No. 664,614. Patented Dec. 25, 1900.

C. A. BAILEY.

MACHINE FOR MAKING PAPER TUBES.

(Application filed May 24, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

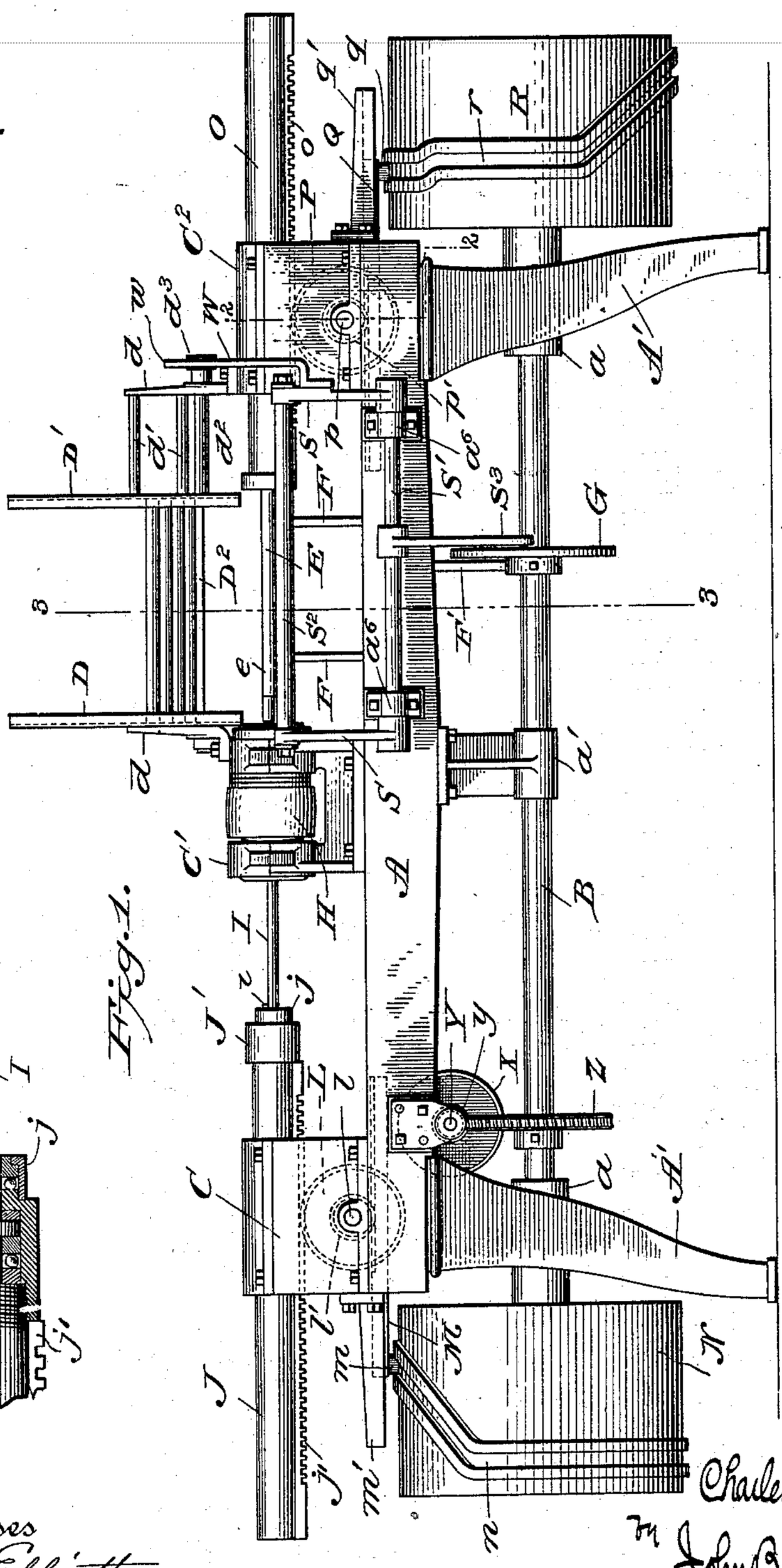

Fig. 6.

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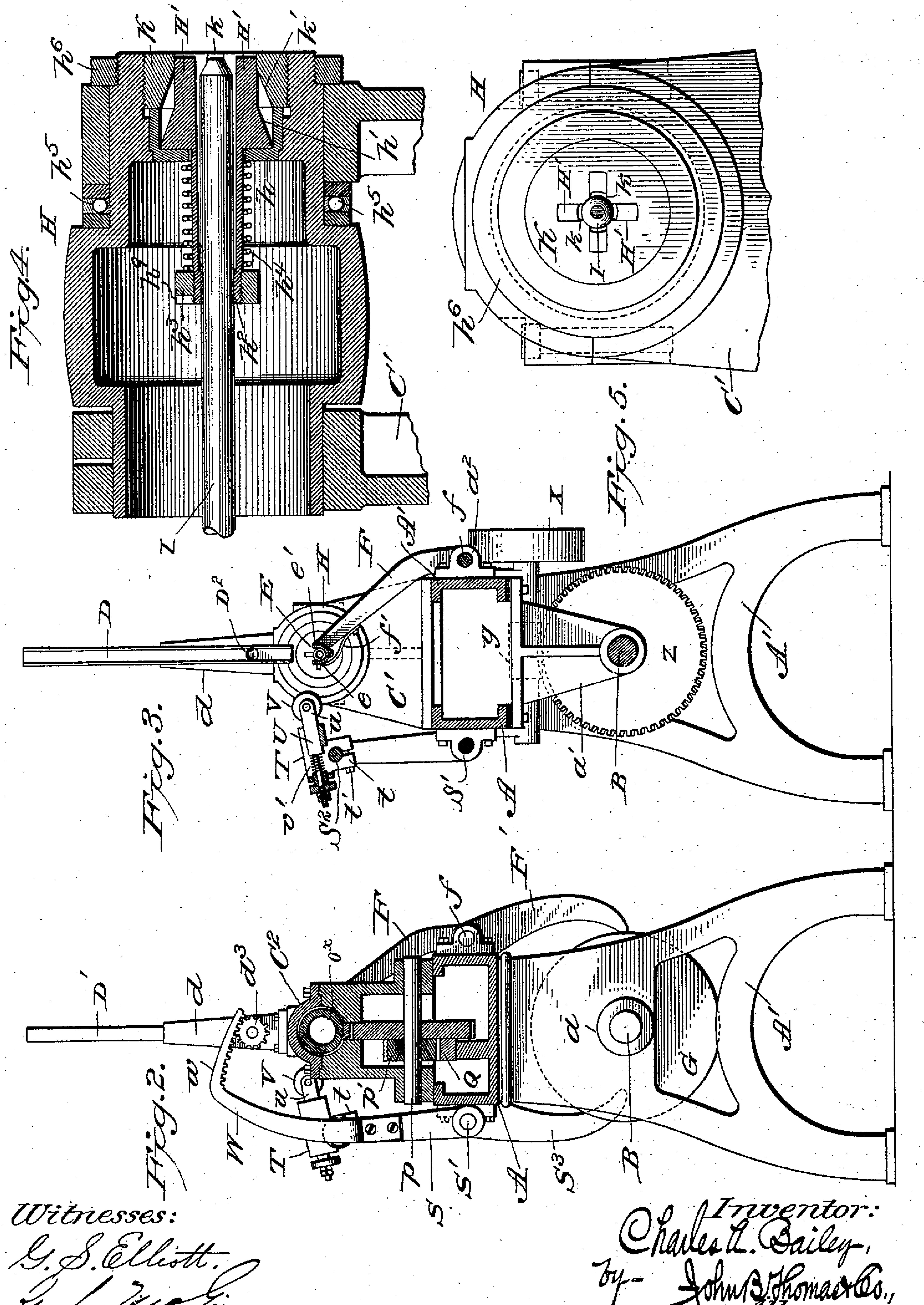

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UNITED STATES PATENT OFFICE.

CHARLES A. BAILEY, OF CROMWELL, CONNECTICUT.

MACHINE FOR MAKING PAPER TUBES.

SPECIFICATION forming part of Letters Patent No. 664,614, dated December 25, 1900.

Application filed May 24, 1900. Serial No. 17,823. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. BAILEY, a citizen of the United States, and a resident of Cromwell, in the county of Middlesex and State of Connecticut, have invented a Machine for Burnishing, Sizing, and Cutting Paper Tubes, of which the following is a specification.

The object of this invention is to provide a machine for burnishing, sizing, and cutting paper tubes which shall be entirely automatic in its operation and by successive steps will deliver a tube from the hopper, clamp or hold it securely in the machine, size and burnish said tube, and cut it into the desired lengths, the machine operating continuously and requiring attention only in so far as to supply the hopper with tubes to be operated upon.

With the above object in view the invention consists in the construction and combination of parts or mechanisms which are supported by a suitable frame and comprise a hopper with means for dropping the tubes intermittently, a swinging arm or tube-receiver into which the tubes are dropped from the hopper, a centering-spindle and chuck or clamping-head by which the tubes are supported and revolved, a reciprocating cylinder or hollow shaft carrying the burnishing and sizing die adapted to polish the tubes and make them of uniform diameter, and a gang of cutters carried by a swinging frame which moves them against the revolving tube, together with mechanism by which the said parts are operated successively and at the proper time.

The following specification enters into a detail description of my invention, reference being had to the accompanying drawings and to letters thereon which designate the different parts, and what I consider to be new, and desire to fully protect by Letters Patent, is more specifically set forth in the appended claims.

In the drawings which form a part hereof, Figure 1 is a side elevation of the machine constructed in accordance with my invention, the gang of cutters being removed from their supporting-frame. Fig. 2 is a sectional view, enlarged, the section being taken on the line 2 2 of Fig. 1 through the actuating mechanism for the sizing and burnishing tool with the operating-cam removed from the shaft. Fig. 3 is also an enlarged sectional view, the said section being taken on the line 3 3 of Fig. 1. Fig. 4 is an enlarged detail sectional view of the clamping-head or tube-holder. Fig. 5 is an end view of the clamping-head or tube-holder. Fig. 6 is a detail sectional view of the head of the shaft which carries the arbor.

The supporting-frame of the machine consists of the side pieces A A, supported upon legs or end pieces A′ A′, the said end pieces being formed with bearing-boxes *a* for the main operating-shaft B, the latter extending the full length of the machine and is supported centrally by means of a drop-hanger *a′*.

Upon the side pieces A A of the supporting-frame are bolted brackets or boxes C, C′, and C^2, the boxes C and C^2 being located at opposite ends of the supporting-frame and the box C′ near the center thereof. The end brackets or boxes are similar, as they support duplicate mechanisms for operating the arbor and burnishing device, respectively, while the central box is designed to support the revoluble clamping-head or tube-holder. Upon the boxes C′ and C^2 are secured uprights or standards *d d*, which support the hopper which is located between said standards, the said hopper consisting of the vertical channel-bars D and D′, separated a distance apart equal to the length of the tubes to be operated upon and adapted to receive the ends of the tubes and support them horizontally one upon another, the lower tube resting upon a rotatable trough D^2, by which said tubes are dropped from the hopper one at a time in the manner hereinafter described. It will be noted that the channel-bar D is attached directly to the standard mounted upon the box C′ and that the channel-bar D′ is located a short distance from the standard on the box C^2 and supported therefrom by means of rods *d′* in order to locate said channel-bar beyond the inner end of the burnishing-tool. The rotatable trough or bottom D^2 of the hopper is semicircular in cross-section and is connected to or formed integrally with a shaft d^2, which extends between the channel-bar D′ and its supporting-standard and beyond the latter to receive a pinion d^3, by which it is turned through the intervention of the rack-bar *w*, hereinafter referred to. It will be understood that when

the trough is turned down the lowest tube in the hopper will fall into the same and that as said tube is turned up or over it will pass between said lowest tube and the one above and drop the lowest tube out of the hopper, the others in the hopper being supported upon the trough or rotatable bottom. When a tube is dropped out of the hopper, it falls into a receiver or trough E, which is carried at the upper end of a pair of arms F F, extending from a shaft *f*, supported in bearing-blocks a^2, secured to one of the side pieces of the supporting-frame of the machine, the said shaft having a depending arm F′, the end of which is in engagement with a cam-wheel G, mounted upon the shaft B. The trough or tube-receiver E consists of two parts or sections *e* and *e′*, the latter being securely attached to the upper ends of the aforesaid arms F, while the section *e* is hinged thereto and is adapted to swing down to release the tube, the said hinged section being supported in its normal or closed position by means of a flat spring *f′*. The end of the trough opposite the rotatable clamping-head is closed in order that the movement of the tube in that direction will be limited and permit of the proper engagement of the clamping-head therewith.

H designates the rotatable clamping-head, which is mounted in the upper end of the bearing-box C′, and the central portion of this head is enlarged between the uprights of the bearing-box to form a band-pulley, as shown. In the forward end of the clamping-head are clamping-jaws H′, slidable upon an arbor I, projecting from a reciprocating shaft J, hereinafter described, the said jaws being limited in their rearward movement by means of a flanged ring *h*, let into a stepped opening in the head and held therein by a plate or disk K, the latter having a central opening through which the arbor passes and radial openings *k*, through which the clamping-jaws pass. The clamping-jaws are provided with inclined surfaces *h′*, which are adapted to ride upon correspondingly-inclined surfaces *k′* in the plate or disk K when said jaws are moved forward, and thereby close said jaws upon the arbor or tube supported thereon. The clamping-jaws are connected at their rear ends by a ring h^2, which is threaded to receive a nut h^3, and between said nut and the flanged ring *h* is an expansion helical spring h^4, adapted to retract the jaws. The end thrust of the clamping-head, imparted by the shaft J in the manner hereinafter described, comes upon a ball-bearing h^5, consisting of several rings between which are interposed a row of balls, and the opposite movement of said head is limited by an outer ring h^6, screwed upon the forward end of said head.

The shaft J is slidably mounted in the bearing-box C and is provided at its forward end with a head *j*, to which the rear end of the arbor or centering-spindle I is rotatably connected, for in the operation of the machine the said arbor rotates with the clamping-head, a pin *i* at the rear end of the arbor engaging a recess h^9 in the nut h^3. The bearing of the arbor in the head of shaft J, as well as the bearing of the rear end of the clamping-jaws against the said head, is formed by rings and interposed balls to reduce friction. The shaft J is provided on its under side with a longitudinal rack *j″* in mesh with a gear-wheel L, inclosed in the bearing-box C and mounted upon a transverse shaft *l*, the said shaft being turned by a pinion *l′*, mounted thereon and in mesh with a rack-bar M, sliding longitudinally in the supporting-frame and operated by a cam N, the said cam having a groove *n*, in which travels a roller *m* at the outer end of the aforesaid rack-bar. The rack-bar is held in proper engagement with the cam by means of an arm *m′*, bolted to the end of the supporting-frame and projecting therefrom. The cam N is mounted upon the shaft B.

Slidably mounted in the bearing-box C^2 is a hollow shaft or cylinder O, having a burnishing-die $O^\times$ at its inner end, which is adapted to move back and forth over the tube, and said shaft is provided at its under side with a longitudinal rack *o* in mesh with a gear-wheel P, inclosed within the bearing-box C^2 and mounted upon a transverse shaft *p*, the said shaft being turned by a pinion *p′* thereon, which is in mesh with a rack-bar Q, projecting beyond the end of the supporting-frame and having a pin or roller *q*, which travels in a cam-groove *r*. The rack-bar has a movement in a guide-arm *q′*, similar to the arm *m′*. It will be noted, therefore, that the mechanism for operating the hollow shaft of the burnishing device is similar to that hereinbefore described for operating the shaft which carries the arbor or centering-spindle.

Upon the side of the machine opposite the swinging tube-receiver hereinbefore described is mounted a swinging frame, which carries the gang of cutters that cut the tube into the desired lengths, said frame consisting of arms S S, extending upward from a shaft S′, supported in bearing-boxes a^6, secured to the side of the supporting-frame of the machine and connected at their upper ends by a bar S^2, upon which said gang of cutters are mounted, the shaft S′ being provided with a depending arm S^3, the lower end of which is in engagement with the cam-wheel G. The gang of cutters each consists of a frame T, having depending spring members *t*, which embrace the bar S^2 and are clamped thereon by a screw *t′*, and in said frame is slidably mounted a bar U, having a bifurcated head *u*, in which is mounted a cutting-disk V. The bar U extends through the rear end of the frame and its outer end is threaded to receive a washer and set-nuts, as shown, which limit the forward movement of said bar or disk-carrier, although permitting a rear movement thereof in order that the said cut-

ting-disks may have a yielding engagement with the tube when the gang of cutters are moved to operate thereon, the said cutters being projected against the tube individually by the helical springs v'.

Attached to the swinging frame, which carries the gang of cutters, is an arm W, the upper portion of which is formed into a curved rack-bar w, extending inward over the pinion d^3 and in mesh therewith. This curved rack-bar serves to turn the trough-shaped bottom of the hopper to drop a tube into the receiver at the proper time, the said trough-shaped bottom being turned to receive a tube therein as the cutters advance to cut the tube which is upon the arbor or spindle and is then turned upward to drop a tube as the said cutters are retracted.

The operating-shaft B is turned by means of the band-wheel X, mounted upon the projecting end of a worm-shaft Y, provided centrally with a worm y, in mesh with a worm-wheel Z, mounted upon the said operating-shaft B. The worm-shaft extends transversely across the under side of the side pieces A′ of the supporting-frame of the machine and is supported in bearing-boxes bolted to the said side pieces. This style of gearing between the driving-wheel and operating-shaft imparts the required slow movement to said shaft, for it will be understood that the several operations from the delivery of a tube from the hopper and the final stripping of the short-length tubes from the arbor or spindle all take place during a single rotation of the operating-shaft in the manner which I shall now proceed to describe.

The operation of the machine is as follows: Supposing the parts to be in the position illustrated in the accompanying drawings, with the cutters, arbor, and burnishing device retracted and a tube deposited in the receiver, the machine, being put in motion, the shaft J will be moved forward by cam N through the intervention of the gear-wheels L and l' and rack-bar M, and the arbor or spindle carried by said shaft will be projected into the tube which is in the receiver, and then the head of the shaft impinging against the rear end of the clamping-jaws will first move them out of the forward end of the clamping-head over the end of the tube, and then the inclined surfaces of the clamping-jaws riding upon the inclined surfaces of the disk will move said jaws upon the tube and clamp it between them. It will be here noted that the clamping-head is revolved independently by a belt passing around the same and that the arbor revolves with said clamping-head as the pin i on said arbor interlocks with nut h^3 by engaging the recess h^9 therein; also, that the tube being clamped in the head and upon said arbor is rapidly rotated in order that it may be properly operated upon by the burnishing-tool and cutters. When the tube is clamped in the head or chuck, the cam G operates to move the tube-receiver out of the way, during which movement the hinged section of said receiver swings down and under the tube. The cam R now operates to move the sizing and burnishing tool O over the tube to smooth and finish the same, the groove r in the cam being so shaped that upon the return of said burnishing device it will not clear the end of the tube, but serve to support the outer end during the operation of the cutters. The gang of cutters are then brought against the tube by the operation of the cam G upon the depending arm of the swinging frame which carries said cutters, and the tube, rotating against the cutters, will be severed into the required lengths, after which the burnishing device is moved to complete its backward movement, and while the gang of cutters are being slowly retracted the jaws of the clamping-head are retracted, the arbor is withdrawn to release and drop the severed tubes, and the tube-receiver is brought under the hopper in order to receive the next tube, which is dropped as the cutter-frame reaches the limit of its backward movement, the rotating bottom of the hopper being operated by the rack-bar carried by said cutter-frame. This operation is repeated upon the second tube, and so on. It will be noted, therefore, that the operation of the machine is entirely automatic and that the feeding of the tube into the receiver, the centering and clamping of said tube by the rotating clamping-head, the sizing and burnishing of the tube by the die carried by the hollow shaft, the cutting of the tubes into the required lengths, and, finally, the stripping of the severed tubes from the arbor or spindle are all accomplished during a single rotation of the operating-shaft.

It will be observed that during the operation of the trough-shaped bottom of the hopper said bottom part moves in between the two lowest tubes in the hopper, and therefore as it drops the lowermost tube it will support the others in vertical column, the next tube taking its place in the trough-shaped bottom as the latter returns to its normal position; also, that as the tube-receiver moves back the hinged section thereof will swing down and pass under the tube, leaving it upon the arbor, the backward movement of the tube-receiver taking place after the tube has been clamped by the stock. It will be further noted that the disk at the outer end of the clamping-head or chuck serves to prevent the severed tubes from being drawn into the clamping-head as the arbor is withdrawn or retracted.

The cutters are arranged or adjusted upon the supporting-bar to cut the tubes into desired lengths, and of course can be rearranged or adjusted to vary the lengths. The cutters are pressed against the tube by spring-pressure and will cut as said tube is revolved against the same, each cutting-disk operating independently.

A chute may be arranged in connection

with the machine to receive the cut tubes and deposit them in a basket or receptacle.

The machine is designed more especially for cutting tubes into suitable lengths for use in connection with the manufacture of paper-tube cartridges, the roughly-finished tubes of long length being taken from the tube-making machine and finished and cut in this machine.

The parts comprising my improved machine for burnishing, sizing, and cutting paper tubes are constructed and arranged as compactly as possible and the gearing mechanism is such as to give a positive and regular movement to the several devices to insure a perfect automatic operation of the machine. However, the particular arrangement of the parts and the manner of operating the same could be changed or modified without sacrificing any of the important advantages of my improved machine, and I therefore do not wish to be limited to what is herein shown and described, but reserve the right to make such changes or modifications as may come within the spirit and scope of my claims.

The unique construction and arrangement of the feeding device, comprising the hopper and tube-receiver, provide for feeding the tubes to the clamping-head one at a time, and therefore the only attention which the machine requires is to supply the hopper with tubes, and said hopper or parallel channel-bars may extend from a box adapted to hold a large number of tubes and feed them by gravity into the said channel-bars.

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

1. In a machine for burnishing and cutting paper tubes, the combination, of a movable trough into which the tubes are dropped, said trough having a closed end; a revolving clamping head or stock located at the open end of the trough; and an arbor adapted to pass through the clamping head or stock and into the tube, the inner end of the tube being clamped between said arbor and jaws of the clamping head or stock, substantially as shown and for the purpose set forth.

2. In a machine for burnishing and cutting paper tubes, the combination, of a laterally-movable trough into which the tubes are dropped, said trough having a closed end and hinged side; a revolving clamping head or stock located at the open end of the trough; and an arbor adapted to pass through the clamping-head and into the tube, the inner end of the tube being clamped between the arbor and jaws of the clamping head or stock, substantially as shown and for the purpose set forth.

3. In a machine for burnishing and cutting paper tubes, the combination, of a hopper having a pivoted trough-shaped bottom; a laterally-movable trough into which the tubes are dropped from said hopper, the trough having a closed end and hinged side; a revolving clamping head or stock located at the open end of the trough; and an arbor adapted to pass through the clamping-head and into the tube, the inner end of the tube being clamped between the arbor and jaws of the clamping-head, substantially as shown and for the purpose set forth.

4. In a machine for burnishing and cutting paper tubes, the combination, of a receiver into which the tubes are dropped, a reciprocating arbor, a revolving clamping head or stock through which the arbor passes into the tube, the jaws of the clamping-head clamping one end of the tube upon the arbor, a reciprocating burnishing device or hollow shaft movable upon the tube over the free end thereof, a gang of cutters, and means for moving said cutters against the tube, substantially as shown and described.

5. In a machine for burnishing and cutting paper tubes, the combination, of a receiver into which the tubes are dropped, a reciprocating arbor, a revolving clamping head or stock through which the arbor passes into the tube, a head at the rear end of the arbor adapted to move the jaws of the clamping-head into engagement with one end of the tube, a burnishing device or hollow shaft reciprocating upon the tube over the free end thereof, means for arresting the outward movement of the burnishing device to support the outer end of the tube, a gang of cutters, and means for moving said cutters against the tube, substantially as shown and described.

6. In a machine for burnishing and cutting paper tubes, the combination, of a laterally-movable trough into which the tubes are dropped, the trough having a closed end and hinged side, a reciprocating arbor, a revolving clamping head or stock through which the arbor passes into the tube, a head at the rear end of the arbor adapted to move the jaws of the clamping-head into engagement with one end of the tube, a burnishing device or hollow shaft reciprocating over the tube, means for arresting the outward movement of the burnishing device to support the outer end of the tube, a swinging cutter-frame carrying a shaft, and cutters mounted on said shaft, the burnishing device supporting the outer end of the tube during the cutting operation, substantially as shown and described.

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