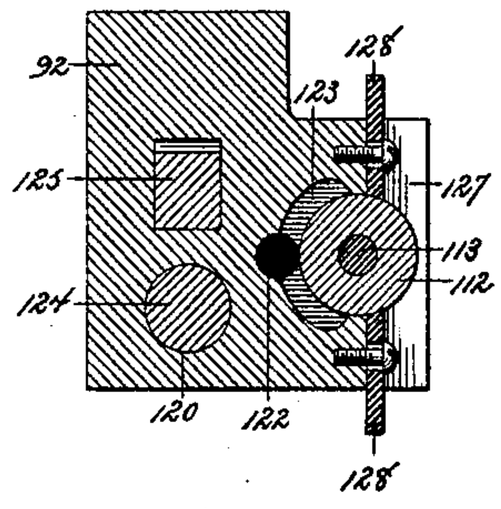


Fig. 17.

Fig. 18.



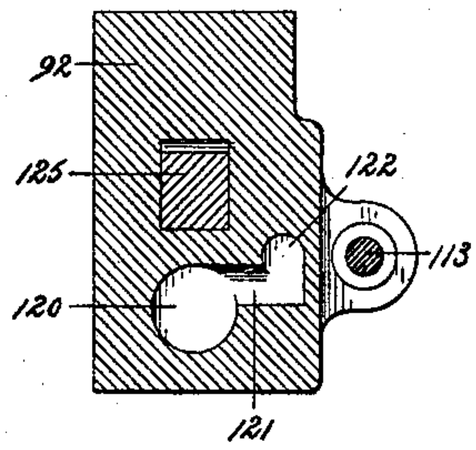


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Fig. 19.

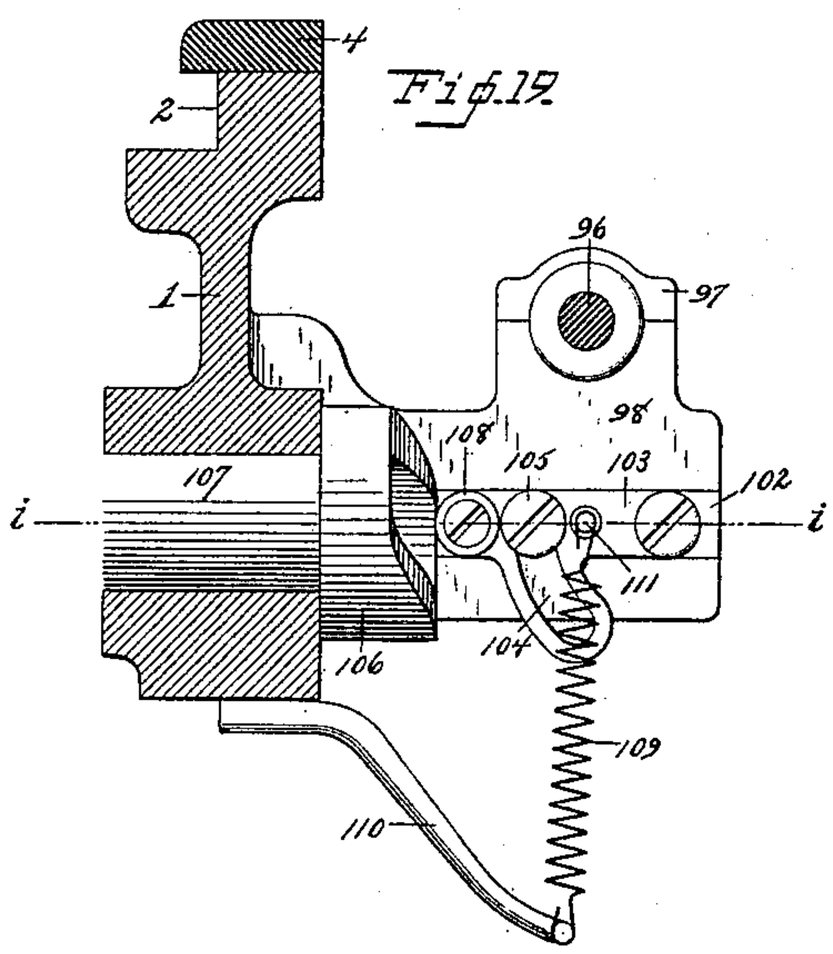


Fig. 20.

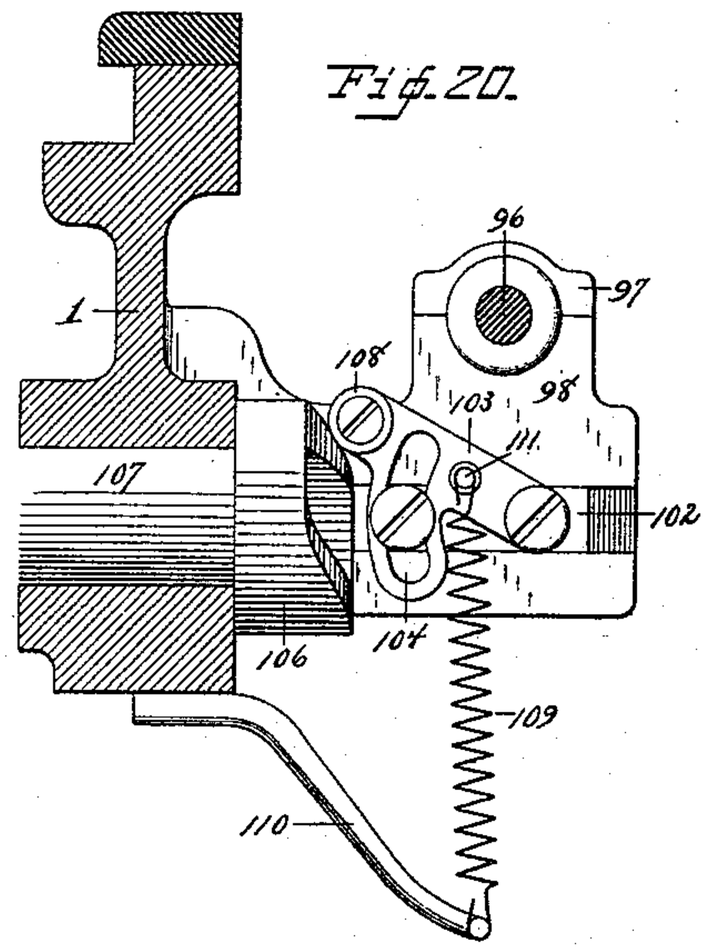


Fig. 21.

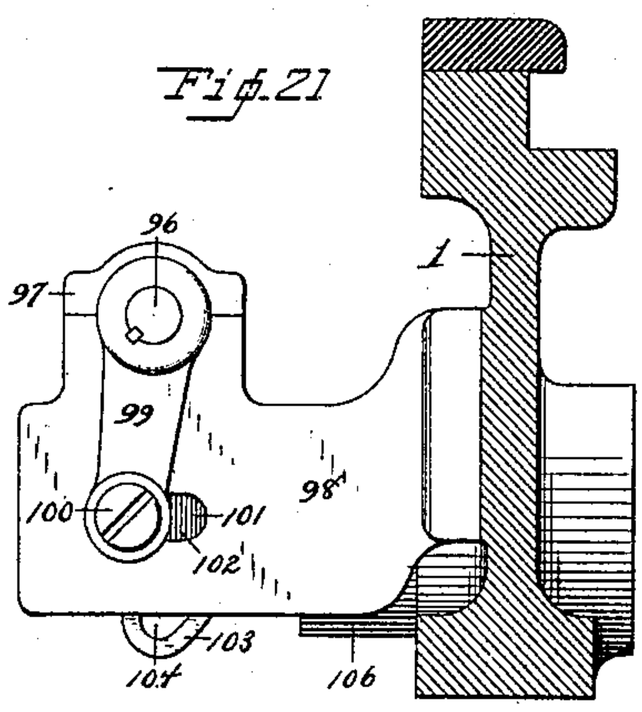
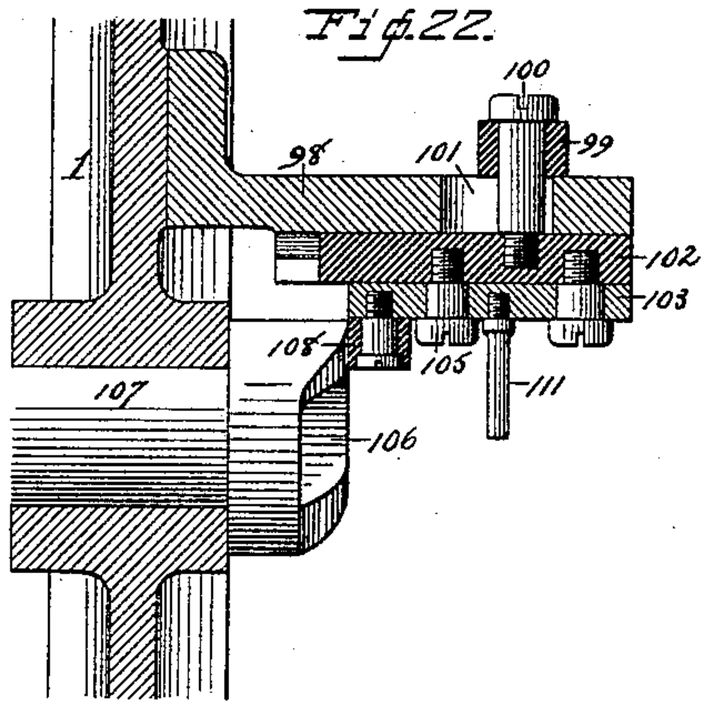


Fig. 22.



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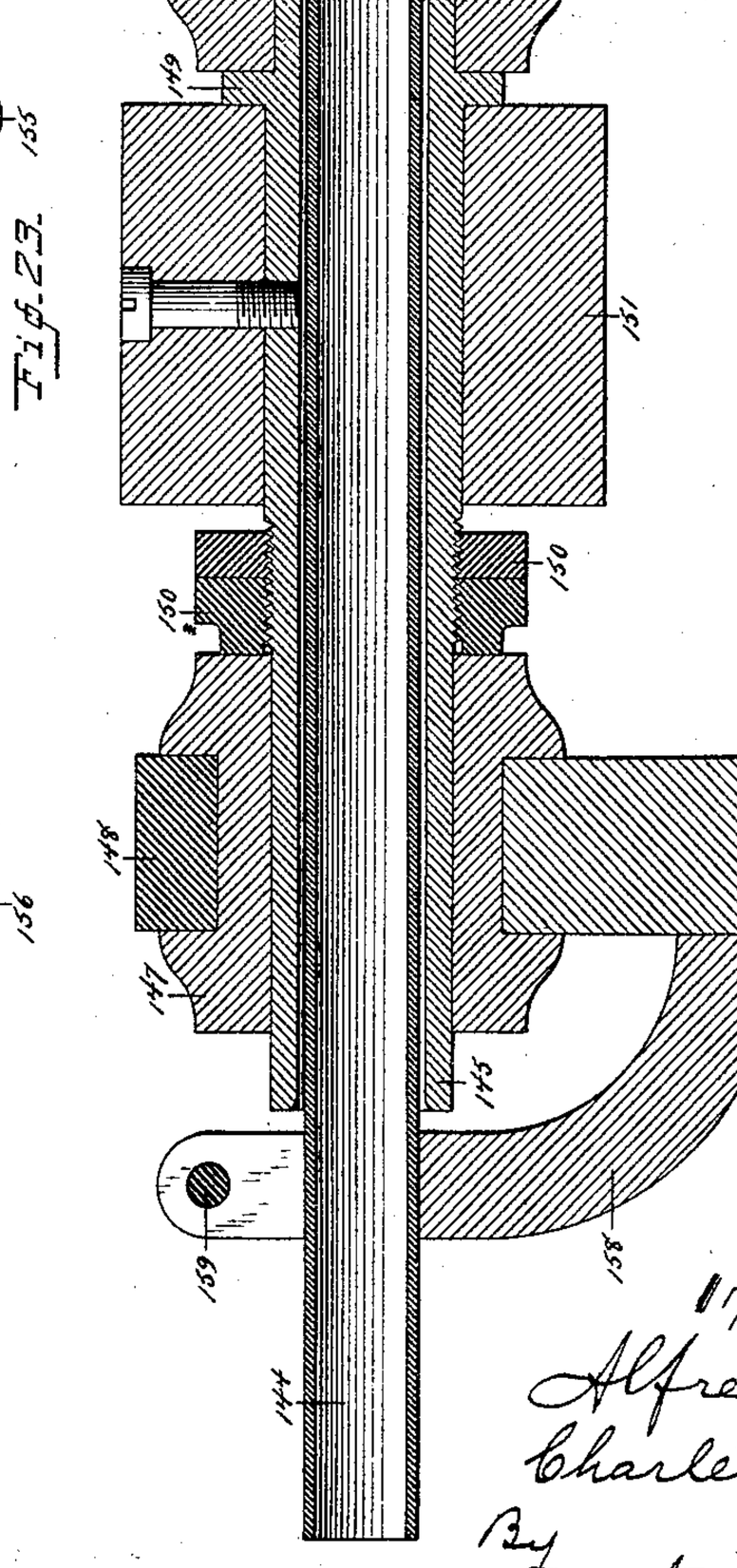


FIG. 23.

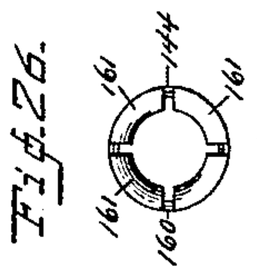


FIG. 25.

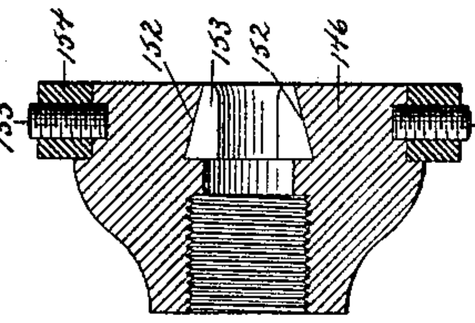
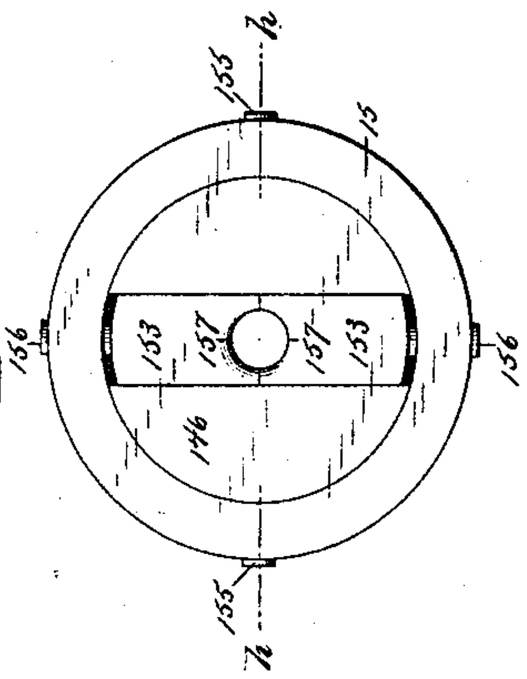


FIG. 24.



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Atty.

UNITED STATES PATENT OFFICE.

ALFRED C. HOBBS AND CHARLES R. RICHARDS, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO THE UNION METALLIC CARTRIDGE COMPANY, OF SAME PLACE.

MACHINE FOR SIZING AND POLISHING PAPER TUBES.

SPECIFICATION forming part of Letters Patent No. 480,017, dated August 2, 1892.

Application filed June 23, 1886. Serial No. 205,959. (No model.)

To all whom it may concern:

Be it known that we, ALFRED C. HOBBS and CHARLES R. RICHARDS, citizens of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Machines for Sizing and Polishing Paper Tubes; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention has for its object to produce a machine that will automatically perform the operations of sizing and polishing, which have heretofore been tedious and expensive operations, as each tube required to be manipulated by hand.

With these ends in view we have devised the novel machine of which the following description, in connection with the accompanying drawings, is a specification, similar numbers being used in the several figures to denote the different parts of the machine.

Figure 1 is a plan view of the entire machine; Fig. 2, a front elevation; Fig. 3, an end elevation, the yoke being in section, on the line *a a* in Fig. 1; Fig. 4, a transverse section on the line *b b* in Fig. 1, looking toward the left; Fig. 5, a central longitudinal section on the line *c c;* Fig. 6, an enlarged detail sectional view on the line *d d* in Figs. 1 and 5, looking toward the left; Fig. 7, a detail sectional view on the line indicated by *e* in Fig. 5; Fig. 8, a detail sectional view on the line indicated by *f* in Fig. 5; Fig. 9, a cross-section of the tube-holding mechanism, the jaws being shown in their opened position; Fig. 10, a similar view, the jaws being in the closed position; Fig. 11, a plan view, the position of the parts corresponding with Fig. 9, the cap-plate being removed; Fig. 12, an end elevation corresponding with Fig. 9, the slide being in section on the line *o o* in Figs. 1 and 13; Fig. 13, a section of the tube-holding mechanism on the line *p p* in Fig. 14; Fig. 14, a section on the line *q q* in Fig. 9, looking down; Fig. 15, a section on the line *k k* in Fig. 1; Fig. 16, a section on the line *l l* in Fig. 15; Fig. 17, a section on the line *m m* in Fig. 15; Fig. 18, a section on the line *n n* in Fig. 15; Fig. 19, an enlarged detail view illustrating mechanism to actuate slide carrying the tube-lubricating roller, the parts being shown in the position they occupy when the roller is in contact with the tube, the bed being in section; Fig. 20, a similar view illustrating the position of the parts after the next forward movement of the carriage has commenced; Fig. 21, a rear view of the parts as shown in Fig. 19; Fig. 22, a section on the line *i i* in Fig. 19; Fig. 23, an enlarged sectional view on the line *g g* in Fig. 1; Fig. 24, a front elevation of the chuck, looking toward the left in Fig. 23; Fig. 25, a section on the line *h h* in Fig. 24; and Fig. 26 is an end elevation of the inner shell detached, showing the spring stripping-jaws.

1 is the bed of the machine, having ways 2, 3 a carriage adapted to reciprocate in said ways, and 4 plates at opposite sides of the bed, whereby the carriage is held in operative position. The carriage is provided on its under side with rack-teeth, which are engaged by an intermediate gear-wheel 5, journaled in the bed. The intermediate gear-wheel in turn is engaged by a pinion 6 on transverse shaft 7.

8 is a driving-shaft journaled in brackets 9, which are bolted to the bed.

10 is a fixed pulley on the driving-shaft, and 11 loose pulleys on opposite sides thereof.

12 is a straight belt, and 13 a crossed belt, which run from a main or counter shaft (not shown) to the pulleys on the driving-shaft.

14 is a bevel-pinion on the driving-shaft, which meshes with a bevel-gear 15 on transverse shaft 7. The belt-shifting mechanism is of ordinary construction, consisting of a rod 16, adapted to reciprocate in guides 17. Arms 18 project from this rod and are provided with slots 19 at their outer ends, through which the belts pass.

20 indicates a link, one end of which is pivoted to rod 16, the other being pivoted to a lever 21, which in turn is pivoted to a bracket 22.

23 indicates adjustable dogs secured to the carriage, which are adapted to engage the inner end of lever 21, which shifts the belt, thus reversing the movement of the driving-shaft

and moving the carriage in the opposite direction. As shown in Fig. 1 the carriage is moving toward the right, the crossed belt being upon one of the loose pulleys and the straight belt upon the fixed pulley. The movement of the carriage toward the right continues from the position shown until the left dog 23 comes in contact with the inner end of lever 21 and carries it toward the right until the straight belt is shifted to the left loose pulley and the crossed belt is shifted from the right loose pulley to the fixed pulley, which of course reverses the movement of the driving-shaft and causes the carriage to travel toward the left. Lever 21 will remain in the position in which it was left when the reverse movement commenced until the right dog 23 comes in contact with it when the movement toward the left is nearly finished and carries it again to the position in which it is shown.

24 denotes yielding buffers against which the ends of the carriage strike at the extremes of its movements, one of said buffers being at the inner end of the bed attached to one of the brackets and the other carried by a yoke 25, attached at the outer end thereof.

The paper tubes during the operation of sizing and polishing are carried by a series of arbors 26, (in this instance four in number,) which are provided with shoulders 27 and project forward from the side of a disk 28, to which they are attached. This disk is carried by a shaft 29, journaled in bracket 30, which is secured to the carriage. The carriage is provided with a lateral extension 31, having ways 32, in which a cross-slide 33 is adapted to reciprocate.

34 denotes plates secured to the lateral extension, by which the cross-slide is held in operative position. A stud 35 is adjustably secured to the cross-slide and projects downward through a slot 36 in the lateral extension. A roller 37 at the lower end of this stud engages an angular cam-slot 38 in the top of a bracket 39, which is secured to the side of the bed. The direction of this slot is straight—that is, parallel with the line of motion of the carriage as the roller first enters it. Its direction is then inward at an angle toward the carriage, the front end of the slot being straight again—that is, parallel with the line of motion of the carriage. As shown in Fig. 1, the cross-slide is at its extreme position outward, the roller being about to enter the inclined portion of the slot. It is of course apparent that as the roller moves down the incline of the slot the cross-slide will move inward until the second straight portion of the slot is reached, and when the reverse movement of the carriage takes place and the roller travels backward in the inclined portion of the slot it will cause the cross-slide to move backward to the position in which it is shown, in which position it will remain until the roller has again entered slot 38 and passed into the inclined portion thereof. The function of this cross-slide is to impart intermittent rotary motion to the disk which carries the arbors.

40 denotes a section of rack-teeth on the cross-slide, which is engaged by a segment-gear 41, which is journaled on shaft 29, being free to turn thereon.

42 is an ear made integral with the segment-gear, to which a pawl 43 is pivoted.

44 is a curved extension at the side of the ear, to which a spring 45 is secured. This spring acts to keep pawl 43 pressed firmly against a ratchet 46, which is keyed to shaft 29.

The operation of this portion of our invention is as follows: As clearly indicated in Figs. 1 and 6, the cross-slide is at one extreme of its movement, the pawl having moved forward with the ratchet to the limit of its forward movement and having remained there until roller 37 is about to move down the incline again. The effect of the movement of roller 37 from the position in which it is shown in Fig. 1 to the other end of the incline is to move the pawl toward the right from the position in which it is shown in Fig. 7 and to place said pawl in engagement with the next ratchet-tooth. The return movement of roller 37 in the inclined portion of the slot takes place almost instantly. As the ratchet has but four teeth, the effect of this movement is to carry ratchet 46 forward a quarter of a revolution. As this ratchet is keyed upon shaft 29, it follows that the disk carrying the arbors must move forward a quarter of a revolution. The shaft and arbors are retained in this position by means of a sliding pawl 47, engaging a holding-ratchet 48, which is also keyed to shaft 29. Ratchet 48 is provided with four notches or depressions, preferably having straight sides, as shown, which are engaged by the end of pawl 47, said pawl being held in engagement with the ratchet by a spring 49. This pawl acts to hold shaft 29 and the arbors against movement in either direction, except when the pawl releases the ratchet to permit the forward movement.

50 is a lever pivoted in a yoke 51, tapped into bracket 30. The upper end of this lever is pivoted to the sliding pawl, and the lower end is provided with a roller 52, which is adapted to engage a cam 53. As the carriage approaches the extreme of its movement toward the right, as seen in Fig. 1, roller 52 engages this cam and as it rides up the incline of said cam forces the lower arm of the lever inward, thus withdrawing pawl 47 from the holding-ratchet and permitting pawl 43, which engages the operating-ratchet 46, to carry shaft 29 forward a quarter of a revolution. At the instant this movement is completed roller 52 will have passed backward down the incline of cam 53 and spring 49 will cause the sliding pawl engaging the holding-ratchet to again lock the parts.

In order to prevent shaft 29, the arbors, &c., from moving in either direction during the instant that said shaft is not locked by pawl 47, we have provided a friction-disk 54 at the

end of shaft 29, which is encircled by clamping-arms 55, which are drawn together by nut 56 upon bolt 57, passing through both of said arms.

58 is a friction packing of leather, rubber, or other suitable material, which bears against the periphery of the disk. This device in use is adjusted by means of the nut and bolt, so that it will be tight enough to hold shaft 29 from moving during the instant that it is not locked. It is not, however, necessary to clamp the disk tight enough to prevent it from moving forward readily when actuated by pawl 43. As has already been fully explained, each reciprocation of the carriage carries disk 28 and the arbors forward and then backward, and during the forward movement a quarter-revolution is imparted to the disk. During each forward movement of the arbors an unsized paper tube is forced upon one of the arbors and a sized tube is removed from another arbor. As already stated, for convenience in organizing the machine disk 28 is provided with four arbors, and consequently is made to complete its revolution in four reciprocations of the carriage. Commencing now with the top arbor, (see Figs. 1 and 5,) suppose that the movement toward the right has been completed and the carriage is moving forward—that is, toward the left. When nearly at the extreme of the movement toward the left, the forward end of the top arbor will enter a lubricator 59, which is secured to one of the brackets, as will be again referred to. This lubricator consists of a washer or series of washers 60, which are compressed inwardly by a spring-band 61 and are held in place by a face-plate 62, as is clearly shown in Fig. 5. The washers are kept saturated with oil, so that each time an arbor enters the end thereof becomes thoroughly lubricated. Continuing with this same arbor, as soon as the carriage again reaches its extreme position toward the right and the return movement commences a quarter-turn of disks 28 and the arbors also commences. At the time the arbors have nearly reached their forward positions again the quarter-turn will be completed. The same arbor already referred to now takes up one of the paper tubes. These tubes (indicated by 63) are placed in a hopper 64 and drop down between the jaws singly when the latter are opened. The feeding mechanism is illustrated in detail in Figs. 9 to 14, inclusive. 65 indicates a bracket by which the feeding mechanism is carried.

66 is a cap-plate by which the parts are held in place and to which the hopper and lubricator 59 are secured.

67 indicates jaws, which are adjustably secured to plates 68 by means of set-screws passing through slots in the jaws.

69 indicates screw-pins, which project downward from plates 68 and carry rollers 70, which engage angular slots 71 in slide 72. This slide is made double—that is, open in the center—each side being provided with slots whereby the two jaws are operated. Reciprocating motion is imparted to slide 72 by means of a lever 73 and rod 74, supported in any suitable manner at the side of the bed. Lever 73 is pivoted to swing in a yoke 75, which is secured to bracket 65, and its opposite ends are pivoted, respectively, to the outer end of rod 74 and to the under side of slide 72.

76 is an arm clamped to rod 74, which is adapted to be engaged by dogs 77, adjustably secured to the carriage, when the latter is at the two extremes of its movement. For example, as shown in Fig. 2 the jaws are open and will remain open until the left dog 77 comes in contact with arm 76 in the movement of the carriage toward the right, and when the jaws are closed they will remain closed until the right dog 77 comes in contact with arm 76 in the movement of the carriage toward the left. In Figs. 9 and 11 the jaws are shown in the open position, in the latter figure the cap-plate only being removed. In Figs. 10 and 14 the jaws are in the closed position. In the latter figure the cap-plate, jaws, and plates 68 are removed. It will be seen that the outline of slots 71 in the slide is such that as the slide is drawn out the jaws are closed and as it moves in they are opened. When the jaws are in their open position, as in Figs. 9 and 11, a single paper tube will drop down from the hopper, pass between the jaws, and will rest upon a bed 78. This bed is made adjustable up and down by means of screws 79, which engage the bracket, and is provided with a V-shaped notch 80, which receives the tubes. The sides of the notch are preferably made straight and are inclined at a right angle to each other. The bearing-faces of the jaws are also preferably made in the same manner—that is, straight—and inclined at a right angle to each other. This causes the actual engagement of the jaws and the bed with the tube to be at four lines of contact, which extend the entire length of the jaws. In order, however, to prevent the forward ends of the tubes from being crushed when the arbors are inserted, we have provided a special clamp having a curved inner surface, which grasps the tubes firmly at their forward ends, passing entirely around them, thus avoiding the possibility of their being crushed when the arbor is inserted. This clamp consists of a semi-cylindrical piece 81, attached at the forward end of the bed, and a quadrant-shaped piece 82, attached to each of the jaws. The open position of the clamp is clearly shown in Fig. 9 and its closed position in Fig. 10. The diameter of the opening is just sufficient to cause the clamp to press firmly upon the tube without crushing it. As the tubes fit the arbors closely, it of course follows that as the arbors are forced in there will be a tendency to crush the inner end of the tube. This, however, is wholly prevented by the clamp. As shown in Fig. 1, the points of the arbors pass entirely through the tubes, the other ends of

the tubes resting against shoulders 27 on the arbors.

83 is a block secured to bracket 65, which is grooved out to receive two vertical slides 84. These slides are forced together at the center by springs 85 at the top and bottom of the block. The block is provided with an opening 86 to receive the ends of the arbors, and the ends of the slides are provided with curved recesses 87, whose length is much greater than their depth. These recesses register, as clearly shown in Fig. 12, and form an elongated opening, which permits the pointed ends of the arbors to pass, but against which the ends of the tubes strike, thus forcing them firmly home on the arbors, the other ends coming in contact with the shoulders, as already described. As soon as the tube is firmly seated against the shoulder the forward end of the tube acts to force slides 84 open sufficiently to permit the end to pass through. The jaws open at this instant, thus allowing the tube to pass out freely. During the return movement the tube just taken up by an arbor is lubricated by a roller 88, (see Figs. 4 and 15,) which is moved up in contact with it. This roller is carried by an arm 89, which is attached to or made integral with a slide 90, adapted to reciprocate in ways 91, formed in casting 92, which forms the body of the lubricator. This casting is supported upon a bracket 93, attached to the side of the bed. Slide 90 is provided with a longitudinal slot to receive a block 94, the block being made adjustable by a screw, as is clearly shown in Fig. 4. This is in order to provide for taking up lost motion and moving the lubricating-roller in or out, if necessary. Motion is imparted to the slide which carries roller 88 by means of a lever 95, carried by a rock-shaft 96, journaled in boxes 97. One of these boxes is upon bracket 93 and the other upon bracket 98, also attached to the side of the bed. The upper end of the lever is pivoted to adjustable block 94. Motion is imparted to the rock-shaft by means which we will now describe.

99 is a crank secured to the opposite end of the rock-shaft, the other end of the crank being pivoted to a stud 100, which passes through slot 101 in bracket 98 and is screwed into a slide 102, adapted to reciprocate in said bracket.

103 is an arm pivoted near the outer end of the slide, which is provided with a curved slot 104. A stud 105 passes through this slot and is screwed into the slide.

106 is a face-cam upon the outside of the bed, carried by a shaft 107, which also carries the intermediate gear 5, from which it receives motion. A roller 108 at the outer end of arm 103 engages the face of cam 106.

109 is a spring, one end of which is attached to an arm 110, projecting from the bed, the other being attached to a pin 111 upon arm 103. The operation of this mechanism is clearly illustrated in Figs. 19 and 20. The position in Fig. 19 corresponds with that in Figs. 1 and 2. In Fig. 19 the top of cam 106 is represented as moving from the point of view—that is, from front to back—and roller 108 is resting upon the highest portion of the cam-face. While roller 108 is in this position lubricating-roller 88 is bearing upon the outside of a paper tube. As soon as the tube is lubricated, in its movement toward the right roller 108 will begin to pass down the incline on cam 106, which will throw the lubricating-roller back away from the line of movement of the arbor. During the movement of the carriage and arbors from left to right the intermediate wheel and cam 106 will have made a revolution from left to right from the position indicated in Fig. 2. At the instant the next forward movement of the carriage commences the reverse movement of the intermediate wheel and cam 106 will of course commence. In order, however, that this movement shall have no effect upon the slide, we have so constructed the parts that when cam 106 is rotating toward the point of view as seen in Fig. 20 the incline of said cam as soon as it comes in contact with roller 108 will act to swing arm 103 upon its pivot against the power of spring 109 instead of acting to force said slide out, as in Fig. 19. This action of the cam upon arm 103 and slide 102 will be readily understood from the fact that when the cam is rotating from front to back, as in Fig. 19, the incline acts upon roller 108 from above, the tendency being to force the arm down against stud 105. As there can be no movement of the arm, the cam action of the incline upon the roller is brought directly to bear upon the slide to force it out, which oscillates the rock-shaft inward, as seen in Fig. 4, carrying the roller against the tube. When the cam is rotating from back to front, as in Fig. 20, the cam action of the incline upon the roller is from below. The tendency, therefore, is to lift arm 103 against the power of spring 109 instead of forcing the slide out, as when the cam rotates in the opposite direction. This of course allows lubricating-roller 88 to remain in the same position that it was left by the movement of cam 106 in the opposite direction. Roller 88 receives the lubricating material from a roller 112, carried by a vertical shaft 113, which passes through casting 92 and bracket 93, roller 88 being placed in contact with roller 112 as soon as roller 108 upon arm 103 travels down the incline of cam 106, as in Fig. 19. Rollers 88 and 112 remain in contact with each other during the forward movement of the carriage and arbors and until another tube is ready to be lubricated in the return movement. A bevel-gear 114 at the lower end of shaft 113 engages a bevel-gear 115 on a short shaft 116, journaled in bracket 93.

117 is a belt-pulley at the inner end of shaft 116, and 118 is a belt-pulley outside of the bed at the end of transverse shaft 7.

119 is a belt between pulleys 117 and 118, through which rotary motion is imparted to roller 112. It will of course be understood that the direction of rotation of roller 112 changes each time the large belts are shifted. This, however, does not affect the operation of this portion of our invention.

The lubricating material is placed in a reservoir 120 in casting 92. An opening 121 at the bottom of the reservoir communicates with a passage 122, at the upper end of which is a recess 123, in which the roller 112 lies.

124 is a piston pivoted at the upper end of a rack 125. This piston fits closely in the reservoir and is forced downward upon the lubricating material by a weight 126, attached to the rack. The weight is sufficiently heavy to force the lubricating material out of the reservoir through opening 121 and passage 122 into the recess in which roller 112 lies, so that the latter is kept continually covered with the lubricating material.

127 indicates the cap-plates of journals at the upper end of shaft 113, roller 112 resting between these plates.

128 indicates guard-plates, which fit closely to the surface of roller 112 and act to prevent any surplus of the lubricating material from being carried out of recess 123 by the roller.

129 is a drip-cup of ordinary construction.

When it is desired to fill the reservoir, the piston is raised by means of a pinion 130 on a crank-shaft 131. When the rack has been raised sufficiently high to lift the piston out of the reservoir, it is locked in that position by pawl 132. The piston may then be turned back out of the way, resting on pin 133, as indicated in dotted lines in Fig. 4. The pawl may be locked either in or out of engagement with rack 125 by a spring-rack 134. Turning now to Fig. 20 for an instant, it will be seen that when the pivoted arm is raised by cam 106 it becomes possible for slide 102 to move inward until stud 105 comes in contact with the face of cam 106. In order to prevent this, we have provided a stop 135, which projects from the side of the bed (see Fig. 4) and is engaged by a set-screw 136, which passes through the lower arm of lever 95 and is locked at any desired position by a check-nut. Should slide 102 move too far inward, it would of course carry shaft 96 and would throw roller 88 into forcible contact with roller 112. The set-screw and stop just referred to avoid the possibility of any such occurrence.

137 is a spring, one end of which is attached to the lower arm of lever 95 and the other to the bed, the action of which is to draw the lower arm of the lever inward, thus carrying roller 88 against roller 112 until the movement is checked by the stop and set-screw just referred to. In order to prevent the outward movement of slide 90, carrying roller 88, from being too violent under any circumstances, we have provided an air-cylinder 138 under the bed, which is provided with a petcock 139. A piston 140, adapted to reciprocate in this air-cylinder, is pivoted at the end of the lower arm of lever 35, the air in cylinder 138 acting as a cushion to prevent violent movement of the slide. During this second forward movement of the carriage and arbors the second arbor is oiled by lubricator 59 preparatory to taking up a tube at its next forward movement. 141 is a guide attached to bracket 65, through which the arbors must pass before entering the paper tubes. The opening in this guide is sufficiently large to permit an arbor with a tube on it to pass out freely, but at the same time is small enough to insure that the arbors shall only enter the tubes in a right line.

We have now described the operations of the different parts of the machine during the first and second reciprocations of the carriage and quarter-turns of the disk which carries the arbors. During the third forward movement of the carriage the third arbor is lubricated, the second arbor takes up a second paper tube, and the first arbor, which carries the first paper tube taken up, simply passes forward through an opening 142 in bracket 143, which carries the sizing mechanism, no operation whatever being performed upon it during this reciprocation. During the fourth forward movement of the carriage the fourth arbor is lubricated, the third arbor takes up a paper tube, the second arbor, with the second tube taken up, passes through opening 142, and the first arbor, with the first tube taken up, passes to the sizing mechanism, which we will now describe, referring more especially to Figs. 23 to 26, inclusive.

The sizing mechanism consists, essentially, of an inner shell 144, an outer shell 145, and a chuck 146. The outer shell is journaled in boxes 147 upon bracket 143.

148 indicates the cap-plates.

149 denotes shoulders upon the outer shell, whereby said shell is held against endwise motion, and 150 indicates nuts upon the outer shell for taking up lost motion. Motion is imparted to the outer shell by means of a belt (not shown) passing over a pulley 151 upon said shell. The chuck is screwed firmly to the inner end of the outer shell.

152 indicates ways in the end of the chuck, in which the sizing-jaws 153 are carried. These jaws are held in place by a ring 154, secured at the end of the chuck by screws 155, and 156 are set-screws, which pass through said ring and bear against the outer ends of the jaws, whereby they may be adjusted in or out or the wear may be taken up. The sizing-jaws are provided at their inner ends with semicircular recesses 157, which are beveled outward slightly, as shown in Figs. 23 and 24, and which form together a perfectly cylindrical opening, through which the paper tubes pass singly while on the arbors, the sizing of the tubes being accomplished by these jaws, which are caused to rotate at a very high rate of speed, each tube having been previously

lubricated externally, as already described. The inner shell extends some distance out beyond the outer shell, serving, however, merely as a guide for the sized paper tubes after they are stripped from the arbors, as will be more fully explained. The inner shell is firmly held in place by a clamp 158, which is secured to bracket 143, the arms of said clamp being drawn together in the usual manner. The inner end of the inner shell is cut away slightly, as shown, leaving shoulders 160.

161 indicates spring stripping-jaws, whose shanks 162 rest against shoulders 160 and are riveted to the inner shell. These jaws are preferably four in number, as shown in Fig. 26, and are provided with shoulders 163, which spring over the ends of the paper tubes after they have passed through. As each tube enters the stripping-jaws from the sizing-jaws the former open out to allow it to pass freely through, their faces being beveled for that purpose, as is clearly shown. As soon as the tube has passed entirely through both pairs of jaws the stripping-jaws spring into place over the end of the tube. As clearly shown in Fig. 5 and as already described, the rear ends of the arbors are provided with shoulders 27. These shoulders are sufficiently high to form a stop for the tube, thus preventing it from being forced too far on the arbor, while at the same time the thickness of the tube is about double the height of the shoulder, so that when the tube is in place on the arbor the combined diameter of the tube and arbor is perceptibly greater than the diameter of the shoulder. As soon, therefore, as the tube has passed through the stripping-jaws the latter spring into place and shoulders 163 bear upon shoulders 27 on the arbor, so that in the backward movement of the arbor the sized paper tube is necessarily stripped therefrom. The inner shell has no motion whatever and the tube stripped from the arbor remains just where it was left until forced forward out of the way by the next tube, the inner shell being made sufficiently long to carry the tubes out of the way of the operative parts of the machine.

The operation of the entire machine may be briefly summarized as follows: A disk carrying a series of arbors (in the present instance four in number) is journaled on a carriage adapted to reciprocate in ways in the bed of the machine. During each forward movement of the carriage the disk which carries the arbors is caused to make a quarter-revolution. Starting with any particular arbor, at the first forward movement of the carriage the arbor enters a lubricator, by which its forward end is lubricated preparatory to taking up a paper tube. The tubes to be sized are placed in a hopper and fed downward by gravity. During each reciprocation of the carriage—that is, during the movement toward the left—peculiarly-constructed jaws below the hopper open and permit a single tube to drop down between them. During the return movement of the carriage—that is, the movement toward the right—the jaws close upon the tube, and at the second forward movement the arbor specially selected enters the tube clamped in the jaws and takes it up, the point of the arbor being forced entirely through the tube, the other end of the tube resting against a shoulder on the arbor. The jaws then open again and allow the arbor to pass forward, carrying the tube with it. During the return movement a lubricating-roller is caused to move forward and lubricate the tube upon the arbor. As soon as the tube is lubricated the roller moves backward and takes lubricating material from another roller, which rotates in a reservoir. At the third forward movement of the carriage the third arbor is lubricated, the second takes up a tube, which is lubricated, as before, during the return movement, and the first arbor, with a tube upon it, merely passes through an opening in one of the brackets to receive it, no operation whatever being performed upon it. At the fourth forward movement of the carriage the fourth arbor is lubricated, the third takes up a tube, which is lubricated externally, as before, on its return, the second has no operation performed upon it, and the first passes between sizing-jaws, which rotate about it at a high rate of speed, being pressed firmly against it. After passing through the sizing-jaws the tube passes through a set of stripping-jaws provided with shoulders, which spring over the rear end of the tube after it has passed through and rest upon the shoulder on the arbor so that when the return movement of the arbor takes place the tube is stripped off from it, remaining in the shell to which the stripping-jaws are attached until it is forced out by the next sized tube. These operations are continuously repeated. As each new tube is taken up by the arbor a sized tube is stripped from the one just behind it.

We do not of course desire to limit ourselves to the exact details of construction shown and described, as it is obvious that they may be widely varied without departing from the spirit of our invention.

We claim—

1. A rotating disk having arbors which take up the tubes, in combination with sizing-jaws which rotate about the tubes while on the arbors and stripping-jaws whereby the tubes are removed therefrom.

2. The reciprocating carriage and the disk having arbors to take up the tubes, said disk being adapted to make a quarter-revolution at each forward movement of the carriage, in combination with a lubricator 59 for the arbors, jaws 67, which hold the tubes singly while they are taken up by the arbors, and sizing-jaws through which the tubes pass singly, as and for the purpose set forth.

3. The reciprocating carriage and the intermittently-rotating arbor-disk, in combination with lubricator 59, jaws 67, the sizing-

jaws, and a set of spring stripping-jaws, operating substantially as described.

4. The reciprocating carriage and intermittently-rotating arbor-disk, in combination with jaws 67, from which the tubes are taken singly by the arbors, roller 88, which lubricates the tubes while on the arbors, and sizing-jaws 153.

5. The arbors having shoulders 27, in combination with jaws 67, from which the tubes are taken singly, rotating sizing-jaws 153, through which the tubes pass while on the arbors, and stripping-jaws 161, having shoulders which spring over the ends of the tubes and rest upon shoulders 27, whereby the sized tubes are removed from the arbors.

6. The combination, with the carriage-disk 28, carrying the arbors, jaws 67, and the sizing-jaws 153, of mechanism, substantially as described and shown, for imparting reciprocatory motion to the carriage and intermittent rotary motion to the disk.

7. The carriage having brackets 30 and lateral extension 31, in combination with disk 28, shaft 29, having ratchet 46, cross-slide 33, engaging cam-slot 38 and segment-gear 41, and a pawl pivoted to said segment, whereby said cross-slide is caused to actuate shaft 29 and the disk.

8. The reciprocating carriage provided with a reciprocating cross-slide and shaft 29 upon said carriage, in combination with ratchets 46 and 48, keyed to said shaft, segment-gear 41, free to turn thereon, pawl 43, pivoted to the segment and engaging ratchet 46, and sliding pawl 47, engaging ratchet 48, whereby after each forward movement of the shaft it is held against backward movement.

9. In a machine of the class described, shaft 29, having ratchet 46, a loose segment 41, pawl 43, pivoted to said segment and engaging the ratchet, and a friction-disk 54, in combination with cross-slide 33, engaging said segment, and clamping-arms 55, engaging said disk.

10. Shaft 29, carrying ratchets 46 and 48, and a loose segment 41, having a pawl engaging ratchet 46, in combination with cross-slide 33, engaging the segment, pawl 47, engaging ratchet 48, and pivoted lever 50, one end of which is pivoted to pawl 47 and the other provided with a roller to engage a cam, whereby pawl 47 is caused to release the ratchet when the forward movement takes place.

11. The combination, with the reciprocating carriage and intermittently-rotating arbor-disk, of lubricator 59 for lubricating the arbors singly.

12. The reciprocating carriage and the intermittently-rotating arbor-disk, in combination with lubricating-washers 60, a spring-band encircling them, and bracket 65, upon which they are supported.

13. The combination, with the arbors and operating mechanism, substantially as described and shown, of the hopper-jaws 67 and means, substantially as shown and described, for opening and closing the jaws.

14. Jaws 67 and plates 68, to which they are secured and which are provided with screw-pins carrying rollers, in combination with a slide having angular slots engaged by said rollers, whereby the jaws are opened and closed.

15. Slide 72, having slots 71, and plates 68, carrying rollers engaging said slots, in combination with jaws 67 adjustably secured to said plates.

16. The slide having slots 71 and the jaws having rollers which engage said slots, in combination with an adjustable bed 78.

17. The bed having a V-shaped notch 80 and screws 79, whereby it is adjusted up or down, in combination with jaws having angular faces corresponding with said notch, rollers 70, and a slide engaged by said rollers, whereby the jaws are opened and closed.

18. The combination, with the slide, of the bed having semi-cylindrical pieces 81 and the jaws having quadrant-shaped pieces 82, whereby the ends of the tubes are firmly grasped, so that they cannot be crushed when the arbors are forced in.

19. The slide and jaws 67, having angular faces and carrying quadrant-shaped pieces 82, in combination with an adjustable bed having a V-shaped groove corresponding with the faces of the jaws and a semi-cylindrical piece 81, which forms with pieces 82 a perfect circle when the jaws are closed, as and for the purpose set forth.

20. The combination, with the arbors and the jaws, of spring-actuated slides 84, having curved recesses at their inner ends which permit the points of the arbors to pass but hold back the tubes and then permit the arbors to pass forward with the tubes as the jaws open.

21. The arbors, the bed, the jaws, and slide 72, in combination with slides 84, having recesses 87, and springs 85, whereby they are pressed together.

22. The bed, jaws 67, slide 72, and the reciprocating carriage having dogs 77, in combination with rod 74, having an arm adapted to engage said dogs, and pivoted lever 73, one end of which is pivoted to the slide and the other to rod 74.

23. The arbors, slide 72, and jaws 67, in combination with block 83, having an opening 86, slides 84, carried by said block, and springs 85, whereby they are held in position.

24. The combination, with the reciprocating carriage, the arbors, and an intermittently-rotating disk by which they are carried, of lubricator 59, whereby the arbors are lubricated, spring-actuated slides 84, and jaws 67.

25. The reciprocating carriage and arbors 26 upon an intermittently-rotating disk carried thereby, in combination with lubricator 59, bed 78, having semi-cylindrical pieces 81, and jaws 67, having quadrant-shaped pieces 82, whereby the ends of the tubes are clamped to prevent crushing when the arbors are forced in.

26. The reciprocating carriage and arbors 26 upon an intermittently-rotating disk car-

ried thereby, in combination with lubricator 59, jaws 67, and bed 78, having pieces 81 and 82, and spring-actuated slides 84, as described, and for the purpose set forth.

27. The arbors and lubricator 59, in combination with guide 141 and jaws 67.

28. The combination, with the arbors and jaws 67, which hold the tubes singly as the jaws are pressed in, of lubricating-roller 88, whereby the exterior of the tube is lubricated.

29. The combination, with the arbors, lubricator 59, and jaws 67, which hold the tubes as the arbors are pressed in, of roller 88, whereby the tubes are lubricated as they are drawn out from the jaws.

30. Slide 90, carrying roller 88 and having an adjustable block 94, in combination with rock-shaft 96 and lever 95, carried by said shaft and pivoted to block 94.

31. The rock-shaft, slide 90, lever 95, and roller 88, in combination with cam 106, slide 102, having pivoted arm 103, and crank 99, secured to the rock-shaft and pivoted to slide 102.

32. The rock-shaft, lever 95, the crank, slide 102, having a pivoted arm, and face-cam 106, against which said arm bears, in combination with air-cylinder 138, having a petcock, and piston 140, pivoted to lever 95 and adapted to slide in said cylinder, as and for the purpose set forth.

33. Slide 96, carrying roller 88, slotted to receive an adjustable block 94, the rock-shaft, and lever 95, in combination with stop 135, spring 137, and the piston and air-cylinder.

34. Roller 88, the slide, and the rock-shaft, in combination with lever 95 and the piston and air-cylinder.

35. In a machine of the class described, cam 106 and the rock-shaft having lever 95 and crank 99, in combination with slide 102, to which said crank is pivoted and which is provided with a roller engaging said cam, whereby the shaft is actuated, and stop 135, whereby the oscillation of said shaft is limited.

36. The rock-shaft having crank 99 and oscillating face-cam 106, in combination with slide 102, to which said crank is pivoted, a stud 105 on said slide, and arm 103, pivoted to said slide and engaging said cam and provided with a curved slot through which the stud passes, whereby when the cam is oscillated in one direction the arm is held down and the slide reciprocated and when oscillated in the other direction the arm is raised and the slide remains stationary.

37. The combination, with the arbors, rollers 88 and 112, and casting 92, having a recess for lubricating material in which roller 112 rotates, of a slide 90, by which roller 88 is carried, and mechanism, as a rock-shaft and connections, by which said slide is reciprocated.

38. The reciprocating carriage and the tube-carrying arbors carried by an intermittently-rotating disk on said carriage, in combination with lubricating-roller 88, carried by a reciprocating slide, and a roller 112, rotating in a recess containing lubricating material, whereby during the forward movement of the carriage roller 88 receives lubricating material and during the backward movement of the carriage it lubricates tubes upon the arbors.

39. The tube-carrying arbors, roller 88, and roller 112 upon shaft 113, in combination with a reservoir, a casting having a recess 123 for lubricating material, and intermediate connections with shaft 107, whereby rocking motion is imparted to roller 112.

40. The combination, with the tube-carrying arbors and lubricating-roller 88, of a reservoir 120, having a passage leading to recess 123, a piston 124 for forcing the lubricating material into said recess, and a roller 112 in said recess, whereby the lubricating material is transferred to roller 88.

41. Arbors 26, rollers 88 and 112, and lubricator-reservoir 120, in combination with piston 124, rack 125, and a pinion and pawl whereby the piston may be lifted out of the reservoir to permit filling.

42. Rollers 88 and 112 and reservoir 120, having a passage leading to recess 123, in combination with rack 125, a piston pivoted to said rack, a weight for forcing down the lubricating material, and a pinion engaging said rack, whereby the piston may be raised out of the reservoir.

43. Reservoir 120, having a recess 123, communicating therewith, and roller 112, journaled in said recess, in combination with rack 125, a piston pivoted thereto, a pinion for raising said rack, a pawl for holding said rack in its raised position, and a spring-rack 134 for holding the pawl in disengaged position when the piston is in operative position.

44. The reciprocating carriage, the arbors, an intermittently-rotating disk upon said carriage by which the arbors are carried, and arbor-lubricator 59, in combination with jaws 67, from which the arbors take the tubes, and lubricating-roller 88, by which the tubes are lubricated on the arbors.

45. The reciprocating carriage, the arbors carried by an intermittently-rotating disk upon said carriage, and arbor-lubricator 59, in combination with jaws from which the tubes are taken by the arbors, a roller upon a reciprocating slide by which the tubes are lubricated during the backward movement of the carriage, and a roller 112, by which roller 88 is lubricated.

46. The reciprocating carriage and the arbors carried by an intermittently-rotating disk on said carriage, in combination with jaws 67, from which the paper tubes are taken by the arbors, and a chuck 146, having jaws 153, whereby the tubes are sized while on the arbors.

47. The arbors, the outer shell, and the chuck secured thereto, in combination with jaws 153, ring 154, secured to the chuck, whereby the jaws are held in place, and set-screws 156, whereby the jaws may be adjusted.

48. The tube-carrying arbors and the rotating outer shell carrying sizing-jaws 153, in combination with a non-rotating inner shell carrying stripping-jaws 161.

49. The outer shell carrying jaws 153 and provided with a belt-pulley whereby rotation is imparted, in combination with the inner shell having spring stripping-jaws secured thereto and clamp 158, whereby the inner shell is held in position.

50. The inner shell having shoulders 160 and the stripping-jaws having shanks 162, secured to the shell, as shown, in combination with clamp 158, the rotating outer shell, and the sizing-jaws carried thereby.

51. The inner shell carrying spring stripping-jaws and held by clamp 158, in combination with a rotating outer shell carrying chuck 146, provided with undercut ways 152 to receive the sizing-jaws, and ring 154, whereby said jaws are held in place.

52. The combination, with the tube-carrying arbors having shoulders 27, of the rotating outer shell carrying sizing-jaws through which the tubes pass while on the arbors and a non-rotating inner shell carrying stripping-jaws provided with shoulders 163.

53. The tube-carrying arbors and lubricating-roller 88, in combination with the chuck carrying sizing-jaws 153.

54. The arbors, lubricating-roller 88, and a rotating outer shell carrying a chuck with sizing-jaws, in combination with a non-rotating inner shell carrying spring stripping-jaws.

55. Lubricator 59 and the tube-carrying arbors, in combination with lubricating-roller 88 and the sizing-jaws.

56. Lubricator 59 and the tube-carrying arbors, in combination with lubricating-roller 88, the sizing-jaws, and spring stripping-jaws.

57. The reciprocating carriage and the arbors carried by an intermittently-rotating disk, in combination with bracket 65, carrying lubricator 59 and the feeding mechanism, bracket 93, carrying lubricating-rollers 88 and 112, and bracket 143, having an opening 142, carrying the sizing and stripping jaws.

In testimony whereof we affix our signatures in presence of two witnesses.

ALFRED C. HOBBS.
CHARLES R. RICHARDS.

Witnesses:
A. M. WOOSTER,
C. E. RUGGLES.