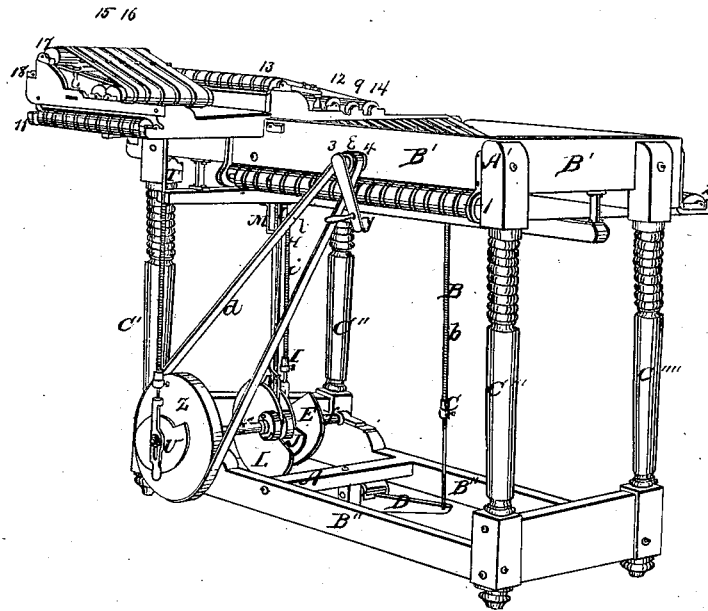
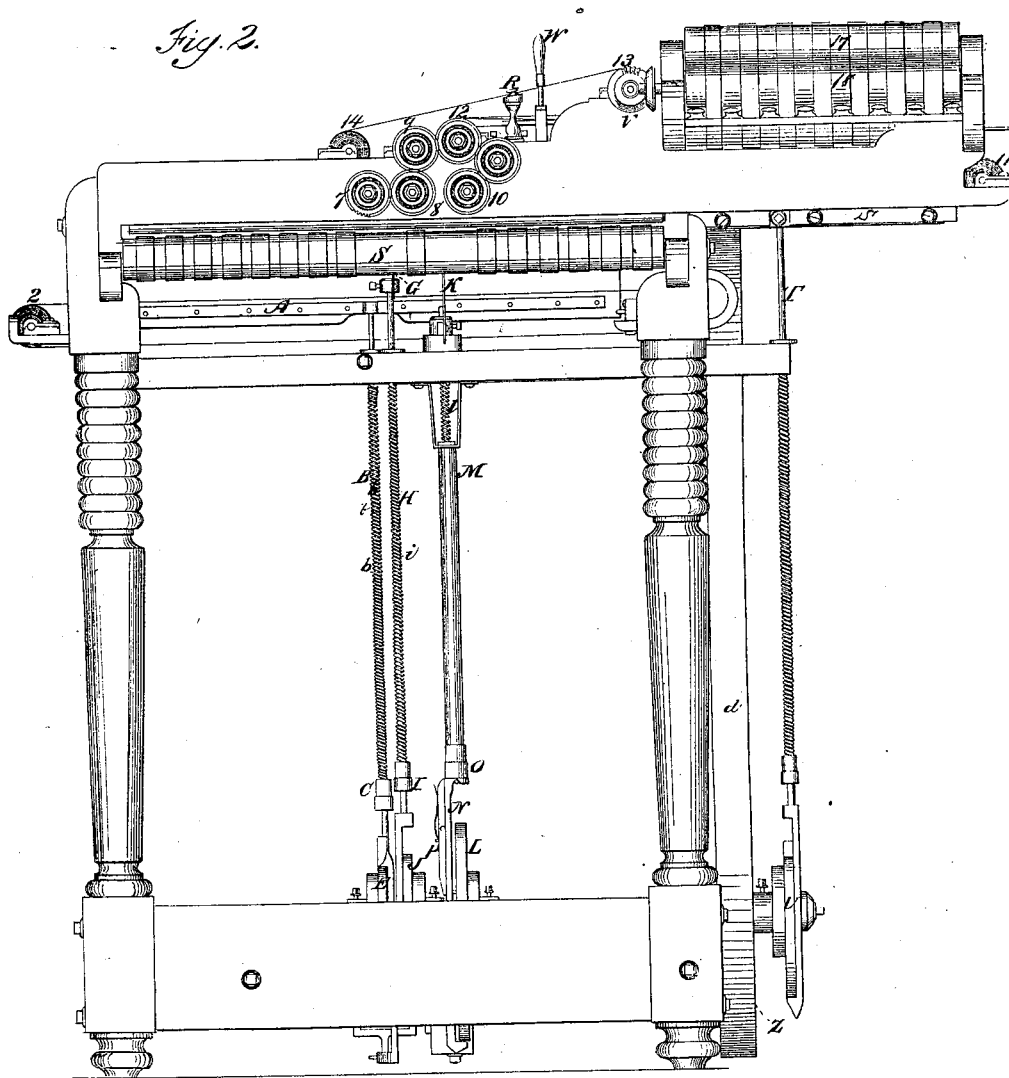


E. N. SMITH.
MACHINE FOR FOLDING PAPER.

Fig. 1.



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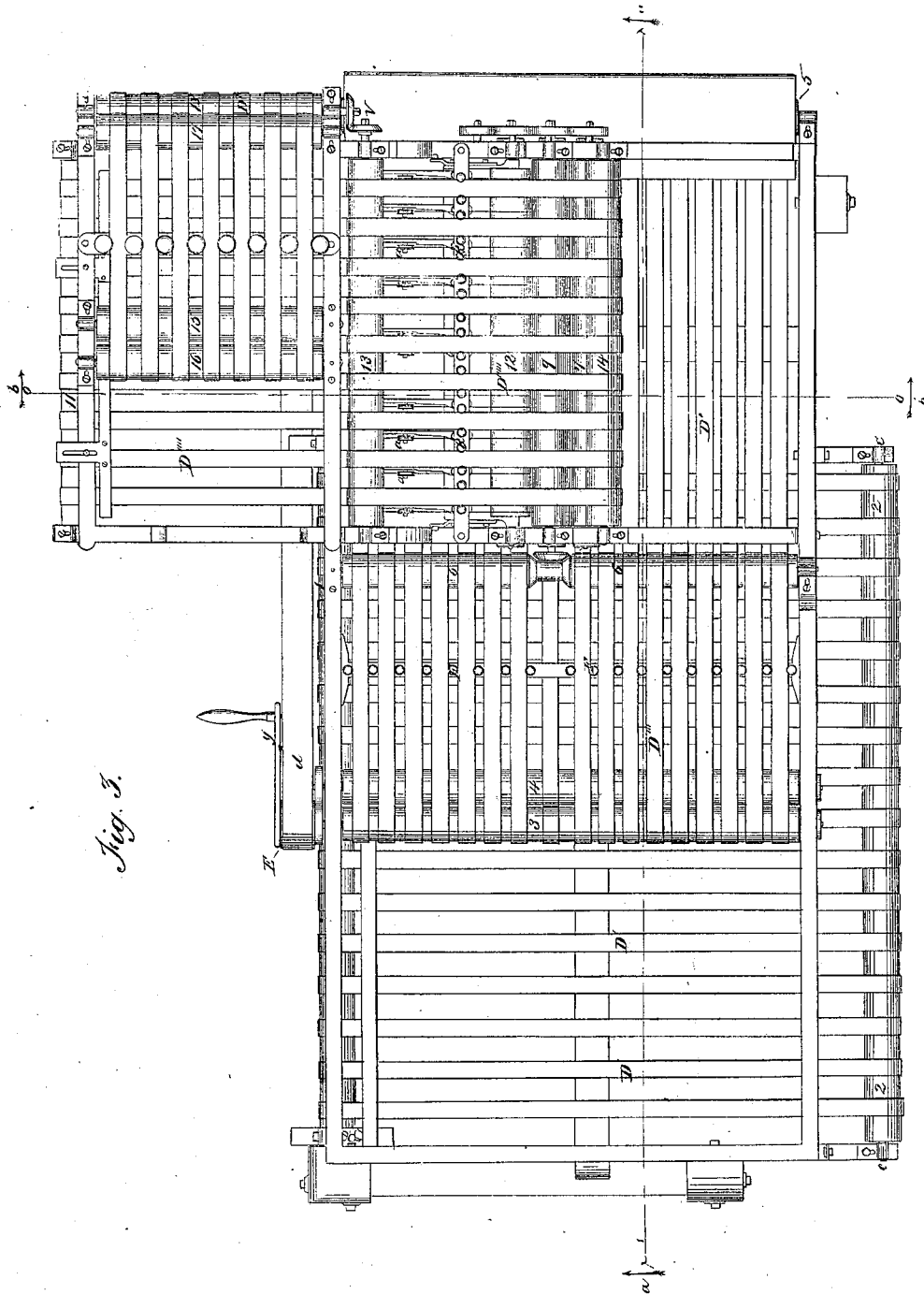


Fig. 3.

MACHINE FOR FOLDING PAPER.
E. N. SMITH.

PATENTED NOV. 27, 1849.

6 SHEETS—SHEET 4.

Fig. 3.

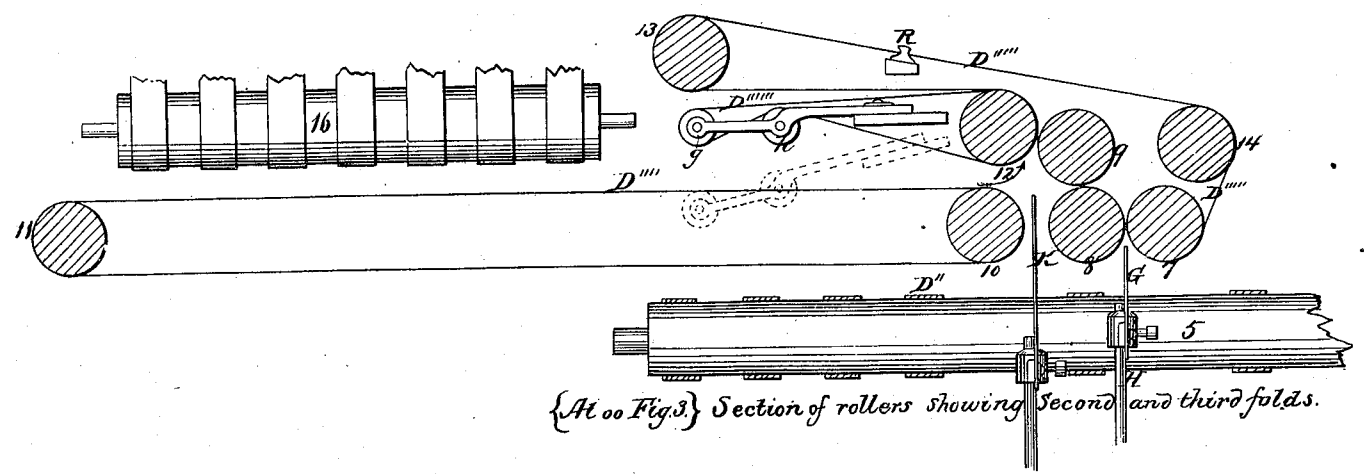
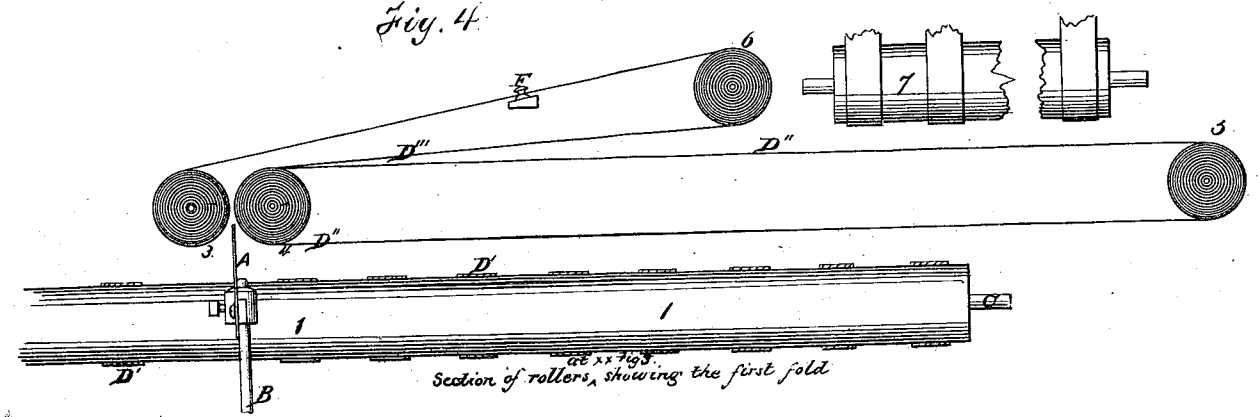


Fig. 4.



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Fig. 6.

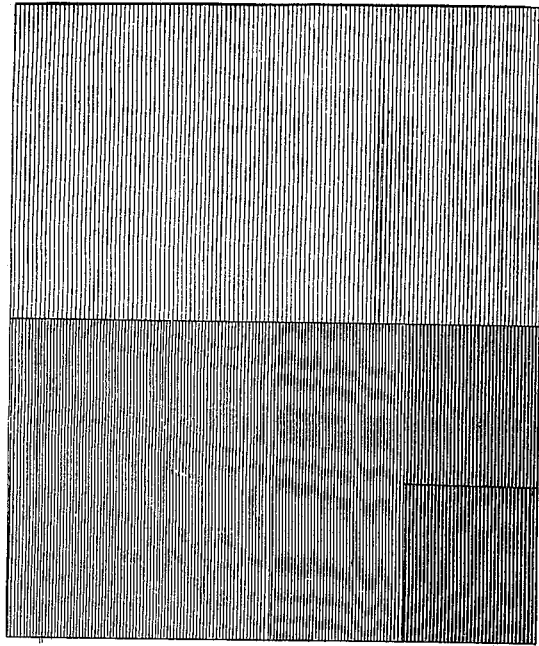
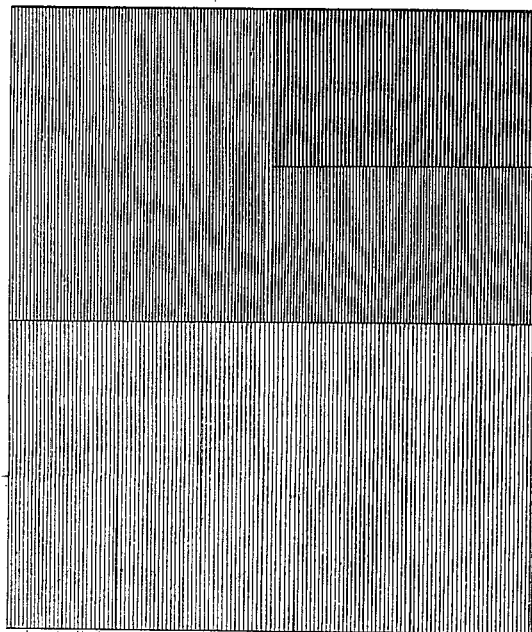


Fig. 7.



UNITED STATES PATENT OFFICE.

EDWARD N. SMITH, OF WEST BROOKFIELD, MASSACHUSETTS, ASSIGNOR TO JAMES H. GRAY.

MACHINE FOR FOLDING PAPER.

Specification forming part of Letters Patent No. 6,896, dated November 27, 1849; Reissued January 7, 1851, No. 186.

To all whom it may concern:

Be it known that I, EDWARD N. SMITH, of West Brookfield, in the county of Worcester and State of Massachusetts, have invented a new and useful Machine for Folding Sheets of Paper or other Flexible Substances, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of my automatic paper folder; Fig. 2 is an elevation of the end of the machine at which the folded paper is discharged; Fig. 3 is a plan showing the arrangement of the endless bands and rollers, Fig. 4 is a vertical section at the line *x x* of Fig. 3, looking in the direction indicated by the arrows *a a*; Fig. 5 is a vertical section at the line *o o* Fig. 3, looking in the direction indicated by the arrows *b b*; and Figs. 6 and 7 are plans of sheets of paper showing the various foldings.

My invention consists in a series of moving plane surfaces one above the other, formed of endless bands on which the paper is extended, and by which it is carried through the machine. The several surfaces move at right angles to each other, and as the paper is successively extended upon each surface, it is doubled by having its central line struck upward, and being seized between a pair of revolving converging surfaces whose axes of revolution are in the direction of the motion of the moving surface on which the paper was first extended, is delivered upon the moving plane surface next above. On this second surface it is again extended to be again struck upward, and the operation is repeated as often as required to produce the required number of folds, each being at right angles to the one preceding it. The operation can be modified as will herein be described to produce two or more successive folds parallel to each other.

In the accompanying drawing *A'* is a strong table composed principally of an upper (*B'*) and lower (*B''*) rectangular frame, connected by, and supported on four legs *C', C'', C''', C''''*. To the longer sides of this frame are attached the rollers 1 and 2 turning on journals *c* supported by bearings

on the frame *A'*; these rollers are parallel to each other and are surrounded by a set of endless bands *D'* connecting the two, and forming the first moving surface on which the paper is extended. Between the central bands and parallel in direction with them is the straight edge *A* supported by a vertical rod *B*, to which a vertical reciprocating motion is given by a cam *E* (secured to a horizontal shaft *f* turning in journals attached to the lower frame (*B''*) of the table) and by a helical spring *b* coiled upon the vertical rod. The cam acts to depress the straight edge *A* below the moving surface (*D'*, Fig. 4) on which the paper is extended; as the shaft revolves, the rod is liberated and the spring *b* contracting throws the straight edge suddenly upward, the edge striking the middle of the paper from side to side forces it upward until it is seized between the adjoining surfaces of two converging sets of endless bands *D'', D'''* traversing two rollers 3, 4, which are parallel with each other, and revolve at right angles to the moving surface on which the paper was first extended. These endless bands are of unequal length; the longer *D''* passes off horizontally, returning round a tightening roller 5, parallel with the first two, 3 and 4, and forming the second movable plane surface on which the paper is extended, and from which it can be struck upward by a second straight edge *G* to be seized in turn by a second set of converging bands. The shorter endless band (*D'''*) after pressing against the first (*D''*) sufficiently long to seize the paper diverges from it and returns over a roller *b*, revolving above the longer band. By increasing the number of the sets of endless bands and straight edges any required number of folds may be made, each at right angles to the preceding one, or by varying the angle of the bands and folding edges any desired angle may be given to the folds.

It frequently becomes necessary that two consecutive folds shall be parallel to each other; to accomplish this result the arrangement of the bands and straight edges is varied (as shown in Fig. 5); the longer folding band *D''''*, does not run directly upon one (8) of the two rollers 7, 8, between which the straight edge (*G*) is projected, but upon a third roller 10, which has its axis

in the same plane and parallel with those of the first two, and is separated by a narrow space from them; in this space a second straight edge K, can be projected upward
 5 against the paper struck up by the first straight edge G and passing over the space to the horizontal band D''''', this straight edge forces the paper upward between two converging bands D''''', D'''''' running on
 10 a pair of parallel rolls (9, 12,) revolving directly above the space between the two lower rolls (8, 10,) through which this second straight edge (K) is projected; one of these bands (D''''') is the short one which has
 15 already acted in making the first fold, and which is bent out of its direct course to the tightening roll 13, by this second pair of folding rolls; the other band D'''''' is very short, and is tightened by passing its several
 20 members over a set of small rolls g all having the same common axis; this set of tighteners can be moved up or down in a circular arc, of which the axis of the folding roll 12, is the center, when the double folding is re-
 25 quired the second folding edge K is put in gear and the tighteners g of this short endless band are depressed to deliver the folded paper upon the horizontal band D''''''; when this parallel folding is not required the
 30 second folding edge (K) is thrown out of gear, the tighteners are raised, and the sheet folded by the first folding edge (G) passes directly to the horizontal band (D''''').

The machine represented in the drawings
 35 is arranged to fold paper four times in the manner shown in Fig. 6. The first fold being across the paper; the second being at right angles to the first; the third, parallel to the second; and the fourth, parallel to the
 40 first fold. The first fold is made by the straight edge A operated by the rod B, the spring b and cam E. The paper is seized by bands D'', D''' running on the rollers 3 and 4, and extended upon the band D''; from
 45 this it is struck upward by the straight edge G operated by appropriate rod H, cam J, and spring i to be seized by the roller 8, and the band running on the roller 7. K is the third straight edge with its rod M cam L
 50 and spring l, 9 and 12 are the third folding rolls. The horizontal band D'''''' receives the paper after the third fold is made and conveys it to be acted upon by a fourth straight

edge S, from which it is seized by the folding rolls 15 and 16 and delivered upon the
 55 band D'', by which it is discharged from the machine.

The power of the prime mover may be applied directly to the cam shaft f or to one of the rolls, and thence by belts and cog
 60 wheels to the several members of the machine. The folder thus constructed may be applied directly to the roller printing press, and receive the sheets as fast as they are
 65 printed.

The paper may be delivered by the machine after any number of folds have been made, by throwing the remaining folding edges out of gear; or any fold may be
 70 omitted as in Fig. 7, where the third fold of Fig. 6, has not been made. The folding edges may be thrown out of, or into gear with their respective cams by the arrange-
 75 ment represented at M, N, O, P, Fig. 2, or in any other convenient manner. I have described the straight edges as projected upward by springs and held down by cams, but
 80 cams may be used to project the folding edges, and springs to hold them down. It is also obvious that a piece of cord or a wire will answer instead of a straight edge, and
 85 even a portion of a curved disk may be used for the same purpose.

What I claim as my invention and desire to secure by Letter Patent is—

Folding sheets of paper or other flexible substance by machinery made and operated substantially upon the principle herein set forth; that is to say, by striking the paper or other substances upward in the line in
 90 which the fold is to be made, from a surface on which it has been extended, and seizing it between converging surfaces which complete the fold and deliver the folded paper; irrespective of the number or forms of the
 95 surfaces employed, and of the number or forms of folding edges required to give the requisite number of folds to the paper; irrespective also of the arrangements and devices for operating the several members of
 100 the machine.

EDWARD N. SMITH.

Witnesses:

E. S. RENWICK,
 P. H. WATSON.