(No Model.) 3 Sheets—Sheet 1.

D. P. McLAUGHLIN.

PAPER FOLDING MACHINE.

No. 490,881. Patented Jan. 31, 1893.

Fig. 1

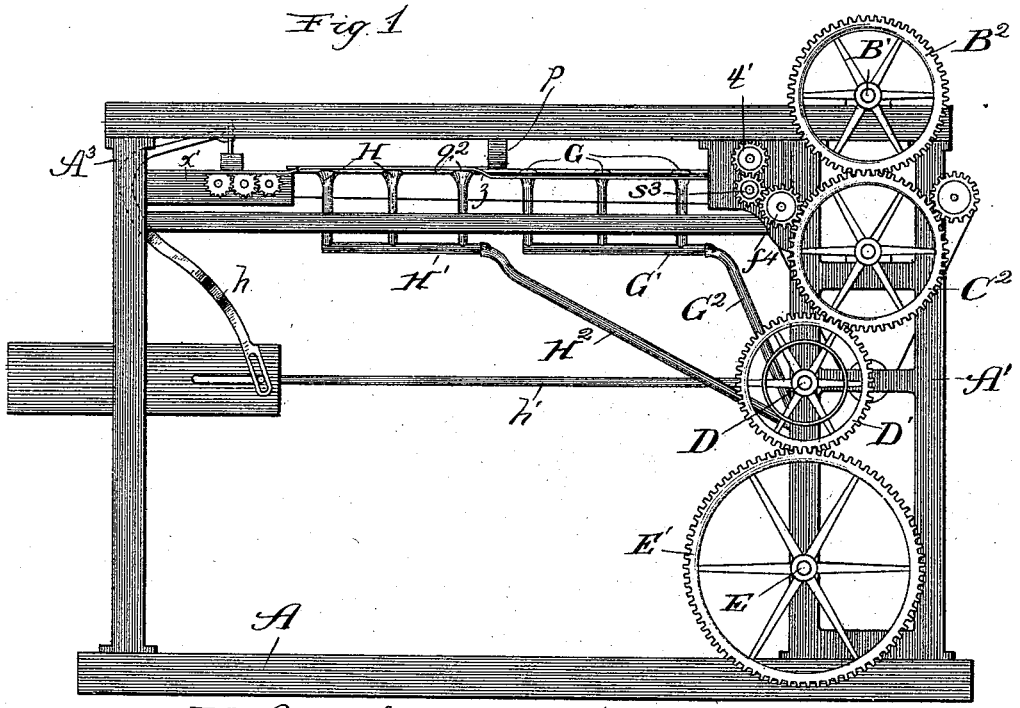
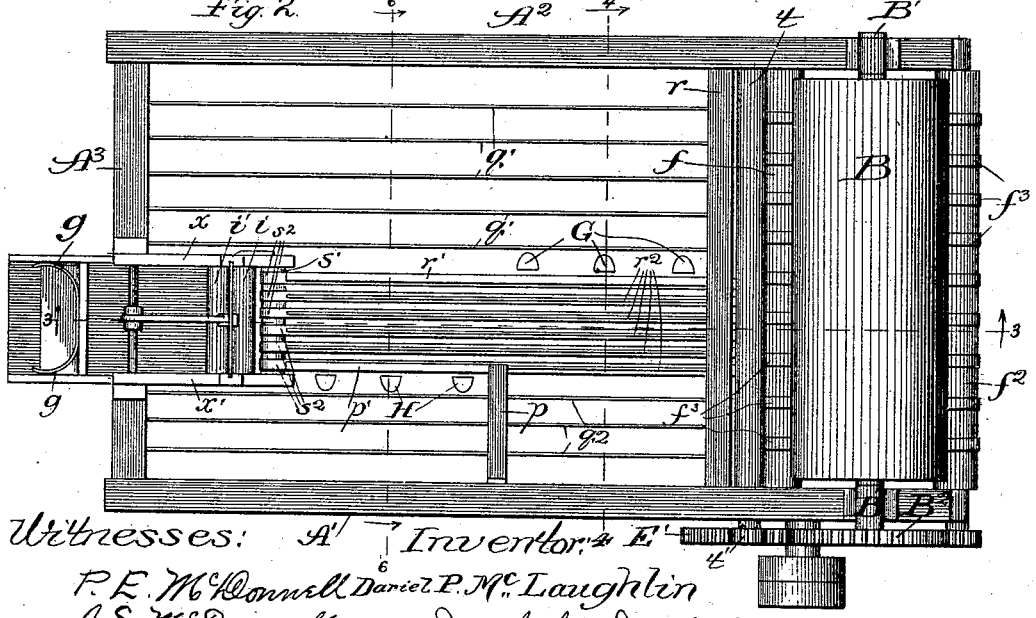


Fig. 2.



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A. S. McDonnell

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

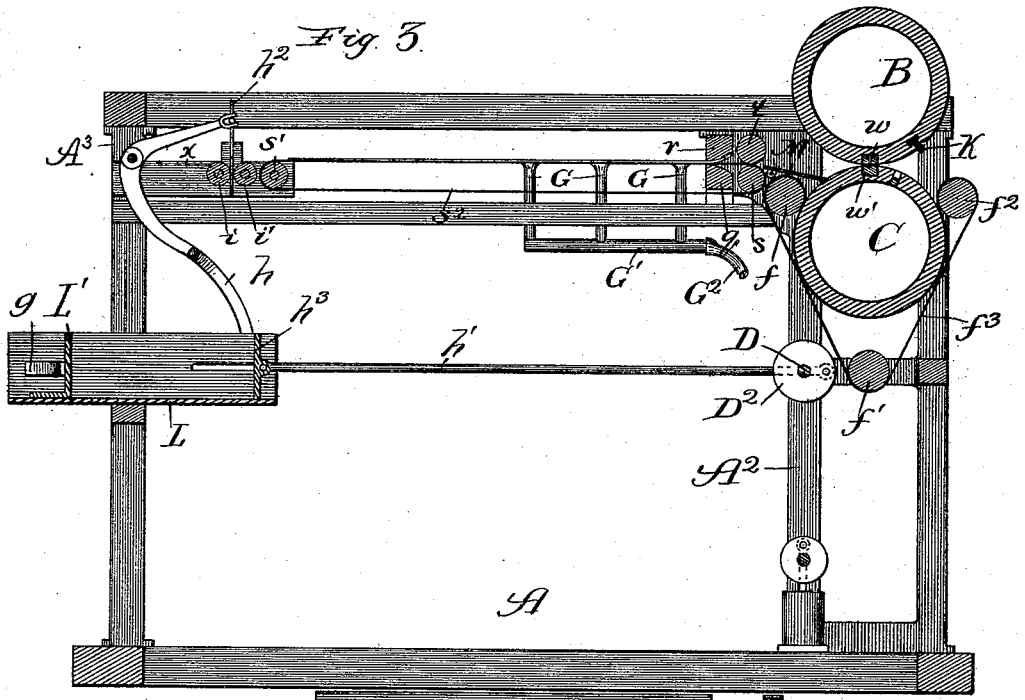
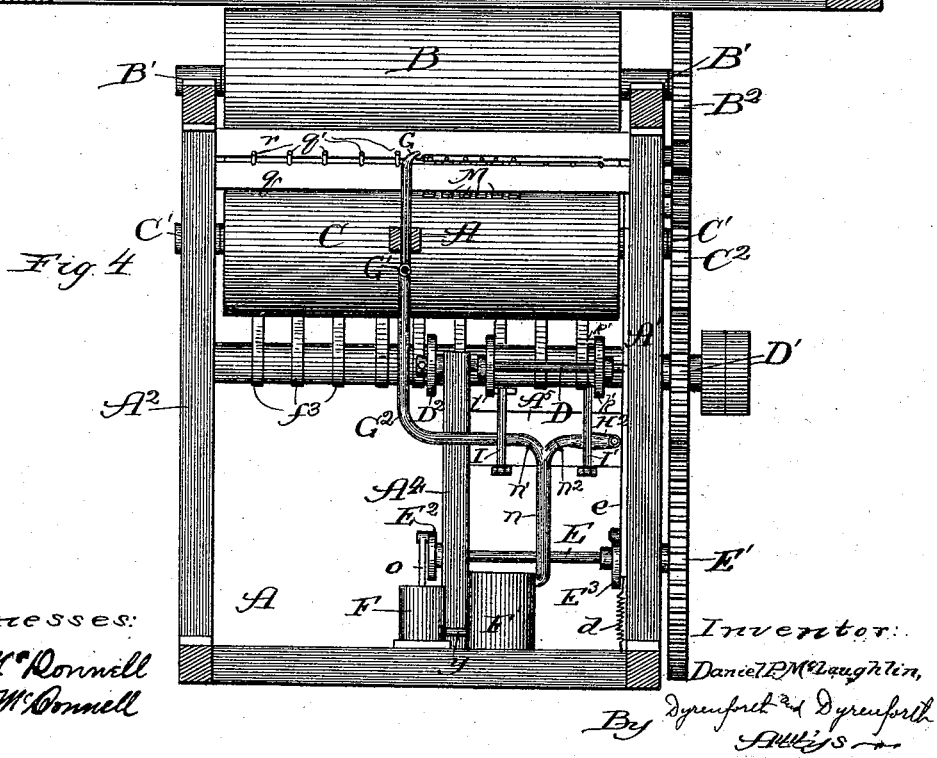


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

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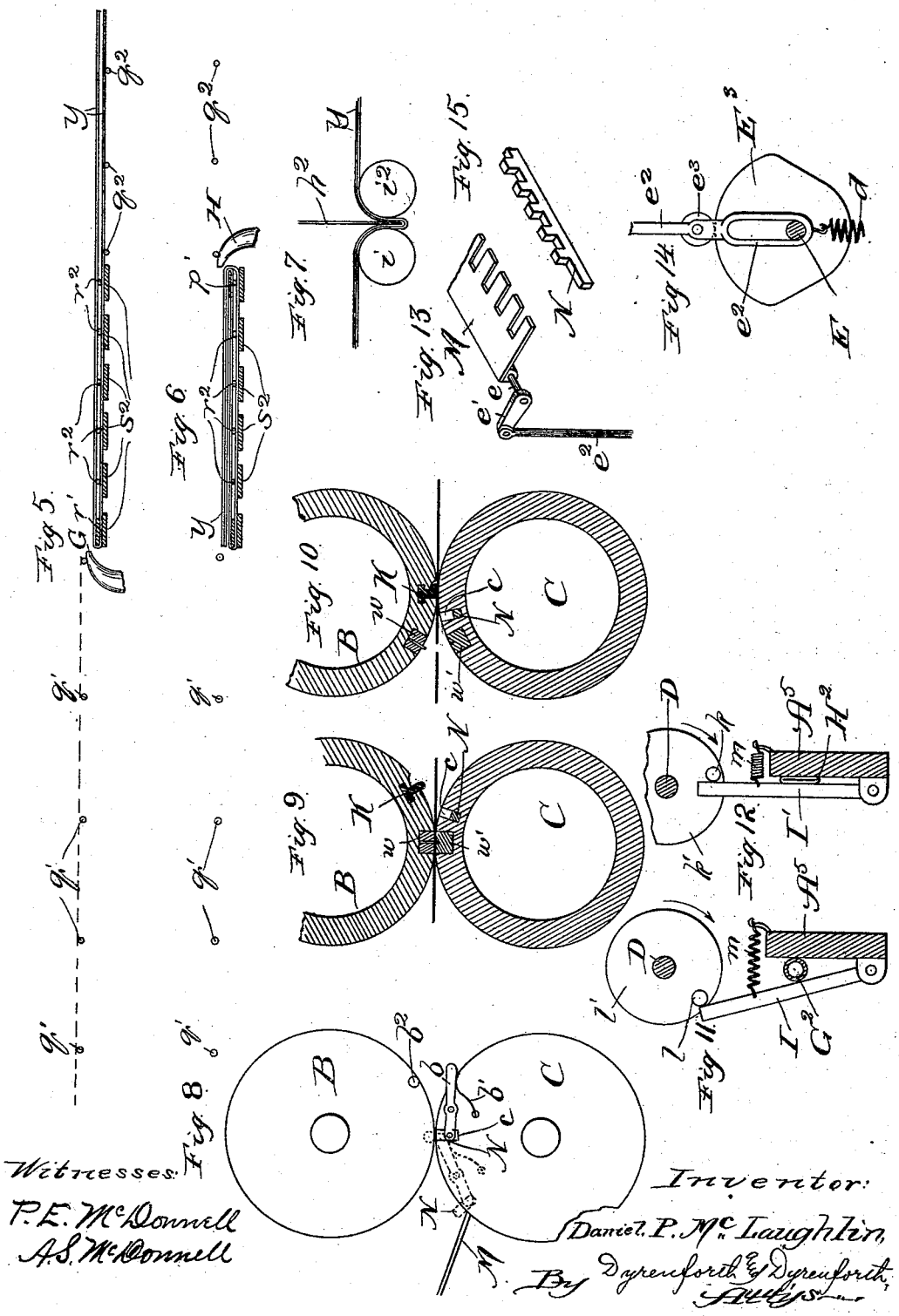

Witnesses:
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UNITED STATES PATENT OFFICE.

DANIEL P. McLAUGHLIN, OF CHICAGO, ILLINOIS.

PAPER-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 490,881, dated January 31, 1893.

Application filed January 12, 1892. Serial No. 417,824. (No model.)

To all whom it may concern:

Be it known that I, DANIEL P. McLAUGHLIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Paper-Folding Machines, of which the following is a specification.

My invention relates to improvement in machines for folding sheets of paper, or other material, though it is more especially designed for folding newspapers as they are delivered from a printing press.

My object is to provide a machine for the above purpose of an improved construction, in which the folding of the sheets is effected by turning them over the edges of folding blades by means of blasts of air, or other suitable fluid, directed against the sheets, preferably from a suitable compressed-fluid reservoir.

In the drawings—Figure 1 is a side elevation of my improved machine; Fig. 2, a top plan view thereof; Fig. 3, a section taken on line 3—3 of Fig. 2, and viewed in the direction of the arrows; Fig. 4, a section on line 4—4 of Fig. 2, viewed in the direction of the arrows; Fig. 5, an enlarged broken view taken at about line 4—4 of Fig. 2, in the direction of the arrows, showing the upper parts of the machine, between the side frames thereof, and illustrating the manner of producing the first fold of the sheet; Fig. 6, a view, similar to the last, taken on line 6—6 of Fig. 2, and illustrating the manner of producing the second fold of the sheet; Fig. 7, an enlarged broken view, showing rollers and a reciprocating blade for forcing the sheet into the bite of the rollers to produce the third and last fold; Fig. 8, a broken, enlarged end-view of the cutting cylinders; Figs. 9 and 10 broken sectional views of the cutting cylinders showing them in different positions to illustrate their operation; Figs. 11 and 12 sectional views of valve-mechanism controlling the air-pipes; and Figs. 13, 14 and 15 broken views of details of the construction.

A is the frame of the machine which may be constructed as shown, or in any other suitable manner. The frame is formed with side frames A′ and A^2 connected together by cross-beams, as shown.

B and C are cutting cylinders journaled, upon trunnions, B′ C′, respectively, in bearings on the frame A, as shown. The trunnions carry intermeshing gear-wheels, B^2 and C^2, at one side of the frame. To the rear of and in horizontal line with the cylinders B C are guide-rollers t s provided with intermeshing pinions t' s^3, the latter pinion engaging a pinion f^4 which is driven by the wheel C^2. Adjacent to the rollers t s and extending parallel therewith are cross bars r q forming part of the main frame of the machine. The bars r q extend close to but out of contact with each other leaving between them a narrow opening for the passage of the sheet to be folded, as hereinafter described.

Extending forward from the rear frame A^3 of the machine is a narrow frame consisting of two side bars x x'. Extending between the side bars x x' and journaled therein at its opposite ends, is a roller, s'. Endless tapes s^2 extend over the rollers s s', as shown. A series of guide-rods q' are secured, at opposite ends respectively, to the upper edge of the cross-bar q and the rear-frame A^3. The rods q' are bent slightly upward at their ends adjacent to the bar q (see Fig. 4), to cause the rods to extend backward in a plane slightly above the upper surface of the tapes s^2. On the opposite side of the tapes s^2 and extending between the upper edge of the bar q and rear frame A^3 is a series of guide rods q^2. The guide rods q^2 are bent upward about midway between the bar r and roller s', as shown at z in Fig. 1, to extend, from that point, in a plane slightly above the plane of the tapes s^2 and rods q', (as shown in Fig. 6).

Secured at one end to the underside of the bar r is a folding-blade, r', which extends to or nearly to the roller s', over one of the tapes s^2. Also secured at one end to the lower edge of the bar r, is a series of guide-rods, r^2, which extend parallel with and substantially the same distance as the folding blade r', over others of the series of tapes s^2.

About midway of the distance between the bar r and roller s' is an arm or bracket, p, secured at one end to the side frame A′ and extending over the rods q^2, but out of contact therewith, to or about to the tape s^2 nearest the side frame A′.

Secured to the free end of the arm p and extending therefrom to or nearly to the roller

s' is a folding-blade, p'. The blade p' extends parallel with the tapes, folding-blade r' and rods q' q^2, in a plane slightly above the rods r^2, but below the plane of the rods q^2.

D is a shaft journaled toward one end-portion in the side frame A′, and toward its opposite end in a standard, A^4, forming part of the main-frame of the machine. The shaft D may be the driving-shaft of the machine, and carries a gear wheel, D′, which meshes with the gear-wheel C^2.

Below the shaft D, and journaled at its opposite end-portions in the side frame A′ and standard A^4, is a shaft, E, carrying a gear-wheel, E′, which meshes with the gear-wheel D′.

F is an air-pump, and F′ a reservoir for compressed air. The stem o of the piston of the pump F connects with an eccentric, E^2, on one end of the shaft E; and the pump and air-reservoir F′ communicate through a pipe, y. Extending upward from the air reservoir F′ is a pipe, n, terminating in branches n' n^2.

At one side of the folding-blade r' is an air-blast, which I prefer to provide in the form of a series of nozzles, G, communicating with an air supply tube, G′, which in turn is connected by means of a flexible, preferably thin rubber, tube, G^2, to the branch n' of the pipe n. The nozzles G extend in the same horizontal plane, slightly above the folding blade r', but below the plane of the guide rods q', and are arranged to direct a blast of air in the horizontal plane across the upper surface of the rods r^2, between the bar r and arm p.

A series of nozzles, H, located at the side of the folding-blade p', communicates with a common air-supply pipe, H′, connected by a tube, H^2, similar to the tube G^2, to the branch n^2 of the pipe n. The nozzles H are in a plane slightly above the folding blade p' but below the plane of the rods q^2, and are arranged to direct a blast of air across the upper surface of the rods r^2, between the arm p and roller s'.

While, as stated, I prefer to provide the air-pipes with nozzles G, H, it is obvious that, if desired, the nozzles could be omitted, and the tubes G′ H′ caused to extend in the planes of the nozzles, and provided each with an outlet or series of outlet openings which would be the equivalent of the nozzles.

Extending between the side frame A′ and standard A^4 is a flat bar, A^5.

I and I′ are tube-compressors hinged, as shown in Figs. 4, 11 and 12, to the lower edge of the bar A^5. The tube compressors comprise levers, as shown, connected near their upper end-portions with the upper edge of the bar A^5 by coiled springs, m. The springs m tend to draw the levers against the adjacent surface of the bar A^5. The flexible tube-section G^2 extends between the lever I and bar A^5, and the spring m acting normally, as above stated, to draw the lever I against the bar A^5, pinches and flattens the tube-section, to prevent the passage of air through the latter. The tube section H^2 passes between the lever I′ and bar A^5, and the spring m, which connects at opposite ends with the lever I′ and bar A^5, tends normally to pinch the tube H^2 and prevent the passage through it of air.

On the shaft D, adjacent to the upper end of the lever I, is a crank pin, l, which may, as shown, be carried by a disk, l'. The upper end of the lever I is in the path of the crank pin l, which, with each revolution of the shaft D, wipes across the lever I and swings it against the resistance of the spring m away from the bar A^5, to permit the tube section G^2 to expand and allow the air to pass. The lever I′ extends into the path of a crank pin, k, which may be mounted upon a disk, k', and is carried by the shaft D. With each rotation of the shaft D the pin k operates to open the lever I′ and permit air to pass through the tube section H^2.

The machine shown in the drawings is intended to be used in connection with a printing-press which prints upon a continuous web of paper, and is delivered from the press in an unsevered condition.

The cylinders B and C, besides operating as feeds for the web to the folding machine, are adapted with each revolution to sever the web into sheets. For this purpose the cylinder B is provided with a cutting blade, w, and the cylinder C with a cutting-block, w', both of common construction.

To insure complete severance of the sheets from the web I provide a strip of rubber, or other resilient material, K, which extends parallel and just back of the knife w longitudinally across the surface of the cylinder B. The strip K is secured in a groove, provided for its reception in the cylinder B, and extends at one edge slightly beyond the outer circumference of the cylinder. At the side of the strip K the cylinder B is provided with a groove or recess for the strip to enter as it is bent over to pass the cylinder C.

The operation of the severing mechanism is as follows: When the web has passed between the cylinders B and C a distance equal to the circumference thereof, the knife w enters the block w' and produces partial severance of the web. The sheet thus partially severed from the web is drawn forward by the guide-rollers of the folding-machine. The further rotation of the cylinders B and C brings the strip K against the surface of the web and presses the latter against the cylinder C. In the further rotation of the cylinders, the strip K is turned over in the backward direction and produces a momentary backward pulling upon the web. This backward pulling has the effect of retarding the progress of the web, momentarily, and the guide pulleys draw the sheet onward, thus completing the severance of the latter from the web.

The machine is belted or otherwise geared to a suitable driving-power, which in practice may be the printing press with which the folding machine is intended to co-operate.

The sheet y, as it leaves the cylinders B and C passes between the guide-rollers t and s and is caused by the traveling tapes s^2 to move forward between the latter, on one side, and the folding blade r' and guide rods r^2, on the other, over the guide rods q' q^2. The distance between the bars, r q, and arm p, is greater than the length of the sheet to be folded, and as the sheet nears the arm p, and is released by the guide-rollers t s, the crank pin l, carried by the shaft D, engages the tube-compressors I and opens the latter, causing a blast of air from the reservoir F' to be directed against the underside of the sheet from the nozzles G. The blast of air is of sufficient force to fold the sheet over upon itself, as shown in Fig. 5, and to cause it to extend flat against opposite sides of the guide rods r^2. The sheet travels uninterruptedly forward over the tapes and guide rods q^2 until it passes the arm p and extends under the folding blade p'. At this moment the crank pin k, carried by the shaft D, meets the valve I', and opens the latter to cause a blast from the nozzles H to be directed against the doubled sheet, and fold it over the blade p', as shown in Fig. 6. Journaled at opposite ends in the bars x x' are folding rollers i i', which are located just in rear of the roller s' and extend parallel with the latter. The rollers i i' and s' are geared together, as shown in Fig. 1, and are driven by the tapes s^2. Fulcrumed in the rear end of the machine is a bell crank lever, h, connected at one end by means of a rod, h', with an eccentric, D^2, on the shaft D. At its opposite or upper end the lever h carries a plunger blade, h^2, which reciprocates vertically into and out of the bite of the folding rollers i i'. Below the side bars x x' is a a receptacle, L. The forward end of the receptacle L consists of a plunger head, h^3, on the end of the reciprocating rod, h', and the rear end of the receptacle consists of a sliding-plate, L', which is prevented from sliding too freely by springs g which bear against the sides of the receptacle. After the sheet has been folded, as shown in Fig. 6, it moves backward between the lower edge of the reciprocating plunger-blade h^2 and rollers i i'. In traveling backward it leaves the tapes s^2, guide rods r^2 and folding blades r' p'. When the sheet has traveled half its length across the under edge of the plunger h^2, the latter reciprocates downward and plunges the sheet into the bite of the rollers i i' (see Fig. 7). The rollers thus operate to double the sheet midway of its length, and in a direction crosswise of the folds shown in Fig. 6, and to squeeze the sheet as it passes between them to produce the proper creases. After forcing the sheet into the bite of the rollers i i' the plunger h^2 is raised by the forward movement of the rod h' and when the sheet has passed between the rollers it drops into the receptacle L. At this moment the rod h' and plunger-head h^3 reciprocate backward and pack the folded sheet against the sliding end L'.

The machine thus far described is adapted to fold the sheets, as delivered to it, singly. It is frequently required, in the case of newspapers, that two sheets be folded together.

To adapt the machine for folding two sheets at once I provide the collector mechanism shown in the figures. Rollers f f' f^2 are journaled in the side frames of the machine about the cylinder C, and are provided with traveling tapes f^3, which extend over the rollers f f^2, under the roller f', and under the cylinder C, which latter thus forms a collector-cylinder, as shown in Fig. 3. M is a switch-plate pivotally mounted upon a rod, e, which is journaled in the frame, and carries at one end a crank arm e', see Fig. 13. On the shaft E is a cam, E^3. A rod, e^2, is pivotally connected at its upper end to the crank-arm e', and at its lower end is slotted, as shown at e^2, Fig. 14, to receive the shaft E. Upon the rod e is a wheel, e^3, adapted to be engaged by and travel upon the surface of the cam E^3. A spring, d, connected at one end to the rod e and at its opposite end to the base of the frame A, tends normally to draw the rod e downward and raise the free edge of the switch-plate M. The rotation of the shaft E causes the cam E^3 to raise the rod e against resistance of the spring d. When the rod is thus raised the free edge of the switch plate M extends close to the surface of the cylinder C.

In operation when two sheets are to be folded simultaneously the switch plate M will be raised from the cylinder C as the first sheet passes between the cylinders, and will operate to guide the sheet into the bite of the roller f and cylinder C. As the second sheet enters between the rollers B C it is joined by the first sheet, which has passed around the collector-cylinder C, so that they will travel between the cylinders together; and, the rotation of the shaft E causes the switch plate M to be swung downward so that the sheets will be guided to the rollers t s. As it is not practical to have the free edge of the switch plate M bear against the rotating cylinder C, there is danger, unless means are provided to obviate it, that the web will tend to cling at its forward edge, when the sheet is completely severed, to the surface of the cylinder C, and that it will pass between the switch plate M and cylinder when the former is swung down.

To prevent the edge of the paper from passing below the switch plate M, when it is desired that it should pass over the latter, I provide "paper-lift" mechanism on the cylinder C, which is most clearly illustrated in Fig. 8. The paper lift consists of a bar, N, (see Fig. 15) which rests loosely in a groove, c, extending longitudinally across the cylinder C just back of the block w'. The upper edge of the paper lift is formed with alternate depressions and protuberances, as shown, and the switch plate M is provided with corresponding depressions and protuberances, in order that the two may intermesh as they pass each other without contact. The paper lift N re-

ciprocates freely into and out of its groove *c*, and at its ends is pivotally connected to levers *b*, fulcrumed upon the ends of the cylinder C. The free ends of the levers extend normally beyond the circumferential line of the cylinder C and are held normally in the position of retracting the paper lift into the groove *c*, by springs *b'*. On the cylinder B at each end, and near the circumference of the latter, is a pin, b^2, adapted with each rotation of the cylinders to engage the levers *b*, where they protrude beyond the circumference of the cylinder C, and depress the latter to reciprocate the paper-lift out of its groove *c*.

In operation, after a sheet has been severed from the web, the forward edge of the latter after passing through the bite of the cylinders is raised by the paper-lift and will pass over the guide plate M. It will be understood that when the guide plate M is raised, the movement of the paper-lift is not sufficient to raise the edge of the web to the switch. The pump F works continuously, so that the reservoir F' is kept supplied with air under desired pressure. The tube sections and compressors I I' afford a very desirable means for opening and closing the supply of air to the nozzles. Metal stop-cocks soon become worn and liable to leak under frequent turning, but the tube-sections besides being very durable, may be quickly replaced with new ones, when desired, at small cost. The blasts of air directed against the sheet, as described, operate to turn it over very quickly and fold it evenly; and as the passage of the sheets along the tapes is uninterrupted, the machine may be run at very high speed.

I do not limit my improved machine to use in connection with a printing press, nor to the use of air, as steam or other fluids might be employed. Neither do I desire to confine my improvements to the construction shown, as it may be modified in various ways, in regard to details, without departing from the spirit of my invention as defined by the claims.

What I claim as new and desire to secure by Letters Patent is—

1. In a folding-machine, the combination with means for advancing the sheet, of a folding blade, extending along the line of travel of the sheet and fluid-blast mechanism acting against one side of the sheet to carry it bodily over the folding-blade, substantially as described.

2. In a folding-machine, the combination with means for advancing the sheet through the machine, of a folding blade located along the line of travel of the sheet, fluid-blast mechanism at the side of the blade acting against one side of the sheet to carry it bodily over the said blade, a second folding blade located along the line of subsequent travel of the sheet, and a second fluid-blast mechanism, at the side of said second blade, acting against one side of the folded leaves of the sheet to carry them bodily over the said second blade, substantially as described.

3. In a folding-machine, the combination with means for advancing the sheet through the machine, of a folding-blade located along the line of travel of the sheet, fluid-blast mechanism at the side of the blade acting against one side of the sheet to carry it bodily over the said blade, a second folding-blade located along the line of subsequent travel of the sheet, a second fluid-blast mechanism, at the side of said second blade, acting against one side of the folded leaves of the sheet to carry them bodily over the said second blade, folding-rollers extending crosswise of the line of travel of the sheet, beyond the second folding-blade, and means for driving the sheet into the bite of the folding-rollers, substantially as described.

4. The combination with the web-severing cylinders and co-operating cutter-mechanism thereon, and with means for advancing the partly-severed sheet, of a resilient projection on one of the said cylinders engaging the web in rear of the cutter-mechanism and acting to retard the web by pressing it in the backward direction against the other cylinder, thus assisting the operation of severing, substantially as described.

5. The combination with the web-severing cylinders B, C, and co-operating cutter-mechanism thereon, and with means for advancing the partly severed sheet, of the strip K, of resilient material, secured along the cylinder B in rear of the cutter-mechanism, and a groove in the cylinder B in rear of the strip K, the strip acting, with each revolution of the cylinders, to engage the web and turn over, in the said groove, to retard the web by pressing the same in the backward direction against the cylinder C, thus assisting the operation of severing, substantially as described.

DANIEL P. McLAUGHLIN.

In presence of—
J. N. HANSON,
M. J. FROST.