No. 640,570. Patented Jan. 2, 1900.

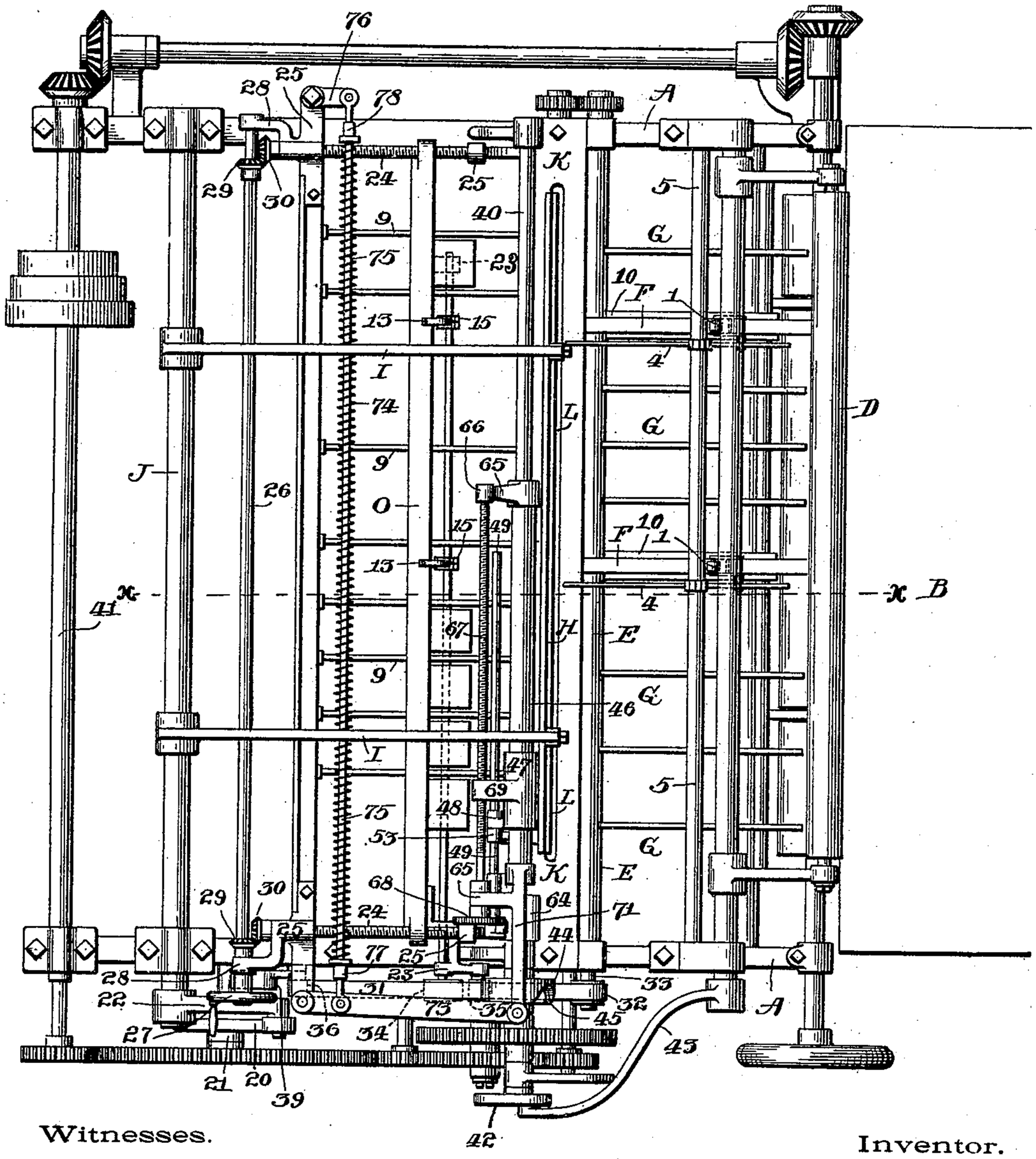
H. K. KING.

PAPER FOLDING MACHINE

(Application filed Dec. 11, 1896.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses.

Walter C. Pusey.

A. V. Groupe

Inventor.

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per Joshua Pusey,

Attorney.

No. 640,570. Patented Jan. 2, 1900.

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(Application filed Dec. 11, 1896.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2.

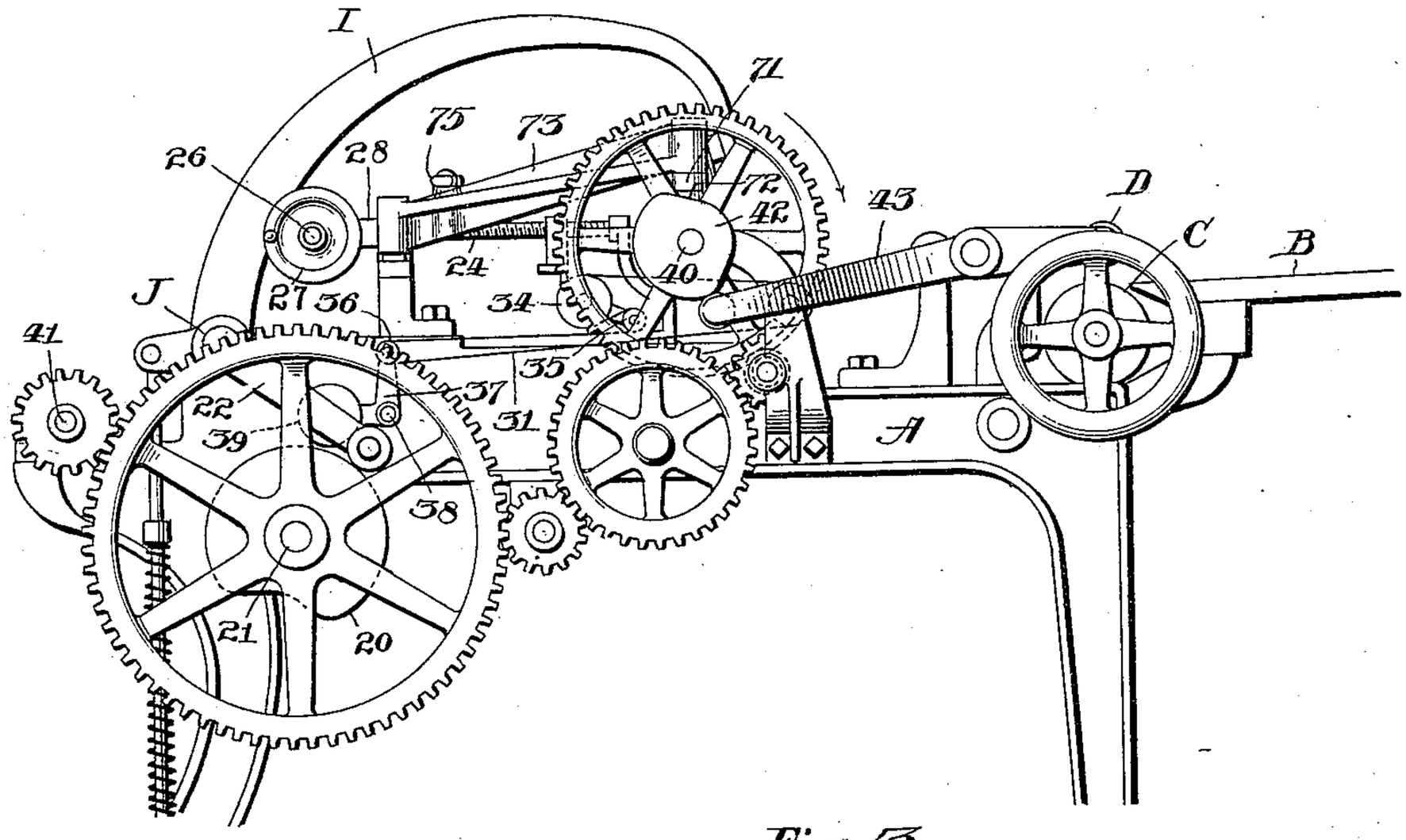


Fig. 3.

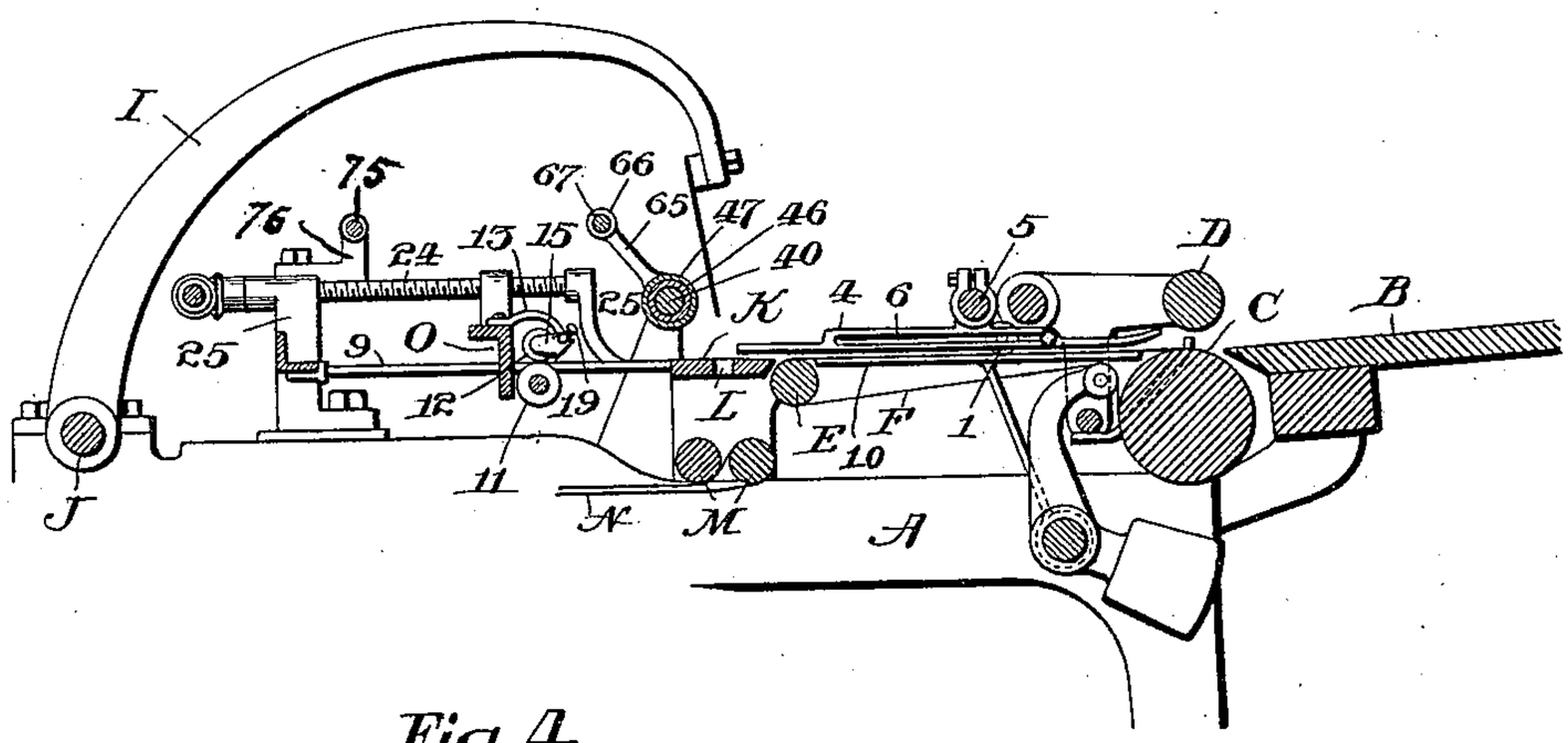
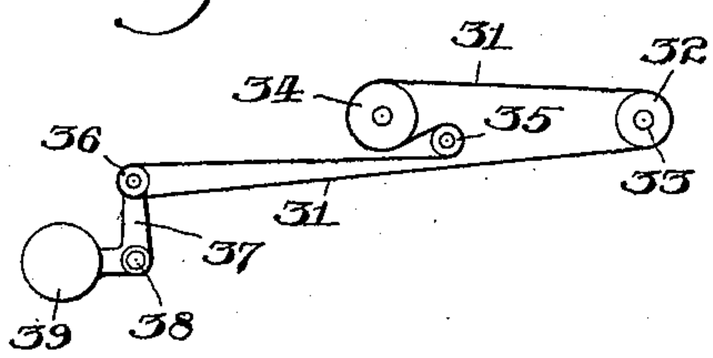


Fig. 4.



Witnesses.

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(Application filed Dec. 11, 1896.)

(No Model.) 4 Sheets—Sheet 3.

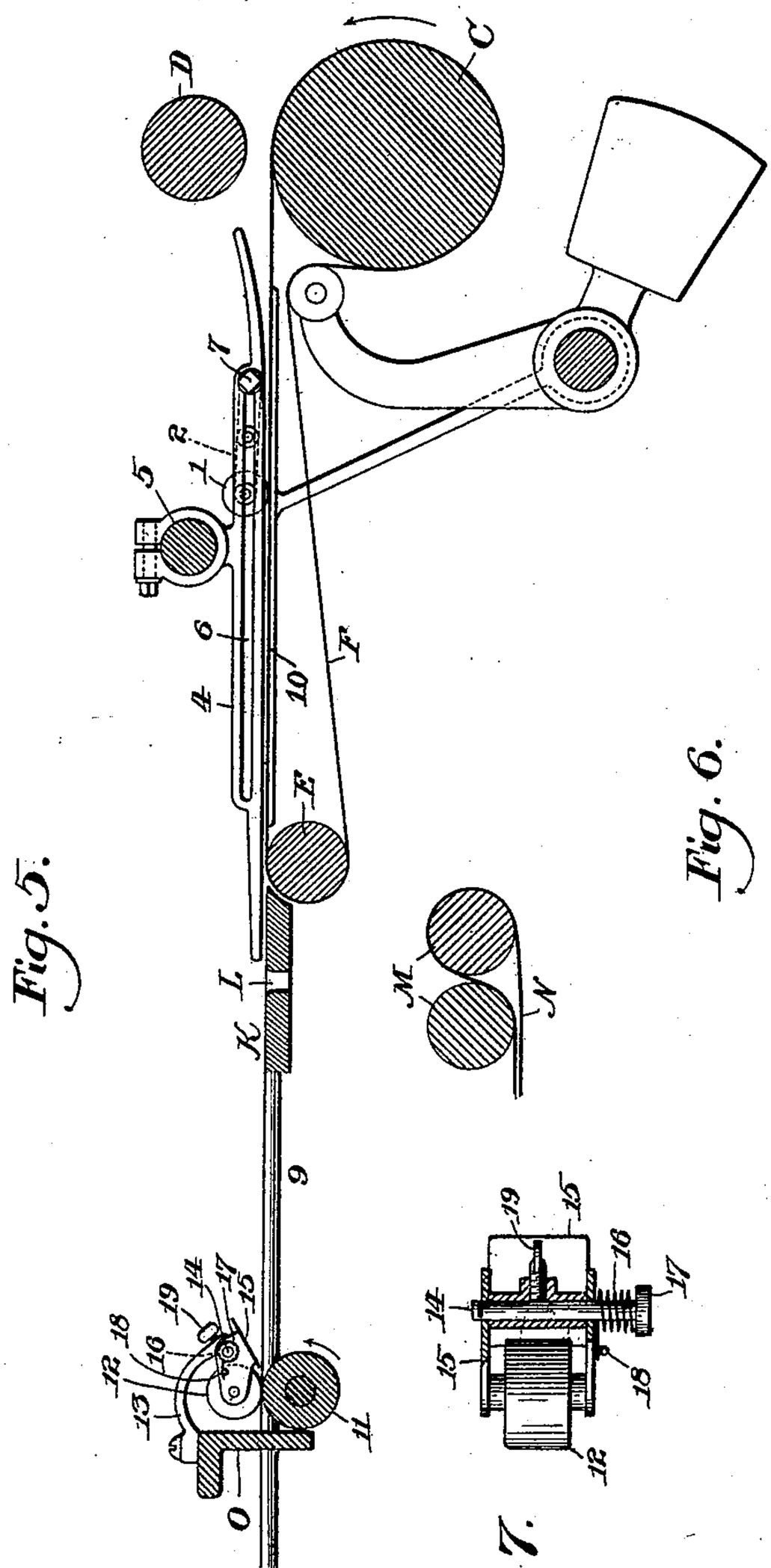

Fig. 5.

Fig. 7.

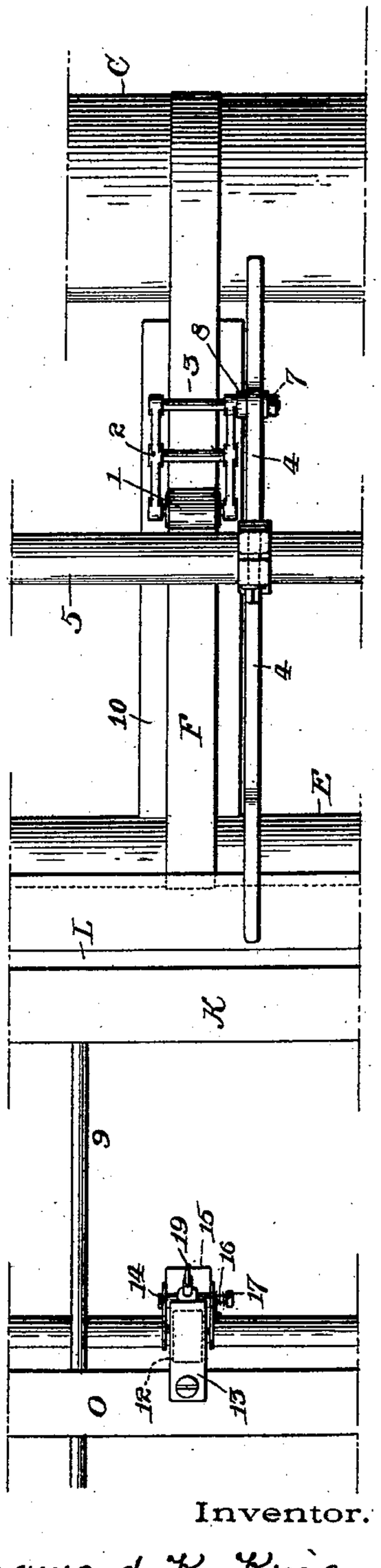

Fig. 6.

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No. 640,570. Patented Jan. 2, 1900.

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PAPER FOLDING MACHINE.

(Application filed Dec. 11, 1896.)

(No Model.) 4 Sheets—Sheet 4.

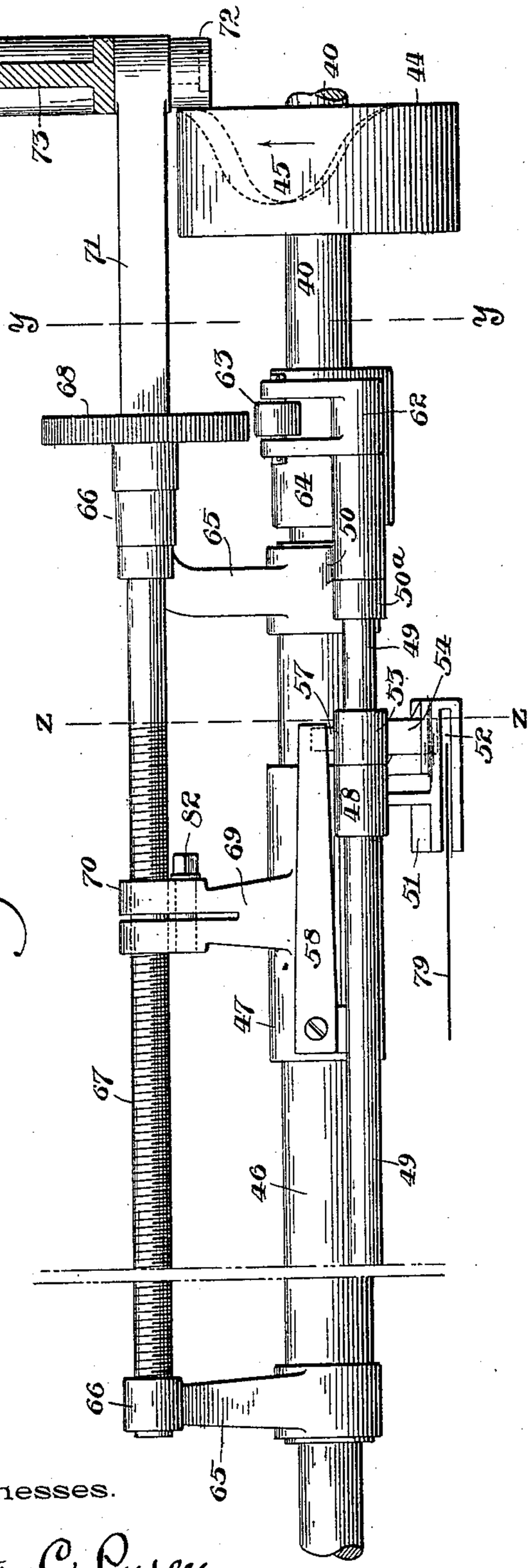

Fig. 8.

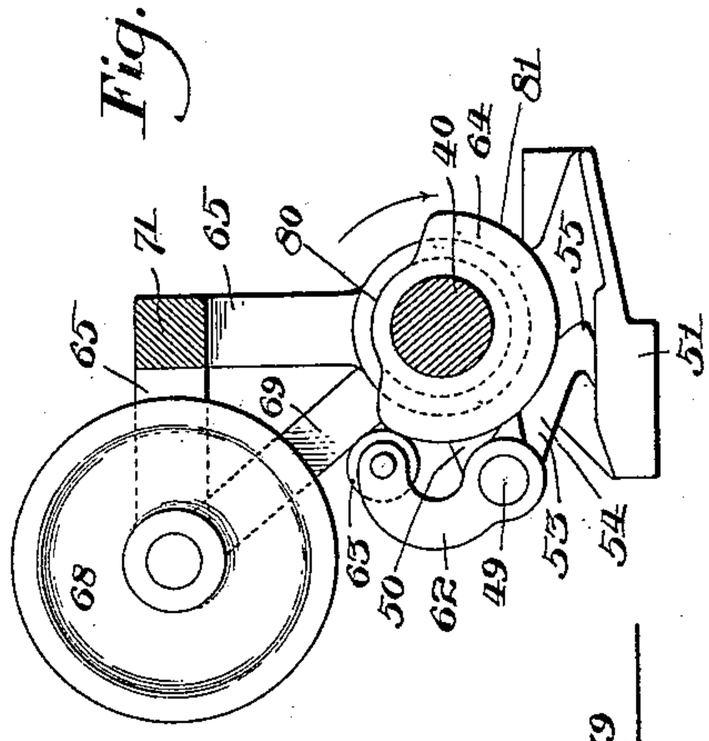

Fig. 9.

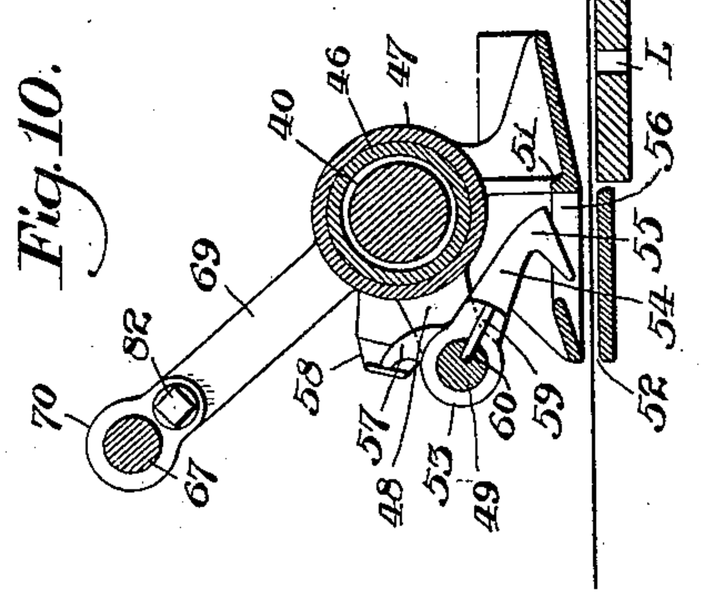

Fig. 10.

Fig. 11.

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. 640,570, dated January 2, 1900.

Application filed December 11, 1896. Serial No. 615,309. (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 and 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 general plan view of a folding-machine in which my invention is embodied. Fig. 2, Sheet 2, is a side elevation of Fig. 1, the lower part of the frame, &c., being broken off. Fig. 3 is a section as on line *x x*, Fig. 1. Fig. 4 is a detail in side elevation, showing the arrangement of the adjustable belt connection for driving the positively-driven stop-bar roller. Fig. 5, Sheet 3, is an enlarged view of a part of Fig. 3. Fig. 6 is a plan view of Fig. 5. Fig. 7 is a detail in plan, partly in section, of the stop friction-roller detached and its tension adjustment device. Fig. 8, Sheet 4, is a front elevation of the side-guide mechanism enlarged. Fig. 9 is a section on line *y y*, Fig. 8. Fig. 10 is a section on line *z z*, Fig. 8. Fig. 11 is a sectional detail showing the sliding connection of the side guide and nipper to the nipper rock-shaft.

This invention relates to paper-folding machines wherein the sheets of paper fed to the machine are carried by suitable driven tapes or the like into the proper position to be folded by the usual folding blades and rollers.

My improvements relate particularly to mechanism or devices for carrying and for the retention of the sheets of paper into proper accurate position for the operation of the folding devices, be the dimension of the sheets what they may, within the scope or capacity of the particular machine.

The object of the invention is to provide a certain construction and combination of mechanism whereby there shall be secured a better, more positive, and uniform placement of the sheets in the proper position for the folding devices than heretofore both longitudinally and transversely.

The precise character of the improvements will clearly appear from the following description in connection with the accompanying drawings, the novel features or combinations being particularly pointed out.

The said drawings represent the invention as applied to a well-known form of the Chambers folding-machine; but I have shown therein only such parts of the machine as are necessary or desirable to a clear understanding of the construction and operation of my present improvements.

Referring to the drawings, A is the frame of the machine; B, the feed-table at its rear end, upon which the sheets to be fed in are piled; C, the carrying-drum; D, the "drop-roller;" E, the roller around which and the said drum pass the sheet-carrying tapes F.

G, Fig. 1, are the usual supporting-rods lying between and parallel with the tapes.

H is the folding-blade, secured to arms I, connected to a rock-shaft J.

K is a plate whose upper surface is in line with the carrying-tapes and having a vertical slot L above the line between the two folding-rollers M. N are the tapes which carry the sheet on from the said rolls to be again folded by suitable mechanism, if desired, or carried to the packing-trough.

O is the stop-bar for arresting the advance of the sheet as it is being carried into the position to be folded.

The foregoing parts relatively arranged, as shown, are old and well known.

Heretofore the sheet of paper would sometimes slip upon the carrying-tapes and so fail to reach the stop O. At other times the tapes would carry the sheet with such an impetus that when it struck the stop it would recoil therefrom. In either case obviously the sheet would not take the proper position longitudinally for accurate folding. In order to avoid these difficulties, I have devised the mechanism now to be described and which is shown in Figs. 1, 3, 5, and 6.

I place a small but somewhat heavy friction-roller 1 over and upon the tapes F, respectively. This roller is journaled at the end of a frame 2, whose other end is pivoted on a pin or stud 3, which is secured to a bar 4. Thus the roller is yielding or self-adjusting with relation to the tape upon which it bears, or rather to the sheet of paper carried

by the tapes, as will hereinafter appear. As a matter of convenience the series of bars 4 are secured to a common transverse rod 5, that is in turn secured to the machine-frame.

As, for a reason hereinafter explained, it is desirable that the friction-rollers shall be adjustable along the tapes F, I provide a longitudinal slot 6 in the bars 4, through which the stud 3 extends and is secured at the required point by means of a nut 7, Fig. 5, and in connection with a shoulder 8, Fig. 6, on the stud, as clearly seen in the drawings. As the sheet of paper is carried forward by the tapes it passes beneath the rollers 1, which press or hold the sheet against the tapes, and thus it is carried on positively toward the folding position. The use of these rollers enables me to dispense with a number of carrying-tapes, two being ordinarily sufficient. It also avoids the necessity of driven tapes or rollers between the lines of the folding devices and the stop O for aiding in carrying the sheet onto the latter, as a suitable support may be used in lieu of the said latter tapes, such as rods 9, Figs. 1, 3, 5, and 6.

In order to secure a firm contact of the rollers 1 upon the sheet, I place immediately beneath each of the tapes F a supporting-plate 10, Figs. 1, 3, 5, and 6.

In order to prevent recoil of the sheet and to insure its contact with the stop-bar O, I place a short distance from and in front of the latter and parallel therewith a roller 11, which is driven forward positively—that is, in the direction of the arrow in Fig. 5—by suitable means (preferably by those hereinafter described) at a surface speed—say one-third to one-half of the surface speed of the carrying-tapes F. The top of this roller is substantially in the plane of the upper surface of the tapes and the top of the supporting-rods 9. I place a small friction-roller 12, or rather two or more rollers at suitable intervals apart, over and lightly in contact with the roller 11. These friction-rollers are, for a purpose hereinafter explained, preferably connected with the stop-bar O by means of a bracket 13. I also provide means for allowing the friction-rollers to bear yieldingly on roller 11 and also for adjusting the degree of their pressure. To these ends I journal the said rollers on an arbor 14 in a frame 15, Figs. 3, 5, 6, and 7, that is pivoted to the brackets 13, and provide a helical spring 16 upon an end of said arbor extended from the frame 15. One end of the spring is secured to a head 17 of the arbor, and the other end bears against a stud 18 in the side of the frame. In order to adjust the degree of tension of the spring and consequent yielding pressure of the roller, I provide a thumb set-screw 19, whose end bears against the arbor 14 and so retains the latter in any position to which it may be rotated by turning it by the head 17. In this way the stress of the spring upon the stud 18 may be set as may be necessary.

Premising that the distance of the front stop-face of the bar O from the line of the path of the folding-blade as the latter enters the slot L in plate K is equal to one-half of the width of the sheet to be folded and that the contact-line of the tape friction-rollers 1 is a little greater distance from the middle of the sheet or the line of folding, the sheet is advanced by the carrying-tapes and their aforesaid friction-rollers over the slotted plate and upon the rods 9 behind it until its edge enters the bite of rollers 11 and 12, its rear end being still between the tapes and rollers 1. It is now carried forward by the rollers 11 and 12, and at this instant before it meets the stop-bar its rear end has escaped from the bite of the tape friction-rollers—that is to say, at or about the time the sheet escapes from the bite of rollers 1 it enters the bite of rollers 11 and 12. At or shortly after the instant the sheet touches the stop-bar the folding-blade descends through the action of well-known devices, such as a cam 20, Figs. 1 and 2, on a drive-shaft 21, which through the medium of an arm 22, having a roller bearing on the face of said cam and connected with the shaft J, to which the blade-arms I are secured, effects the necessary vibrations of the blade. When the blade tucks the sheet through the slot L or between the folding-rolls M in case the slotted plate is not used, the yielding and lightly-contacting friction-rollers 12 allow the end of the sheet to be drawn out by the pressure of the blade.

As it is at least desirable that the machine shall be adapted to fold sheets of different lengths as well as widths, it is necessary that the stop-bar and its coöperating adjuncts—the roller 11 and the friction-rollers 12—shall be capable of a to-and-fro adjustment in a line parallel with the slot L or the folding-rolls, as well as with the tape friction-rollers 1, for which, as hereinbefore described, a means for a corresponding independent adjustment has been provided. For convenience and celerity of adjustment it is also desirable that the stop-bar, positively-driven roller, and its friction-rollers shall be adjustable as a unit, as also the devices for driving the said driven roller. I accomplish these desiderata by the following means: I journal the roller 11 on arms or bearings 23, Fig. 1, connected to the stop-bar, and mount the stop-bar on two screw-threaded shafts 24, Figs. 1, 2, and 3, one at each end, passing through threaded apertures in the stop-bar. These shafts are journaled in bearings of supports 25, attached to the frame of the machine, and may be rotated simultaneously by means of a shaft 26, with a hand-wheel 27, which shaft is also journaled in suitable fixed bearings 28 and having bevel-gears 29, whose teeth engage those of like gears 30 on the ends, respectively, of the said threaded shafts. Other equivalent means for adjusting the stop-bar, &c., are within the knowledge and skill of the ordinary mechanic; but those

which I have shown and described are as efficient as they are convenient.

The means for driving the roller 11 and for the self-adjustment thereof with the adjustment of the stop-bar, &c., are shown in part in Figs. 1, 2, and 4 and are as follows: The roller 11 is driven in the present instance by a belt 31, that runs over and is driven from a pulley 32 on the end of the shaft 33 of the tape-roller E, which shaft and roller are driven through a suitable train of gears from the main or driving shaft 41 of the machine, said belt passing over a pulley 34, Figs. 1, 2, and 4, on the end of said roller 11, and thence over a pulley 35, that is journaled in the outer one of the roller-bearing arms 23, thence over a pulley 36 on the upper arm of a bell-crank lever 37, that is pivoted on a stud 38, fixed to the frame of the machine, the other or horizontally-extending arm being weighted by a ball or disk 39 or the like. It will be obvious that the tendency of this weighted arm is always to maintain the belt 31 taut and is self-adjusting to any position of the roller 11 and adjuncts. It will also be obvious that the adjustment of the roller, stop-bar, &c., may be readily made without stopping the machine. It will also be obvious that adjustments of the tape friction-rollers 1 may be easily made.

I shall now proceed to describe the mechanism for securing when necessary side-guiding or adjustment of the sheet on its way to the folding devices, special reference being had to Figs. 1, 8, 9, and 10.

40 is a shaft that is continously driven in the direction of the arrow in Figs. 2 and 8 by a train of gears from the main driving-shaft 41. In the present instance this shaft is the one that carries the cam 42, that acts upon the arm 43, that carries the drop-roller D. Said shaft also carries a cam-wheel 44, having a cam edge or depression 45, as seen in Fig. 1 and as indicated by dotted lines in Fig. 8.

46, Figs. 1, 8, and 10, is a sleeve through which the shaft 40 passes, and it (the sleeve) is freely movable longitudinally thereon.

47 is a second sleeve upon sleeve 46 and which is free to slide upon the latter. From the outer sleeve 47 projects a lug or bearing 48, through which passes, parallel with the shaft 40, a shaft 49, hereinafter termed the "nipper rock-shaft." The latter shaft also has a bearing in a lug 50, projecting from the sleeve 46. 50^a is a collar abutting against lug 50 and fixed upon the said shaft. To the sleeve 47 is also secured a guide-plate 51, that is provided with a horizontal slot 52, Figs. 8 and 10, closed at the outer end. The location of this plate is such, as shown in Figs. 8 and 10, that the part constituting the bottom of the slot is substantially in the same horizontal plane as that of the upper surface of the slotted plate K, or, in other words, coincident with the plane of movement of the sheet of paper on its way to be folded.

On the nipper rock-shaft is a nipper 53, having a leg 54 terminating in a foot 55, that is adapted to move in a slot 56 in the upper wall of the horizontal slot in the guide-plate. The nipper has also an arm 57, against which presses the end of a flat spring 58, whose other end is secured to the outer sleeve 47. The nipper is secured to the rock-shaft 49 by means of a key or feather 59, Figs. 10 and 11, Sheet 4, entered into a longitudinal slot 60 in said shaft. A portion of this key passes into a radial slot of the nipper, as seen in Figs. 10 and 11, while the outer edge of the part that passes through the guide-plate bearing is flush with the periphery of the nipper rock-shaft. The key is provided with heads or offsets 61, one at each end, whereby the nipper is maintained in place in connection with the guide-plate, as clearly seen in said Fig. 11.

It will be obvious from the described construction that the nipper rock-shaft and the guide-plate and its nipper may slide longitudinally with relation to each other and that a rocking or rotary motion imparted to the said shaft will carry with it the nipper.

It will of course be understood that the slot 60 is open at the end of the shaft, so that the guide-plate and nipper as connected by the key may be slid onto the shaft in assembling the parts. On the end of this nipper rock-shaft is an arm 62, in the end of which is journaled a small roller 63, Figs. 8 and 9, which bears against the face of a broad cam 64, of the form substantially as shown in Fig. 9, that is secured to shaft 40. From the sleeve 46 extend arms or posts 65, Figs. 1, 8, 9, and 10, in the bearings 66 of which is journaled a screw-threaded shaft 67, that may be rotated by a milled hand-wheel 68 on the end thereof. From the outer sleeve 47, which, it will be remembered, carries the guide-plate, extends an arm 69, with a threaded head 70, through which passes the correspondingly-threaded shaft 67.

71 is a bar, the inner end of which is connected to the sleeve 46 and has on its under side a head or, preferably, a roller 72, Fig. 8, which is always maintained against the side or edge of the cam-wheel 44 on the end of the continuously-driven shaft 40 during the rotation of the latter. For this purpose I pivot to the free end of bar 71 a bar 73, whose other end is pivoted to the frame of the machine, as seen in Fig. 1. This latter bar is drawn inwardly, and thus the roller maintained against the cam-wheel 44, by means of a helical compression-spring 74, Fig. 1, through which extends a rod 75, one end of which is connected to the bar 73 and the other end to a part or lug 76 of the frame of the machine. The inner end of the spring bears against a head 77, fixed to the frame A, in which head the rod 75 is free to slide, and the other end of said spring bears against a head 78 on the rod.

The mode of operation of the foregoing-described side-guide mechanism is as follows: Premising that in the drawings the guide-

plate is in the outward or retracted position, at which time the roller on the end of bar 71 is riding upon the plane portion of the cam-wheel 44 and the roller 63, carried by the nipper rock-shaft, is also riding upon the larger circular part of its cam-wheel 64 and the nipper-leg is raised out of action, it will, be obvious that at a certain stage in the rotation of the driven shaft 40 the roller 72 will, by the stress of spring 74, be caused to enter the depressed portion 45 of the cam-wheel 44, and the roller 63 of the nipper rock-shaft will, by the stress of the spring 58 bearing upon the nipper-arm 57, which latter is, as seen, keyed to the said shaft, ride upon the cut-away portion of the cam 64. As the arm 69 moves inwardly all the hereinbefore-described parts fixedly connected with it will partake of its movement as a unit—that is to say, the sleeve 46 slides on the shaft 40 and the guide-plate with its nipper and the nipper rock-shaft slide inwardly as a unit. This movement is so timed as to begin to take place just prior to the time that the sheet of paper reaches the stop O. At this inward movement of the guide-plate the edge of the sheet of paper 79, Figs. 8 and 10, which has entered the slot 52 in the plate comes into contact with the closed end of the said slot and the sheet is pushed inwardly a greater or less distance, according to the location of the line of the moving sheet, it being understood that the tension of rollers 12 upon rollers 11 is always so adjusted as to hold the sheet lightly, and thus this sidewise movement of the latter may occur while it is held in the bite of said rollers. During the latter part of this movement of the guide-plate the nipper-leg is being rotated by the nipper rock-shaft, owing to the action of the cam 64, and just before the guide-plate has reached the limit of its inward throw the foot of the nipper bites the sheet between it and the bottom of the guide-plates, and thus holds the sheet while the roller 63 is riding upon the rounded portion 80 of the cam 64. As the shaft 40 continues to rotate the roller 72 ascends the cam-face 45, and consequently the guide-plate, with the sheet therein held by the nipper-leg, is retracted, thus bringing the sheet into proper position sidewise, whereupon before the folding-blade descends the rise of the nipper 53 is caused by the roller 63 of the nipper rock-shaft again riding upon the larger circular part 81 of the rotating cam 64, and thus releasing the sheet.

The guide-plate might be connected directly to the sleeve 46—that is, in effect, to the bar 71; but as it is desirable to have a longitudinal adjustment of the said plate without affecting the extent of the lateral throw or movement of the plate and its nipper I employ means for such adjustment. Those shown in the drawings I have found to be very convenient. It will be obvious that by turning the milled wheel 68 of the threaded shaft 67 the outer sleeve, with its attached guide-plate, nipper, spring, and key, may be shifted longitudinally as a whole to the required position.

I have shown the head of the arm of the sleeve 47, which constitutes a nut for the threaded shaft, as bifurcated, the bifurcations being connected by a screw 82, Fig. 8. The purpose of this construction is to permit a certain jamming of the screw-threads, if necessary, in order to hold the parts up to their work and to take up any wear of the screw-threads.

Although I have shown in the drawings mechanism for making the first fold of a sheet of paper, the described side-guide mechanism is used in connection with a folding or foldings of the sheet subsequently to the first fold, there being usually no advantage in using it in connection with the first fold, excepting when the sheet is to be folded on a line parallel with the direction of its movement from the carrying-tapes. In such case the side-guide mechanism suitably adjusted serves to bring the sheet in position for the folding devices to make the fold along the middle line of the sheet.

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

1. In a folding-machine, the combination of suitable folding devices, the stop-bar, the positively-driven roller, adjacent thereto, the coacting friction-rollers, means for simultaneously adjusting the said bar and rollers with relation to the folding devices, without changing the positions of said bar and rollers with relation to each other, together with means for carrying the sheet of paper into the bite of said rollers, substantially as and for the purpose set forth.

2. In a folding-machine the combination of suitable folding devices, the stop-bar, the roller journaled to said bar, the coacting friction-roller connected to said bar, means for simultaneously adjusting said bar and rollers as a unit, with relation to the folding devices, the belt connection whereby the first-mentioned roller is positively driven, and means for maintaining a yielding tension upon said belt; the construction and arrangement being such as hereinbefore described, whereby when the said bar and rollers are adjusted the said driving-belt will be automatically adjusted to correspond with the adjustment of the bar and rollers, substantially as set forth.

3. In sheet-stopping devices for folding-machines the combination of the stop-bar, the screw-threaded shafts upon which said bar is mounted, the bevel-gear and shaft connections whereby the said threaded shafts may be simultaneously rotated and the bar be thereby adjusted, the roller journaled to said bar, the coacting friction-rollers connected to said bar, and means for imparting a continuous rotary movement to the first-mentioned roller, substantially as and for the purpose described.

4. In a folding-machine, the combination

with suitable folding devices, of sheet-carrying tapes or the like, the friction-rollers superposed thereon, the stop-bar, the positively-driven roller adjacent to said bar, the superposed friction-rollers, coacting with said roller, and means for supporting and directing the sheet of paper into the bite of said positively-driven roller and its coacting friction-rollers, substantially as and for the purpose set forth.

5. In a folding-machine, mechanism for side placement or adjustment of the sheets of paper to be folded, consisting of the combination with suitable folding devices, of means for carrying the sheet into position to be folded thereby, the rotatable shaft, the cam thereon, the nipper rock-shaft, the slotted guide-plate, the nipper secured to said rock-shaft, a longitudinally-movable bar or the like to which the said guide-plate and nipper are connected, and which bar bears against the aforesaid cam; together with the cam upon the said rotatable shaft, adapted to actuate the said rock-shaft and its nipper; substantially as and for the purpose set forth.

6. In a folding-machine, the combination of suitable folding devices, the rotatable shaft, 40, the cam-wheel, 44, thereon, the slotted guide-plate adapted to slide upon said shaft, the bar connected to the guide-plate, and adapted to bear against said cam-wheel, the nipper rock-shaft connected with the said bar, the nipper mounted on said shaft, the cam, 64, upon the said rotatable shaft, the arm on the nipper rock-shaft, the roller carried thereby, means for maintaining said roller in contact with said cam, 64, all constructed and adapted to operate substantially as and for the purpose set forth.

7. In a folding-machine, the combination with suitable folding devices, of the rotatable shaft, 40, the cam, 44, thereon, the sleeve, 46, adapted to slide on said shaft, the sleeve, 47, adapted to slide upon sleeve, 46, the slotted guide-plate and its coacting nipper attached to said sleeve, 47, the bar connected to the sleeve, 46, and adapted to be operated longitudinally by the cam, 44, the screw-threaded journaled shaft connected with said sleeve, 47, the rock-shaft upon which said nipper is mounted and upon which shaft the guide-plate and nipper are adapted to slide, and means, substantially as described, for vibrating said shaft at predetermined intervals, whereby the position of the guide-plate and adjuncts may be varied without affecting their operation substantially as set forth.

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

HOWARD K. KING.

Witnesses:
ANDREW V. GROUPE,
WALTER C. PUSEY.