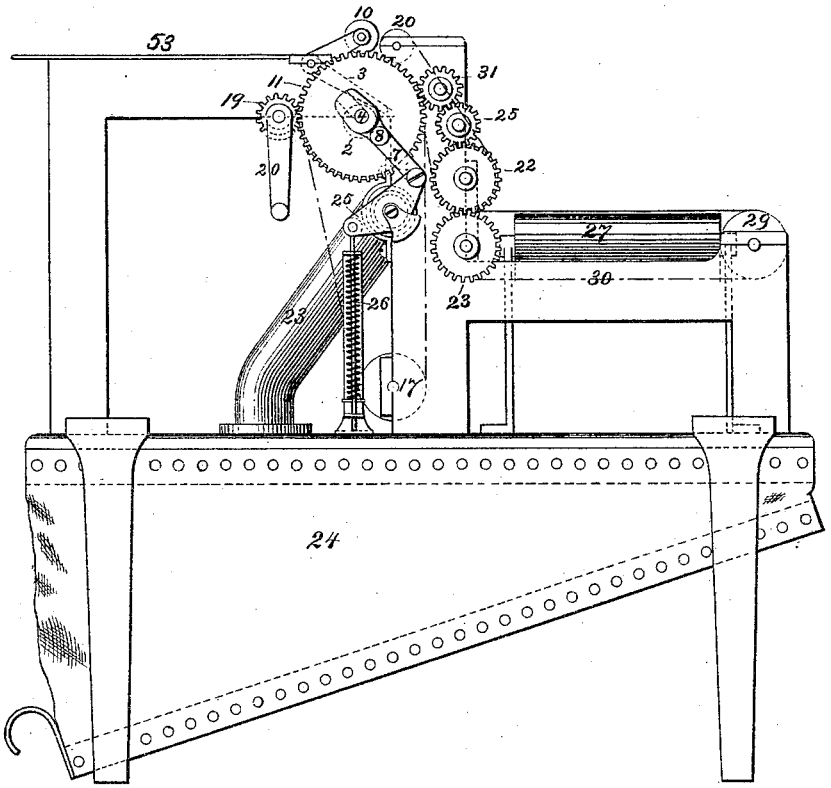
4 Sheets—Sheet 1.

R. M. HOE.

PAPER-FOLDING MACHINE.

No. 180,880. Patented Aug. 8, 1876.

Fig. 1.



Witnesses
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C. H. Ridenour

Inventor
Richard M. Hoe,
by Munson & Philipp attys.

4 Sheets—Sheet 2.

R. M. HOE.

PAPER-FOLDING MACHINE.

No. 180,880. Patented Aug. 8, 1876.

Fig. 1.

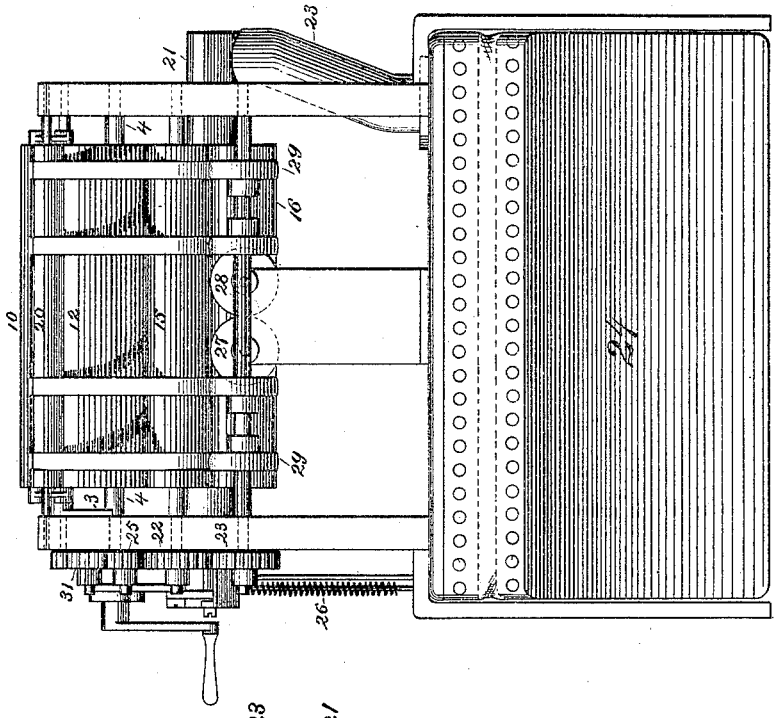
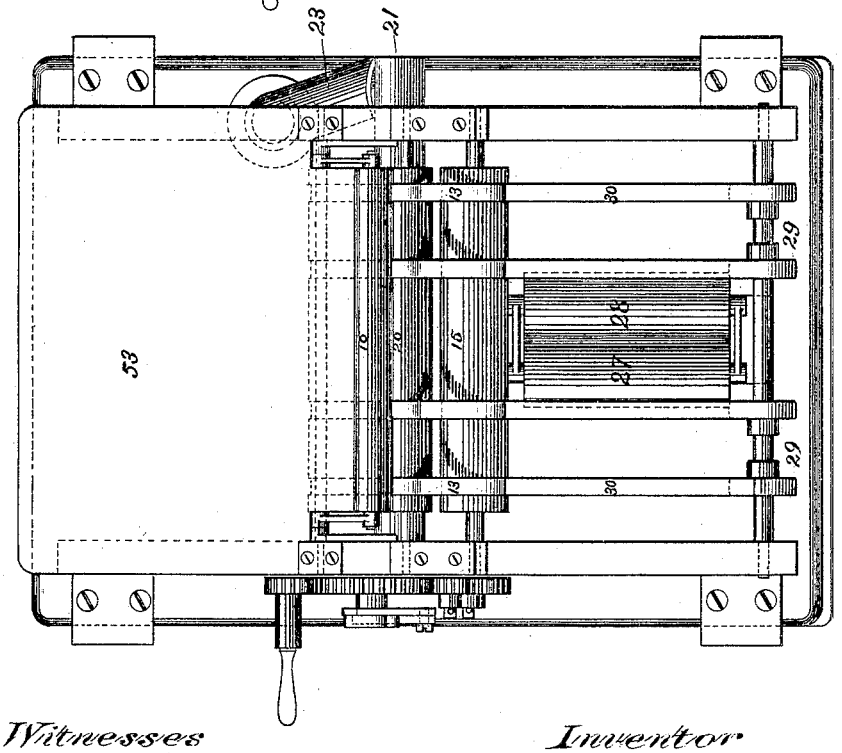


Fig. 2.



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4 Sheets—Sheet 3.

R. M. HOE.

PAPER-FOLDING MACHINE.

No. 180,880. Patented Aug. 8, 1876.

Fig. 6.

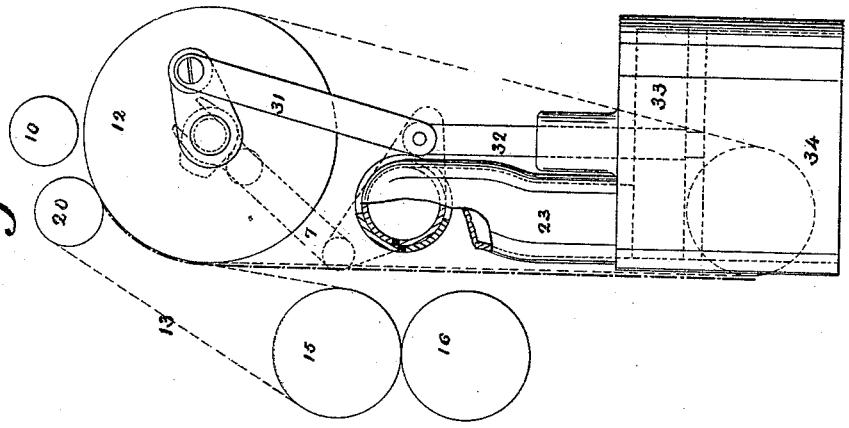


Fig. 5.

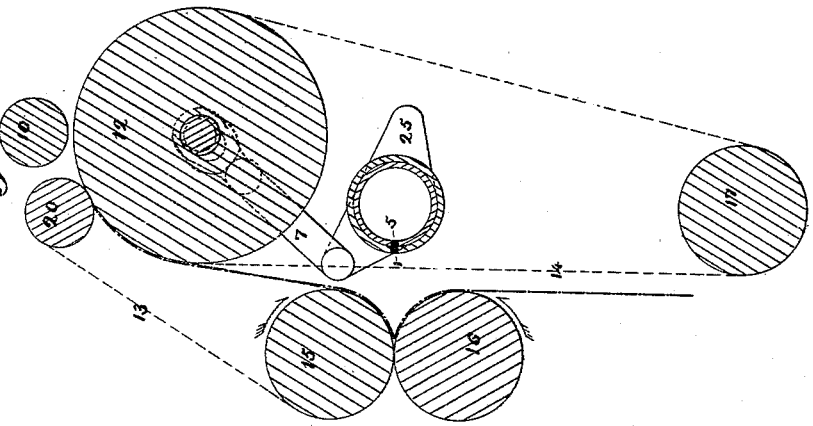
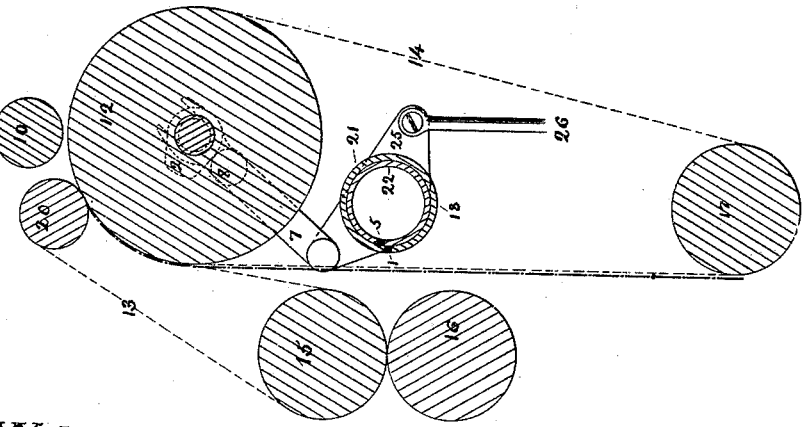


Fig. 4.



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4 Sheets—Sheet 4.

R. M. HOE.

PAPER-FOLDING MACHINE.

No. 180,880. Patented Aug. 8, 1876.

Fig. 10.

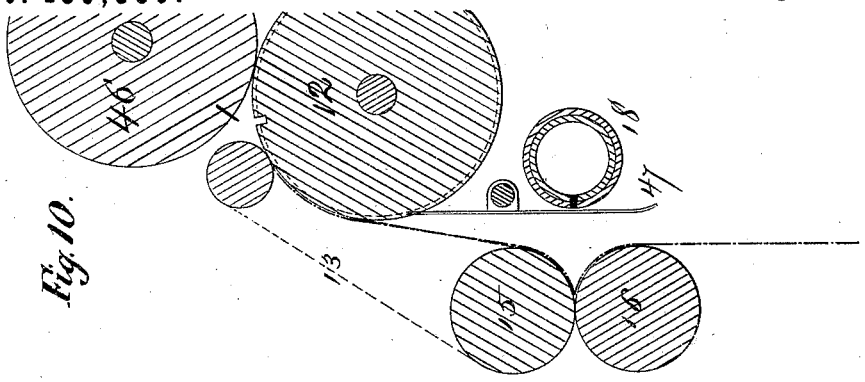
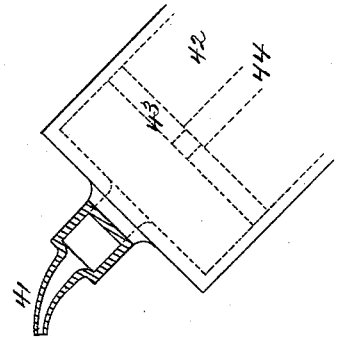


Fig. 9.



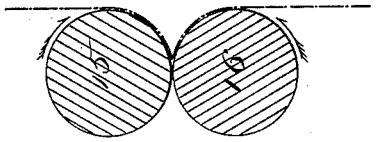


Fig. 7.

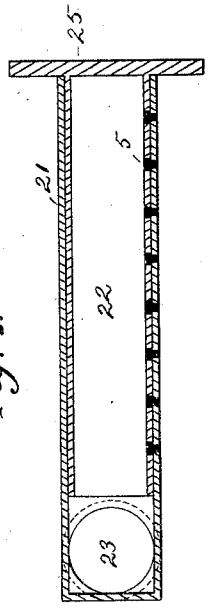
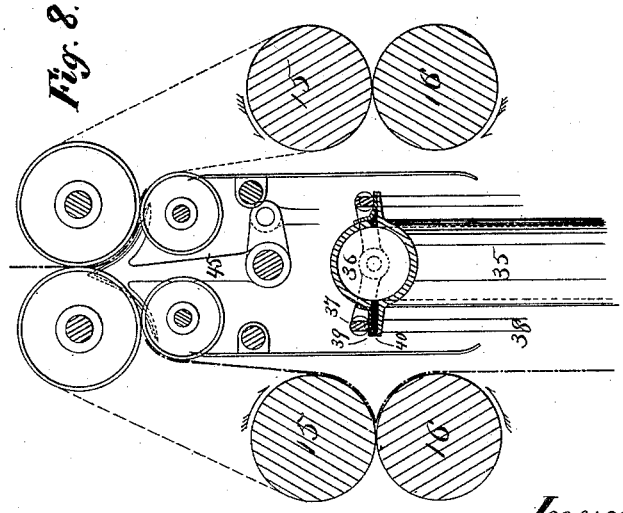


Fig. 8.



Witnesses
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E. H. Ridenour.

Inventor
Richard M. Hoe,
by Munson & Philipp
attys.

UNITED STATES PATENT OFFICE.

RICHARD M. HOE, OF NEW YORK, N. Y.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. **180,880**, dated August 8, 1876; application filed March 28, 1876.

To all whom it may concern:

Be it known that I, RICHARD M. HOE, of the city, county, and State of New York, have invented an Improvement in Apparatus for Folding Sheets of Paper, of which the following is a specification:

In the accompanying drawings, in which like letters indicate like parts, Figure 1 is a side elevation; Fig. 2, a top view; Fig. 3, an end elevation; Figs. 4 and 5, sectional views of the folding mechanism. Fig. 6 shows a modified construction of an air-supplying apparatus; Fig. 7, a section of the blast-pipe; and Figs. 8, 9, and 10, modifications of the pneumatic folding apparatus.

My improved apparatus is designed for folding printed sheets of paper, and is intended to be attached to a printing-machine, so that the printed sheets may be folded as they issue therefrom. It is, however, adapted to fold sheets, whether blank or printed, which may be fed to it either by hand or by any automatic apparatus.

The invention consists, essentially, of a pneumatic apparatus for doubling a sheet so as to produce the fold therein, in combination with suitable sheet-receiving devices, the details of which will be particularly hereinafter set forth.

The drawings illustrate the apparatus as an independent machine, and as such it will be first described, and then the mode of adapting it for use with a printing-press will be pointed out.

The sheets of paper, supported upon a feeding-table, 53, are successively fed to the carrying-cylinder 12, with their front edges underlying the drop-roller 10, which, at each revolution of the cylinder 12, is vibrated to press the sheet upon the cylinder 12, and thus propel it into the machine. This roller is vibrated by means of an arm, 3, engaging with a cam, 2, (dotted lines, Fig. 1,) which is fast upon the shaft 4 of the cylinder 12, and carries the sheet between endless bands or tapes 13 and 14, the former being stretched from carrying-pulleys 20 to the upper folding-roller 15, so as to bear upon the face of the cylinder 12, and the latter stretched around the carrying-cylinder 12 and pulleys 17. These tapes guide the sheet down between the folding-rollers 15 and 16 and the pneumatic folding mechanism 18, where it is suspended in a nearly perpendicular position. These devices are actuated as follows: A toothed wheel, 19, (shown as having a crank, 20, attached to its shaft,) meshes with and drives a toothed wheel, 11, fast on the shaft of the cylinder 12, and this wheel 11 drives the wheels 22 23 on the shafts of the folding-rollers 15 and 16 through idlers 31 and 25. The tapes 13 derive their motion from the driven roller 15 and cylinder 12, and the tapes 14 theirs from the cylinder 12. The freely-hung drop-roller 10 rotates while in contact with the cylinder 12 at a uniform surface-speed therewith.

The pneumatic fold-forming mechanism herein illustrated consists of a stationary pipe, 21, and an oscillating interior pipe or rotary valve, 22. The stationary pipe 21 is fixed to the frame-work in a position parallel with and opposite to the folding-rollers, and has at one end a branch pipe, 23, communicating with a means for supplying air, that shown in Fig. 1 being, for convenience of illustration, a bellows, 24, supposed to supply a constant pressure of air. The opposite end of the pipe 21 is open for the purpose of admitting the interior pipe 22, whose inner end is open to provide a free passage for the air, and the outer end of the pipe 22 is closed by a head, 25, between which and the outer end of pipe 21 an air-tight joint or bearing is provided. The stationary pipe 21 is provided with perforations 1 1, arranged in a straight line on that side of the pipe toward the folding-rollers, and at a point opposite to the meeting peripheries of said folding-rollers. The interior pipe 22, which is provided with a similar line of perforations at coinciding positions, is automatically rocked or oscillated to bring the perforations of the two pipes into alignment, as in Fig. 5, to allow the air to escape, and is rocked out of such adjustment, as in Figs. 4 and 6, to confine the air.

The means employed for rocking the pipe or valve 22 is a rod, 7, pivoted at one end to one arm of the bell-crank-shaped pipe-head 25, and bifurcated at the other to straddle the shaft 4, it being provided with a roller, 8, with which the cam 2 engages to reciprocate it, and thereby to oscillate the pipe 21 in one direc-

tion, while the return movement is accomplished by means of the spring-seated rod 26, attached to the opposite arm of the bell-crank head 25.

When the sheet of paper has been entered between the tapes 13 and 14 by the operation of the drop-roller 10, and it has passed down before the folding-rollers to such a distance as to bring its center, or that point upon which it is desired to fold it, opposite to the folding-rollers 15 and 16 and the air-blast mechanism, the rotation of the cylinder 12 will (through the rod 7 and bell-crank pipe-head 25) have brought the perforations 5 in the pipe 22 into communication with the perforations in the pipe 21, as in Fig. 2, thus permitting the air in the reservoir 24, where it is confined under pressure, to escape through said perforations, and to impinge upon the sheet, so as to force it into the bite of the folding-rollers 15 and 16. The blast of air thus discharged upon the sheet is directed, by means of the position of the perforations 1, in a straight line toward the point of contact of the folding-rollers, and by its force causes the sheet to assume the V form which the said rollers in contact present, thus doubling the sheet upon a determined and straight line.

The leading end of the sheet is slightly raised by this operation, which movement is aided by the motion of the lower folding-roller, since the moment the sheet is blown into contact with the roller the friction of it will be sufficient to impart this upward motion to the sheet until it is caught in the bite of the rollers. The rear end of the sheet, though held and supported by the tapes 13 and 14, moves onward with a speed sufficient to compensate for that portion of it which is taken up in this doubling operation, and also to allow it to pass through the folding-rollers without strain or buckling. The fold is thus made at the point where the stratum of air strikes the sheet, and with a precision and exactness which accomplishes like folds in any number of sheets successively presented to its operation.

The air-reservoir, as thus far described, is supposed to maintain a constant pressure. This is not essential, as it is alone requisite that the air-blast shall be created at the intervals of time when the sheets are to be folded, and when the air-eduction orifices are in a position to permit its escape. An arrangement of devices for producing this pressure of air at the proper time is shown in Fig. 6, where an air-cylinder, 34, is fitted with a piston, 33, worked by a piston-rod, 32, actuated by a crank-rod, 31, from the crank on one end of the shaft of the cylinder 12. These parts are so connected and timed as to work in unison, and produce the blast of air at the moment when the sheet has been delivered into the proper position for folding.

It is obvious that the pneumatic fold-forming mechanism may be modified in various ways, the essential requisite being that a blast of air shall be exerted against the sheet along the line of the desired fold, in such a manner that the sheet shall be forced into the bite of a pair of folding-rollers, or between two surfaces which shall, in connection with the air-blast, cause the sheet to be doubled. The sheet thus doubled is griped between the rollers, and by the rotation is drawn between them to complete the fold.

Two modifications of the blast apparatus are illustrated, that in Fig. 8 showing a pipe having a long slit or mouth, 40, directed toward the folding-rollers 15 and 16, which mouth is provided with a valve, 39, capable of being closed by a bar, 37, automatically raised and depressed by a rod, 38, actuated intermittingly from some moving part of the machine. This pipe 36 is in communication with a pipe, 35, through which a constant pressure of air is exerted.

The mouth, closing valve, and folding-rollers may be duplicated on its opposite side, and the sheets from the printing-machine directed to each set alternately by means of guides or switches 45, as described in a patent granted to myself and S. D. Tucker, December 1, 1868, No. 84,627, or by an equivalent means. In Fig. 9 is shown a cylinder, 42, from which extends a pipe, 41, having a slot in length equal to the width of the sheet, through which sharp puffs of air are forced to act upon the sheet by means of a piston, 43, actuated by the rod 44, which is quickly forced forward at the proper time by some moving part of the machine.

In adapting this device for operation with a printing-press it may be arranged so that the fly-frame shall deliver the sheets to the feed-table 53, from whence they may be introduced between the tapes 13 and 14, either by hand or by automatic mechanism. This folding mechanism may be arranged in many ways to operate with a web-printing machine, one of the most direct being to make the carrying-cylinder 12 one (preferably the female) of a pair of cutting-cylinders, and having a companion cylinder, 46, as shown in Fig. 10. The tapes 14 around the cylinder 12 are here dispensed with, and narrow grooves are cut circumferentially in the surface of cylinder 12, into which one end of the conductors 47 enters, said conductor extending and guiding the sheets down past the blast-pipe. Or the cutting mechanism may be attached to the printing-machine, and the separated sheets conveyed thence to the folding device by tapes or other conducting means; or the sheets may be left joined together at two or more points, and torn asunder at the proper time by being taken by a faster-traveling medium, as in the Patent No. 25,199, granted to me August 23, 1859, and extended. As the sheets emerge from the folding-rollers 15 and 16, they are guided by tapes 30, Figs. 1, 2, stretched from the lower roller 16 to pulleys 29, to a position over the second folding-rollers 27 and 28, where they are a second time folded, either by a vi-

brating folding-blade, or by a duplication of the air-blast device.

What I claim is—

1. The combination of a reservoir, emitting a blast of air to impinge upon the sheet along the line of the desired fold, and receiving devices, substantially as described, between which the sheet is doubled by said blast.

2. The combination of an air-blast folding apparatus with an air-reservoir and controlling-valve, substantially as set forth.

3. The combination of a sheet-conveying mechanism, an intermitting air-blast for doubling the sheet, and a sheet-receiving mechanism, substantially as set forth.

4. The combination of a sheet-conveying mechanism, an intermitting air-blast for doubling the sheet, and sheet-folding rollers, substantially as set forth.

5. The combination of the stationary chamber or pipe 21, having eduction-openings 1, with the oscillating pipe or valve 22, an air-supplying apparatus, and sheet-receiving folding mechanism, substantially as set forth.

6. The combination, with the folding-rollers, of the automatically-operated air-blast-controlling apparatus and an air-pump, substantially as shown and described.

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

RICHD. M. HOE.

Witnesses:
ISAAC KRAUS,
ROBERT COCHRAN.