(No Model.) 2 Sheets—Sheet 1.

L. C. CROWELL.

FOLDING MACHINE.

No. 259,978 Patented June 20, 1882.

Fig. 1.

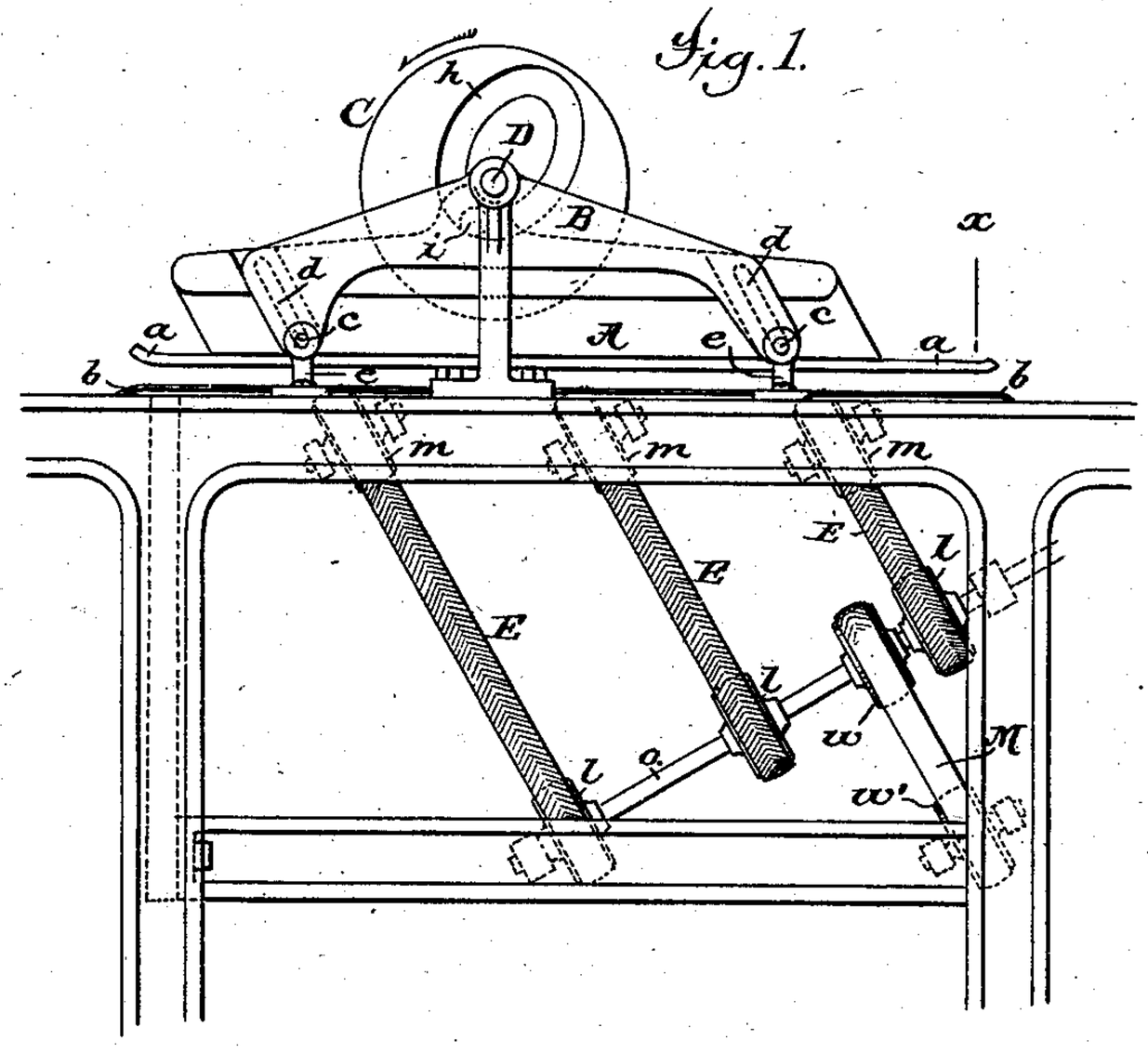
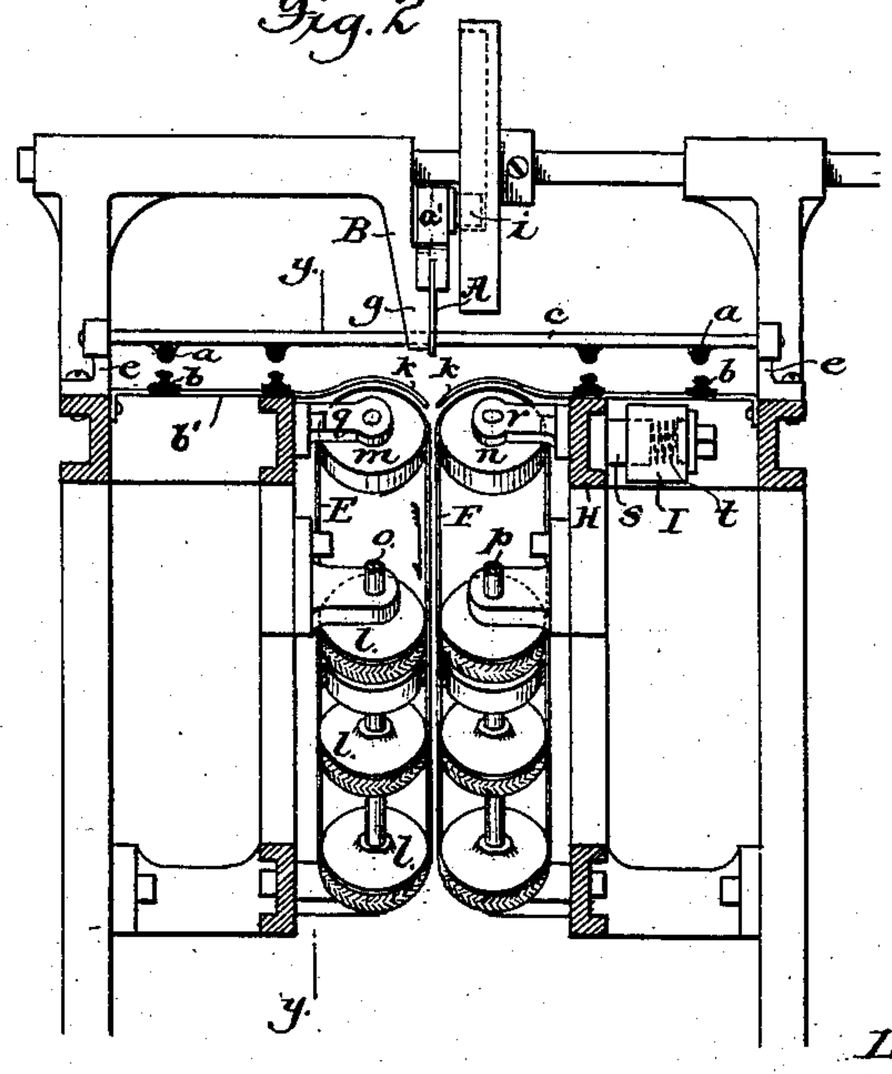


Fig. 2.



Attest;

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

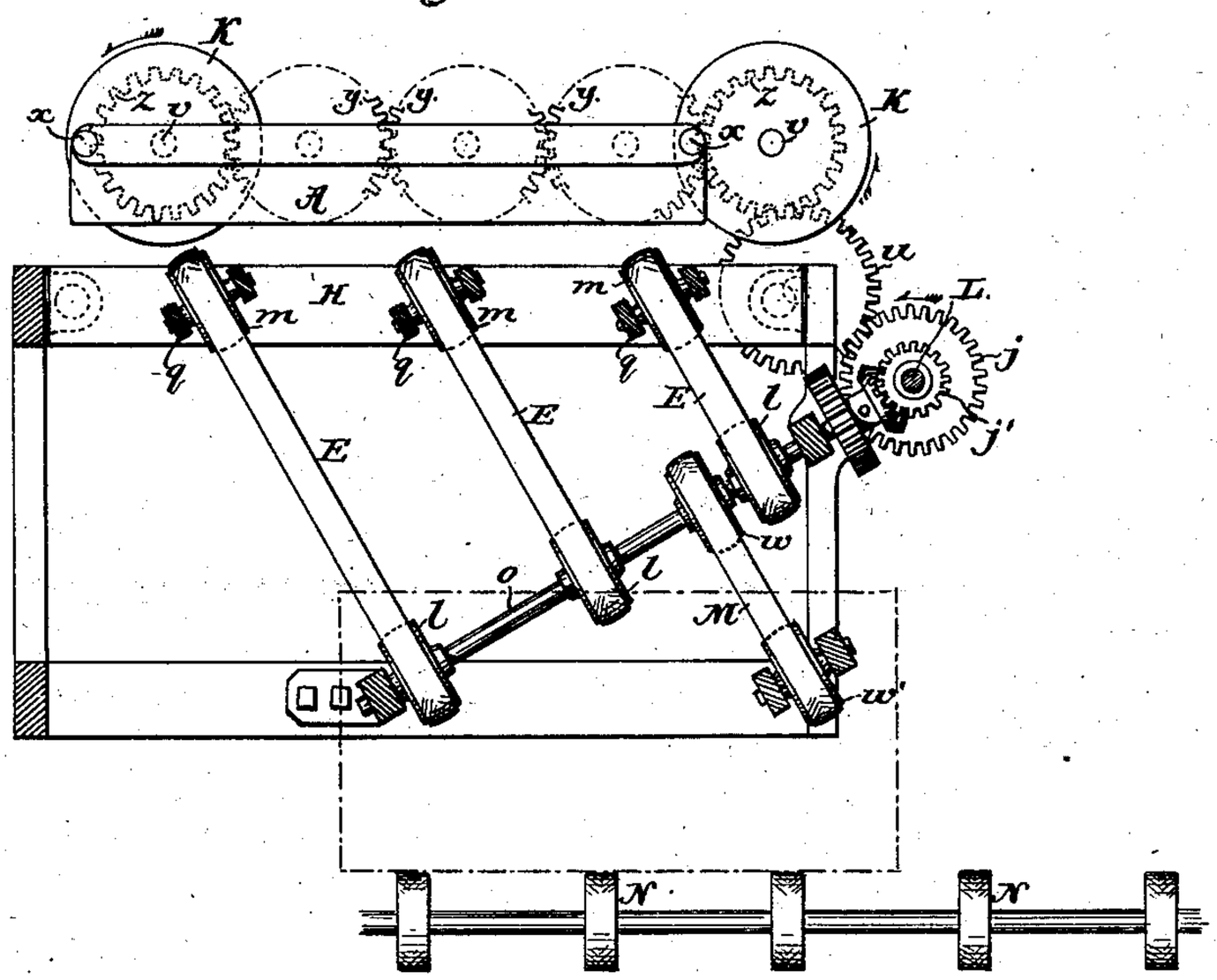
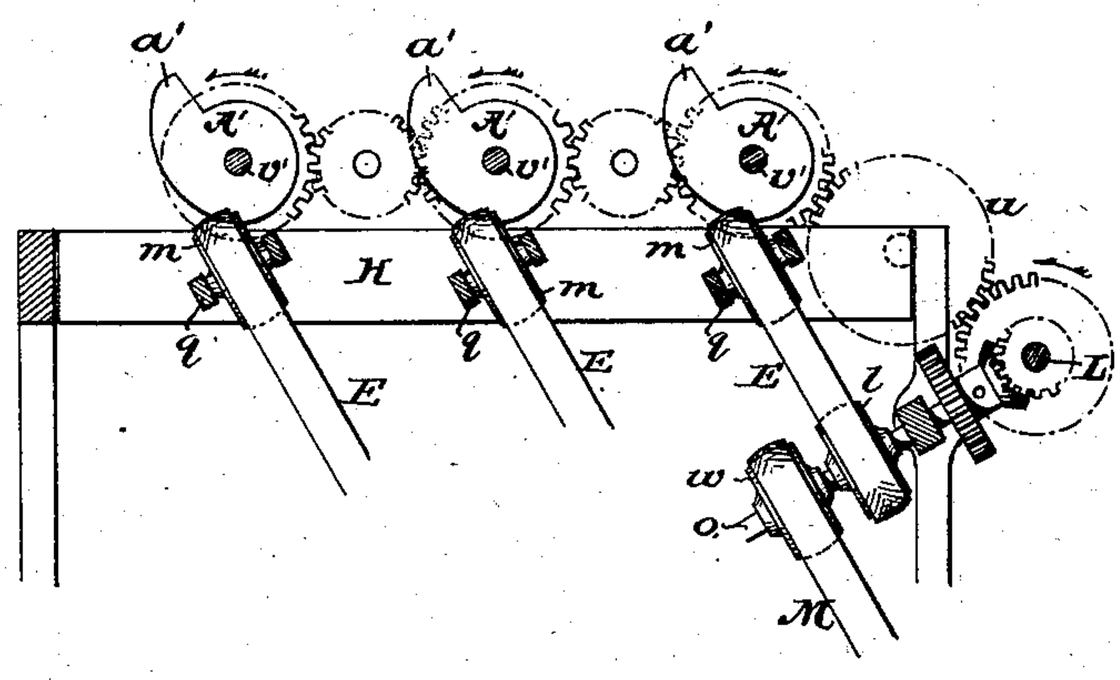


Fig. 4.



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UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR TO R. HOE & CO., OF NEW YORK, N. Y.

FOLDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 259,978, dated June 20, 1832.

Application filed November 28, 1881. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing in the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Folding-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to that class of folding-machines which are adapted to operate upon sheets of paper to fold them longitudinally—that is to say, upon a line parallel to the direction of their travel through the machine—and to that particular class of these machines in which the fold is made by a blade which strikes the sheet upon the fold-line and forces it between turning-edges or into the bite of rolls. In the operation of machines of this kind as heretofore constructed the forward motion of the sheet was arrested at the time of making the fold, which was generally effected by causing it to strike against fixed stops. This stopping of each sheet necessarily reduced the speed with which the machine could be made to operate, and the striking of the moving sheet against fixed stops sometimes caused it to buckle, so that the product was wrinkled and imperfect or the machine became clogged and inoperative. Another disadvantage attending the use of these machines came from the fact that the sheets could not be fed to the folding-blade in close succession, it being necessary to separate the sheets in the line of feed by a space equal to somewhat more than one-half the width of the sheet in order to prevent the incoming sheet from fouling with the sheet just folded and passing between the folding-rolls. This made it impossible for these machines to fold the sheets as they issued from an ordinary web-printing machine unless such sheets were first folded transversely, and even then it was impossible unless the sheets were very narrow in proportion to their length.

It is the object of this invention to produce a machine which shall be free from these disadvantages; and to that end the invention consists primarily in a folding-blade which has a longitudinal movement, so as to travel with and fold longitudinally a continuously-moving sheet, and in devices which carry the sheet forward while the fold is being made; and it further consists in certain details of construction and combinations of parts, which will be fully explained hereinafter and pointed out in the claims.

In said drawings, Figure 1 is a side elevation of a folding-machine containing one embodiment of the invention. Fig. 2 is a transverse vertical section taken on the line *x x* of Fig. 1. Fig. 3 is a longitudinal vertical section taken on the line *y y* of Fig. 2, but showing a modified mechanism for driving the folding-blade, and also a mechanism for removing the folded sheets. Fig. 4 is a longitudinal vertical section of a part of the machine shown in Fig. 3, but provided with a folding-blade of a modified construction.

The sheets, as they issue from any ordinary form of printing mechanism or from a folding mechanism which has previously operated upon them or from the hands of an operative, are carried by tapes or any other well-known form of conveying mechanism between the upper and lower guides, *a b*, and beneath the folding-blade A. The lower guides, *b*, are smooth rods or bars of metal, and are attached to the frame of the machine in any convenient manner, they being shown in this case as attached to transverse supporting-bars *b'*. The upper guides, *a*, are also smooth metal rods or bars, and are secured to and supported by the transverse rods *c c*. The sheet of paper, instead of being carried between these guides by tapes or other carrying mechanism, may be projected under the blade by being slid along the smooth surface of the lower guides, *b*.

The folding-blade A is provided near its ends with oblique slots *d*, through which pass the guide-rods *c*. These guide-rods pass also through the downwardly-projecting ends of the overhanging bracket B, which is rigidly secured to the side frame of the machine in the manner shown in Fig. 2, and have their ends secured in posts *e e* at the sides of the machine. The thick back *a'* of the blade A is provided with dovetail grooves, in which work projections on the bracket B, thus affording a means for holding the blade accurately in its position during its reciprocations.

The blade A is driven by the face-cam C upon the rotating shaft D, the blade being provided with the stud or pin *i*, which travels in the groove *h* of the cam. Motion being communicated to the shaft D from any convenient source of power, the blade A will be caused to reciprocate in a path which is the resultant of the vertical motion given by the cam and the longitudinal motion given by the rods *c* working in the oblique slots *d*. The amount of this longitudinal motion will of course be governed by the angle to the edge of the blade at which the slots *d* are placed. This angle should, however, always be sufficient to give the blade a longitudinal velocity while in contact with the sheet equal to the feed of the sheet through the machine.

The movements of the blade A are so timed with relation to the feed of the sheets through the machine that as it passes below the guides *a* from the elevated position shown in Figs. 1 and 2 a sheet will have arrived in proper position to be acted upon, and will be struck by the blade upon the fold-line and forced downward between the turning edges or guides *k k* and into the bite of the rolls *m n*. During this operation the forward movement of the sheet will not be checked, but the blade, while traveling with it, will at the same time force it downward, its path thus becoming an oblique one, the resultant of the two motions—the downward movement which is given by the blade and the forward movement due to its travel through the machine. As the folded sheet passes below the guides *k k* it is caught in the bite of the series of obliquely-arranged pulleys *m n*, carrying the obliquely-running tapes E F, which carry the sheet onward and deliver it from the machine or to other devices which are to operate upon it. When the folded sheet is caught in the bite of the pulleys *m n* its forward movement is somewhat checked; but these pulleys and the tapes E F are set at such an angle with relation to the guides *b* that as the sheet is carried downward below the guides it is at the same time carried forward sufficiently fast to prevent the incoming sheet from fouling, even should the sheets be closely upon each other.

It is to be remarked that the guides *k k* may in some cases be dispensed with and the blade A operate to fold the sheet directly into the bite of the pulleys *m n*. The number of these pulleys, also, is not material. There may be three pairs, as shown, or there may be four or more pairs—a sufficient number of them carrying tapes and the remainder acting only as folding-rolls. In some cases it may be found desirable to use a large number of these pairs of oblique pulleys placed close together, so as to afford practically a continuous biting-surface. The tapes E F pass over pulleys *l* at their lower ends, said pulleys being mounted upon shafts *o* and *p*, one of which, *o*, in this case receives motion from any convenient source of power. The shafts *o p* are geared together, so that both sets of tapes will be driven positively and at the same rate of speed. The upper ends of the tapes E pass over pulleys *m*, hung in brackets *q*, rigidly attached to the frame of the machine. The upper ends of the tapes F pass over the pulleys *n*, hung in brackets *r*. Each bracket *r* is provided with a shank, *s*, which extends through the rail H of the machine-frame, the outer ends of these shanks resting in recesses formed in a bar or rail, I, and seated against springs *t*, by which they are so pressed inward as to cause the tapes to have a firm nip upon the folded sheet.

It will be noticed that the series of tapes E and F are not of uniform lengths, the pair at the left extending much lower than the pair at the right. This arrangement is necessary in order that they may all be driven by pulleys on a single shaft. In order, however, that both ends of the folded sheet may be held in the bite of the tapes down to the same point, as illustrated in Fig. 3, the supplemental tapes M are provided. These tapes run over and are driven by pulleys *w* on the shafts *o p* and loose pulleys *w'*, which are hung in brackets attached to the frame of the machine at a point as low as the left-hand pair of pulleys, *l*. Only one of the tapes M and pulleys *w* and *w'* are shown in the drawings, the companion in each case being arranged opposite in the usual manner, as will be readily understood by those familiar with this class of machines.

There may be as many pairs, less one, of the supplemental tapes M as there are pairs of the main tapes E F. A less number will, however, often be found sufficient.

By the arrangement of tapes just described the folded sheet can be delivered squarely and evenly upon carrying-tapes or a carrying-apron, or to a fly or other mechanism which is to operate further upon it.

In the modification shown in Fig. 3 the folding-blade, instead of being reciprocated obliquely, has a "parallel" movement. This movement is given to the blade by the following mechanism: Upon the ends of the shafts *v v*, which extend inward from the side frame of the machine, are mounted the disks K K, carrying upon their faces crank-pins *x*, which work in journals in the ends of the blade. The shafts *v v* are provided with gears *z z*, which are connected by idle-gears *y*, the train thus formed being driven by the gear *j* on the driving-shaft L through the intermediate idle-gear, *u*. It can readily be seen that the operation of the mechanism just described will cause the blade A to descend upon and move longitudinally with the traveling sheet at the same time that it forces it downward upon the fold-line and into the bite of the rolls *m n*, so that the onward motion of the sheet will not be arrested at the time the fold is made. The driving-shaft L is also provided with the bevel-gear *j'*, which meshes with a similar bevel-gear upon the shaft *o*, thus giving motion to the tapes E F and M. In this figure (3) is also shown a mechanism for delivering the folded sheets to a position to be removed by an attendant. This

mechanism consists of the transversely-running tapes N, upon which the sheets are delivered as they emerge from the oblique tapes, and by which they are conveyed to the side of the machine or to a packing-box. The folded sheets, instead of being delivered upon the tapes N, may be taken by a fly or other delivery mechanism and placed upon a table or fly-board; or, as before said, they may pass to other mechanism to be further folded.

In Fig. 4 is shown the same arrangement of tapes and driving mechanism as that described in connection with Fig. 3, but the folding-blade is of different construction. It consists of a series of disks, A′, each of which has a cam-like projection, *a′*. These disks are mounted upon transverse shafts *v′*, which shafts are connected with the driving-shaft L by a train of gearing, as shown, so that the disks are made to revolve in unison. These disks are so timed in their revolutions that when the sheet to be folded has arrived in proper position over the pulleys *m n* the projections *a′* strike upon it, and while moving forward with it press it downward into the bite of the folding-pulleys *m n*. The number of the disks A′ which may be employed is not limited. The series may consist of two, three, or more, as may be desired. The specific construction shown in this modification is not herein claimed, as it is my intention to make it the subject of a separate application for United States patent.

What I claim is—

1. The combination, with a folding-blade arranged to move longitudinally with the sheet, of means for continuing the forward or longitudinal movement of the sheet during the folding, all substantially as described.

2. A folding-blade, as A, having an oblique reciprocation in the direction of its length, substantially as described.

3. The folding-rolls, as *m n*, set obliquely with respect to the folding-blade, substantially as described.

4. The combination of the series of folding-rolls, as *m n*, with a folding-blade arranged to enter the bite of said rolls at an angle to their axes, substantially as described.

5. The combination, with folding-rolls arranged to fold a sheet longitudinally—*i. e.*, in the direction of its travel through the machine—and to carry it forward while being folded, of means for forcing the fold-line of said sheet into the bite of the rolls, all substantially as described.

6. The series of folding-rolls, as *m n*, set obliquely to the path of the entering sheet, in combination with the oblique tapes, substantially as described.

7. The series of folding-rolls, as *m n*, set obliquely to the path of the entering sheet, in combination with the oblique tapes E F and the single driving-shaft *o*, substantially as described.

8. The series of folding-rolls, as *m n*, set obliquely to the path of the entering sheet, in combination with the oblique tapes, as E F, and the supplemental tapes, as M, substantially as described.

9. The combination of the obliquely-arranged folding-rolls, as *m n*, and the vertically and longitudinally moving folding-blade, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
J. A. HOVEY,
GEO. H. GRAHAM.