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METHOD OF MAKING PAPER BOXES.

No. 332,983. Patented Dec. 22, 1885.

Fig. 1.

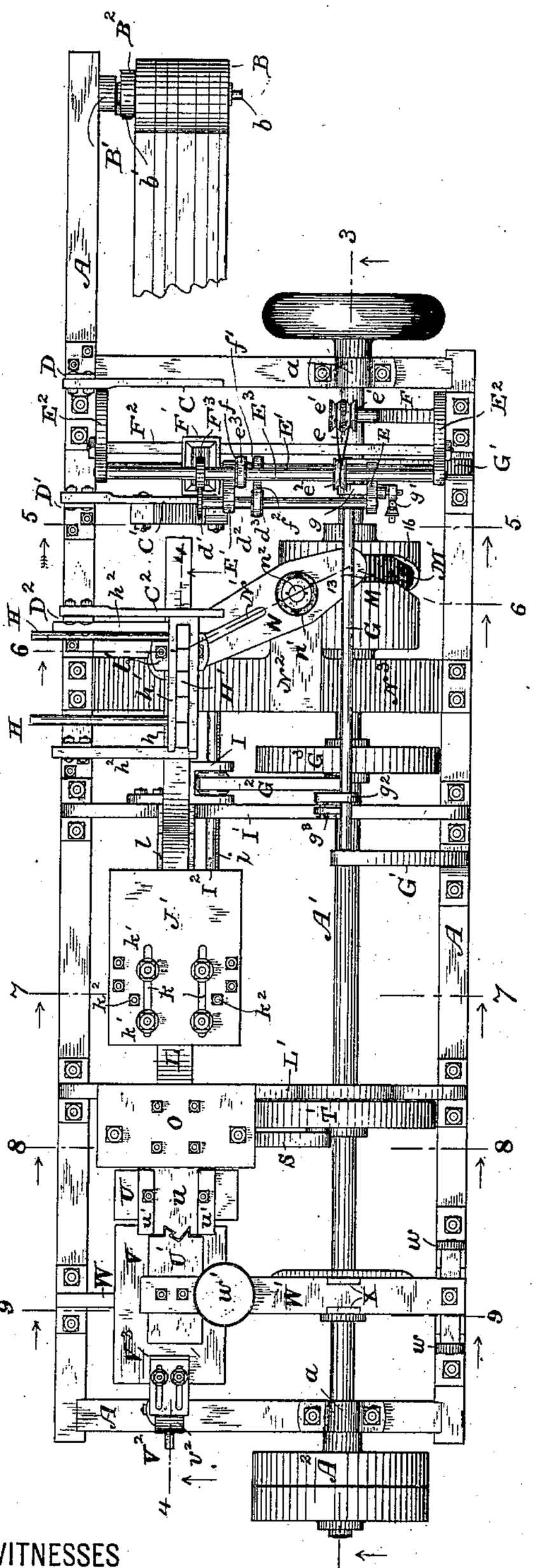
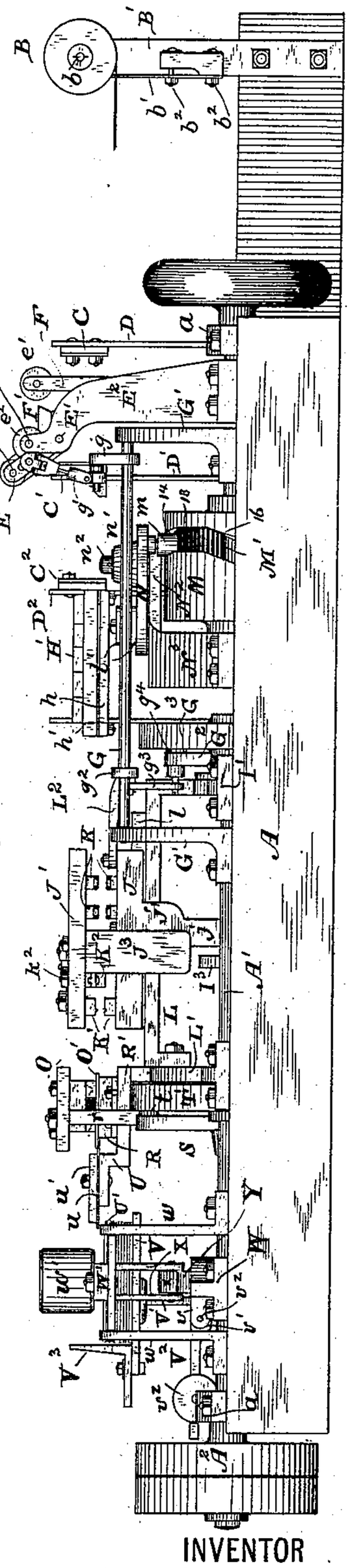


Fig. 2.



WITNESSES

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Baldwin, Hopkins & Peyton.

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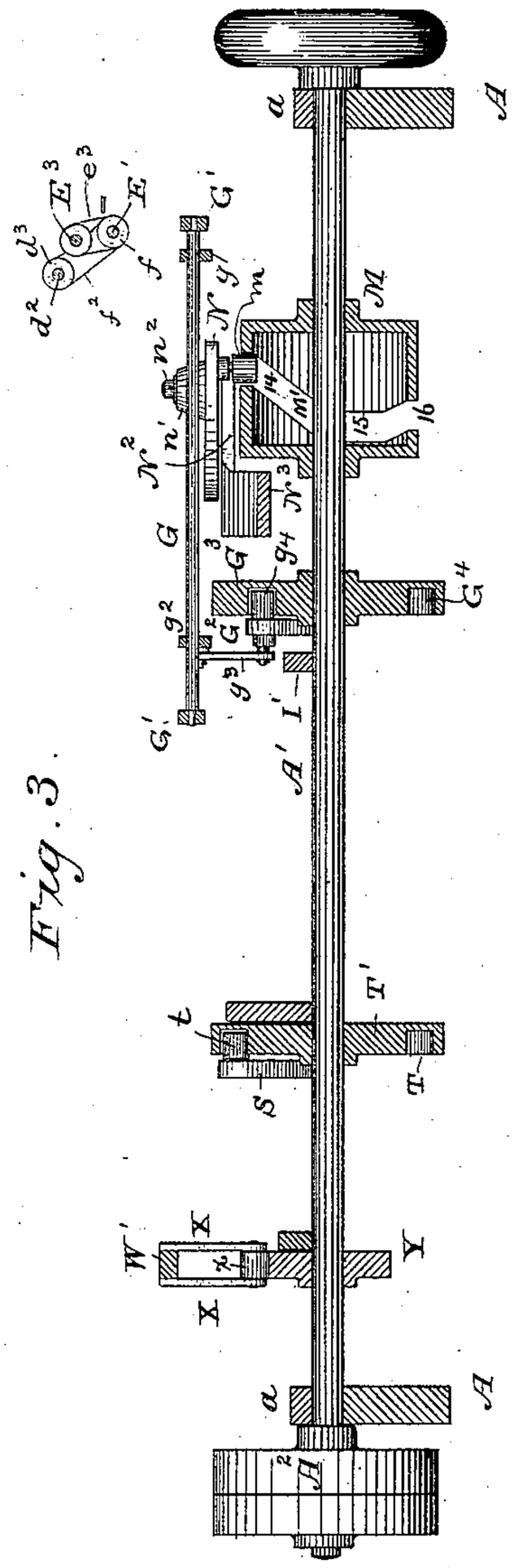

Fig. 3.

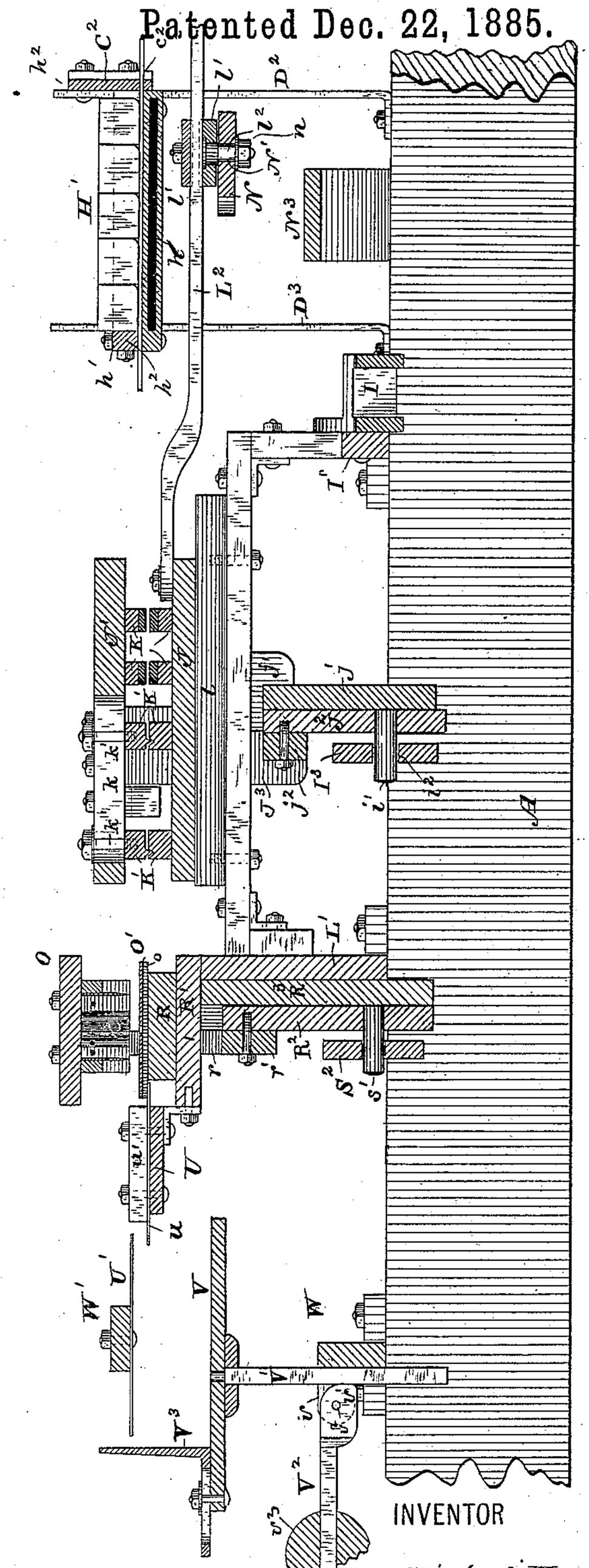

Fig. 4.

WITNESSES

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Fig. 5.

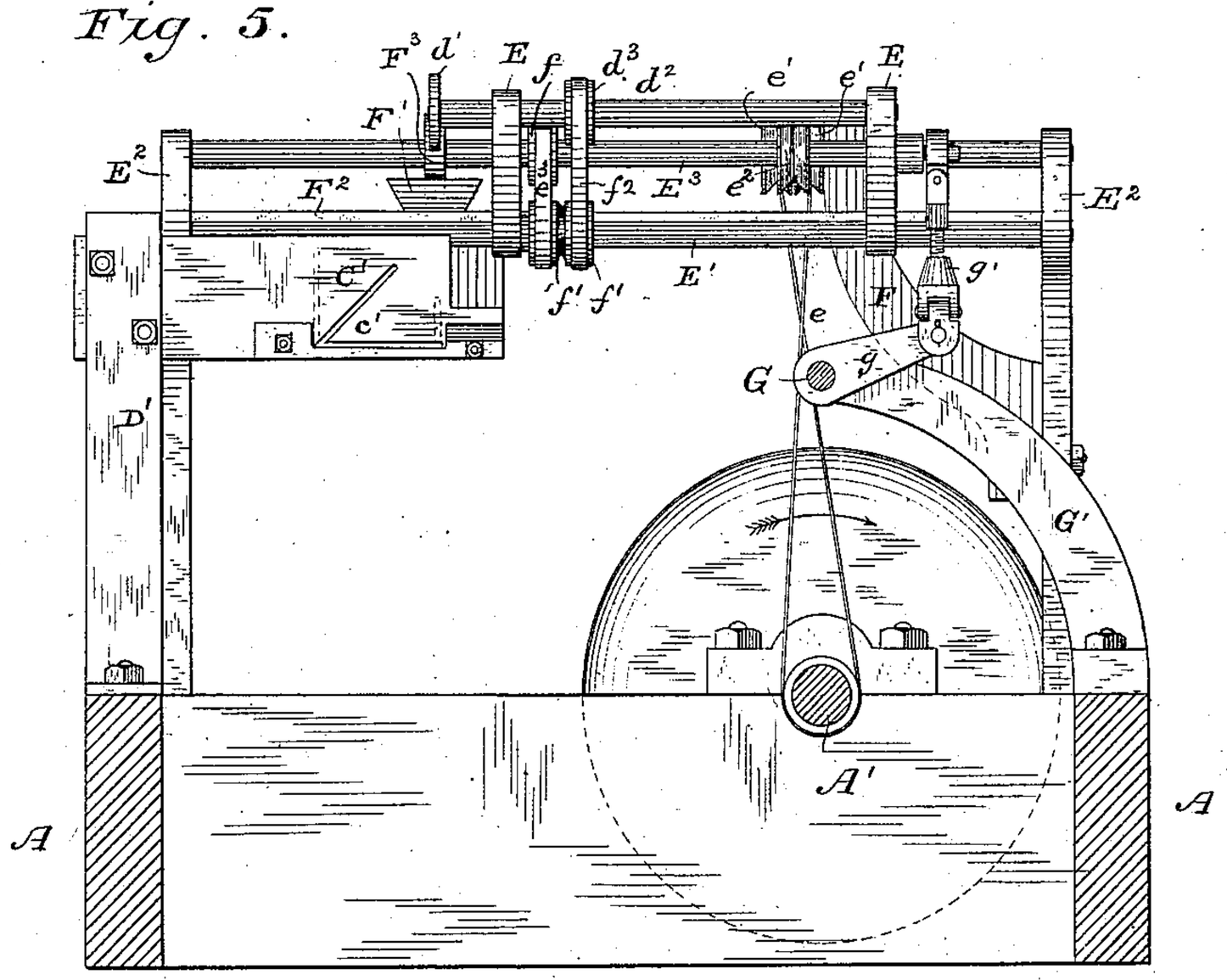

Fig. 6.

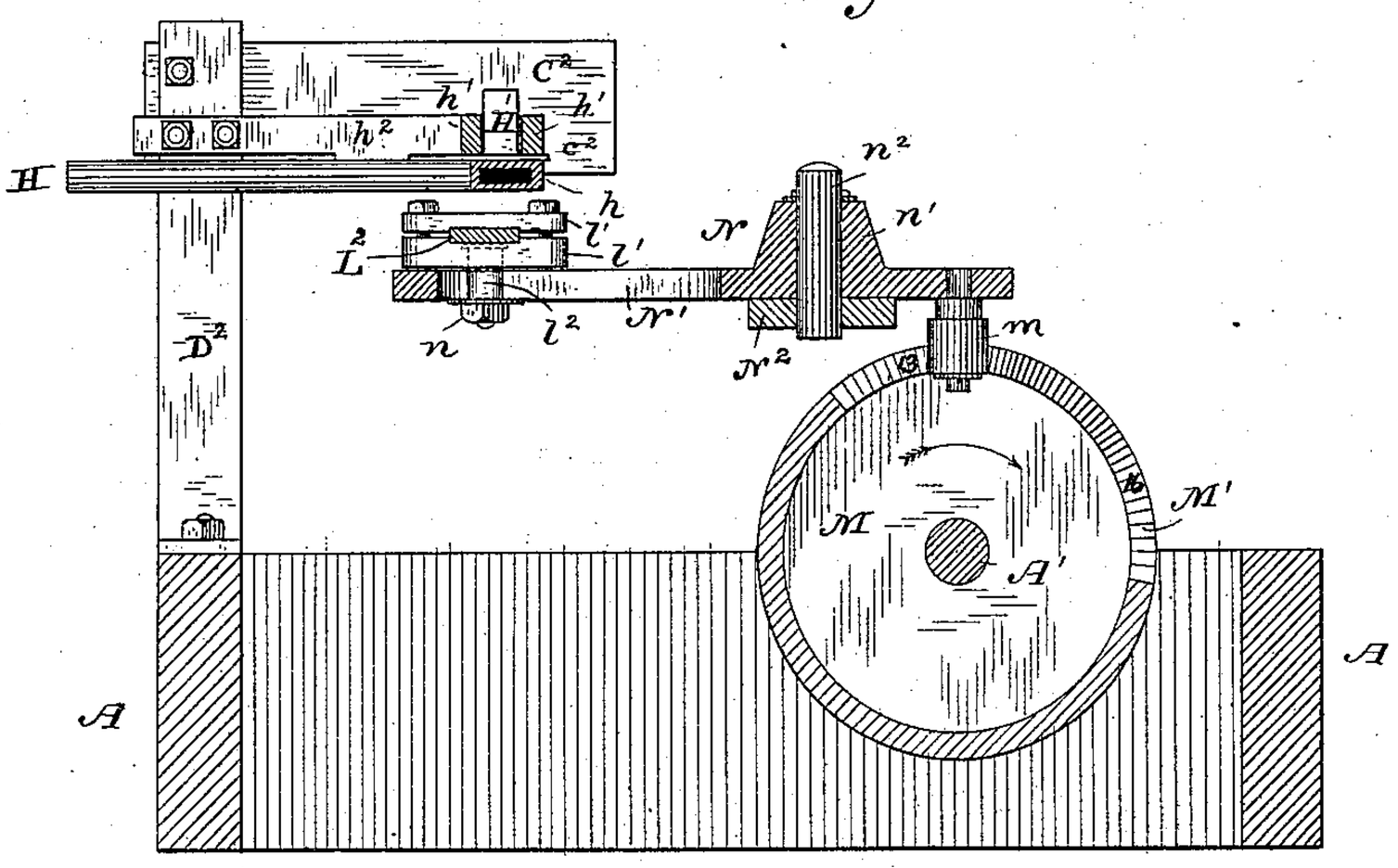

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Fig. 7.

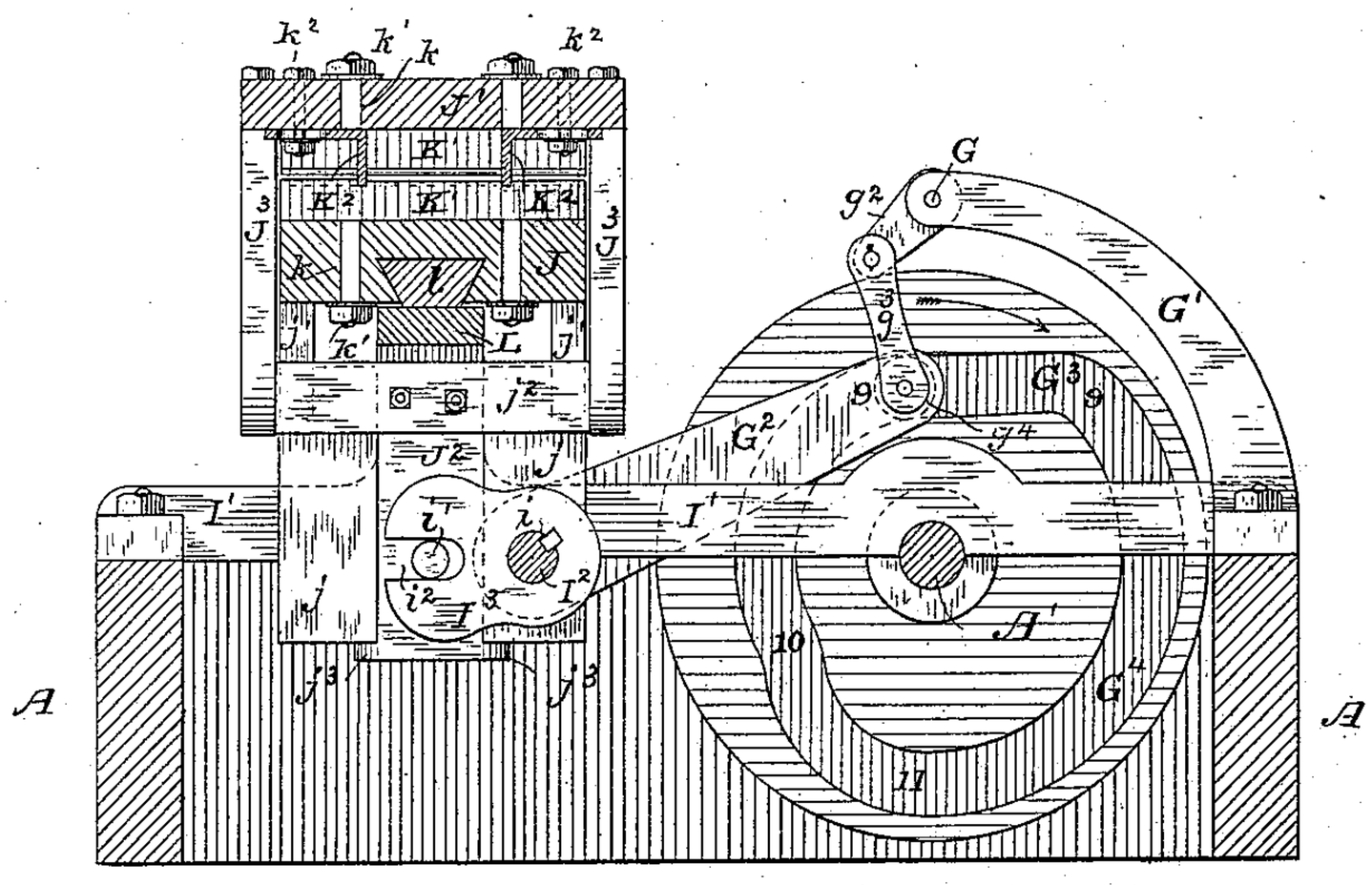

Fig. 8.

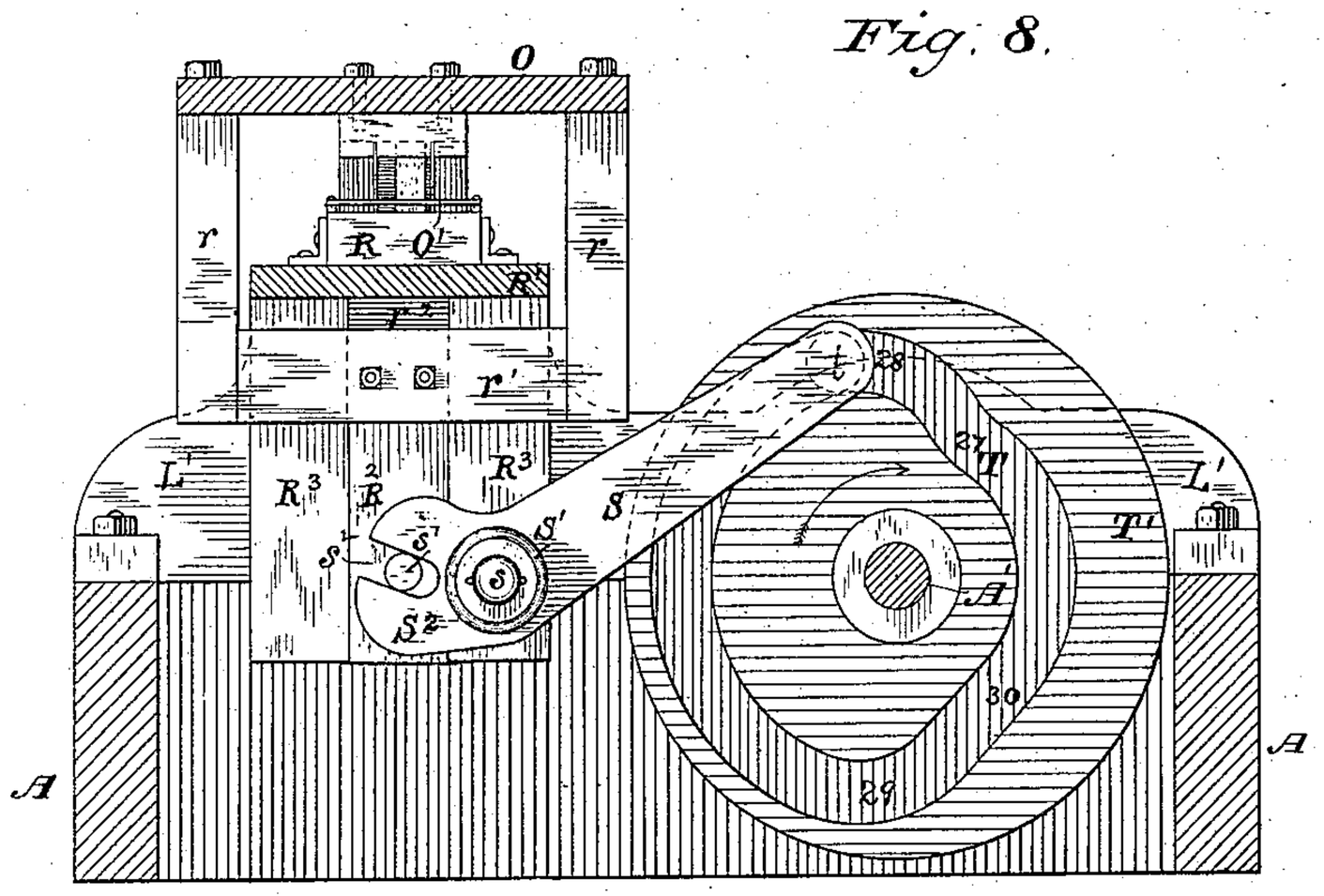

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Fig. 9.

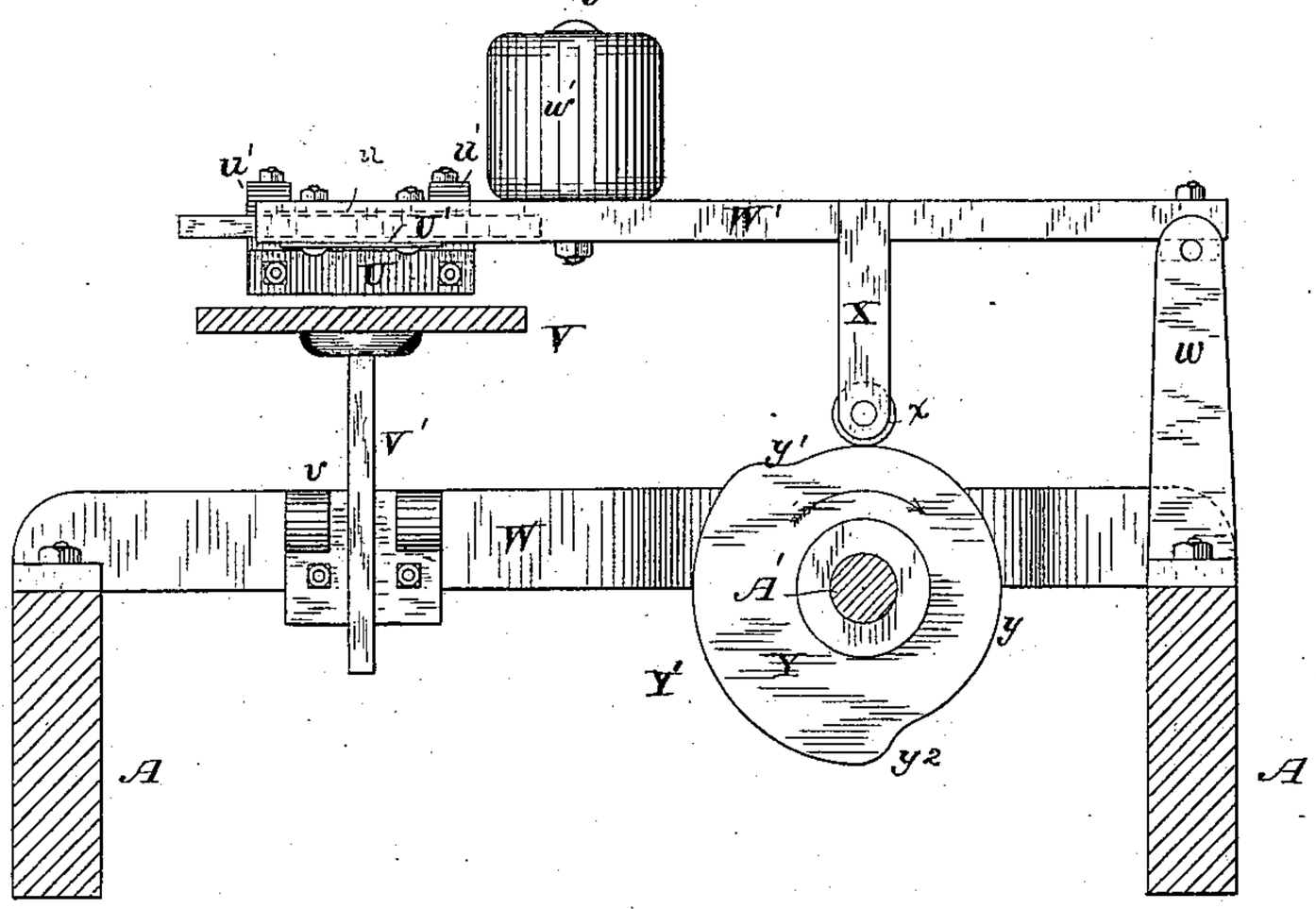


Fig. 14.

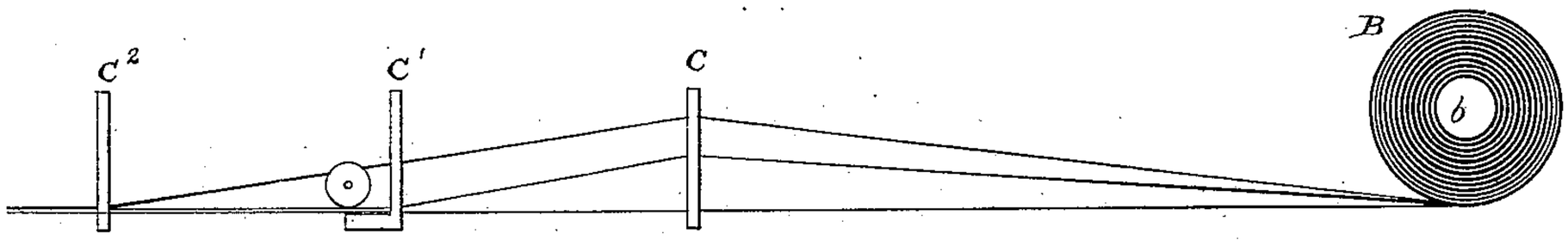


Fig. 15. *Fig. 16.* *Fig. 17.*

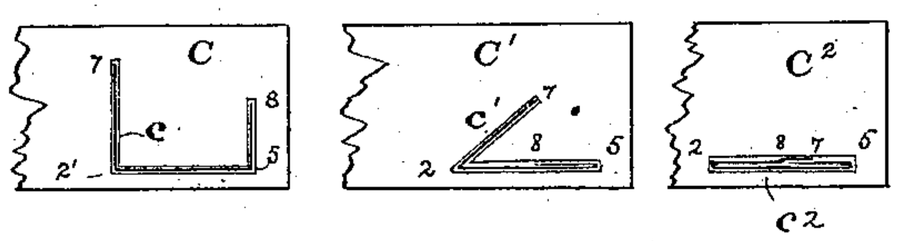
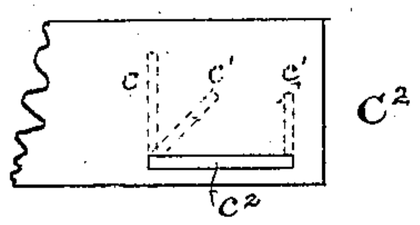


Fig. 18.



WITNESSES

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METHOD OF MAKING PAPER BOXES.

No. 332,983. Patented Dec. 22, 1885.

Fig. 10.

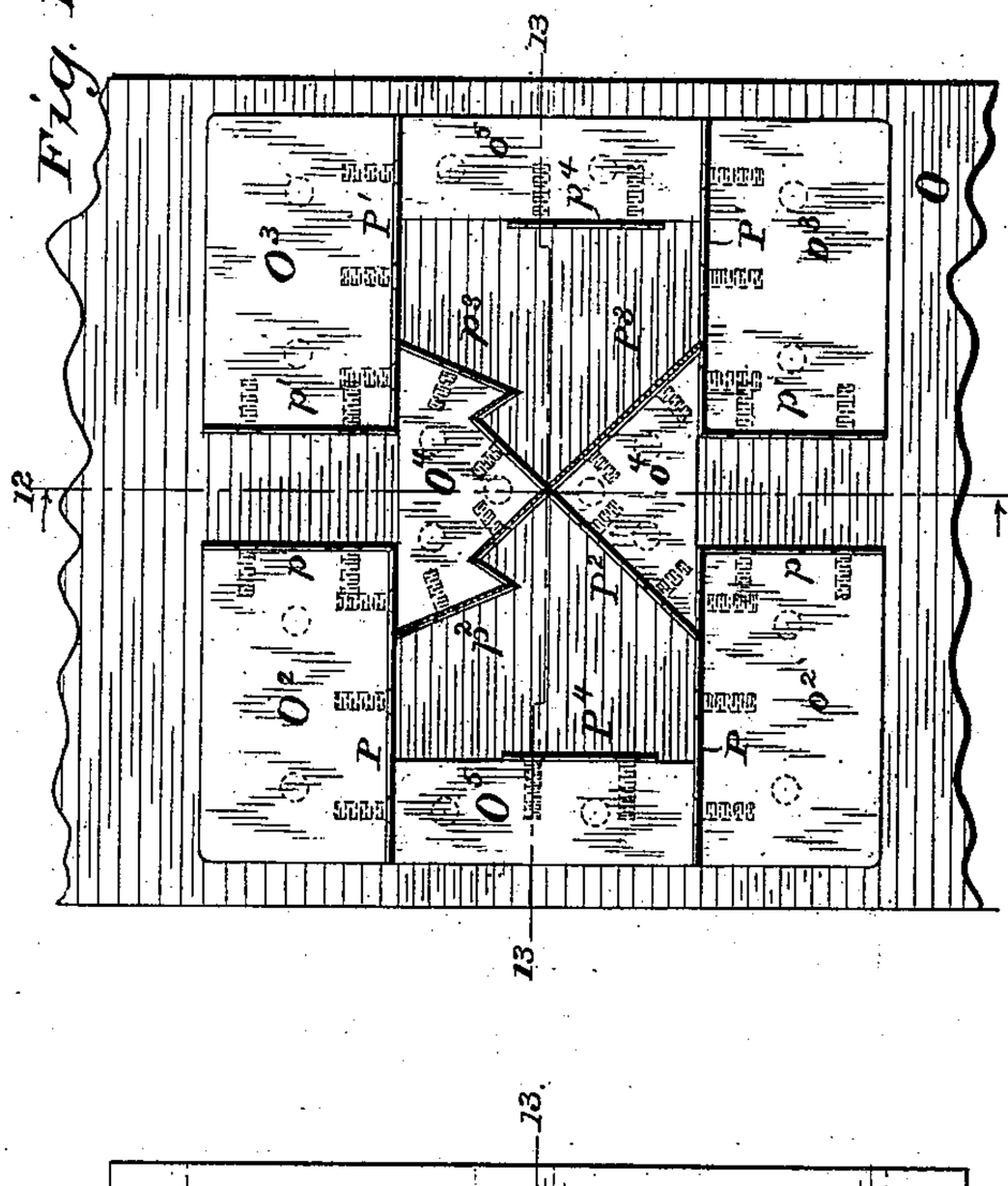


Fig. 12.

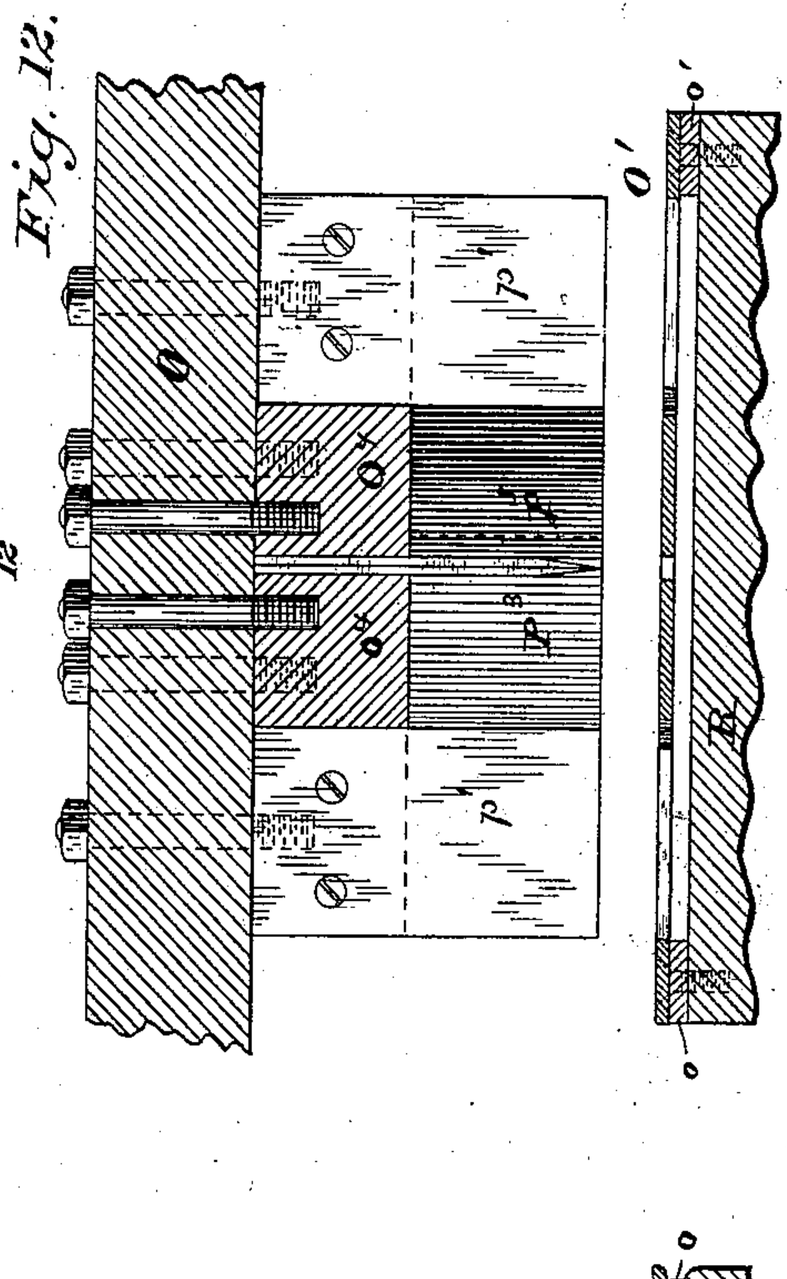


Fig. 11.

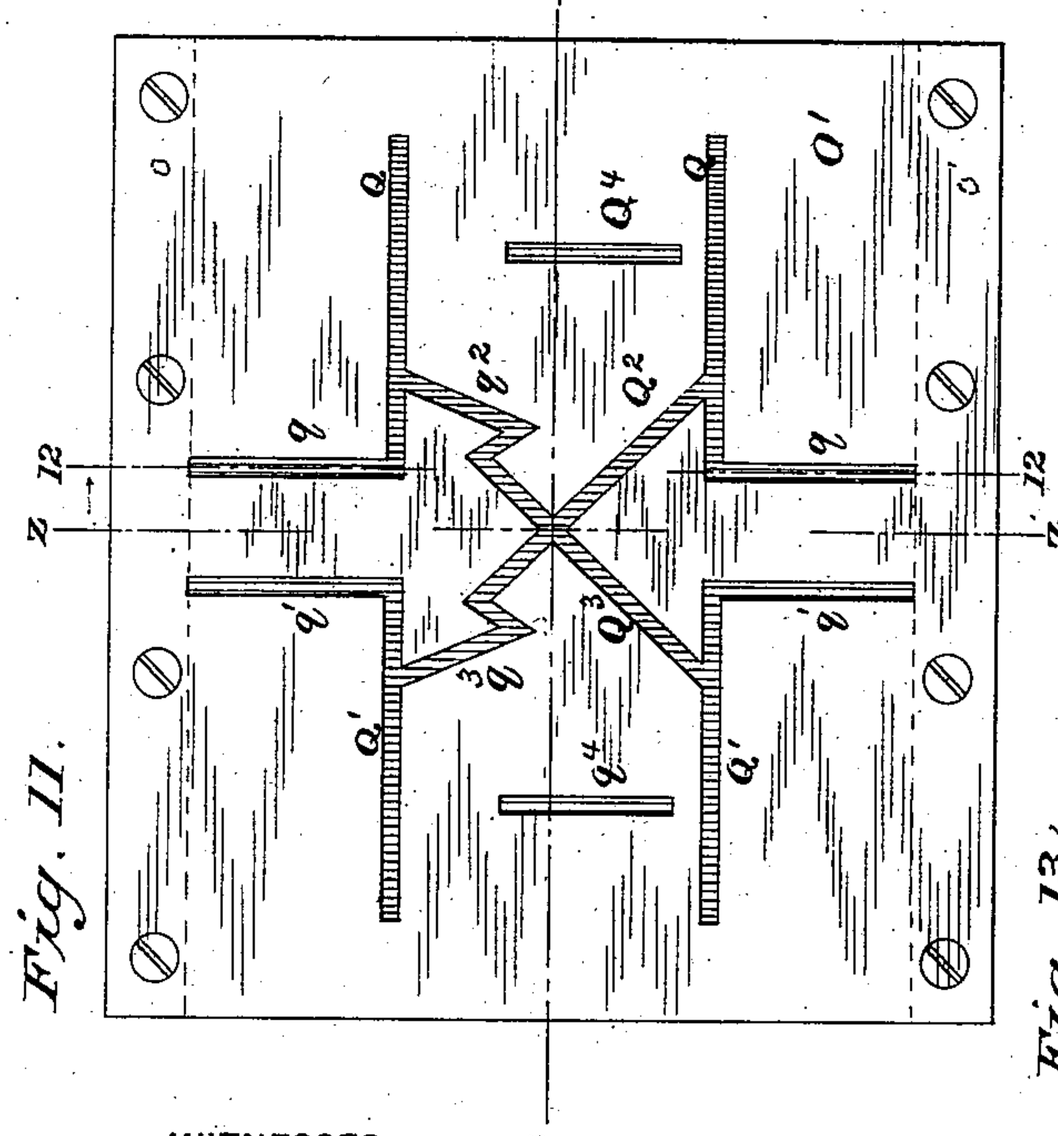
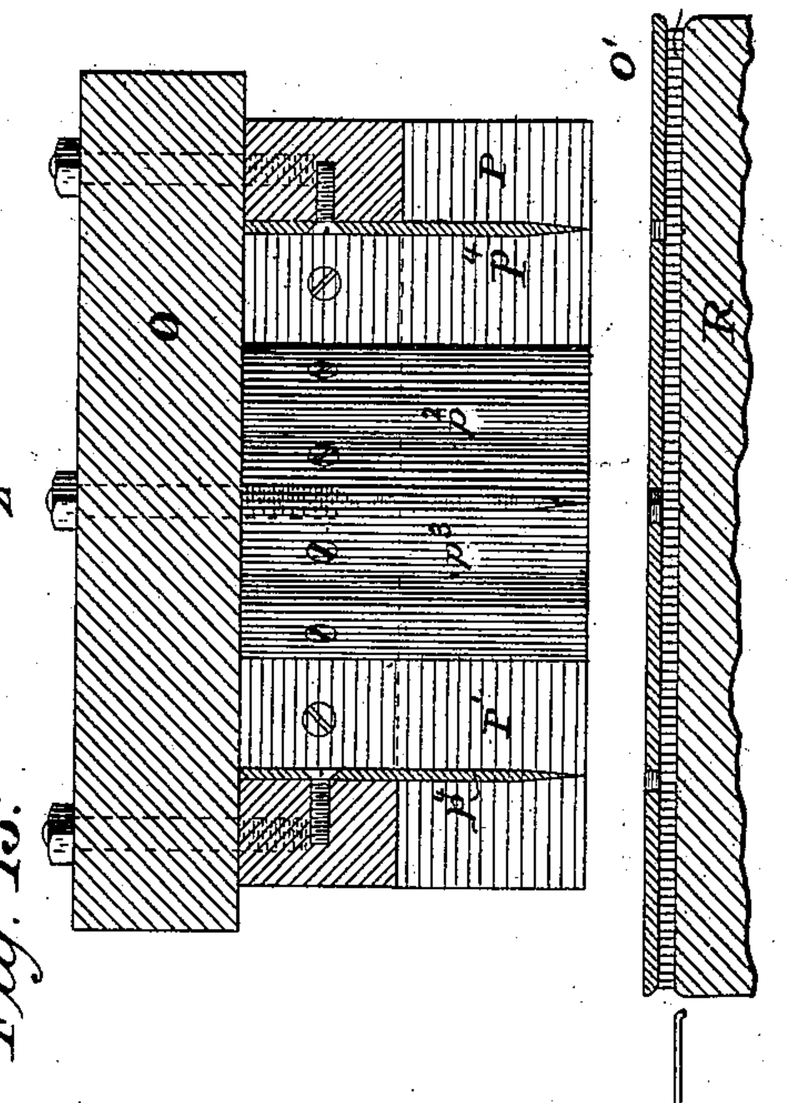


Fig. 13.



WITNESSES

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METHOD OF MAKING PAPER BOXES.

No. 332,983. Patented Dec. 22, 1885.

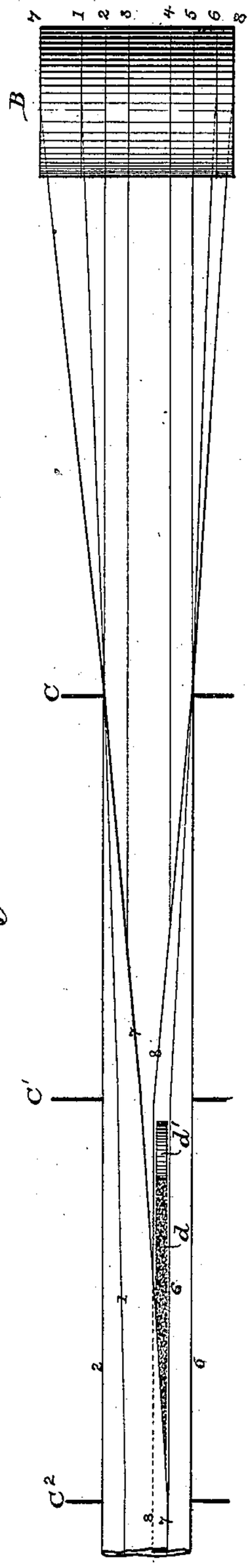

Fig. 19.

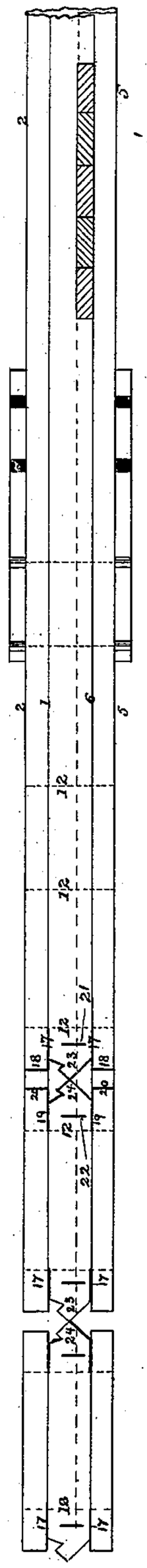

Fig. 20.

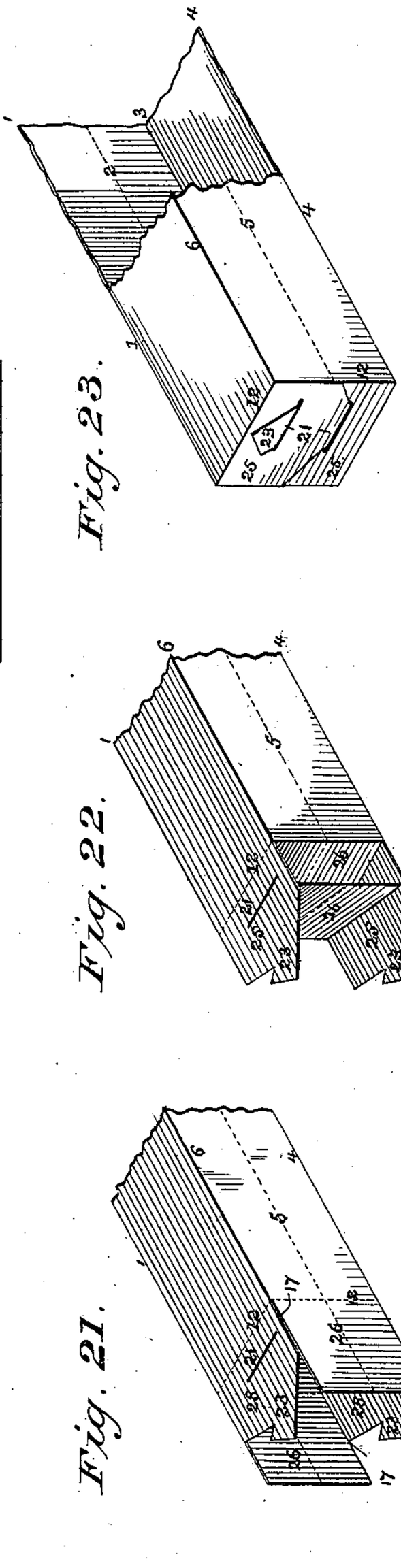

Fig. 23.

Fig. 22.

Fig. 21.

WITNESSES

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METHOD OF MAKING PAPER BOXES.

No. 332,983. Patented Dec. 22, 1885.

Fig. 24.

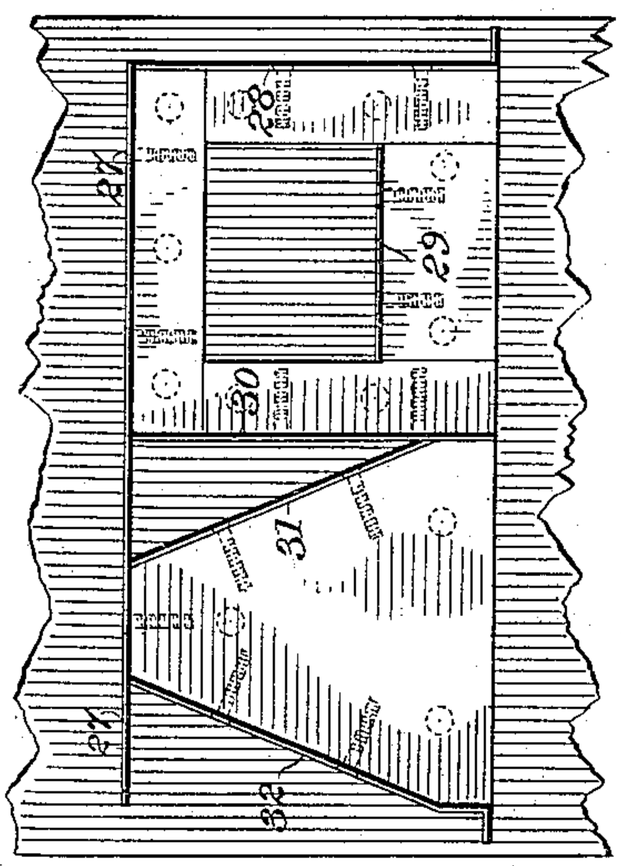


Fig. 25.

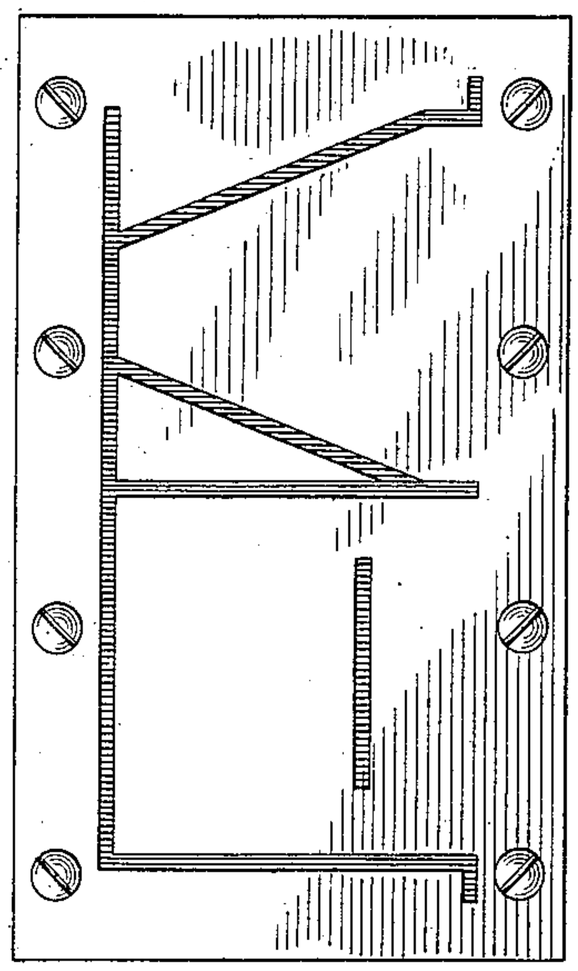


Fig. 27.

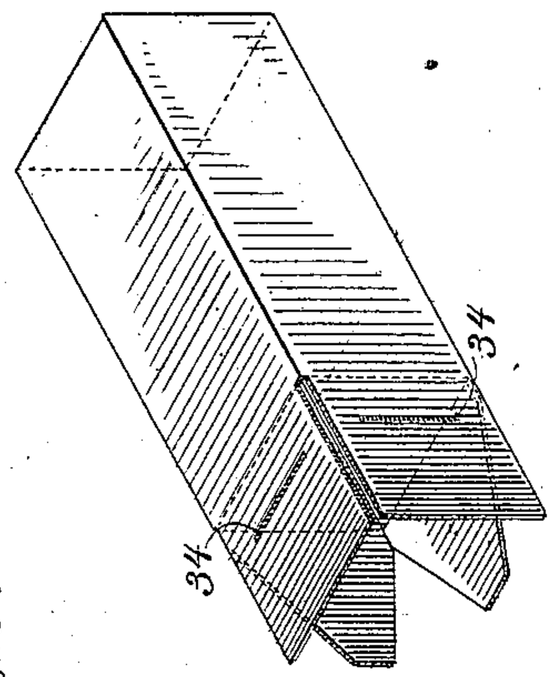
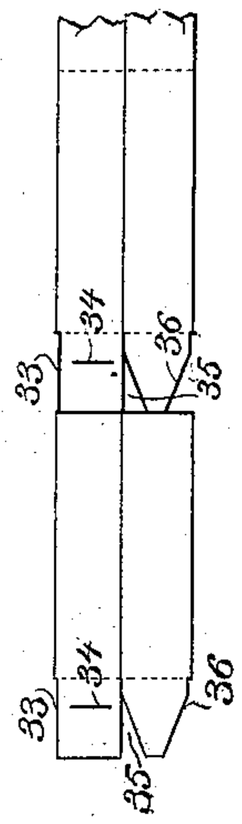


Fig. 26.



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UNITED STATES PATENT OFFICE

McCLINTOCK YOUNG, OF FREDERICK, MARYLAND.

METHOD OF MAKING PAPER BOXES.

SPECIFICATION forming part of Letters Patent No. 332,983, dated December 22, 1885.

Application filed December 26, 1883. Serial No. 115,617. (No model.)

To all whom it may concern:

Be it known that I, McCLINTOCK YOUNG, of Frederick, in the county of Frederick and State of Maryland, have invented certain new and useful Improvements in the Art of Manufacturing Boxes of Paper, &c., of which the following is a specification.

My invention relates to improvements in the manufacture of boxes of paper, combined paper and cloth, or other suitable material, of the class provided with end flaps, by the folding and interlocking of which the ends of the boxes are closed and secured, the flaps being formed at one or both ends of a box.

My objects, mainly, are to provide boxes which may readily and without injury be folded flat for packing and transportation, and to automatically produce tubes to form such boxes from a longitudinally-creased strip of paper, &c., by first forming the creased strip into a flattened tube by folding it upon two of its longitudinal creases and pasting its lapped edges, and afterward, while the tube is in its flattened condition, severing it into short tubes with end flaps and of the length required to constitute boxes of the desired size.

The improvements deemed novel will be particularly pointed out by the claims after being fully described by reference to the accompanying drawings, which represent mechanism suitably organized in accordance with my invention.

Figure 1 is a plan or top view, and Fig. 2 a side elevation, of the entire mechanism. Fig. 3 is a view, partly in side elevation and partly in section, on the line 3 3 of Fig. 1, showing the main shaft, its cams, &c., and in part the pasting devices, with the parts in the positions they occupy after a short length or box-tube has been severed from the flattened tube and the tube-feeding devices are about to be caused to engage and feed forward the flattened tube preparatory to the completion and severing of another box-tube. Fig. 4 is a view, on an enlarged scale, partly in side elevation and partly in section, on the line 4 4 of Fig. 1, the parts being represented as in the positions occupied by them after the flattened tube has been fed the distance required for a box-tube, and just previous to an actuation of the cutters for forming the end flaps and severing a box-tube. Fig. 5 is a view, partly in elevation and partly in section, on the line 5 5 of Fig. 1, showing details of the pasting mechanism. Fig. 6 is a view, partly in elevation and partly in section, on the line 6 6 of Fig. 1, showing details of devices for drying and pressing the pasted tube and for reciprocating the feeding mechanism. Fig. 7 is a view, partly in elevation and partly in section, on the line 7 7 of Fig. 1, showing details of devices for clamping, feeding, and transversely creasing the tube. Fig. 8 is a view, partly in elevation and partly in section, on the line 8 8 of Fig. 1, showing the cutters for forming the end flaps and severing the box-tubes, and details of devices for actuating them. Fig. 9 is a view, partly in elevation and partly in section, on the line 9 9 of Fig. 1, showing details of mechanism for piling the completed box-tubes. Fig. 10 is a bottom view of the vertically-reciprocating member of the cutters on a considerably enlarged scale; Fig. 11, a plan view of the slotted cutter-plate or fixed member of the cutters; Fig. 12, a view, partly in elevation and partly in section, on the lines 12 12 of Figs. 10 and 11; and Fig. 13, a view, partly in elevation and partly in section, on the lines 13 13 of Figs. 10 and 11. Figs. 14 to 18, inclusive, are diagrams designed to show the manner of forming the flattened tube. Fig. 14 shows the strip as being drawn through three guideways or slotted folders, by which it is gradually formed into a tube and flattened. Fig. 15 shows the first folder with the partially-folded strip; Fig. 16, the second, and Fig. 17 the third or final, folder with the tube completed. Fig. 18 shows the final folder with the side slots of the first and second folders represented by dotted lines. Figs. 19 and 20 are diagrams designed to represent the various steps performed in the formation of the box-tubes. Fig. 21 shows in perspective one end of an opened box-tube with its flaps unfolded. Fig. 22 is a similar view with the end of the box partially closed by the folding of the flaps; Fig. 23, a like view with the end of the box closed and secured. Fig. 24 is a bottom view of modified form of cutters, and Fig. 25 is a plan view of a modified form of slotted cutter-plate for use in connection therewith. Fig. 26 shows folded box-tubes of modified form. Fig. 27 is a per-

spective view of the modified box-tube open with its flaps unfolded.

A suitable base or frame, A, is provided, as in turn to be described, with sundry cross-pieces, uprights, brackets, &c., to support various parts of the mechanism, and has bearings *a a* at its ends for a main or driving shaft, A′, which is near one side of the frame, and actuates all the working parts when operated in suitable way, as by a driven band passing around the fast pulley A^2.

Webs or strips of paper or its equivalent from which the box-tubes are to be made are wound upon rolls or spools, which are in turn placed in position to supply the strips to the tubing mechanism, as required. As shown, a roll of paper, B, is supported by its spool on a shaft, *b*, secured to a post, B′, of the frame-base. A spring, *b*′, adjustably secured in position at its lower end, bears at its upper end against a collar or annular shoulder, B^2, of the spool to keep the paper under tension or prevent its too free unwinding. The tension of the spring may be varied, so as to increase or lessen the force with which it bears on the spool, by adjusting the nut of the upper one of the pair of bolts b^2 b^2, by which the spring is fastened in place.

The strips of paper are prepared for use previously to winding them into rolls by creasing them longitudinally throughout their extent upon parallel lines—in this instance six in number. These creases 1 2 3 4 5 6 are shown clearly in Fig. 19. Upon lines defined by two of these creases, (those numbered 2 and 5,) the strip is afterward folded flat when tubed. The remaining four creases, 1 3 4 6, locate the longitudinal corners of the boxes, as in turn will be made fully apparent. The rectangular boxes made in accordance with my invention, as shown in Figs. 21, 22, and 23, are nearly but not quite square in cross-section, the diametrically-opposite sides in which the creases 2 and 5 are provided being equal and of somewhat greater width than the two remaining sides, which equal each other. It follows, therefore, (see also Fig. 19,) that the spaces between the creases 1 and 3 and 4 and 6, respectively, correspond in width, and exceed in width the spaces between the creases 3 and 4 and 6 and 1, respectively, which correspond. The creases 1, 3, 4, and 6 predetermine the box-corners, while the creases 2 and 5, which are respectively midway between the creases 1 and 3 and 4 and 6, predetermine the lines of folding the flattened tube.

In tubing a strip its edges lap (see Fig. 19) so that, as in this instance shown, the outer or overlapping edge, 7, terminates at the corner crease 6. Therefore the distance from the crease 1 to the edge 7 equals the distance between the corner creases 3 and 4. The strip terminates at its underlapping edge 8, to which the paste is applied, quite close to the crease 6, the distance between this edge and the crease 6 being, as shown, less than half as great as that between the edge 7 and crease 1. However, if preferred, the distance between the crease 6 and the adjacent edge of the strip may equal that between the edge 7 and the crease adjacent to it, so that one side of the box may be of double thickness throughout. The strip is intermittingly acted upon by feeding devices in turn to be described, so that it is fed at each actuation a distance equal to the length of a box tube or section of the flattened tube required to form a box. The strip passes from the source of supply to the action of folding devices, which, as in this instance shown, consist of three slotted plates, C C′ C^2. As the strip is drawn through the slot *c* in the first folder, C, its edges are turned up, the partial folding of the strip being on the lines of the creases 2 and 5. Next, in passing through the slot *c*′ of the second folder, C′, one edge of the strip is folded down and the other edge is partially turned down. After this the passage of the partially-tubed strip through the slot c^2 of the final folder completes the tubing operation, paste having been applied by suitable means to the first-turned edge of the strip just after the action thereon of the second folder. (See Fig. 19.) The folders are supported by uprights D D′ D^2, secured to the frame-base. After the formation of the flattened tube it is pressed and the paste dried preparatory to forming the end flaps of the boxes and cutting it into short lengths, which I term "box-tubes." It should be noticed that an internal support or "former" for the tube is dispensed with.

As shown, the pasting mechanism and its actuating devices are as follows: The line of paste *d* is applied to the paper by a roller, *d*′, secured to a rotary shaft, d^2, turning in bearings in a rising-and-falling frame, shown as formed by oscillating or vertically-vibrating arms E E, carried by a rock-shaft, E′, mounted in bearings in frame-posts E^2 E^2. A rotating shaft, E^3, is supported in bearings in these posts above the rock-shaft, and is driven from the driving-shaft A′ by a belt, *e*. This belt passes around pulleys *e*′ *e*′, supported on a stud-shaft secured to a bracket, F, and thence around a pulley, e^2, fast on the shaft E^3. A belt, e^3, passes around another pulley, *f*, on this shaft and around one of a pair of connected pulleys, *f*′ *f*′, loosely mounted on the rock-shaft E′. Another belt, f^2, passing around the other one of the pair of united pulleys, also passes around a pulley, d^3, on the shaft d^2 of the paste-applying roller and so rotates it. A paste-reservoir, F′, is supported on a frame cross-bar, F^2, and a roller, F^3, fast on the shaft E^3, projects into the paste, so that when the shaft of the paste-applying roller *d*′ is rocked upward this roller is brought against the paste-coated periphery of the roller F^3, and is supplied with paste to be applied to the paper strip when the shaft d^2 is swung down.

The devices next to be described for lifting and depressing the shaft d^2 by imparting motion to the rock-shaft E′ are so timed relatively to the actuations of the mechanism by which

the strip and tube are fed through the machine that the paste-applying roller *d'* is lifted to be coated with paste on its periphery and then lowered into its operative position during the intermissions in the operation upon the strip and tube of the feeding mechanism, so that as the strip is fed along at each actuation of the feeding mechanism the freshly-coated pasting-roller will apply paste to it. A rock-shaft, G, is supported above and parallel with the driving-shaft in bearings in frame-brackets G' G'. A crank-arm, *g*, fast to this rock-shaft near one of its ends, has a universally-jointed link-connection, *g'*, with one of the arms E of the rock-shaft E' of the frame supporting the shaft of the pasting-roller *d'*. A crank-arm, g^2, fast to the rock-shaft G, near its end opposite that to which the crank *g* is secured, has link-connection g^3 with the outer end of a lever, G^2, pivotally supported at its heel end, and carrying a stud, upon which revolves a roller, g^4, actuated by a cam, G^3, fast on the driving-shaft. The cranks *g* and g^2 project in opposite directions from their rock-shaft. The roller g^4, at the outer end of the lever, projects into the double-walled track G^4 of the cam. The lever is vibrated by the roller as the roller is operated upon by the cam to cause the feeding mechanism to clamp and release the tube, as soon to be described.

From the above description (see Figs. 1, 2, 3, 5, and 7) it will be understood that while that portion of the cam-track G^4 extending from 9 to 9, Fig. 7, is acting on the roller g^4 the paste-applying roller *d'* is elevated to bring it in contact with the reservoir-roller F^3; that the rollers are kept in contact while the cam-actuated roller is borne upon by that part of the cam-track extending from 9 to 10; that the paste-applying roller is lowered by the action on the roller g^4 of that part of the cam-track extending from 10 to 11, and brought in contact with the paper, as indicated in Fig. 19, and that the pasting-roller is kept in contact with the paper while the cam-track roller is being acted upon by that portion of the track extending from 11 to 9. At each revolution of the driving-shaft the above-described actuations of the pasting devices are repeated. The strip and tube remain stationary while the pasting-roller is out of contact with the paper, and while the roller is in contact with the paper it is fed along a distance corresponding with the length of a box-tube.

The pasted seam of the flattened tube is pressed and the paste dried by means, as follows: The tube passes above and in contact with a hollow plate or steam chamber, *h*, to which steam is admitted and allowed to pass off by pipes H H and suitable connections. (See Figs. 1, 2, 4, and 6.) While the tube is being dried by the heating-plate and supported thereby, it is also pressed and smoothed by blocks or irons H' bearing on the tube and supported against other than vertical movement by a slotted or centrally-open frame, *h'*. This frame surrounds the blocks, which are left free to be self-adjusting vertically to accommodate themselves to variations in the thickness of the tube and the inequalities of its surface. The heater and the frame of the pressers are supported by arms h^2 h^2, one of which is secured to the before-mentioned frame-upright D^2 and the other to another upright, D^3.

The feeding mechanism and means for transversely creasing the flattened tube to facilitate the folding of the end flaps of the boxes are, as in this instance shown, as follows: The before-mentioned lever G^2, carrying the roller g^4, actuated by the cam G^3, is supported at its inner or heel end, so as to vibrate between the arms of a forked bracket, I, Figs. 1 and 4, firmly fastened to a frame cross-piece, I'. A sliding rock-shaft, I^2, is supported so that it may be readily moved endwise, in bearings in the arms of the bracket I, and is provided with a longitudinal groove, *i*. The lever G^2 is fitted about this rock-shaft and has a feather engaging with its groove, so that reciprocating movement of the shaft independently of the lever is allowed, as will readily be understood, while the rocking movement is imparted to the shaft by the lever as it is vibrated by its actuating-cam. This rock-shaft is connected at one end with a sectional reciprocating clamp for feeding and transversely creasing the tube. The rock-shaft end passes loosely through a downwardly-projecting plate or wide arm, *j*, having rigid connection at *j' j'*, Fig. 7, with the lower section, J, of the clamp, the rock-shaft being connected with the arm, so as not to interfere with its rocking motion, by means of collars fastened to it at the opposite sides of the arm, as will readily be understood. The upper section, J', of the clamp reciprocates vertically toward and away from the lower section, J. The vertical reciprocation of the upper clamp-section is imparted to it by the rock of the shaft I^2. This shaft has a slotted crank-plate, I^3, fastened to its end. (See Figs. 4 and 7.) A pin, *i'*, is carried by a downwardly-projecting arm, J^2, having rigid connection with the upper clamp-section, and this pin engages with the slot i^2 of the crank I^3. A yoke shown as formed by downwardly-projecting side arms, J^3 J^3, and a cross-piece, j^2, serves to make the connection between the arm J^2 and the clamp-section J'. This clamp-section is guided in its up and down movements by the sliding connection of its arm J^2 with the arm *j* of the lower clamp-section. A dovetail guideway connection is made between these arms by providing a recess undercut at its edges in the arm *j*, and forming the arm J^2 with beveled edges j^3 j^3, to fit in the recess. The arms J^3 J^3 of the yoke, secured to the top section of the clamp, embrace the bottom section of the clamp and aid in maintaining the top section in proper position throughout its movements. It will be seen that the connection of the upper and lower sections of the clamp is such as cause them to move together when reciprocated lengthwise of the machine to engage and feed

the tube. Four ribs, K K K K, secured transversely in pairs upon the adjacent faces of the upper and lower sections of the clamp, serve to engage and release the tube. These ribs are faced with rubber or its equivalent to insure a proper grip upon the tube without possibility of injuring it. The transverse creases 12 12, Fig. 20, in the tube, for determining the lines upon which the end flaps are to be folded, are formed by the two pairs of recessed and lipped ribs K′ K′ K′ K′, secured to the adjacent faces of the upper and lower sections of the clamp and crosswise of the sections. The creasing-ribs are adjustably secured in place by means of slots *k k* in the clamp-sections and the bolts *k′* and their nuts, as will readily be understood from the drawings. The clamp is provided with a guideway for the tube, (shown as formed between angle-lugs K^2 K^2,) secured to the under side of the top section of the clamp by means of screws or bolts k^2 k^2. The distance between these guide-lugs corresponds with the width of the flattened tube, and consequently the proper position of the tube for creasing is insured. The bottom section of the clamp has sliding supporting-connection with a longitudinal frame-bar, L, connected at one end with the before-mentioned frame cross-piece I′, and secured at its opposite end to another frame cross-piece, L′. As shown, a dovetail groove in the clamp bottom section and an inclined-sided bar or rail, *l*, secured upon the bar L, constitute the supporting and sliding connection of the clamp with the frame, and the clamp is reciprocated, so as to alternately approach and move away from the roll of paper, by means of a cam, M, a lever, N, and a bar or flat rod, L^2, connecting the lever and lower section of the clamp. The connecting-bar L^2 is pivoted at one end to the feeding-clamp, and is adjustably secured at its opposite end to the lever N by means of the clamp-plates *l′ l′* and their bolts, and a bolt, l^2, passing through a longitudinal slot, N′, in the lever, and held in the desired position therein by a washer and nut, *n*, beneath the lever. The securing-bolt l^2 turns freely in the lower one of the clamp-plates *l′*. A head on the upper end of this bolt, countersunk in the upper surface of the lower clamp-plate, prevents accidental displacement of the bolt, as will readily be understood from inspection of Figs. 4 and 6. The lever N is provided with a hub or bearing-sleeve, *n′*, by which it is pivoted on a stud-shaft, n^2, supported by a bracket or arm, N^2, of a cross-piece, N^3, of the frame. A roller, *m*, carried by the lever, enters the peripheral slot or track M′ of the cam M, which is fast on the driving-shaft.

From the above description the operation of the intermittingly-actuated feeding and creasing mechanism will be understood to be as follows: While that portion of the track G^4 of the cam G^3 extending from 9 to 9 is acting on the roller g^4 of the lever G^2 the outer end of the lever is depressed and the upper section of the clamp is elevated by the rock of the shaft I^2 and its slotted crank to release the tube from the creasing and clamping ribs. During this time the portion 13, Figs. 1, 2, and 6, of the track M′ of the cam M is acting on the roller *m* of the lever N, and this lever is held stationary. At this stage of the operation the feeding and creasing clamp is at the end of its movement in the direction of travel of the tube and strip. The top section of the clamp is held up while the portion of the cam-track G^4 extending from 9 to 10 is acting on the roller of the lever G^4, as during this stage of the operation the lever remains at rest. During this time the portion 14, Figs. 2 and 3, of the cam-track M′ acts on the roller *m* and moves the lever N about its pivot, so that by way of the connecting-bar L^2 the feeding-clamp is moved toward the paper-roll a distance equaling the length of a box-tube. (During this stage in the operation of the feeding mechanism the tube is being acted upon by the cutting and end-forming mechanism, to be described, and thus held against accidental retrograde movement.) Next, the action upon the roller g^4 of that part of the cam-track G^4 extending from 10 to 11 elevates the outer end of the lever G^4 and imparts a downward movement to the top section of the feeding-clamp by way of the rock-shaft I^2, thus clamping the tube. During this stage in the operation the pasting-roller is brought into position to apply paste to the partially-tubed strip, as before explained, and movement of the feeding-clamp in the direction of the length of the tube is prevented by the action of the part 15, Fig. 3, of the cam-track M′ on the roller *m* to hold the lever N at rest. The feeding movement of the tube-clamp is next imparted to it by the action of the part 16 of the cam track M′ on the roller *m*, thus imparting the needed movement to the lever N and the connecting-bar L^2. The feeding-clamp comes to rest when the part 13 of the cam-track M′ is presented to the roller *m*. During the feeding movement of the tube-clamping devices that part of the cam-track G^4 extending from 11 to 9 acts on the roller g^4, resulting in holding the clamping-ribs firmly against the opposite sides of the tube until it is fed the distance needed. The above-described operations are repeated at each revolution of the driving-shaft.

The cutters for severing the box-tubes and forming the end flaps consist of an upper movable member formed by a series of knives carried by an intermittingly-actuated vertically-reciprocating head, O, and a lower fixed member or slotted plate, O′. As in this instance shown, there are fourteen knives and the two ends of each box-tube are formed alike. The knives P P, in connection with the corresponding portions Q Q of the slots in the plate O′, form the longitudinal slits 17, Fig. 20, in the flattened tube in the lines of the creases 1, 3, 4, and 6. The knives *p p*, in connection with the portions *q q* of the slots in the plate O′, cut through the tube at 18 18 from its edges (the

lines of the creases 2 and 5) to the slits 17 17. Knives P′ P′ and *p′ p′*, in connection with the portions Q′ Q′ and *q′ q′* of the slots in the fixed member of the cutters, form the longitudinal slits 19 19 and the edge cross-cuts 20 20. Knives P^2 and p^2, in connection with the portions Q^2 and q^2 of the slots in the fixed member of the cutters, cut across and through the tube from one of the slits, 17, to the other. Knives P^3 and p^3, in connection with the portions Q^3 and q^3 of the slots in the fixed member of the cutters, cut across the tube from one of the slits, 19, to the other. Cutters P^4 and p^4, in connection with slots Q^4 and q^4 in the fixed member of the cutters, form slits 21 and 22 in the tube, which extend, respectively, part way between the slits 17 17 and 19 19. It will be seen that when operated, as presently to be explained, the cutters in severing the box-tubes form both ends of the respective tubes precisely alike, each end having four folding-flaps, two of which, at diametrically opposite sides of the box, have the slits 21 or 22 and hooks 23 or 24, which interlock with the slits, making a double fastening, as clearly shown in Fig. 23. The slitted hook-ended flaps 25 25 are somewhat longer than the flaps 26 26, as pieces are cut out of the tube at the adjacent ends of two box-tubes between the pairs of cutters *p p′ p p′*. The difference in the lengths of the flaps 25 and 26 equals half the distance which separates each of the cutters *p* from the cutter *p′*, adjacent to it. With the pieces cut from the tube between the cutters *p p′ p p′* there are also cut out pieces of shapes corresponding with the outlines of the hereinafter-mentioned blocks O^4 and o^4, as will readily be understood from inspection of Figs. 10, 11, and 20. The various knives are suitably fastened to the cutter-head O, as by means of blocks O^2 o^2 O^3 o^3 O^4 o^4 O^5 and o^5, to which the cutters are respectively detachably secured by screws, while the blocks are fastened to the head by tap-bolts, as plainly shown. The slotted plate or fixed member O′ of the cutters is secured in place upon its bed or supporting block R by means of bars *o o′* and fastening-screws. A space is thus left beneath the cutter-plate to permit of the knives projecting through its slots and allowing them to be given sufficient movement to insure proper action. The cutter bed-block R is adjustably secured in place upon the frame of the machine in suitable way. It is shown as fastened to a frame bar or plate, R′, which is secured to the frame cross-piece L′. The cutter-head O is reciprocated vertically, and, as shown, is supported and actuated, as will now be described, referring particularly to Figs. 4 and 8. The upright arms *r r* of a carrier frame or yoke are bolted or otherwise firmly fastened at their upper ends to the cutter-head. The lower end or cross-bar, *r′*, of the yoke has a downwardly-projecting arm, R^2, firmly fastened to it, and, as the yoke is reciprocated, this arm slides up and down in a suitable guideway, r^2, in a plate or block, R^3, which is secured to the frame cross-piece L′. A lever, S, is provided with a hub or sleeve-bearing, S′, by which it is pivoted so as to vibrate vertically about a stud, *s*, secured to the block R^3. The lever is provided with a slotted heel projection or short arm, S^2, and a pin, *s′*, on the yoke-arm R^2 is engaged by the slot s^2 of the lever-heel. At its outer end the lever carries a roller, *t*, which projects into the cam groove or track T of a cam, T′, fast on the driving-shaft.

From the above description it will be understood that in the operation of the machine the cutters are actuated as follows: While the portion of the cam-track T extending from 27 to 28 is acting on the roller *t* the reciprocating member of the cutters is brought down and acts on the tube. Immediately after the cutters engage the tube the elevation, as hereinbefore explained, of the top section, J′, of the feeding-clamp leaves the tube free, and while the feeding-clamp is moving toward the strip-roll and until it has again engaged the tube the roller *t* is acted upon by that portion of its cam-track extending from or near 28 to 29. Preparatory to the feeding of the tube by the clamp the roller *t* is acted upon by that portion of its cam-track which is between 29 and 30, and the reciprocating member of the cutters is lifted clear of the flattened tube, from which it has severed a box-tube. The feeding clamp next pushes the tube along over the slotted cutter O′ the distance required for a box-tube, and during this feeding action, and while the roller *t* is engaged by that portion of its cam-track extending from 30 to 27, the cutter-head is held up. A repetition of the above-described operations of the cutters take place at each revolution of the driving-shaft. The respective box-tubes, as they are in turn produced from the flattened tube by the cutters, rest for a greater portion of their length over and upon a plate, *u*, secured to a shelf or bracket, U, which is suitably attached to and supported by the frame-plate R′. (See Figs. 1, 2, and 4.) The shelf-plate projects at one end beneath the slotted cutter-plate O′, and at its opposite end is formed with notches and projections to correspond in shape or register with the end of the tube which rests upon it. Rails or strips *u′ u′* on the plate *u* serve as guides for the tube. A striker-plate, U′, is formed at one end with projections the counterpart of the notches in the plate *u*, and with notches corresponding with the projections of this plate, so that, as will presently be explained, the box-tubes, as in turn projected along and beyond the shelf-plate, are struck down and compactly piled upon a table, V. The table V is self-adjusting vertically, so as to descend gradually as the box-tubes are piled upon it.

To provide for readily elevating the table when an accumulated stack of box-tubes have been removed, and to enable it to descend gradually as the box-tubes are piled upon it,

the table is supported on a post, V′, adapted to slide vertically in a guideway in a bracket, *v*, and yieldingly sustained against downward movement by a cam, *v′*, at the heel end of a weighted lever, V^2. This lever is pivoted to rock vertically about a pin, v^2, supported by lugs of the guideway-bracket, which is fastened to a cross-piece, W, of the frame. The weight v^3 is adjustably secured upon the lever V^2, being adapted to slide back and forth thereon, and be secured by a set-screw in an obvious way. The force with which the heel-cam *v* of the lever bears against the table slide-post V′ can thus be readily adjusted. An adjustable stop or slide bracket, V^3, is provided on the table, against which the box-tubes abut as delivered upon the table. Each box-tube after it is severed, or perhaps not quite entirely severed, by the cutters is pushed along a distance corresponding with its length, and is brought beneath the striker U′ and over the table upon top of the pile which may have been already delivered.

The striker is actuated by means as follows: The striker proper or plate U′, as shown by Figs. 1, 2, 4, and 9, is secured to a vertically-vibrating arm, W′, which is pivoted at its heel end to frame uprights *w w*. A weight, *w′*, on the striker-arm acts with a tendency to move it downward, or else to hold it down as far as its elevating devices will permit. The striker-arm is provided with a roller, *x*, which is journaled between the lower ends of downwardly-projecting short arms X X, fastened to the striker-arm. The roller bears against a cam, Y, fastened to the driving-shaft. It will be seen that during the time the portion *y* of the cam which is of least radius is acting on the roller *x* the striker is in its depressed position; that during the time the portion *y′* of the cam is acting on the roller the striker is being elevated; that while the portion Y′ of the cam which is of greatest radius is acting on the roller it is in its elevated position, and that during the action of the portion y^2 on the roller the striker is caused to descend by its weight into the depressed position. The descent of the striker takes place while the cutters are acting on the tube, and a box-tube previously formed and thrust along by the feed of the tube is pressed down upon the table or pile of box-tubes thereon. As the box-tubes are accumulated the table yields to the pressure of the striker, and thus gradually descends until a pile is completed. It will be seen that a complete vibration or up and-down movement is imparted to the striker at each revolution of the driving-shaft, and that the box-tubes, if not completely severed by the cutters, are separated from each other by the action of the striker in connection with the shelf-plate *u*, above the level of which the striker ascends when moved upward, and beneath the level of which it descends when moved downward to strike off and pile up the box-tubes as they are in turn projected over the vertically-moving table.

It is not deemed necessary to enumerate advantages of my improvements, as they are obvious.

I do not wish to be understood as limiting my invention to the details of construction and arrangements of parts as hereinbefore particularly described, as my improvements may be modified in many respects, and some of the novel features or essential co-operating parts may be used without the other.

As one of the modifications of my invention, which it may be deemed advisable to make under some circumstances, may be mentioned the alteration of the cutters, so as to make box-tubes each of which shall be provided with the hook-ended flaps 25 and slits 21 at one of its ends only, the other end being formed with four plain or simple rectangular flaps, all of one length. To make such box-tubes, it would only be necessary to omit one-half of the knives—say all to the right of the section-line 12 12 of Fig. 10—and provide a long cross-knife in the plane of said line to cut entirely across the tube, and two slitting-knives, such as P P, except that they would have to extend to the cross-knife, and, further, to omit all portions of the slots in the cutter-plate O′, which are located to the left of a line crossing from Z Z, Fig. 11, and provide a long cross-slot for the long cross-knife, and two slots, such as Q Q, except that they would intersect the long cross-slot to correspond with the altered slitting-knives. A box-tube so formed with the four corresponding rectangular flaps at one end might have such end closed, when the tube is opened out to form a box, by folding and pasting the flaps or securing them by eyelets, fastening-staples, &c., in well-known way.

As a further modification in the form of the cutters and the box-tubes to be made may be mentioned the following: (See Figs. 24 to 27 inclusive.) The cutters as thus modified are designed for severing the flattened tube into box-tubes of square cross-section, instead of forming these tubes of other rectangular form in cross-section. The modified box-tube is shown as having flaps at one end only. The cutters for forming such a tube consists of a long knife, 27, which cuts entirely across the flattened tube, thus forming the tube at one end without flaps, and of other knives, 28, 29, 30, 31, and 32. The slots in the cutter-plate (shown by Fig. 25) correspond with the knives of the modified form of cutter. The knife 28 cuts the tube at the edge 33. The knife 29 forms a slit, 34, in two adjacent flaps at one side of the center of the box-tube. The knives 30 and 31 form the triangular opening 35 between the slitted flaps and inclined edged flaps of the box-tube, and the knife 32 cuts a piece from the box-tube at the edge 36.

When box-tubes square in cross-section are made, the strip from which the flattened pasted tube is formed is provided with four longitudinal and parallel creases instead of

six. These creases predetermine the corner folds of the tube, and when the tube is flattened it folds upon two of these creases instead of folding upon creases intermediate the corner creases, as hereinbefore described.

As another of the many means which may be selected for severing a folded box-tube cut square across or without flaps at one end, and with flaps at its opposite end of any suitable form, may be mentioned the following: a long knife arranged in the plane of the line 12, Fig. 10, of the cutter-head, working in connection with a corresponding slot in the plane of the line Z of the cutter-plate, Fig. 11, together with the omission of all the slots in the cutter-plate at the right of the line Z, Fig. 11, and the knives of the cutter-head at the left of the line 12, Fig. 10.

By making the tubes of different lengths and of proper relative sizes in cross-section it is obvious that they may be adapted to form sliding boxes, or boxes in which one section slides within the other, as well as to form boxes and tops therefor, and also what may be termed "drawer-boxes," such as used for matches, &c., and in which there is a case provided to inclose a draw which slides in and out.

I claim as of my own invention—

1. As an improvement in the art of manufacturing boxes of paper, &c., the hereinbefore-described method of forming folded box-tubes, consisting in advancing a flattened tube, severing the box-tubes, and at the same time forming their end flaps, substantially as hereinbefore set forth.

2. As an improvement in the art of manufacturing boxes of paper, &c., the hereinbefore-described method of forming folded box-tubes, consisting in advancing a flattened tube, transversely creasing the tube on lines upon which fold the end flaps of the boxes to be made, severing the box-tubes, and at the same time forming their end flaps, substantially as hereinbefore set forth.

3. As an improvement in the art of manufacturing boxes of paper, &c., the hereinbefore-described method of forming folded box-tubes, consisting in supplying a strip creased longitudinally upon parallel lines to predetermine the location of the corners of the boxes to be made, forming the tube by folding upon lines predetermined by two of said creases, advancing the flattened tubes, severing the box-tubes, and forming their end flaps, substantially as hereinbefore set forth.

4. As an improvement in the art of manufacturing boxes of paper, &c., the hereinbefore-described method of forming folded box-tubes, consisting in supplying a strip creased longitudinally upon six parallel lines, four of which creases predetermine the location of the box corners, forming a pasted flattened tube folded upon lines predetermined by two of such creases, transversely creasing the tube, and severing the flattened tube into box-tubes with end flaps folding upon the lines of the transverse creases, substantially as hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name this 22d day of December, A. D. 1883.

McCLINTOCK YOUNG.

Witnesses:

JOSEPH I. PEYTON,

MARCUS S. HOPKINS.