No. 667,021. Patented Jan. 29, 1901.

H. K. KING.

PAPER FOLDING MACHINE.

(Application filed Aug. 27, 1897.)

(No Model.) 6 Sheets—Sheet 1.

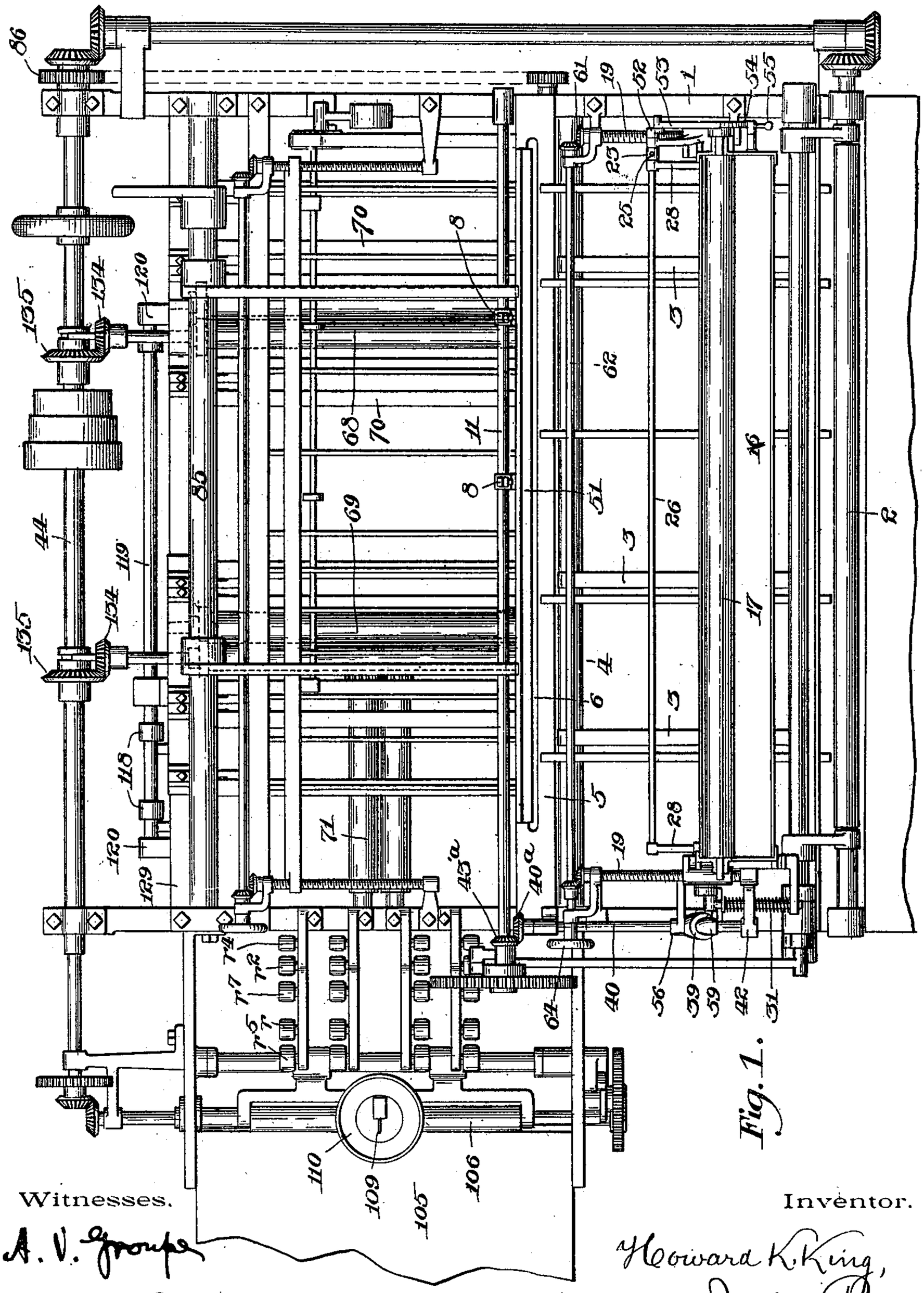

Fig. 1.

Witnesses.

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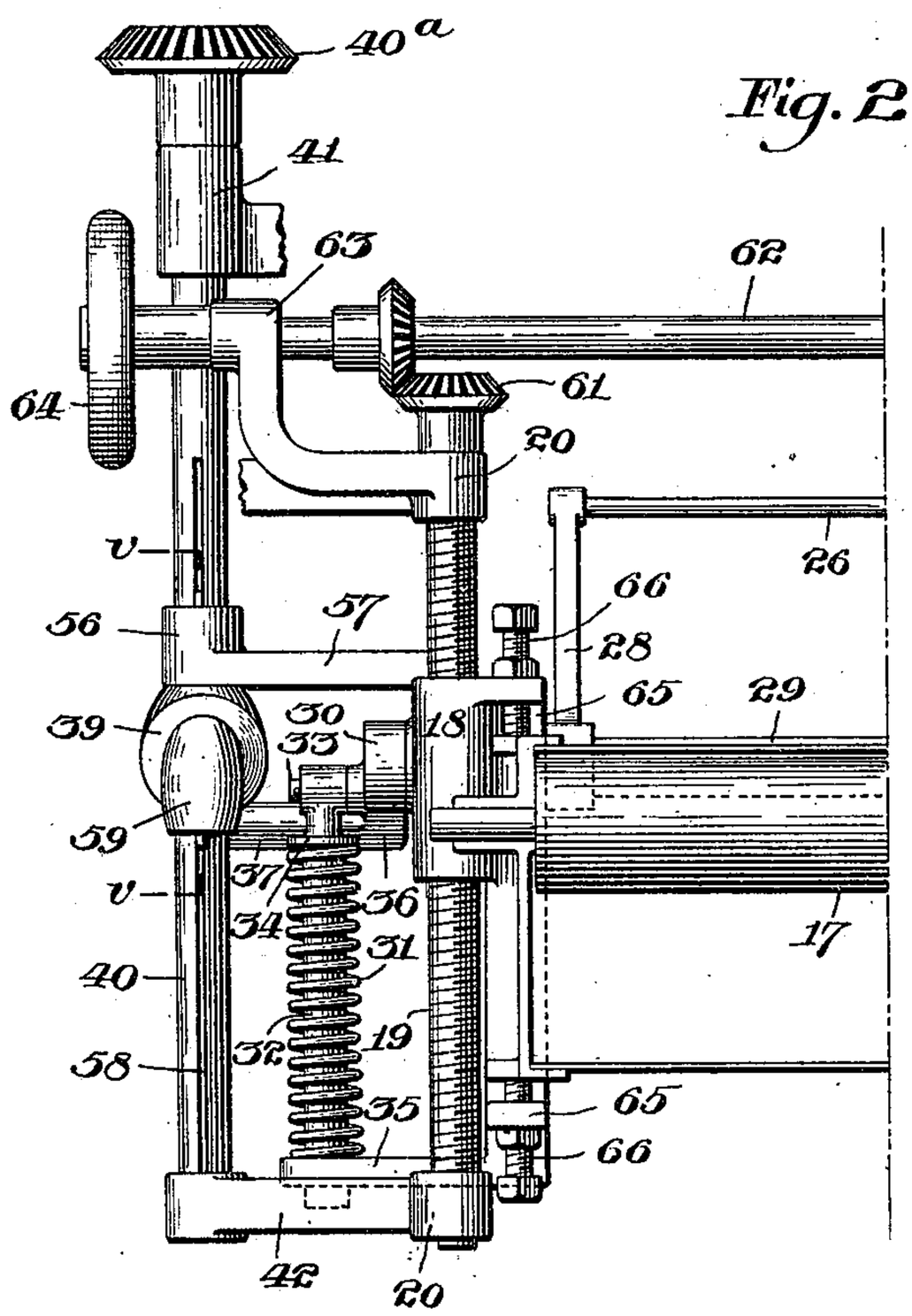
(No Model.) 6 Sheets—Sheet 2.

Fig. 2.



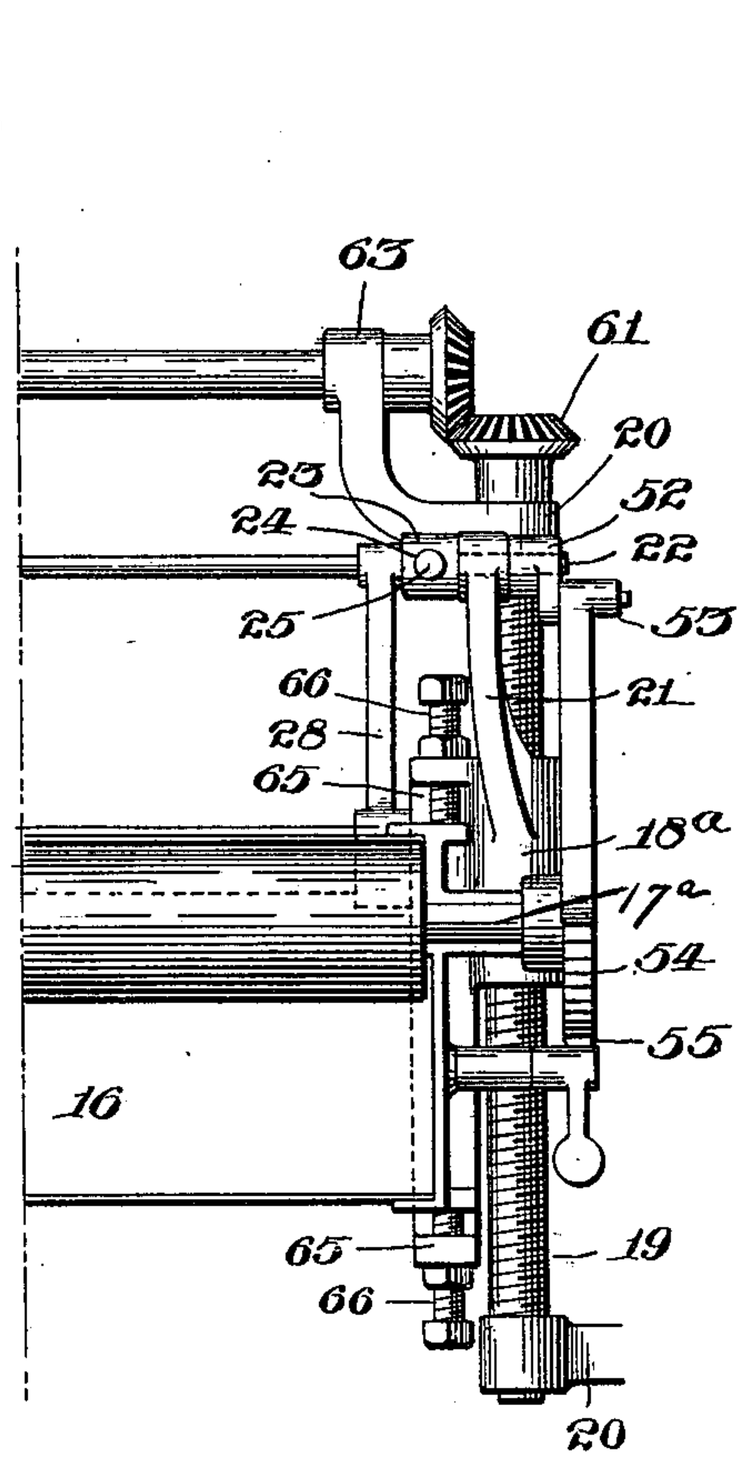


Fig. 3.

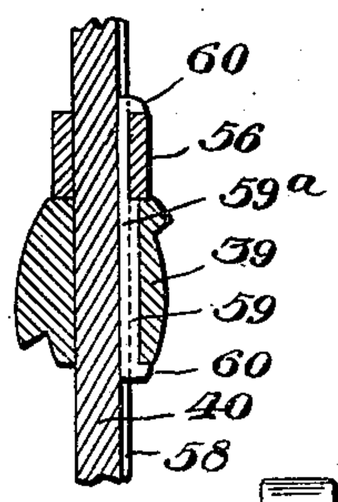


Fig. 4.

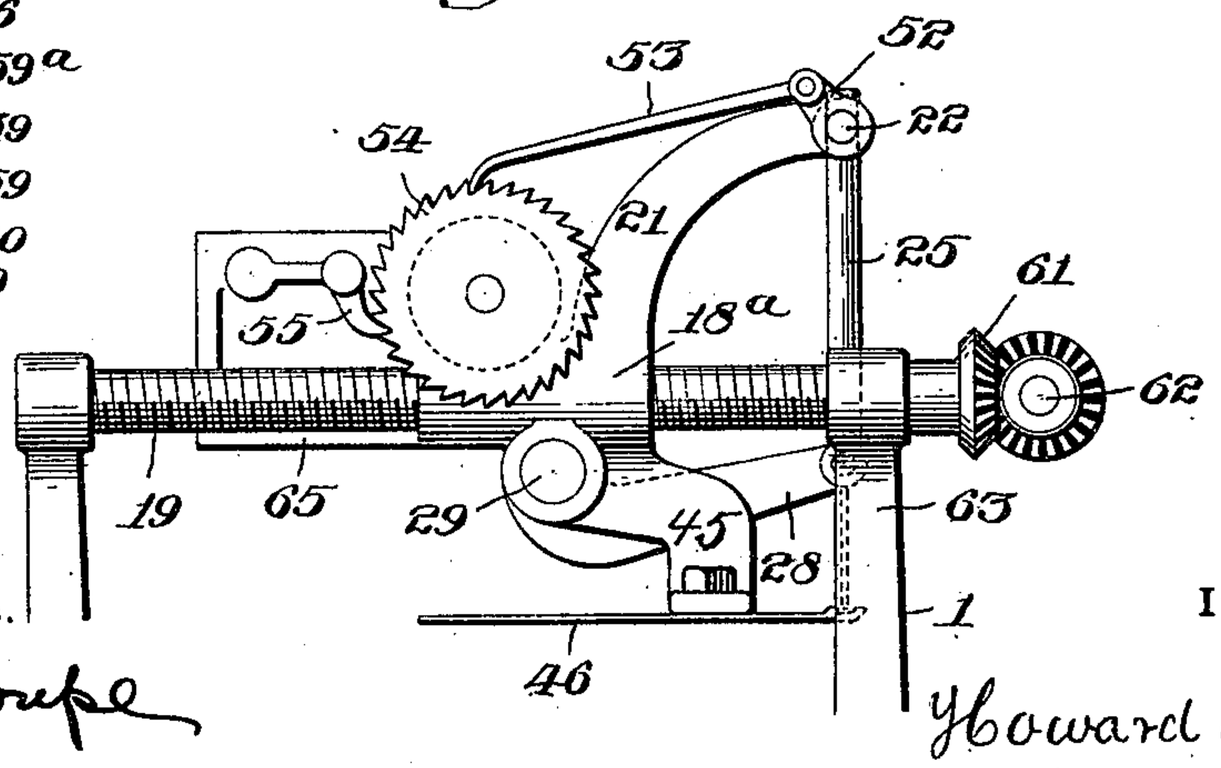


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Fig. 5.

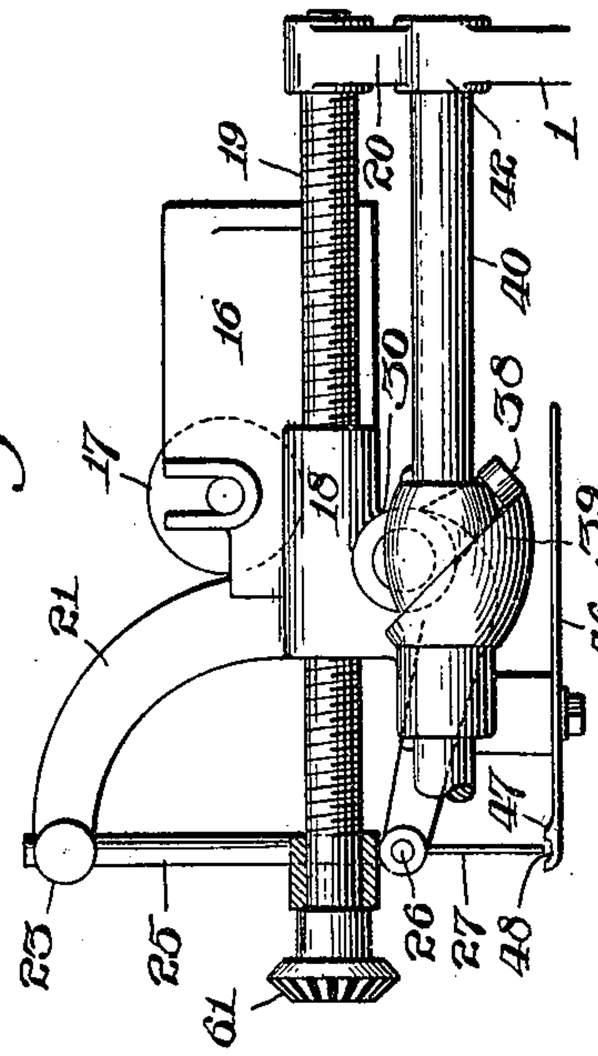


Fig. 6.

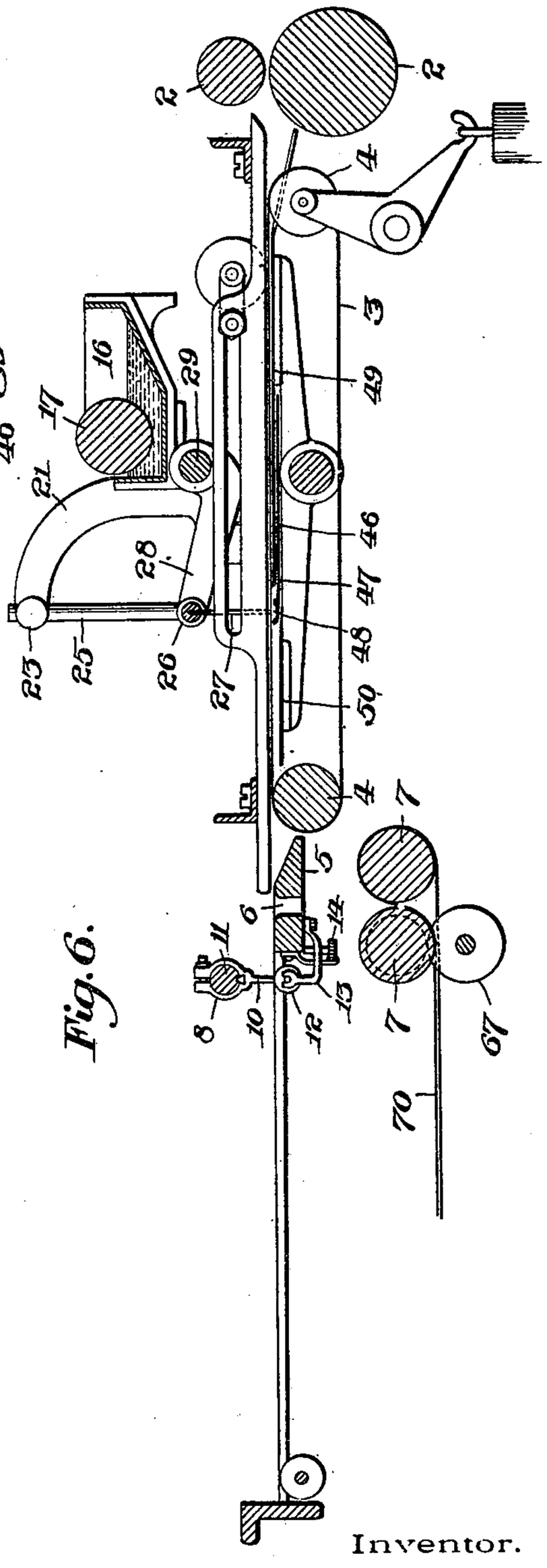


Fig. 7.

Fig. 8.

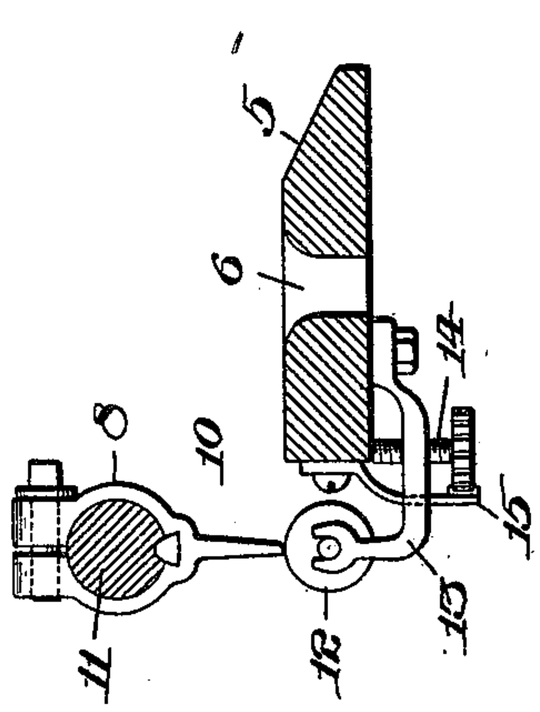
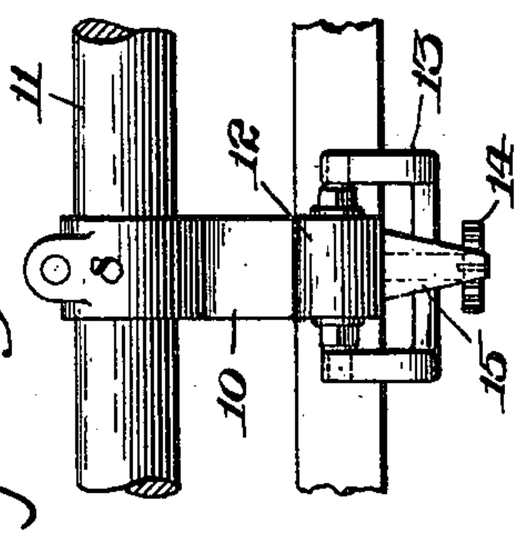


Fig. 9.



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(No Model.) 6 Sheets—Sheet 4.

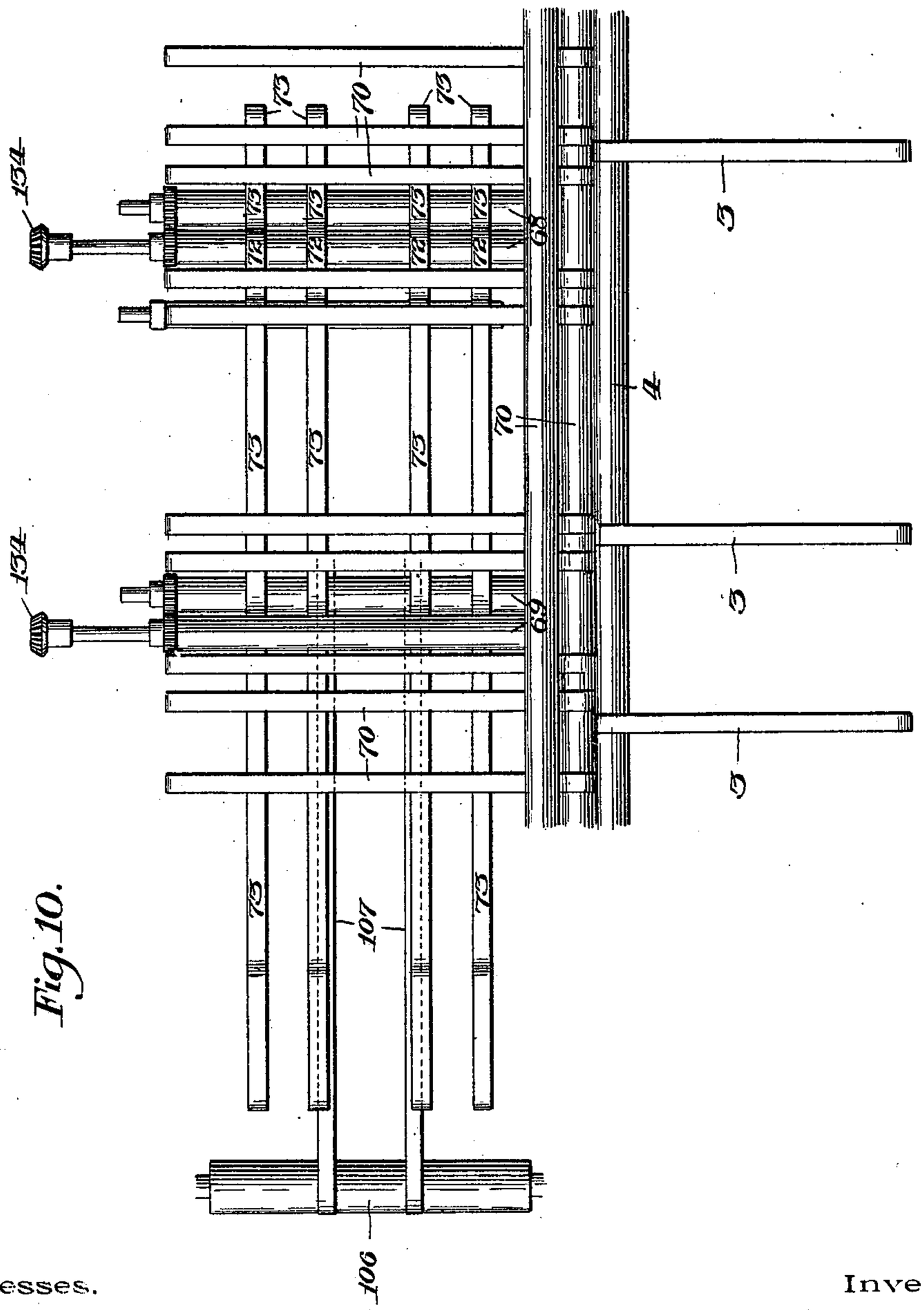

Fig. 10.

Witnesses.

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(Application filed Aug. 27, 1897.)

(No Model.) 6 Sheets—Sheet 5.

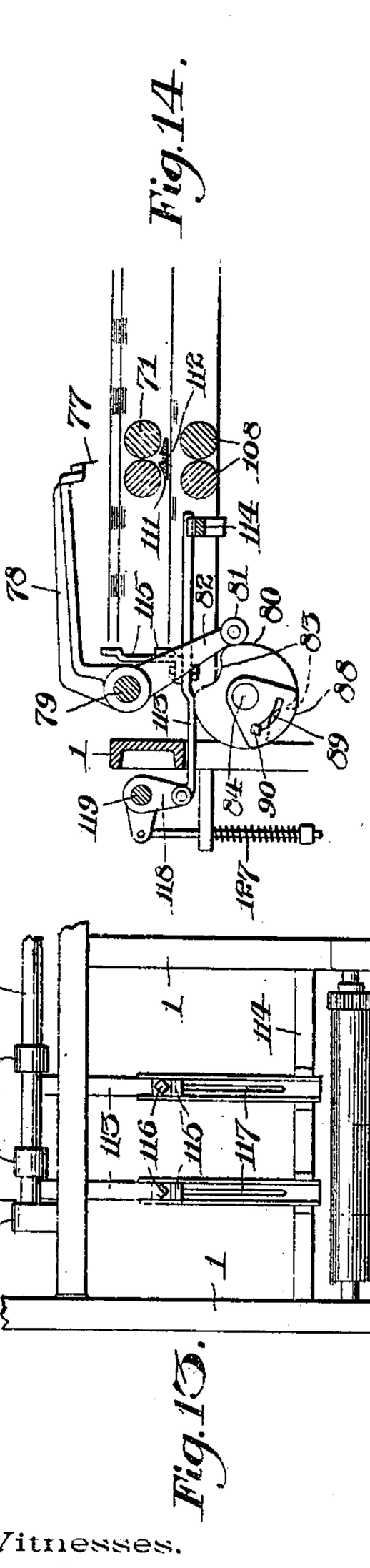

Fig. 14.

Fig. 13.

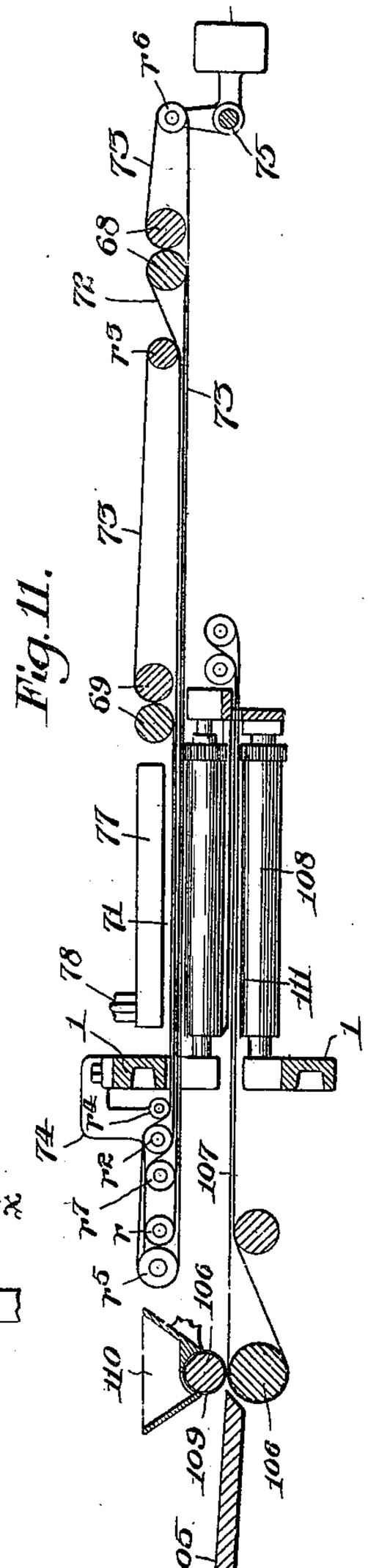

Fig. 11.

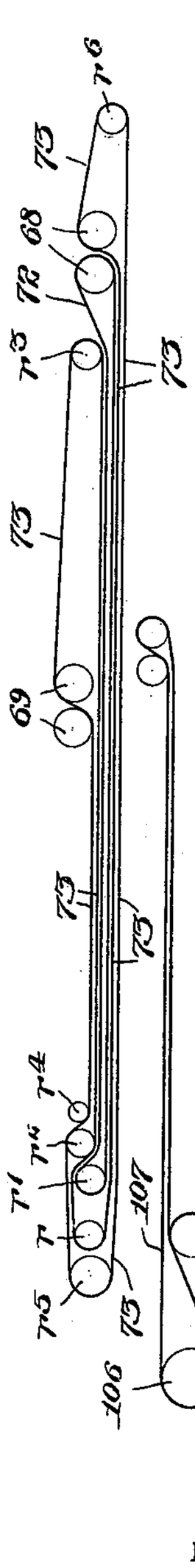

Fig. 12.

Witnesses.

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PAPER FOLDING MACHINE.

(Application filed Aug. 27, 1897.)

(No Model.) 6 Sheets—Sheet 6.

Fig. 15.

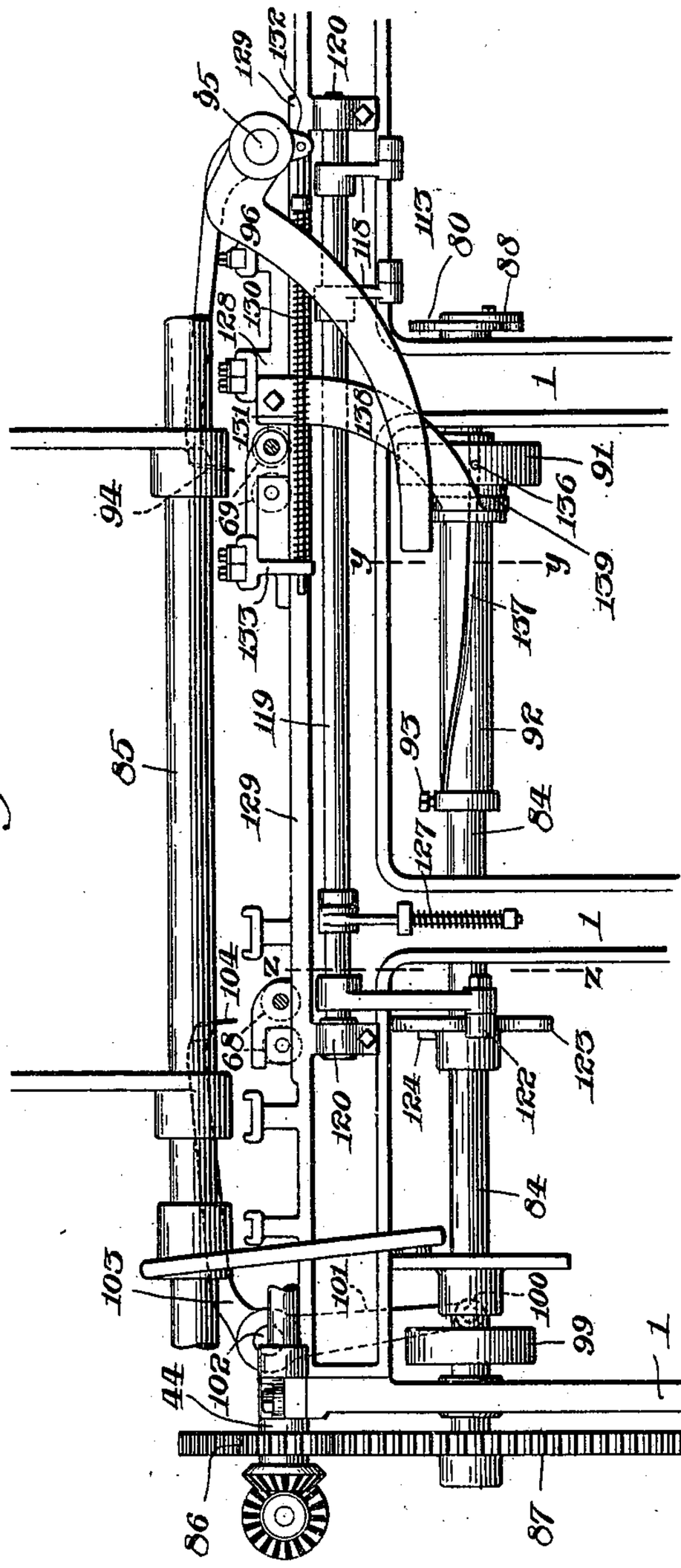


Fig. 17.

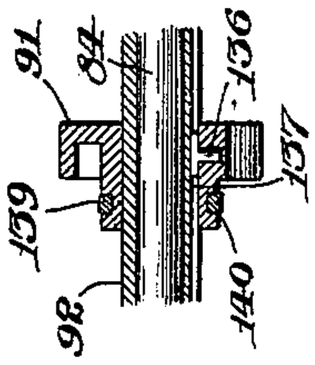


Fig. 16.

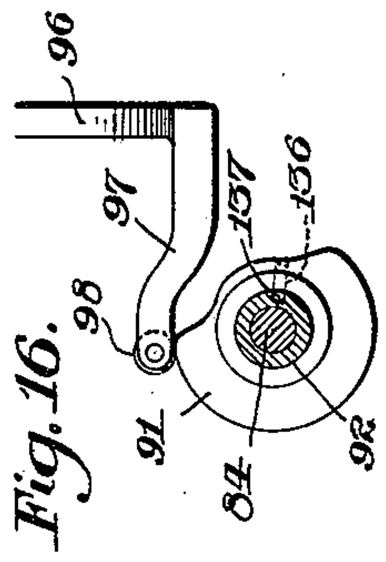
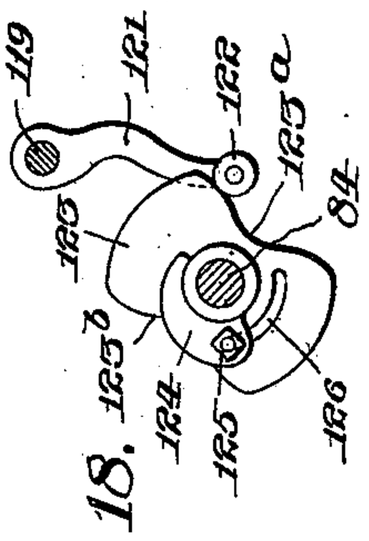


Fig. 18.



Witnesses.

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UNITED STATES PATENT OFFICE.

HOWARD K. KING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE CHAMBERS BROTHERS COMPANY, OF SAME PLACE.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 667,021, dated January 29, 1901.

Application filed August 27, 1897. Serial No. 649,701. (No model.)

To all whom it may concern:

Be it known that I, HOWARD K. KING, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Paper-Folding Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, of which—

Figure 1, Sheet 1, is a plan view of a folding-machine in which my improvements are embodied, certain parts for perspicuity being omitted. Fig. 2, Sheet 2, is a plan view of the mechanism for applying a transverse line of paste to the sheet after it has arrived in position over the first set of folding-rollers. Fig. 3 is an end view looking from the right of Fig. 2. Fig. 4 is a vertical section on line *v v*, Fig. 2. Fig. 5, Sheet 3, is an end view looking from the left of Fig. 2. Fig. 6 is a longitudinal vertical section through the paste-applying mechanism, first set of folding-rollers, stop-bar, and other adjacent parts of the machine. Fig. 7 is an enlarged detail view in section of the adjustable plate having the paste-groove and the sheet-supporting plates contiguous thereto. Fig. 8 is a detail enlarged from Fig. 6 of the tail-gripper and connections. Fig. 9 is a front side view of Fig. 8. Fig. 10, Sheet 4, is a plan view of the rollers for imparting the first two folds to the sheets, also showing the arrangements of the carrying-tapes. Fig. 11, Sheet 5, is a transverse vertical section through the two sets of folding-rollers for imparting the second fold to the sheets, also showing the third set of rollers and the cover-applying mechanism. Fig. 12 is a diagrammatic view in side elevation, showing the arrangement of the two sets of tapes for carrying the sheets from the rollers for making the second fold and the rollers over which said tapes run. Fig. 13 is a plan view of the third set of folding-rollers and of the guide-bars for adjusting the sheet with relation to said rollers. Fig. 14 is a transverse section, as on line *x x*, Fig. 13, but also showing the last folding-blade and its actuating mechanism, which is omitted in Fig. 13. Fig. 15, Sheet 6, is a front end elevation of the machine broken away, certain parts, not necessary to illustrate the invention, being omitted. Fig. 16 is a section on line *y y*, Fig. 15, showing the form of the cam for operating the folding-blade. Fig. 17 is a vertical section through said cam and shaft. Fig. 18 is a section on line *z z*, Fig. 15, showing the shaft and construction of the cam for actuating the guide-bars.

This invention relates to that general class of folding-machines wherein sheets of paper fed consecutively into the machine have imparted to them a succession of folds by means of suitable folding rollers and blades coacting therewith, respectively, and finally issue from the machine as signatures of a predetermined number of pages.

The main object of my invention is to produce a folding-machine wherein shall be embodied a comparatively simple and an efficient combination of mechanism or devices coöperating to properly and finally fold sheets of paper of any size into two signatures, each of sixteen pages or one of thirty-two pages, as may be required, and also, when desired, to apply a cover to each of such signatures. The construction and mode of operation of said mechanism or devices will hereinafter be fully and clearly explained, reference being had to the accompanying drawings, and the particular combinations or features which I believe to be new will be duly pointed out.

Referring to the accompanying drawings, 1 is the main frame of the machine.

2, Figs. 1 and 6, represents the usual feed-rollers at the rear end of the machine, between which the sheets to be operated upon are successively fed, whence they are carried forward by suitably-driven tapes 3, running over rollers 4, Figs. 1, 6, and 10, over a plate 5, having the usual slot 6 above the first set of folding-rollers 7.

8 is a tail-gripper, Figs. 6, 8, and 9, consisting of a blade 10, that is carried by a rotatable shaft 11 and operates in conjunction with a roller 12, the upper side of whose periphery is substantially in the same horizontal plane with the top of plate 5. The function of this tail-gripper is to check the forward movement of the sheet and carry it against the usual stop-bar. There is nothing new in this gripper excepting the devices for vertically adjusting the roller 12, so that it

may be brought into proper contiguity to the gripper-blade. These devices are as follows: Said roller is journaled in somewhat elastic brackets 13, (one at each end,) that are bolted to the under side of the slotted plate 5. A set-screw 14 passes through the bracket and bears against the said plate, as clearly seen in said Figs. 6, 8, and 9. In order to maintain the screw at any adjustment, I secure a flat spring 15 to the plate 5 and provide the head of the screw with teeth, between two of which the spring rests so as to keep the screw from turning.

In the operation of the folding-machine in which my improvements hereinafter to be described are embodied it is necessary to apply to the upper side of the sheet previous to making the first fold a transverse line of paste, which line shall be midway between the line of folding and the rear edge of the sheet—in other words, this paste-line shall be at a distance from the rear end of the sheet equal, substantially, to one-fourth the length of the latter, so that when, as hereinafter described, the sheet receives the first fold it will be pasted on a line midway between the line of folding and the rear edge of the sheet.

As the machine is designed to fold sheets of different sizes, the position of the paste-line must vary accordingly, although its said position relatively to the sheet remains always the same. To these ends I provide the following pasting mechanism, which is suitably mounted on the frame of the machine, reference being had to Fig. 1, but mainly to Figs. 2, 3, and 4, Sheet 2, and Figs. 5 and 6, Sheet 3.

16 is a paste-box having journaled therein the usual roller 17. It (said box) is secured to screw-threaded nuts 18 and 18ª upon correspondingly-threaded shafts 19, that are journaled in bearings at the top of posts or brackets 20 of the main frame 1. The inner one of these nuts 18ª has connected thereto an overhanging arm 21, to the free end of which is journaled horizontally a small shaft 22, with a head 23, having a vertical aperture 24 therein, through which passes freely a rod 25. Secured to and extending horizontally from the lower end of the latter, parallel with the paste-roller 17, is a bar 26, which carries a thin pasting-blade 27, which lies in a vertical plane parallel with that of the paste-roller. The blade-carrying bar is pivotally connected to two arms 28, that are carried by a rock-shaft 29, which is journaled in an enlargement on the lower side of each of said nuts. This shaft has a crank 30 at one end, and a compression-spring 31 on a rod 32, that is pivoted to the crank-pin 33, serves to tend to elevate the free ends of arms 28. One end of the spring bears against a head 34 on the rod 32 and the other end against a bracket 35, connected to the nut 18 on that side, the rod being adapted to slide in an aperture in the bracket when the rock-shaft is oscillated, as hereinafter described. Secured to the rock-shaft is a second crank 36, whose horizontally-extending pin 37 has a small roller 38, journaled on its free end. This roller bears against the plane surface of a cam 39 upon a shaft 40, upon which it is longitudinally movable, as and for a purpose hereinafter explained. The face of this cam is inclined to the major axis of the shaft, as shown. One end of the latter is journaled in a bearing of an arm 41, that is supported by a top bar of the main frame of the machine, and the other end is journaled in a bar 42, that extends out from the brackets 20, in which are journaled one of the threaded shafts 19. The said cam-shaft 40 is driven in the present instance by the aforesaid shaft 11, Fig. 1, which is in turn driven through intermediate gearing (not shown) from the main driving-shaft 44, Fig. 1, of the machine, shafts 40 and 11 having engaging bevel-gears 40ª and 43ª, respectively, thereon. Fixed to arms 45, depending from the nuts 18 18ª, is a horizontal plate 46, one end of which has a projection 47, with a groove 48 extending the width of the plate, and which groove is adjacent to the lower edge of the pasting-blade, as seen. The top of the said grooved projection over which the sheets pass on their way to the first folding-rollers 7 is substantially in the same horizontal plane as the top of the aforesaid slotted plate 5, as seen in Figs. 6 and 7, Sheet 3. The upper sheet as it is carried by the tapes 3 into position over the rollers 7 is partly supported by a thin plate 49. It is also supported by a thin plate 50, whose forward end extends some distance beyond plate 49, adjacent to the tape-roller 4. The grooved plate lies between and closely adjacent to the other two plates, and when said grooved plate is adjusted to the position for the larger-sized sheets its head 47 is close to or in contact with the upper plate 49.

In order to prevent the forward edge of the advancing sheet as it arrives at the head 47 from catching thereon, I bevel the rear side of the latter, as shown.

I remark that the object of the groove 48 is to prevent the blade from putting paste on the plate if it should happen that a sheet of paper was not over the latter when the machine was running. I do not claim this groove as new, as it has been in use.

The mode of operation of the described pasting mechanism is as follows: Starting with the parts in the relative positions shown in the drawings, as the cam-shaft 40 rotates the roller 38 rides upon the face of cam 39, against which it is pressed by the action of the spring 31, and the shaft 29 is rocked backward, whereupon by reason of the described connection of the latter with the rod 25, to which the pasting-blade 26 is fixed, the latter will be swung back and upwardly and its edge come into contact with the pasting-roller 17, and as the shaft continues its rotation the cam 39 permits the spring 31 to reverse the motion of the rock-shaft 29, and thus returns

the pasting-blade to the vertical position, and so at the required predetermined instant—just as the forward end of the sheet has been arrested by the stop-bar—applies the transverse line of paste to the sheet, whereupon the suitably-timed folding-blade 51, Fig. 1, tucks the sheet through the slotted plate into the bite of the underlying folding-rollers.

In order to insure a supply of paste to the pasting-blade, I provide the following means for imparting an intermittent rotation to the pasting-roller: Fixed to the end of the shaft 22 (which it will be remembered has the apertured head 23 in which the rod 25 is adapted to slide) is a crank 52, to which is pivoted a pawl 53, Figs. 2 and 3, Sheet 2, whose free end is adapted to engage the ratchet-teeth of a wheel 54 on the end of the paste-roller shaft 17ª. Obviously as the shaft 22 is turned by the rotary reciprocations of the rod 25 the pawl will rotate the paste-roller to the extent of one or more teeth, as the case may be. A gravity-pawl 55, such as shown in Fig. 3, may be employed to prevent the reverse movement of the roller by the return of the pawl 53. The forward end of the cam has contact with the head 56 (through which passes the cam-shaft 40) of an arm 57, that is fixed to and is carried by one of the nuts 18. This head is adapted to slide upon the cam-shaft and carry the cam with it in either direction. To this end, I key the cam and head to the shaft in the manner shown in the longitudinal section, Fig. 4, Sheet 2. The shaft has therein a longitudinal groove or key-seat 58, that is open at one end of the shaft. The key 59 has a spline portion 59ª, that enters a groove in the cam, while the other part of the key, when the head 56 of the arm 57 encircles the shaft, is flush with the surface of the shaft 40. The key has also a head 60 at each end, which serves to maintain the head and cam together. In putting the parts together the key is preferably inserted in the opening of the head and cam and the shaft is then inserted, the key being entered into the open end of the groove in the shaft, and when so entered it is clear that the shaft may rotate in the head, but must carry the cam around with it; also that if the head be slid along the shaft in either direction the cam must follow.

It will be obvious from the described construction of this pasting mechanism that by simply turning the threaded shafts 19 the paste-box and all the other parts carried directly or indirectly by the nuts 18 18ª may be adjusted to any desired position as a whole, always retaining their proper relation longitudinally that the said mechanism may be adjusted to suit different sizes of sheets to which the line of paste is to be applied.

As a convenient means for turning the screws 19, I provide on an end of each a bevel-gear 61, that engages a similar gear on a transverse shaft 62, that is suitably journaled in fixed brackets or arms 63, said shaft having a hand-wheel 64 on its outer end.

It is sometimes desirable to have an independent adjustment of the paste-box, so that the periphery of its roller may be in suitable position with regard to the movement of the pasting-blade. To this end the paste-box is mounted and adapted to slide upon extensions of the nuts 18 18ª, respectively. The adjustments are effected by means of opposite set-screws 66, whose inner ends bear against the ends of the paste-box, as seen in the plan view, Fig. 2, Sheet 2.

The sheet having had the line of paste applied thereto and directed between the folding-rollers is divided in the middle by a circular knife 67, Fig. 6, in contact with one of the folding-rollers 7, such as is commonly used in folding-machines. At right angles to said rollers are two sets of similar folding-rollers 68 and 69, to which the once-folded sheets are respectively carried by means of tapes 70 in the ordinary way. The positions of these sets of rollers are and must be such that the middle of one of the sheets shall be in line with the bite of one set and that of the other sheet in line with the bite of the other set of rollers, so that the sheets will be evenly folded. Beyond the forward set of rollers 69 and at right angles thereto is another set of rollers 71, whose function is to impart the third or final fold to the sheets, to which they are carried over by tapes 72 and 73, respectively—that is, the tapes 72 and the coöperating part of the tapes 73, extending between one of the set of rollers 68 and the rollers r, carry the sheet that has been folded by the set of rollers 68 farthest from the rollers 71, which sheet has the greatest distance to travel to reach its position over the final set, and the tapes 73 carry the other sheet from the rollers 69 nearest to the final set. It is a simple matter to arrange the tapes for the sheet that has the short distance to travel; but in order to also insure the proper conveyance of the other sheet I have devised the arrangement of the two sets of tapes shown in Figs. 10, 11, and 12 and which I shall now proceed to describe.

The tapes 73 run over one roller of the set of folding-rollers 68 and under the other roller of said set, then under the other set 69, and then over a short roller r, that is journaled near the free end of a bracket or arm 74, (seen at the left of Fig. 11,) which in the present instance is secured to and projects horizontally from a part of the frame 1, in which the outer ends of the set of rollers 71 are journaled. Said tapes then pass under a second roller r^2, under and around a roller r^3 adjacent to folding-rollers 68, returning over the one and under the other of the folding-rollers 69, thence under a roller r^4, over the roller r^2, and then around a roller r^5 at the end of bracket 74, whence they (the tapes) pass below the two sets of folding-rollers 69 and 68

around a roller r^6 beyond the folding-rollers 68. In order to keep the tapes 73 suitably taut, I journal the latter roller in the vertical arm of a suitably-pivoted bell-crank 75, Fig. 11, having a weight 76 on its horizontal limb. The other set of tapes 72 pass around one of the folding-rollers 68, under the aforesaid rollers r^3 and r^2, and around a roller r^7. Thus said tapes 72 are carried between portions of the other set 73. It will be seen that the sheet that is folded by the set of rollers 68 farthest from the set 71, that imparts the final fold, (the two sets of rollers 68 and 69 being in the same horizontal plane,) is carried between the adjacent surfaces of the tapes 72 and 73, while the sheet passing through the set of folding-rollers 69 nearest to the set 71 is carried by and on the top of that part of the tape 73 stretching between the folding-rollers 69 and the idle roller r^4 nearest thereto. The series of rollers r, r^2, r^4, r^5, and r^7 are all journaled in the frame 74, there being one frame and set of rollers for each line of the tapes, and said rollers are arranged, as shown, so as to properly carry or direct the tapes.

The advantage of the specified arrangement of the tapes 72 and 73 is that the sheet folded by rollers 68, which, as above stated, has the longer distance to travel, is prevented by the contiguous tapes between which it is carried from being displaced on the way to position over rollers 71.

When the first sheet (coming of course from the rollers 69) reaches the proper position over the rollers 71, as in Fig. 14, Sheet 5, it is tucked into the bite of the first-mentioned rollers by a vibrating blade 77 at the end of an arm 78, that is mounted on a rock-shaft 79, which is actuated by a cam 80, against whose face a roller 81 on the end of an arm 82, connected to the shaft 79, is maintained by a spring (not shown) in the well-known way. The said cam has two opposite depressions 83, and thus the blade is caused to vibrate twice at each revolution of the cam. The latter is carried by a shaft 84, which, as it also carries the cams for actuating the other three folding-blades of the machine, as also the sliding side guide for the sheets to be folded by the set of rollers 71, as hereinafter described, I shall term the "cam-shaft." This shaft lies directly below the shaft 85, upon which the first folding-blade 51 is mounted, and is therefore not seen in Fig. 1. It is driven from the main driving-shaft 44 through gears 86 and 87. The said first sheet having passed between the rollers 71 and the blade 77 reached the elevated position, the second sheet from rollers 68 arrives in position over the first-mentioned rollers and is in like manner folded thereby, both sheets having finally been folded into signatures of sixteen pages each. When, however, it is desired to do insetting work—that is, to fold the two sheets as one signature—it is necessary that the blade 77 be caused to vibrate but once with each revolution of the cam. It is also necessary that the sheet that has the longer distance to travel shall be caused to reach its proper position over the rollers 71 and beneath the first sheet at a predetermined time. This latter result is effected by the relative timing of the strokes of the folding-blades that coöperate, respectively, with folding-rollers 68 and 69, as hereinafter explained. To effect the first result—*i. e.*, to cause the blade 77 to vibrate but once with each revolution of the cam—I use what I term a "filling-piece" 88, (shown in Fig. 14,) which piece is rotatable upon the cam-shaft and is provided with a slot 89, through which passes a screw 90, whereby it may be set in the required positions. The end of the piece is rounded, being struck on the same center as the circular portions of the cam. When it is shifted to one position—that shown in Fig. 14—the blade will be vibrated once at each revolution of the cam, and when shifted to the other position, its periphery coinciding with the circular part of the cam, the blade will obviously have two vibrations at each revolution of the cam.

91, Figs. 15, 16, and 17, is a cam mounted upon a sleeve 92, which latter is secured to cam-shaft 84 by a set-screw 93 in such manner that the said sleeve, and consequently the cam carried thereby, may be rotatably adjustable upon the shaft by loosening said screw and turning the sleeve on the shaft to a desired position and then tightening the screw, thus securing the said sleeve rigidly to the shaft, for a purpose hereinafter set forth. A folding-blade 94 is carried by a rock-shaft 95, from which extends an arm 96 with a limb 97, which has on its free end a roller 98, Fig. 16, which rides upon the cam. When the cam-shaft is rotated, the cam 91, through the described mechanism, actuates the blade 94, allowing the latter at the proper instant to descend and tuck the sheet over rollers 69 into the bite of the latter rollers and by which it is folded. Cam 91 is adjustably mounted upon the sleeve 92 in a manner and for a purpose hereinafter explained. A cam 99, similar to cam 91 and also on the shaft 84, has riding thereon a roller 100 on the free end of an arm 101, whose other end is secured to a rock-shaft 102, journaled in the frame 1, also secured to said rock-shaft, and at an angle to arm 101 is an arm 103, carrying at its free end a folding-blade 104, which when said cam is rotated is actuated thereby and at the proper instant tucks the sheet over rollers 68 into the bite thereof, by which they are folded.

When it is required to put a cover on the sheet when it has received the final fold by the rollers 71, whether it is to form a signature of thirty-two pages by insetting or two of sixteen pages each when not insetting, I feed the cover from a feed-board 105, Figs. 1 and 11, between suitable rollers 106, whence it is carried by tapes 107 in proper position over a set of rollers 108, that, as shown, lie

directly under the rollers 71. A line of paste is applied midway of the cover, as it passes between the feed-rollers 106, by means of a thin roller 109, running in a paste-box 110, Figs. 1 and 11, in the usual manner.

As the sheet passes through the rollers 71 its edge acts practically as a folding-blade to tuck the applied cover between the rollers 108. In order to insure the entrance of the sheet between the latter rollers, I usually employ a fixed bar 111 beneath the rollers 71, with a longitudinal slot 112 therein in line vertically with the bite of the latter and preferably tapering—that is, wider at the top—as shown, through which slot the sheet is guided to the subjacent rollers 108.

It is of course necessary in order to do accurate work that the sheets coming from rollers 68 and 69, whether they be folded successively or together as in insetting, shall be properly guided into position over the third set of rollers 71, so that they will always be folded by the latter on a line midway between the adjacent edges of the printing upon the sheets, whether the printed pages on the sheets be equidistant from the middle line thereof or not, as is frequently the case. To effect the proper guiding of the sheets—that is, so that the folding-blade 77 will in its descent strike the former midway between the printed pages—I have devised the mechanism shown in the drawings and now to be described, particular reference being had to Figs. 13 and 14, Sheet 5, and Fig. 15, Sheet 6.

113 represents two horizontal bars that are adapted to slide in guideways on a transverse bar 114, which is supported by a part of the frame 1. Rising from said bars 113 are two vertical guide-bars 115, which are preferably made adjustable longitudinally on the bars 113 by means of set screws or bolts 116, passing through slots 117 in the bars, whereby the distance between the guide-bars and the rollers 71 and 108 may be altered, if required. The outer ends of the bars 113 are pivoted, respectively, to similar cranks 118 of a rock-shaft 119, that is journaled in bearings 120, Figs. 13 and 15, of the main frame of the machine. This shaft carries a crank 121, with a roller 122 on its free end that is adapted to bear upon a cam 123 on the aforesaid cam-shaft 84. The shape of this cam is clearly seen in Fig. 18. It has two opposite portions in the arc of a circle and two other opposite depressions or incut portions 123^a and 123^b, also a filling-piece 124 for one of the said depressions of the form shown in Fig. 18. This piece has a set-screw 125, which passes through a curved slot 126 in the cam, whereby the said piece may be turned or shifted and set so as to fill out the depression to any required extent—that is to say, so that the throw of the arm, and consequently the extent of the inthrow of the guide-bars 113 by that side of the cam, may be adjusted.

The operation is as follows: At a proper instant with relation to the movement of the sheets coming from the rollers 68 and 69 and just prior to the descent of the blade 77 (the guide-bars 115 being at the limit of their outward throw when the roller is riding on a circular part of the cam) the roller 122 enters one of the depressions 123^a through the stress of a spring 127, acting upon the crank-shaft, and pushes the sheet over a sufficient extent, the guide-bars having been so adjusted with relation to their distance from the rollers 71 and the folding-blade 77 that the said extent is such as to bring the middle line between the printed pages on the opposite sides of the blade directly in the path of the latter. The blade then descends and tucks the sheet between the folding-rollers 71, and the roller 122, again riding on the circular part of the cam 123, retracts the guide-bars 115, and when the next sheet arrives in position over the said rollers the described operation is repeated. If the printed pages are in regular position, the depressions 123^a and 123^b of the cam will be of the same depth and the blade will strike midway between the opposite pages of each of the sheets or both when inset. If, however, the printed pages should not be in such regular position, it will be obvious that if the guide-bars be set so that the sheet will be guided into position for the blade to strike midway between opposite pages of one of the sheets coming from the folding-rollers 69 it would not strike midway between the corresponding pages of the succeeding sheet coming from rollers 68; but by suitably shifting the filling-piece, so as to lessen or increase, as the case may be, the throw of the guide-bars, it will be obvious that such succeeding or alternate sheets may be pushed such distance that the blade 77 will strike midway between the opposite printed pages, and thus the printed matter of one page of the sheet will when folded by the rollers 71 register with that of the opposite page. The guide-bars 115 also serve to bring the cover into proper position with regard to the line of folding the same.

It will be obvious that if the machine is set to suit sheets of a certain size if the size of the sheets be changed they will not be carried by the tapes 72 and 73 into proper position over the rollers 71 in the same time that the other larger or smaller sheets were so carried. In other words, the sheet coming from rollers 68 farthest from the rollers 71 would be too quick or too slow, as the case may be, in arriving in position over the said rollers. It will therefore be equally obvious that if the machine is to be adapted to fold sheets of different sizes it is requisite that some means be provided whereby the sheets from the two sets of rollers 68 and 69 will always be caused to arrive in position, as before described.

Premising that the devices for imparting the first fold to the sheet (by the rollers 7) the coacting stop-bar, as well as the before-described pasting devices, are adjustable to suit different-sized sheets, I shall now pro-

ceed to describe the mechanism whereby the folding devices succeeding the first may be adapted for different-sized sheets.

Referring particularly to Fig. 15, Sheet 6, of the drawings, the rock-shaft 95, that carries the blade 94 of the set of rollers 69 nearest to the set 71, is journaled in frames 128, one for each end of the shaft, that are adapted to slide upon guide-rails 129 of the main frame and are secured in the desired position or adjustment by any convenient means. The usual spiral spring 130 for maintaining the roller 98 at the end of the arm 97 against the face of the cam 91 is upon a rod 131, that is connected to an arm 132 of the blade rock-shaft. 95 is adapted to slide in a lug 133 of the sliding frame 128. The set of rollers 69 are also journaled in bearings of the frames 128. These rollers are driven by the main shaft 44 through a bevel-gear 134 on the shaft of one roller and a corresponding gear 135 on the shaft. The latter gear is attached to the shaft by a spline-and-groove connection, whereby the gear is adapted to slide on the shaft. The cam 91 is carried by the sleeve 92 upon the cam-shaft 84, and the cam is adapted to slide on the sleeve. A pin 136, fixed to the cam, is entered into a groove 137 in the periphery of the cam-sleeve. This groove is of the shape shown in Fig. 15—that is, it runs around a part of the sleeve as the thread of a screw of elongated pitch. The cam 91 is connected to the sliding frame 128 by means of an arm 138, whose free end is in the form of a yoke 139, that engages a circular groove 140 in a lateral extension of the cam.

From the foregoing construction it will be seen that by sliding the frames 128 on their guideways 129 the rollers 69, with the blade 94, may be adjusted to or from the rollers 68, and the cam 91, sliding on the sleeve 92, will adjust with them by reason of the yoke connecting the frame and cam. At the same time that the cam slides on the sleeve it will, owing to the shape of the groove, be rotated, and thus cause a change in the timing of the vibration of the blade corresponding to the distance between the two blades 94 and 104.

When it is desired to do insetting work, and thus make one signature of thirty-two pages, it is obvious that the sheet coming from rollers 68 must catch up, as it were, with that from rollers 69, so that both sheets may be tucked into the bite of rollers 71 by the same stroke of blade 77. Premising that when it is desired to do insetting work the filling-piece 88 of the cam 80 is adjusted, as in Fig. 14, so that it fills one of the depressions in the cam, and thus the folding-blade 77 will descend but once for each revolution of the said cam, in order to so adjust the mechanism that the sheet to be folded by rollers 69 will, as it were, be retarded in order that the sheet coming from rollers 68 may catch up with it the set-screw 93 is loosened, and the sleeve 92, carrying the cam 91, is rotatably adjusted upon shaft 84 a predetermined distance and again secured thereto by retightening the screw. The timing of the cam 91 with relation to that of cam 99 then becomes such that blade 94 is retarded to an extent that will allow the sheet from rollers 68, which has the longer distance to travel, to arrive over rollers 71 and under the sheet that issues from rollers 69 at the same instant, immediately after which they (the two sheets) are tucked together into the bite of rollers 71 by the descending knife 77, thus forming one signature of thirty-two pages. It will be understood that before the blade descends to tuck the sheets into the bite of the rollers 71 they (the sheets) are side-adjusted by the reciprocating bars 115, as previously described; but it will be obvious that (owing to the two depressions of the cam 123) one of the strokes of the said bars will be an idle one.

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

1. In a pasting mechanism for folding-machines, the combination of the paste-box, the rotatable roller journaled therein, the sliding reciprocating rod, the pasting-blade carried thereby, the rock-shaft connected with said rod, the spring-controlled rock-shaft, the crank thereon, the roller on the free end of said shaft, the rotatable shaft, 40, at right angles to said rock-shaft, the inclined cam carried and adapted to slide upon shaft, 40, against which cam said roller is adapted to bear, the plate underlying the pasting-blade, the threaded shafts, means for turning said shafts simultaneously, and the nuts on said last-mentioned shafts, by which nuts the aforesaid parts or elements, with the exception of the shaft, 40, are supported, together with the arm connected with said nuts, and the free end of which arm is so connected to the sliding cam as described that the latter is free to rotate, the construction being such as hereinbefore described whereby a line of paste is applied to the sheets of paper as they successively pass over the said plate, and whereby also the paste-applying mechanism may be adjusted to suit sheets of different sizes.

2. In a paste-applying mechanism for folding-machines, the combination of the paste-box, the roller journaled therein, the rock-shaft, means for actuating the same, the shaft, 22, the head thereon, the rod passing freely through an aperture in said head, the arms secured to said rock-shaft, and their free ends pivotally connected with said rod, the ratchet-wheel on the paste-roller, and the pawl connected to said shaft 22, substantially as shown, and its free end adapted to engage the teeth of said ratchet-wheel, whereby at each movement of said shaft, the paste-roller will be rotated a certain distance, substantially as and for the purpose set forth.

3. In a folding-machine of the character described, the combination of the first set of folding devices, the two second sets of fold-

ing devices, the third set of folding-rollers, said devices and rollers being relatively arranged as and for the purpose described, means for adjusting one of the second sets of folding devices so as to change the distance between the same, the rock-shaft, the folding-blade mounted thereon and coacting with said third set of rollers, together with the rotatable cam adapted to actuate said rock-shaft and having opposite depressions therein, together with the independently-movable filling-piece whereby the said blade is adapted to make either two or one vibration at a revolution of said cam.

4. In a folding-machine, the combination of two sets of rollers, as 68 and 69, the folding-blades adapted to coöperate therewith, respectively, one of said sets of rollers, as 68, and its folding-blade, being in a relatively-fixed position, and the other set of rollers, as 69, with its folding-blade being adjustable with relation to the distance from the set, 68, and mechanism whereby the proper timing of the strokes of the folding-blade of the said adjustable set of rollers with relation to the movement of the folding-blade of the relatively-fixed set of rollers, 68, can be automatically effected simultaneously with the adjustment of the set of rollers, 69, and the said blade coacting therewith; together with the third set of rollers, as 71, and the folding-blade coacting therewith, and means for conveying the sheets folded by the rollers 68 and 69 respectively, into position to be folded by the said rollers, 71, substantially as set forth.

5. In a folding-machine of the class recited, the combination of the set of folding-rollers, 69, journaled in the longitudinally-adjustable frames, the rock-shaft journaled in said frames, the folding-blade carried thereby, the rotatable shaft, 84, having the elongated screw-threaded groove therein, the arm connected to the rock-shaft, the rotatable, sliding cam on the shaft, 84, for actuating said arm, the stud connecting the cam and said groove, and the arm, 138, connected to one of said frames, and also engaging said cam in such manner as described, whereby the latter is free to both slide and rotate on the shaft, substantially as and for the purpose set forth.

6. In a folding-machine of the character described, the combination of the longitudinally-adjustable frames, the folding-rollers, 69, journaled therein, means for driving said rollers at all adjustments of said frames, the rock-shaft journaled in said frames, the folding-blade carried by said shaft, the rotatable cam-shaft, the sleeve carried thereby, the elongated screw-thread groove in said sleeve, the cam on the latter, its stud entered into said groove, the arm connecting said cam and rock-shaft, together with the arm connected to one of said adjustable frames also engaging the cam, all substantially in the manner described, whereby the movement of the last-mentioned arm will not interfere with the sliding rotary movement of the cam, all constructed, arranged and adapted to operate substantially as and for the purpose set forth.

7. In a folding-machine of the character described, the combination of the cam-shaft, the independently-rotatable sleeve thereon, means for securing the latter at any adjustment thereof, the elongated screw-thread groove, in said sleeve, the cam having the stud engaging said grooves, and loosely mounted on the sleeve so as to be free to slide and rotate thereon, the longitudinally-adjustable frames, the folding-rollers journaled therein, the rock-shaft journaled in said frames, the folding-blade connected to the rock-shaft, the arm connecting said shaft and cam, together with the arm connected to one of the said adjustable frames and also engaging loosely said cam, all constructed and adapted to operate substantially as and for the purpose set forth.

8. In a folding-machine of the character described the combination with the sets of folding-rollers, 68, and 69 said sets of rollers being in substantially the same horizontal plane, and the set of rollers, 71, of the series of tapes, 72 and 73, and their respective rollers all, arranged in the manner described, whereby the sheets that have passed through the rollers, 68, farthest from the rollers, 71, are carried into position over the latter by and between adjacent surfaces of the tapes, and the sheets that have passed through the rollers, 69, nearest to the rollers, 71 are carried into said position by and upon the upper surface of a part of tapes, 73, substantially as set forth.

9. In a folding-machine of the character described the combination of the folding-rollers, and folding-blades coacting therewith, respectively, all relatively arranged as shown, the rock-shaft, the horizontally-movable guide-bars connected therewith, the cam for actuating said shaft, having the opposite depressions, together with the filling-piece and means for adjusting the same whereby the extent of the projection, radially, of its working face may be varied, substantially as and for the purpose set forth.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

HOWARD K. KING.

Witnesses:
WALTER C. PUSEY.
JOSHUA PUSEY.