3 Sheets—Sheet 1.

L. C. BUFFINGTON.

Paper-Folding Machine.

No. 217,857. Patented July 29, 1879.

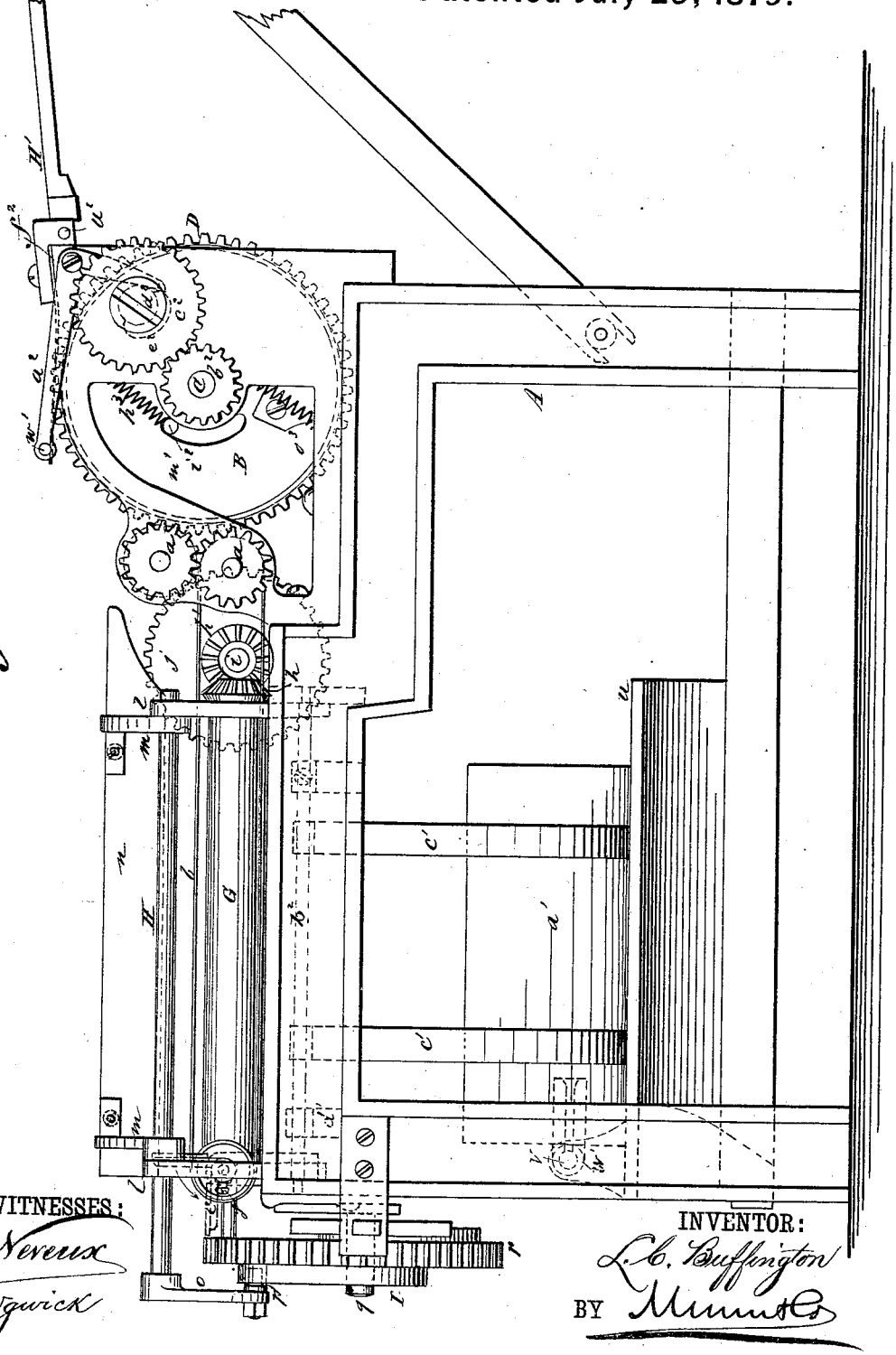

Fig. 1.

WITNESSES:

C. Nereux

C. Sedgwick

INVENTOR:

L. C. Buffington

BY Munn & Co

ATTORNEYS.

3 Sheets—Sheet 2.

L. C. BUFFINGTON.

Paper-Folding Machine.

No. 217,857. Patented July 29, 1879.

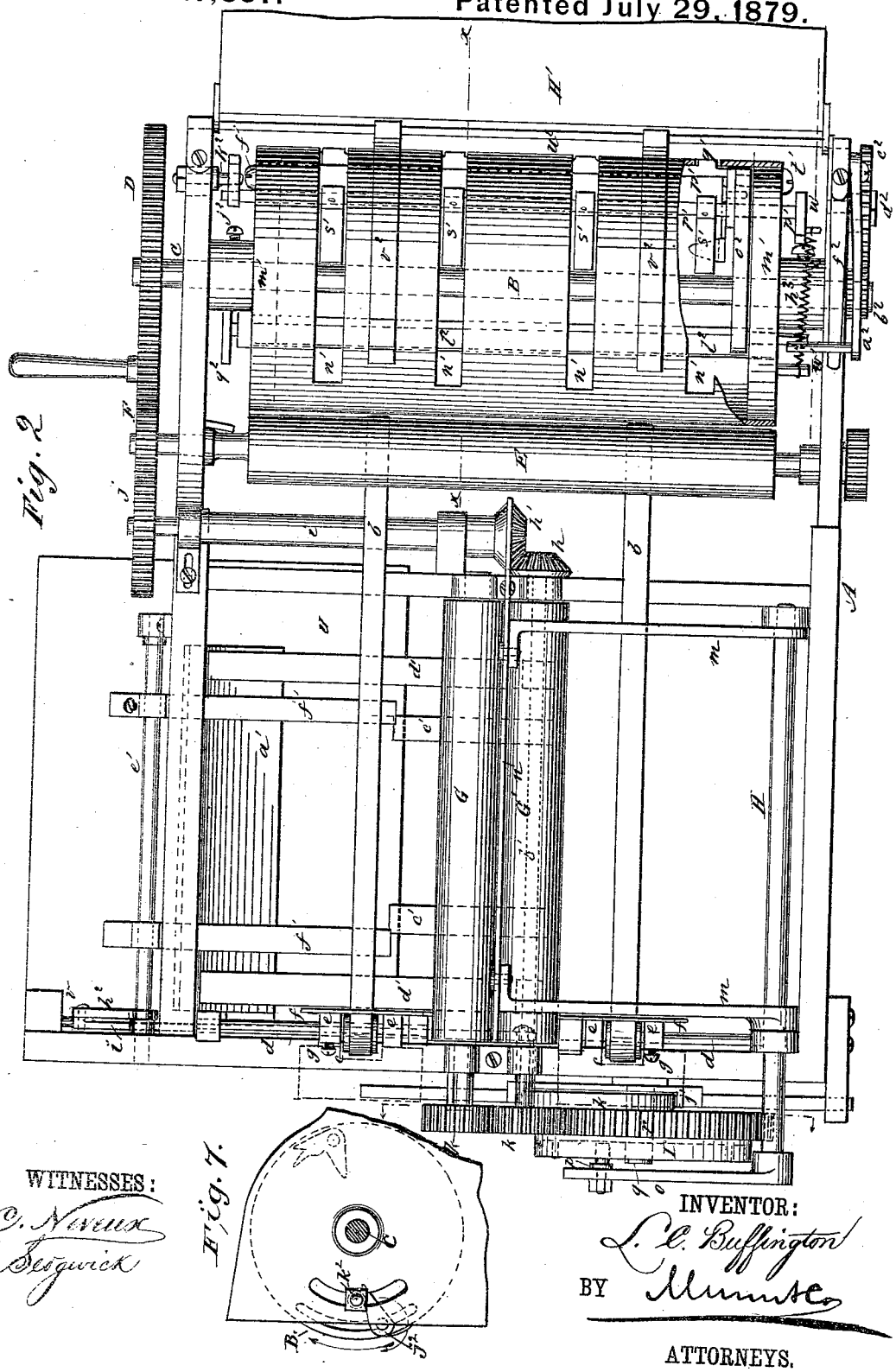

Fig. 2

Fig. 1.

WITNESSES:

C. Neveux

C. Sedgwick

INVENTOR:

L. C. Buffington

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ATTORNEYS.

3 Sheets—Sheet 3.

L. C. BUFFINGTON.

Paper-Folding Machine.

No. 217,857. Patented July 29, 1879.

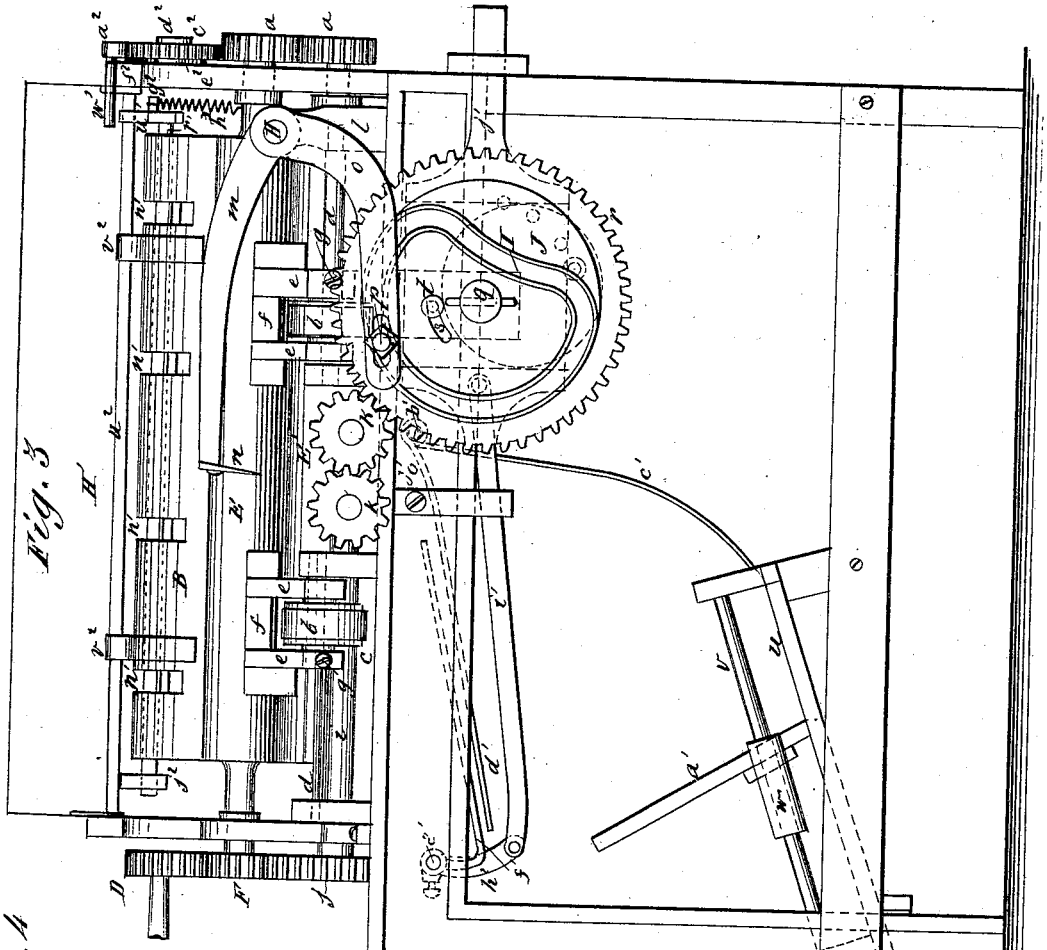

Fig. 3.

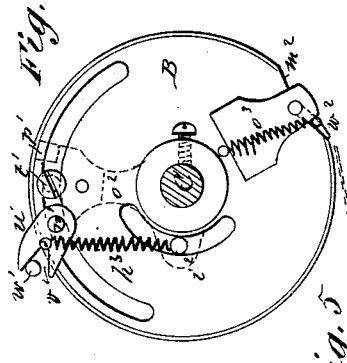

Fig. 4.

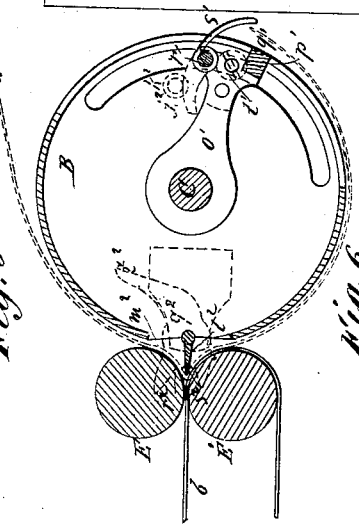

Fig. 5.

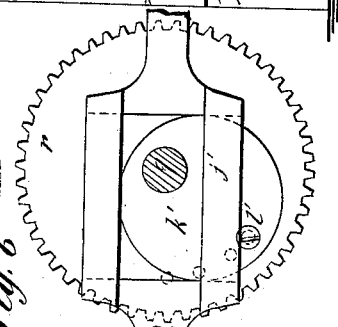

Fig. 6.

WITNESSES:

C. Neveux

C. Sedgwick

INVENTOR:

L. C. Buffington

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

LEWIS C. BUFFINGTON, OF CINCINNATI, OHIO, ASSIGNOR TO HIMSELF AND CHARLES B. MURRAY, OF SAME PLACE.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **217,857**, dated July 29, 1879; application filed March 5, 1878.

To all whom it may concern:

Be it known that I, LEWIS CASS BUFFINGTON, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and Improved Paper-Folding Machine, of which the following is a specification.

The object of this invention is a machine to make one or more folds in sheets of different sizes, and deliver the folded sheets in a convenient form.

My machine is also adapted to be fed by hand or to be attached to the delivery end of a printing-press and fed by it.

The invention will be fully understood from the following description of the accompanying drawings, and specifically pointed out in the claims.

Figure 1 is a side elevation of the machine. Fig. 2 is a plan view. Fig. 3 is an end elevation. Fig. 4 is a detail view of one of the cylinder-heads. Fig. 5 is a transverse section of cylinder and rollers for completing the first fold, taken in line $x\ x$, Fig. 2, looking in the direction of the cylinder-head opposite to the one shown in Fig. 4. Fig. 6 is a detail view of the eccentric and cross-head for operating the packer. Fig. 7 is a detail view of part of the machine, showing the adjustable pin for operating the cams of the nipper-shaft and folding-blade.

In the different figures similar letters of reference indicate like parts.

Referring to the parts, A is the frame of the machine, and B a cylinder mounted upon shaft C, its two heads being keyed to the shaft and the shaft journaled in suitable bearings at the front end of the machine.

In the shell of the cylinder are four circumferential slots, n', through which a similar number of nippers, s^1, are adjustable within said slots by means of a nipper-frame journaled upon shaft C within cylinder B.

The nipper-frame consists of two arms, $o^1\ o^2$, journaled upon shaft C near the cylinder-heads m^1, said arms being united rigidly by a bar, p^1, and a nipper-shaft, r^1, journaled in the outer ends of these arms.

The nipper-shaft has rigidly secured to it the nippers s^1, and cams w' and j^2 upon its opposite ends outside of the cylinder-heads, the shaft r^1 projecting through circumferential slots in said heads for this purpose. The bar p^1 has serrated or milled projections q^1 extending through slots n' to the periphery of the cylinder, forming stationary jaws, between which and the nippers s^1 the paper is held.

The frame is adjusted and secured in any desired position within the range of slots n' by a set-screw, t, which enters the arms $o^1\ o^2$ through circumferential slots in the cylinder-heads.

The devices for closing the nippers s^1 at the same point in front of the feeding-table H′ are a rectangular lever, a^2, fulcrumed upon a pin in the side of the machine, said lever carrying a pin, w^1, at its upper end, and the devices for operating said arm. The lower end of arm a^2 is held in contact with the face of a cam, c^2, which is secured upon the face of a spur-wheel, c^2, by a flat spring, f^2. The cog c^2 is journaled upon a stud, d^2, secured to the frame of the machine, and is driven by a pinion, b^2, upon the shaft C. The proportions of the cogs d^2 and c^2, as shown, will bring the pin w^1 in the path of a notched cam, w', upon the shaft r^1, and close the nippers s^1 at alternate revolutions of the cylinder B.

The devices to open the nippers and return the cam w' in a position to be again acted upon by pin w^1, are a cam, j^2, secured upon the opposite end of shaft r^1 and a pin, k^2, secured in a slot in frame A, said slot being concentric with shaft C, in order that the pin may be readily adjusted to open the nippers by being in the path of cam j^2 at whatever point in the range of its adjustability the nipper-frame is secured. A spring, k^3, has one end secured to the cam w' by means of a stud, g^2, and the opposite end to a pin, i^2, projecting from arm o^2, through a slot in the cylinder-head near the hub, to complete the motion of the nippers s^1 one way or the other after they have been turned past the dead-center by cams w' and j^2, pressing them upon the projections q^1, or holding them back beneath the periphery of the cylinder, and retain the cams u and j^2 in position to engage pins w^1 and k^2, respectively.

In the periphery of the cylinder, nearly opposite the center of the slots n', is a longitudinal slot, m^2, within which a folding blade, l^2,

is centrally journaled in boxes secured to the cylinder-heads.

One end of the blade-shaft projects beyond its box to receive a cam, q^2. This cam has a notch, r^2, which engages a pin, s^2, secured in the frame A opposite the space between the rollers E E^1, said rollers being arranged, one above the other, in proximity to the cylinder B, and parallel to it.

The inclined edges of the notch r^2 of the forked cam, moving along the fixed pin s^2, first cause the projection of the edge of the folding-blade l^2 in a path about concentric to the surface of the upper roller, and then its withdrawal in a path similarly concentric to the surface of the lower roller. By reason of this movement the folding-blade can be very gradually projected and retracted, avoiding all danger of tearing the sheet.

The cam q^2 also has a curved finger, t^2, which engages the stud k^2 as the cylinder revolves and returns the blade l^2 and notch r^2 in position for the next operation.

A spring, o^3, has one end attached to an arm, w^2, which is secured to blade l^2, and projects beyond the cylinder-head and its opposite end to a pin, p^2, that projects from the head near the hub. This spring completes the movements of the knife in either direction after its journals are drawn past the center.

The cylinder B, with its attachments and devices for opening and closing the nippers and operating the folding-blade, in combination with the folding-rollers E E^1, constitute that part of my invention which produces the first fold in the paper. Having described the construction and arrangement of these parts separately considered, I will now describe how they operate in combination to produce the desired result.

Preliminarily, it should be understood that the power should be applied to shaft C in any well-known manner. Secured upon this shaft is a spur-wheel, D, which meshes into a pinion, F, upon the shaft of the upper folding-roller, E. The rollers E E$'$ are geared together by pinions a a upon the opposite ends of their shafts, and in order to avoid strain upon the sheet they are given a surface speed slightly less than that of the cylinder B, so as to slightly slacken the sheet as it is fed off from the cylinder to the folding-rollers.

To feed the machine by hand a pile of papers is placed upon the table H$'$, which may be dropped out of the way when not in use, and the sheets are fed over the guides v^2 one at a time. As the cylinder revolves, the cam w', engaging the pin w^1, closes the nippers s^1 upon the edge of the sheet, which is at that moment over the serrated projections q^1. The sheet is now carried around by the cylinder, as indicated by dotted lines in Fig. 5, until released by cam j^2 engaging pin k^2 and opening the nippers. Simultaneously with this operation the notch r^2 in the cam q^2 engages the pin s^2, turning the blade l^2, which delivers the sheet to the folding-rollers E E^1, from which it emerges folded once. The engagement with the pin k^2 of the cams upon the ends of the nipper and knife shafts turns the knife and nippers into position to act upon the next sheet. The cam e^2 holds the pin w^1 out of the path of the cam w' during the revolution of the cylinder next succeeding the opening of the nippers, and the cylinder revolves without taking a sheet, so as to give the operator the time of one idle revolution to feed his sheet to the nippers.

It is evident the pin s^2 could be controlled in the same way as pin w^1, so as to operate the blade l^2 at alternate revolutions, and when the machine is attached to the delivery end of a printing-press to take and fold papers from it the pin w^1 may be made stationary, like pin s^2, to close the nippers at each revolution of the cylinder. The blade l^2 may also be worked alternately by providing a pin like w^1 to operate the curved finger t^2.

To adjust the machine to fold different-sized sheets the clamping-screws t^1 in arms o^1 o^2 are loosened and the nipper-frame moved nearer to or farther from the blade l^2 in its path of travel, as smaller or larger sheets are to be folded, and the screws again tightened to clamp the frame in the desired position, and the pin k^2 is adjusted in its slot to release the paper when the part to be folded has reached a point opposite the junction of rollers E E^1.

The part of the machine for forming a second fold is driven by a spur-wheel, j, upon shaft i, which meshes into pinion F upon the shaft of the folding-roller E.

The outer journal-box of shaft i is slotted, so as to throw the wheel j in or out of gear with pinion F, to couple the second-fold mechanism with, or uncouple it from, the mechanism for forming the first fold.

Tapes b run over the lower roller, E^1, and over pulleys c, journaled on rods d at the opposite end of the frame A. Their distance apart, to adapt them to deliver sheets of different widths, is adjustable on the rods d, said pulleys being held in their places on said rods by arms e, that are apertured and attached to the stop-pieces f.

The arms e are provided with set-screws g, by which they are adjusted in any desired position. When the second-fold mechanism is uncoupled these stops are turned back. Thus set, they guide the once-folded sheet over the gearing at the rear end of the machine, to be received in any suitable manner.

I will now describe the mechanism for making the second fold.

Two rollers, G G$'$, are journaled in frame A at right angles to rollers E E^1, one on each side of the middle of the frame. One is driven by a miter-wheel, h, secured to its shaft, which meshes into a miter-wheel, h^1, upon driving-shaft i. Upon the opposite ends of the rollers are pinions k, which mesh into each other and cause the rollers to rotate together.

Journaled in standards l upon one side of the machine is a shaft, H. Secured to this

shaft are arms m, which extend over the rollers G G′ and carry a folding-blade, n. A curved arm, o, also keyed to shaft H and extending downward, has a stud, p, secured in a slot in its end. The pin p enters a grooved cam, I, which cam is adjustably secured to the spur-wheel r. The spur-wheel r is journaled upon a stud, q, and driven by pinion k upon the roller G.

The purpose of the slot in the lower end of arm o is to adjust the stud p to regulate the depth the blade n should pass between the rollers.

As the sheet emerges from the rollers E E^1 once folded, it is carried by tapes b against the stops f, when the blade n descends and carries it into the bite of the rollers G G′, through which it emerges, completing the second fold.

The devices for packing the folded paper will now be described.

In the lower part of the frame A there is an inclined board, u, for receiving the papers as they are folded. At one side of the board u there is a rod, v, upon which rod there is a sleeve, w, to which is secured a follower-board, a^1, the board a^1 being inclined with its top toward the delivery side of the machine. Below and parallel with the rollers G G′ there is a rod, b^1, from which two curved guides, c^1, extend downward to the upper edge of the inside end of the board u, for preventing the paper from escaping from the ends of the packer-arms f^1. Two curved arms, d^1, extend from the rod b^1 toward the delivery side of the machine, to receive the papers from the rollers G G′. One of the arms d^1 is adjustable upon the rod b^1.

A rock-shaft, e^1, is journaled at the delivery side of the machine, and carries two packer-arms, f^1, one of which is adjustable, and both are capable of passing between and above the arms d^1 and swinging down into a nearly-vertical position in front of the follower-board a^1.

Upon the shaft e^1 there is a short arm, k^2, which is connected by a rod, i^1, with a sliding cross-head, j^1, which is placed in guides at the rear end of the frame A, and is moved by an eccentric, k^1, on the inner side of the spur-wheel r. The eccentric k^1 is secured to the back of the spur-wheel r by means of a screw, l^1.

As the paper emerges from the rollers G G′ it passes upon the holding-arms d^1, and beneath the packer-arms f^1, when the packer-arms are moved downward by the eccentric k^1, carrying with them the folded sheet, which is placed against the follower a^1, their lower edges resting upon the board u. As the papers accumulate, the packer-arms move the board a^1 back, and as this is guided by the sleeve w, sliding over the rod v, the board a^1 will always slide without locking. As the papers accumulate, the packer-arms move the follower a^1 and the folded papers back. The follower is guided by sleeve w, sliding over rod v, and as the packer-arms press the papers back at a point opposite the rod v, the follower will slide without locking, and papers of different sizes may be received and packed without requiring any change to be made in either the receiving-board u or follower a^1.

The cam I is formed in the face of a disk, J, and the disk has an arc-shaped slot, s, through which a screw, t, passes to clamp the cam I to the spur-wheel r. The cam is adjusted by this means for the purpose of making the packer-arms f^1 and blade n time with each other. The spur-wheel, with its eccentric and cam, forms a very compact and convenient means of operating the packer-arms and folding-blade, and dispenses with the use of cam-shafts.

When the machine is attached to a cylinder printing-press and fed directly from it, the cylinder will be of a size to conform to the size and speed of the press-cylinder, and be so placed at the delivery end that the nippers of the machine will clamp the edges of the sheets as they are delivered one at a time already cut into proper sizes.

When sheets are delivered from the cylinder at every revolution it will be necessary to change the relative proportions of the spur-wheels D on the shaft C and j on the shaft i in such manner as to cause the rollers G G′, blade n, and packer-arms f^1 to double their speed to fold and pack the papers as fast as delivered from the rollers E E^1. To increase the number of folds it is only necessary to duplicate the parts herein represented.

It is evident that by slightly changing the proportions of the notched cam q^2 and varying the position of the notch r^2, the shaft of the roller E may be made to perform the function of the pin s^2.

I claim—

1. The combination, substantially as specified, of the circumferentially-slotted cylinder, the nippers, the nipper-shaft, and the adjustable bearings of the nipper-shaft pivoted on the cylinder-shaft.

2. The combination, substantially as specified, of a nipper-carrying frame journaled within cylinder B upon shaft C, and a clamping-screw, t^1, passing through a circumferential slot in the cylinder-head, to clamp the nipper-frame in any desired position, substantially as herein shown and described.

3. The combination, substantially as specified, of the circumferentially-slotted cylinder, the nippers, and the nipper-frame bar within the cylinder, provided with projections extending through the cylinder-slots to the exterior surface thereof.

4. A nipper-frame capable of circumferential adjustment within cylinder B, and having nipper-shaft projecting through a circumferential slot in one of the cylinder-heads, and carrying a cam, j^2, in combination with a stud, k^2, capable of adjustment in a slot in the frame A, said slot being concentric with the axis of shaft C, so that pin k^2 may be set to open the nippers to release the sheet at any desired point.

5. In combination with the adjustable nipper-frame, having a nipper-shaft, r^1, loosely

journaled in arms o^1 o^2, as described, a spring, h^3, having one end attached to arm o^2, and the opposite end to cam u' upon shaft r^1, to complete the movements of the nippers in either direction after they have been turned past the dead-center by the engagement of cams u' and j^2 with pins w^2 and k^2, so as to close the nippers within the cylinder or bring them down upon the projections q^1, to clamp and hold the sheet.

6. The folding-blade l^2, having a cam, q^2, with a notch, r^2, and curved finger t^2, secured upon its journal-shaft, in combination with pins s^2 and k^2 and spring o^3, said pins being secured in the frame in the path of the cams, substantially as described.

7. In a folding-machine having a longitudinally-slotted cylinder with a folding-blade journaled therein, as described, the combination, substantially as specified, of the cam q^2, secured upon the end of the blade-journal, and having notch r^2 and curved finger t^2, pins s^2 and k^2 to turn the blade, with spring o^3 to complete the motion of the blade in either direction, and retain the cam in position to be again acted upon by the pins s^2 and k^2, respectively.

8. The combination, substantially as specified, of the rollers for making the first fold, the folding-blade of the cylinder, the forked cam on the axis of the folding-blade, and the fixed pin in the path of the fork of the cam to operate on both legs thereof, whereby the folding-blade is projected and withdrawn in paths about concentric to the surfaces of the folding-rolls.

9. In combination with cylinder B, carrying a folding-blade and adjustable nippers, with the ends of their shafts projecting beyond the cylinder-head, with actuation-cams t^2 and j^2 secured thereon, the pin k^2, adjustable in a slot in the frame A, the said slot being concentric with the axis of the cylinder-shaft, so that at whatever point the pin k^2 may be adjusted it will be in the path of both cams, substantially as described.

10. In a folding-machine, the combination of tape-pulleys c c, adjustable upon rod d, for delivering papers of different widths, and adjustable stops e f g, said stops being also adapted, when turned back, to serve as guides for delivering the papers, when folded once, over the gearing at the rear end of the machine.

11. The oscillating packer-arms f^1, the paper-holding arms d^1, and the guides c^1, in combination, substantially as herein shown and described.

12. In combination, the inclined board u, inclined follower a^1, packer-arms f^1, holding-arms d^1, and guides c^1, said board and follower being capable of receiving papers of different sizes without adjustment, substantially as described.

L. C. BUFFINGTON.

Witnesses:
R. H. HAMMOND,
C. A. PARTRIDGE.