2 Sheets—Sheet 1.

L. C. CROWELL.

PAPER-FOLDING MACHINE.

No. 186,309. Patented Jan. 16, 1877.

Fig. 4.

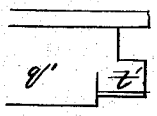


Fig. 1.

Fig. 3.

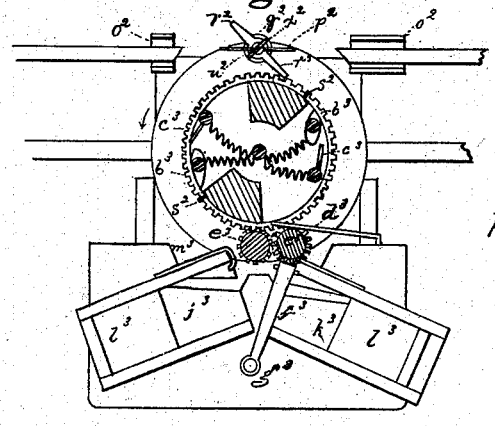
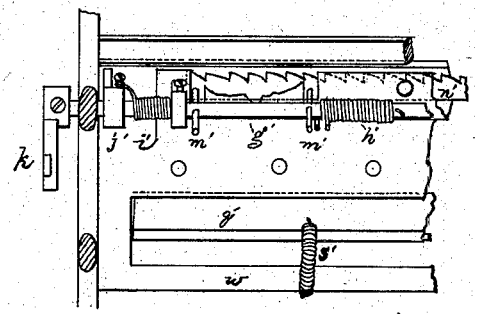


Fig. 7.



Witnesses

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2 Sheets—Sheet 2.

L. C. CROWELL.

PAPER-FOLDING MACHINE.

No. 186,309. Patented Jan. 16, 1877.

Fig. 2.

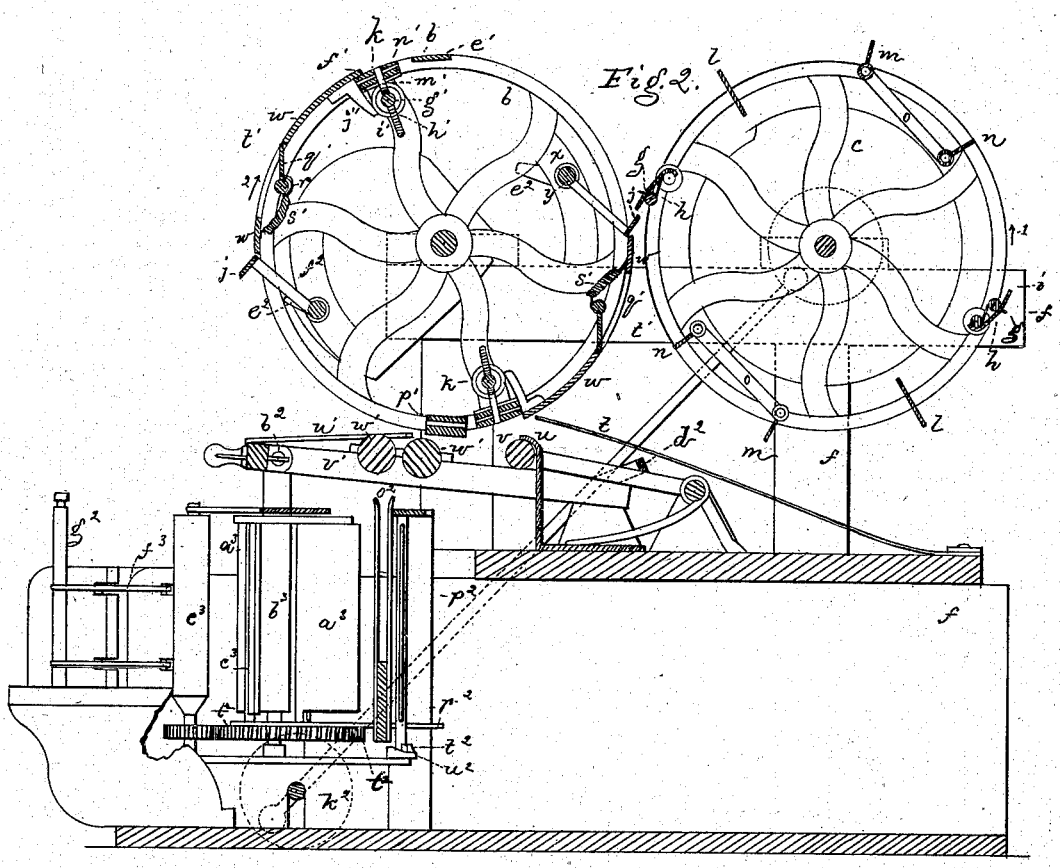


Fig. 6.

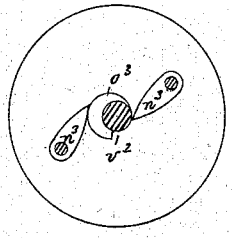
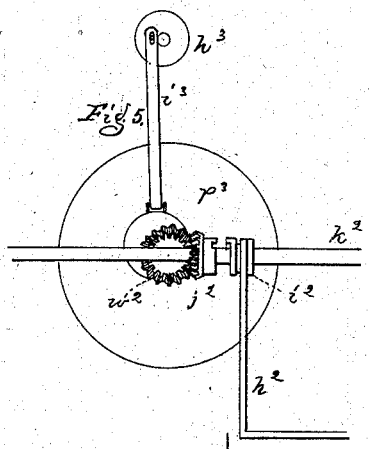


Fig. 5.



Witnesses.

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UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **186,309**, dated January 16, 1877; application filed June 6, 1876.

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, of Boston, county of Suffolk, and Commonwealth of Massachusetts, have invented Improvements in Paper-Folding Machines, of which the following is a specification:

This invention relates to mechanism for folding and delivering paper, and is specially adapted to fold paper passing from a cylinder or perfecting web press. The paper, passing through the press in continuous length from a roll, and, being taken by the folding mechanism, is folded in a direction transverse to its length and cut, and is then folded in an opposite direction, ready for transmission through the mail, or for other purposes.

This invention consists in the combination, with a cylinder or carrier and a pivoted or swinging folding-blade, of a stop or deflector, to throw outward the edge of the folding-blade to fold and direct a piece of paper into the bite of a pair of feeding-rollers; also, in the combination, with the fold-nipping mechanism and its carrier, of supplement-cutters, to sever the folded edge of the paper to produce half-sheets, as for supplements; also, in the combination, with mechanism adapted to fold a sheet in a line parallel with the axis of the folding cylinder or carrier, of an adjustable roller carrying frame, which may be thrown into or out of operation when it is desired to form a second fold in a once-folded paper; also, in a hinged folding-blade and a feeding device, arranged to form a second fold in a sheet of paper, in combination with a guide, a hinged or pivoted folder, and mechanism working in connection therewith, to form a fold substantially at right angles to the second fold, as set forth, and in other features of invention hereafter described.

Figure 1 is a side elevation of a folding mechanism provided with my invention; Fig. 2, a longitudinal section thereof, except through the vertical folding mechanism. Fig. 3 is a cross-section taken through the vertical folding mechanism. Fig. 4 is a view of the hinged folder detached; and Figs. 5 and 6 are details, to which reference will be hereafter made; and Fig. 7 is an enlarged detail of the supplement-cutting mechanism.

The shaft *a* of the rotating cylinder or carrier *b* is, in this instance, the driven shaft, and the cylinder *c* is connected and moved with it through pinions *d e*, the shafts of the cylinders being mounted in bearings on the frame *f*, of any suitable construction to properly sustain the working parts. When the folding-machine is to be employed to fold newspapers or other printed matter issuing from a printing-press, the cylinder *c* is placed at the delivering end of the press, with its axis parallel with the axis of the printing-machine cylinders, and the paper passing from the press is impaled on the points or holding-pins *g*, that project through slots in a movable cutting-blade, *h*, having its edge *i* preferably serrated, it acting as one member of a cutting mechanism, the other member being the fly *j*, Fig. 2. This figure shows one set of holding-pins, *g*, just coming into position to engage the paper (not shown) issuing from the press. The other corresponding set of holding-pins and its blade *h* are in the position they would occupy immediately before severing the sheet of paper. The paper or sheet severed by the action of the movable cutting-blade *h*, and the edge of the fly *j* extended, prior to its being severed, from the fold-nipping mechanism *k*, (composed of several parts to be described,) and the holding-pins. Assuming that the folding-pins at the right-hand side of Fig. 2 have just entered the paper, the rotation of the cylinder *c* in the direction of the arrow 1 will carry the paper (which, in operation, is already engaged and held by the holding-pins at the left of the cylinder *c*) about the cylinder, over the support *l*, the folder *m*, and the slacker *n*, the latter being carried by arms *o*. Projecting pins *p* on the slacker *n* rest on the stationary cams *q*, (one at each side of the machine,) provided with depressed parts, to allow the slacker *n* to fall just as the folder *m* commences to enter between the jaws f^1 e^1 of the fold-nipping mechanism *k*. (See Fig. 2.)

The folder *m*, to fold a newspaper centrally, is placed on the cylinder midway between the series of holding-pins *g*, the latter holding that portion of the paper constituting the edges of the newspaper. These holding-points and folding-blades will be placed at such distances apart upon the cylinder as to hold and fold at the desired places. It will be

noticed that in this instance the cylinder c carries two sets of holding-pins, two supports, folders, and slackers. When a movable cutting-blade, in the rotation of the cylinders, reaches a fly, j, the paper is severed, and the end of the paper, caught on the holding-pins, is carried toward the lower side of the cylinder c. During this movement the folder m comes opposite the jaws f^1 e^1 of the nipping mechanism, presses the paper lying on it between the jaws, folding the paper transversely, the slacker-bar giving up paper to form the fold. The jaws grasp the fold firmly, and as the fold is commenced a finger, r, on the shaft of the movable cutter, acts on a projection, s, (see Fig. 1,) and turns the movable cutter to strip the paper from the holding-pins g. The nipping mechanism k holds the folded portion of the sheet just discharged by the movement of the cutter h, but the free end of the paper drops upon the support t, (preferably a sheet or strip of light spring-metal,) the edge of which holds such free end up toward the cylinder b and away from the holding mechanism, composed in this instance of a lip, u, and a yielding roller, v. When the cylinder b, carrying the folded part of the paper, moves far enough in the direction of its arrow 2 to bring a movable cutting-blade and fly together, the paper is again severed, and the nipping mechanism then holds a newspaper with two free ends, both of which are held up by the support t against the smooth face w of the cylinder. The fly j in this instance is a bar carried at the ends of arms projecting from a shaft, x, having connected with it at one end a spring, y, the tendency of the spring being to hold the fly against the cross-plate or face w. The shaft x has attached to it (see Fig. 1) an arm, a^1, that, as cylinder b rotates, strikes a stop, b^1, just as the two free ends of the newspaper held by the nipping mechanism are passing between the fly and the roller v of the holding mechanism, and when the arm engages the stop the fly-shaft is turned, (the cylinder continuing to move,) and the fly thrown out away from the cylinder in a tangential direction, presses the free ends of the paper down on the roller v, or on other paper, or a pile of papers, already folded and deposited there. The holding mechanism holds each paper while the folded portion is released from the nippers. As the fly releases the free ends of the paper they are caught and held between the lip u and the roller held pressed upward by a spring coiled about the shaft c^1, from which project the roller-carrying arms d^1.

At the opposite end of shaft x from that shown in Figs. 1 and 2 is an arm, e^2, that, as the fly leaves the paper and the roller v bears against a cam, f^2, holds the fly, and permits its axis x to turn gradually back to the position shown between the cylinders b and c, or to cutting position.

The action of the parts so far described will deposit papers once folded in a pile, and their folded edges will be placed substantially parallel or uniform, sufficiently so to be taken away in a pile, ready for rapid hand-folding.

This fly, carried by the rotating cylinder b, may be thrown out and in at the proper times, to operate as described, by other devices than those shown and just described.

In case half-sheets or supplements are to be delivered, it is only necessary to set up the types to print half-sheets, and the folding goes on as usual; but to separate the half-sheets, there is arranged, in connection with the nipping mechanism, a supplement-cutting mechanism. (See Fig. 2.)

The nipping mechanism is composed of a stationary bar or jaw, e^1, extending across the cylinder b, and a movable jaw, f^1, faced preferably with india-rubber or leather, and carried at the ends of arms projecting from a shaft, g. In this instance of my invention, the arms are loosely connected with the shaft g^1, a spiral spring, h^1, being connected with the shaft and with the arms, so as to allow the arms to move for a short distance about the shaft when desired, a spring, i^1, connecting an arm on the shaft, and a stud, j^1, on plate w, so as to throw the jaw f^1 away from its stationary jaw e^1.

At the proper time for the nipping mechanism to close on the paper presented by the folder, an arm, k^1, Fig. 1, meets the cam l^1, and closes the jaws, and the arm bears on this cam as long as it is necessary to hold the folded paper; but when it is to be released, then the arm passes beyond the cam, and the spring i^1 throws back the movable jaw f^1.

On the shaft g^1 are arms m^1, to the outer ends of which is attached a cutting-blade, n^1, the latter being guided in an opening made for its reception in the jaw f^1, and the springs h^1 are connected, one end to these arms m^1, and the other to the arms of the jaw f^1.

Now, to operate the supplement-cutting mechanism, or the blade n^1, the movable cam-piece o^1 is thrown up into action, so as to give arm k^1 a greater movement, which causes the shaft g^1 to move after the jaw f^1 meets jaw e^1, and carries with it the blade n^1, which passes through the folded paper near the extreme edge of the fold, and cuts the paper into half-sheets. At the lower side of cylinder b is shown a modified form of cutter, and instead of using the jaw e^1 as the cutting-edge, there is connected with e^1 a spring-blade, p^1, the spring-blade being connected at one end only, and extending diagonally across the edge of the cutter n^1, and, being a spring-blade, it wipes along the edge of n^1, producing a shear-cut.

On the cylinder b are pivoted or hinged folders q^1, they being plates connected, each with a shaft, r^1, held in the position shown in Fig. 2, by a spring, s^1, and each blade has a finger, t^1, adapted to engage a stop or deflector, w^1, on an adjustable roller-carrying frame, v^1, provided with feeding-rollers w^1, having pin-

ions x^1 gearing together, and adapted to be thrown into engagement with teeth d of cylinder b, whenever it is desired to fold the paper a second time. This frame v^1 is pivoted at a^2, has locking-pins b^2, adapted to be placed in one of the two holes c^2, to hold the pinions x^1 up in engagement or out of engagement with teeth d. When lifted into engagement a bar, d^2, acts on arms d^1 of the roller v, and depresses the roller, so that it cannot rise under the action of the spring and press the ends of the paper up against the lip u. As the frame v^1 is lifted it moves a lever, g^2, connected with a lever, h^2, that slides a loose toothed hub, i^2, into engagement with a bevel, j^2, on a shaft, k^2, provided with a crank, l^2, connected by link m^2 with a crank, n^2, on the shaft of cylinder c, the shaft k^2 getting its motion in this instance from shaft of cylinder c, in this way; but many different devices or modes of connection might be employed instead of the connections shown.

The frame v^1, when in its elevated position, places the deflector u^1 in the path of the finger t^1 of the pivoted folder q^1, and stops or detains the folder, causing its edge to turn outward from the cylinder b, and to bear against the paper already once folded, and fold it and press the bight or fold between the faces of the moving rollers w^1 w^1, which then carry the paper away, folding and feeding it into a guide, o^2, it being a series of upright narrow plates, at the side of which is a vibrating double folder, p^2, connected with a vertical shaft, q^2, supported in bearings, and provided with fingers r^2, adapted to be struck by projections s^2 (see Fig. 3) on a toothed wheel, t^2, on the vertical folding-cylinder, adapted to fold the papers in a direction opposite to the direction in which they were folded by cylinders b c. A pin, x^2, at the lower end of shaft q^2, rests on a double inclined crown-cam, u^2, which serves the purpose of turning the shaft q^2 of the double folder back to its normal position after each operation, the weight of the shaft and folder being sufficient to ride down the cam-faces. The shaft v^2 of the vertical folding apparatus has at bottom a bevel-gear, w^2, engaged by the bevel j^2 on the shaft k^2. This vertical cylinder is provided with nipping-jaws a^3 b^3, and with movable vertical folders c^3, held by springs and provided with fingers, as are movable folders q^1, a deflector, d^3, engaging such fingers to throw the vertical movable folders c^3 outward, to cause them to fold the papers passed from the guide o^2 by the double folder p^2, and held between the parts a^3 b^3 of the vertical nipping mechanism, and as the papers so folded are carried around by the vertical cylinder, each vertical folder c^3, under the action of the deflector d^3, folds the paper, and forces the fold made through or into the bite of the vertical rollers e^3, provided with gear, and operated from the pinion t^2. The shaft of each jaw b^3 has a shoe, n^3, Fig. 6, that bears against a stationary cam, o^3, on a plate, p^3, in which the shaft v^2 turns.

In Fig. 6, the shoe n^3 at the right is just about to strike the cam o^3, and the cam will move n^3, and throw the jaw b^3 toward the jaw a^3, and cause the jaws to grasp a folded paper, and carry it beyond the rollers e^3, and after the folder c^3 folds the paper, the shoe n^3 leaves the cam o^3, and the springs connected with the jaws (see Fig. 3) open the jaws and release the paper. Papers issuing from between the vertical rollers e^3, in this instance folded four times, are fed rapidly into a mailing or wrapping box, in which is placed a packer, f^3, it being a vibrating arm carried by a rocking-shaft, g^3, at the lower end of which is a crank, h^3, connected by link i^3 with an eccentric strap embracing an eccentric on the shaft v^2. The papers are moved alternately into the boxes j^3 k^3, in which are placed movable slides l^3, which are gradually moved back as the boxes and slides are filled. The papers are prevented from crowding backward to the rollers e^3 by spring-fingers m^3. With the packer I may connect a counting mechanism, to indicate the number of papers folded.

It will be seen, by those conversant with mechanism, that the mechanical details for operating the parts actively engaged to fold the paper and deliver it, as described, can be varied without departing from this invention, as equivalently operating, connecting, and driving mechanisms may be employed.

The principal element of the supplement-cutter is a blade carried by a nipping-jaw, and adapted to slide on or in such jaw, and in this part of my invention it will be noticed that the blade is moved to sever the paper after the paper is grasped and held by the jaw, and the movable jaw and cutter are both moved by the same shaft, the jaw, however, being connected with the shaft, so that the latter, with the blade, can move farther than the jaw.

This feature of my invention could be carried out by many different connecting and operating devices other than those shown, which would be mere equivalents; so I do not limit this feature of my invention to the mechanism shown.

The supplement-cutter might be placed in connection with the stationary jaw, and have mechanism arranged to operate it, after the jaws met to grasp the paper. Springs r^3 restore the folders c^3 to position against jaws b^3, after passing out from between the rollers e^3.

The part u of the holding mechanism might be hinged and arranged to be moved backward as the fly presses the paper down, and to come forward over the end of the paper like a hook when the fly moves away.

A spring bar or rod might take the place of support t.

In this application I have described a fly for operating in connection with the sheets of paper; but I do not, however, claim such device broadly, or combined with the cylinders b c and their folding devices, as such

elements form the subject-matter of another application filed in the United States Patent Office November 11, 1875.

I claim—

1. The rotating cylinder *b*, and the hinged blade or fly pivoted thereto, and adapted to operate, substantially as described, in combination with a holding mechanism, substantially as described, to hold the free ends of the newspaper discharged from the jaws of the cylinder, substantially as herein set forth.

2. The hinged blade or fly, its spring *y*, arms e^2 and a^1, in combination with the cylinder, the cam f^2, and stop b^1, substantially as described.

3. The combination, with the cylinder and nipping mechanism for holding the folded paper, of a spring-support, *t*, to hold up or retain the free ends of the paper, substantially as described.

4. The cylinder and pivoted or hinged folding-blade, in combination with a pair of rollers, and a stop or deflector to turn the folding blade out from the cylinder, and press the fold made in the paper into and between the rollers, substantially as described.

5. The roller-carrying frame and the rollers, in combination with the cylinder, hinged or pivoted folding blade, and guide to receive the folded papers delivered from the rollers, substantially as described.

6. The roller-carrying frame and locking devices adapted to retain the pinion of one roller into or out of engagement with the cylinder-teeth, in combination with the vertical folding cylinder and with mechanism, substantially as described, to engage or disengage the shaft of the vertical folding cylinder and its operating mechanism, substantially as set forth.

7. The cylinder and fold-nipping mechanism, in combination with a supplement-cutter, substantially as described, to sever the folded portion of the paper held by the nipping mechanism, substantially as described.

8. The guide to hold the paper, a pivoted folding blade, p^2, adapted to be projected through the guide, and the connected finger, in combination with a vertical folding-cylinder and nipping mechanism, substantially as described, and a projection to operate the pivoted folding-blade, substantially as described.

9. The cylinder, and the pivoted folding-blade carried by it, the roller-carrying frame and rollers, and deflector to operate the blade to form a second fold in a paper, in combination with the vertical folding-blade, vertical folding-cylinder, provided with fold-nipping mechanism and folding-blade, and with a pair of vertical rollers, substantially as described.

10. A movable nipping-jaw and its operating shaft, in combination with a supplement-cutting blade, carried by the jaw, and a spring to connect the arms of the jaw, and the arms to which the cutting-blade is attached, whereby the cutting-blade is adapted to move after the jaw comes to rest, substantially as described.

11. The horizontally-rotating folding-cylinders, provided with blades and nipping mechanism, substantially as described, adapted to fold the web of paper at right angles to its length, in combination with a vertically-placed folding-cylinder, provided with jaws a^3 b^3, and a pair of rollers, and a folding-blade, p^2, arranged between the cylinders to remove the folded newspaper from the cylinder *b* to the vertical cylinder, to be folded at right angles to the direction of the length of the first fold in the newspaper, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
G. W. GREGORY,
W. J. PRATT.