(No Model.)

5 Sheets—Sheet 1.

L. C. CROWELL.

FOLDING MACHINE.

No. 510,527. Patented Dec. 12, 1893.

Fig. 1.

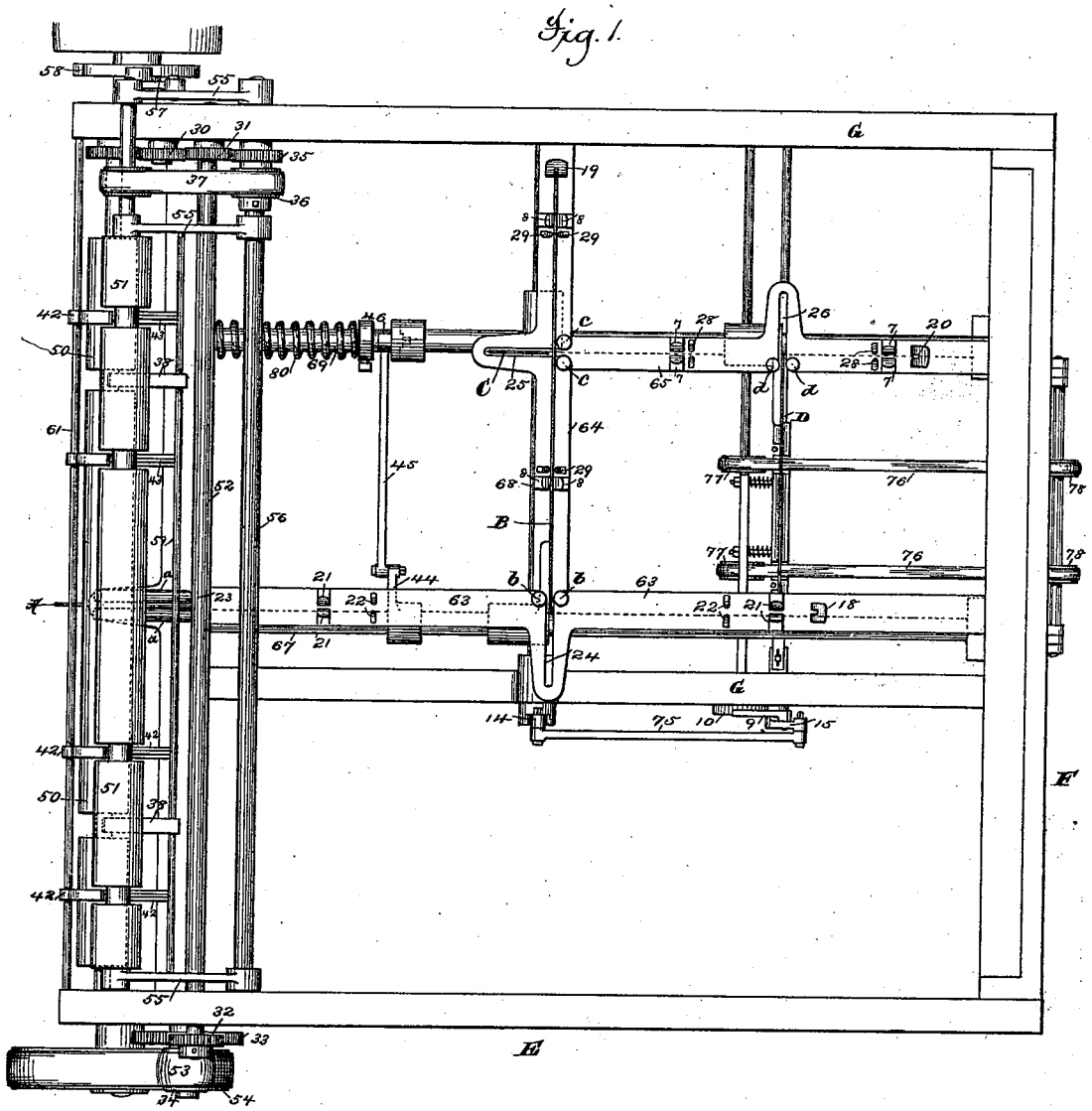


Fig. 10.

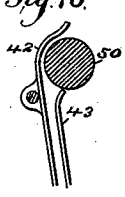


Fig. 11.

Fig. 12.

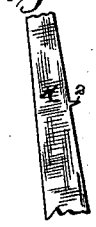


Fig. 13.

Attest:

Geo. H. Graham

J. A. Hovey

Inventor:

Luther C. Crowell

by Munn & Philipp

Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.)

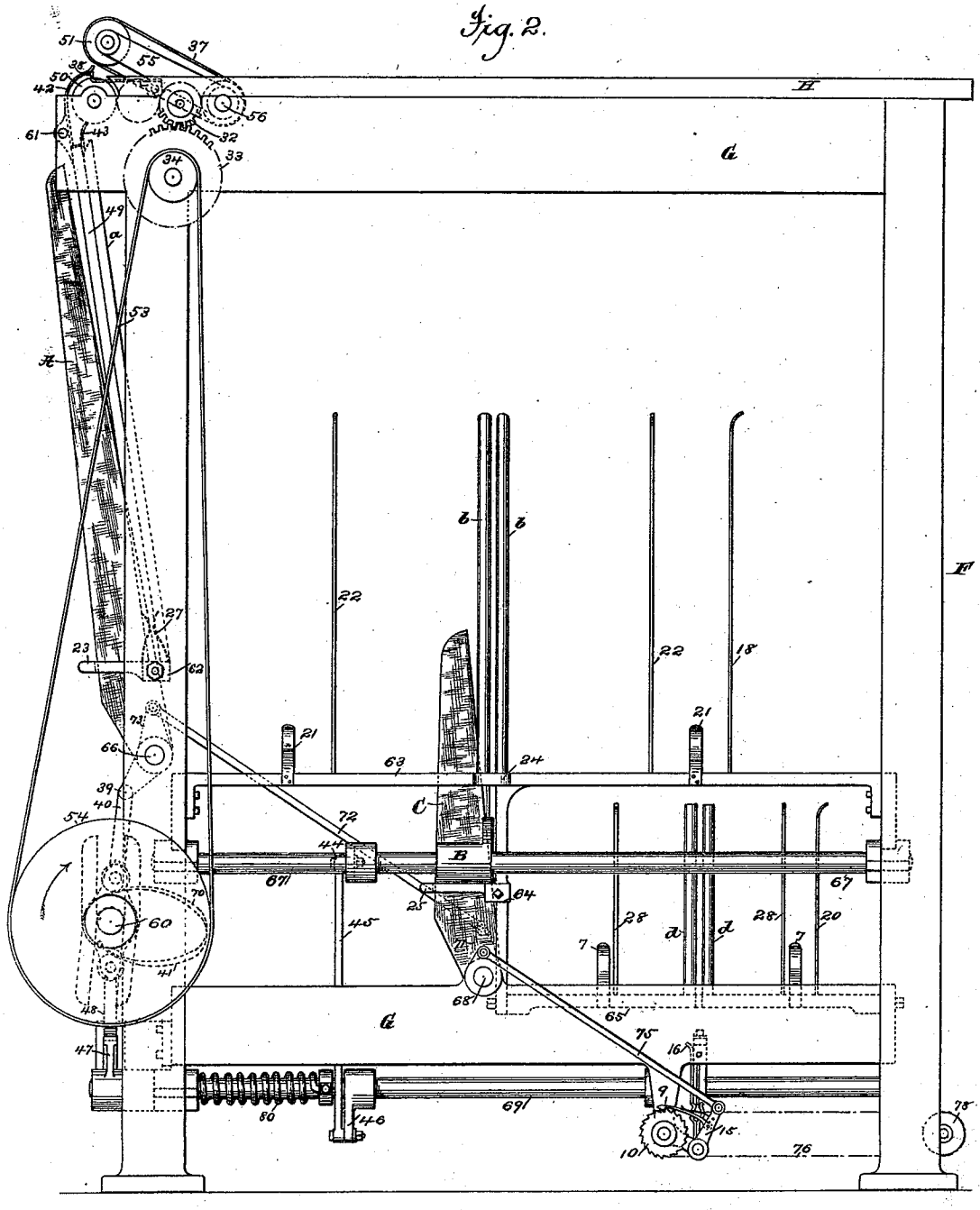
5 Sheets—Sheet 2.

L. C. CROWELL.

FOLDING MACHINE.

No. 510,527. Patented Dec. 12, 1893.

Fig. 2.



Attest:

Geo. H. Graham

J. A. Hovey

Inventor:

Luther C. Crowell

by Munson & Philipp

Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

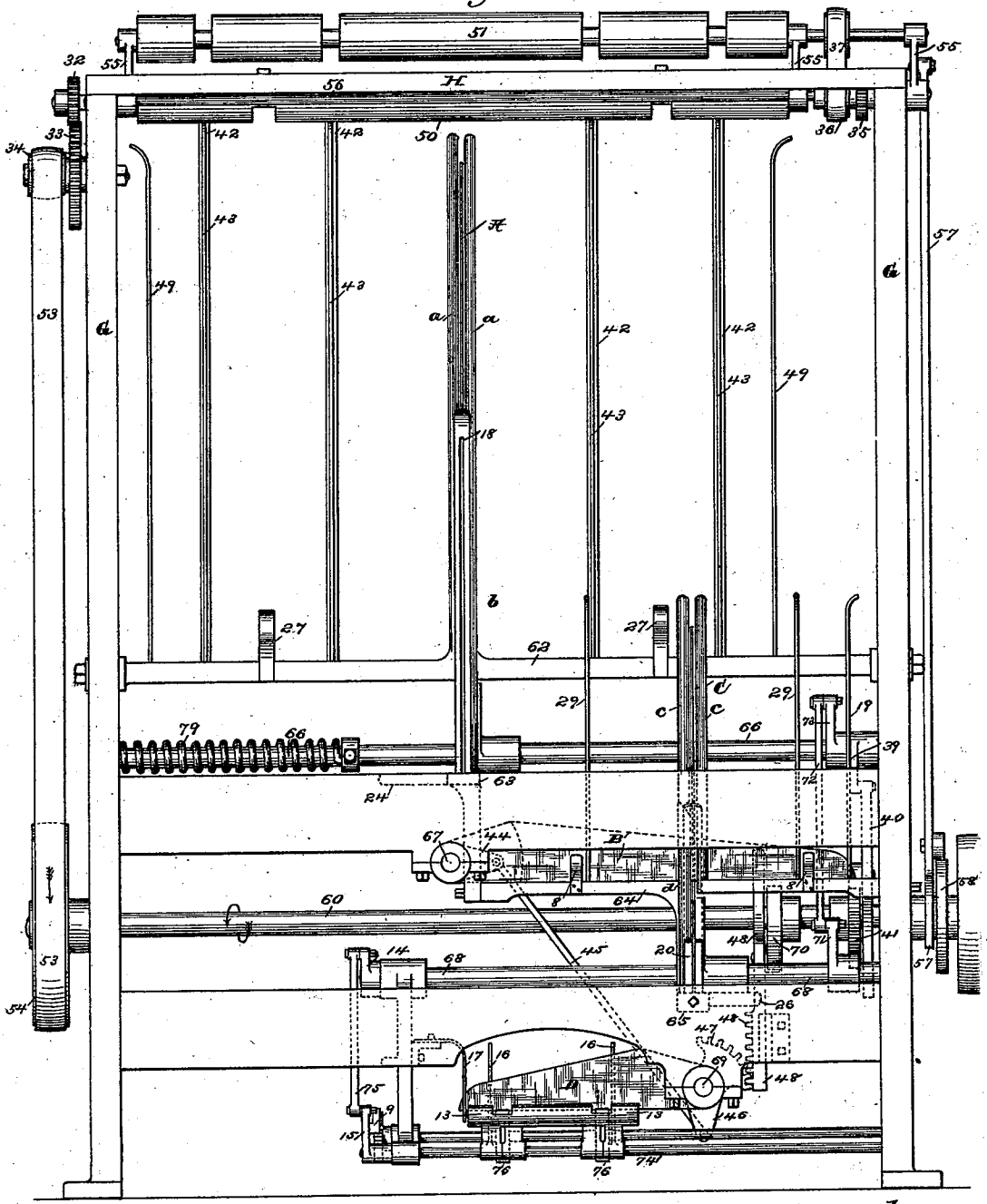
(No Model.) 5 Sheets—Sheet 3.

L. C. CROWELL.

FOLDING MACHINE.

No. 510,527. Patented Dec. 12, 1893.

Fig. 3.



Attest:

Geo. H. Graham

J. A. Storey

Inventor:

Luther C. Crowell

by Munson & Philipp

Attys

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.)

5 Sheets—Sheet 4.

L. C. CROWELL.

FOLDING MACHINE.

No. 510,527. Patented Dec. 12, 1893.

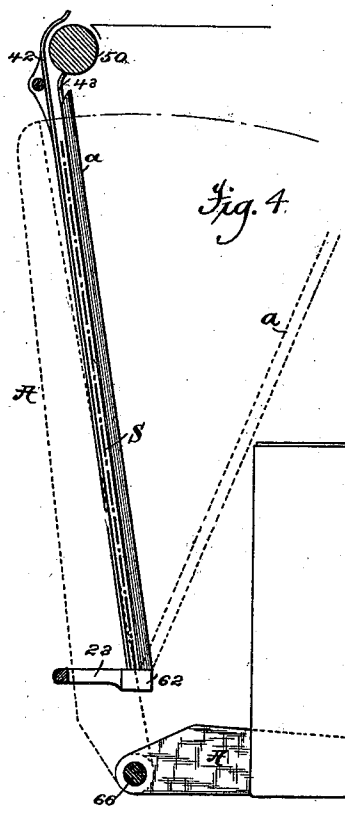


Fig. 4.

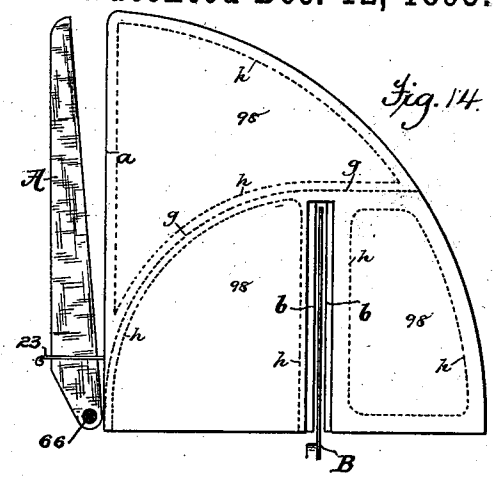
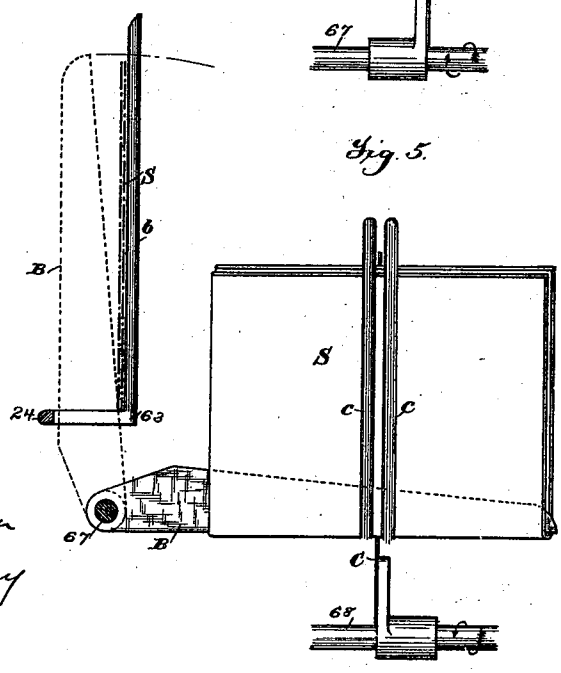


Fig. 14.

Fig. 5.



Attest:

Geo. K. Graham

J. A. Hovey

Inventor:

Luther C. Crowell

by Munson & Philipp

Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.)

5 Sheets—Sheet 5.

L. C. CROWELL.

FOLDING MACHINE.

No. 510,527. Patented Dec. 12, 1893.

Fig. 6.

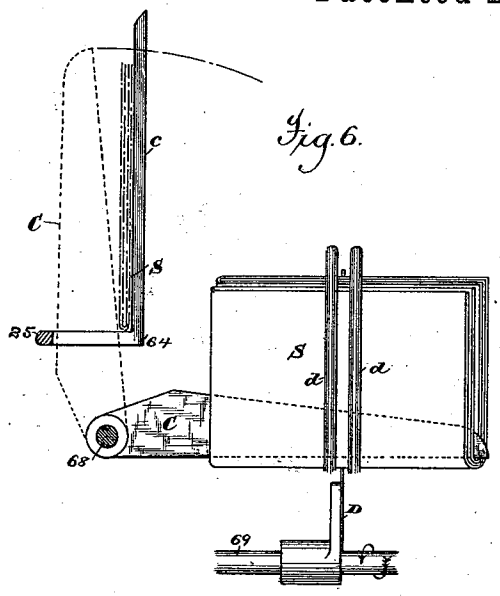


Fig. 8.

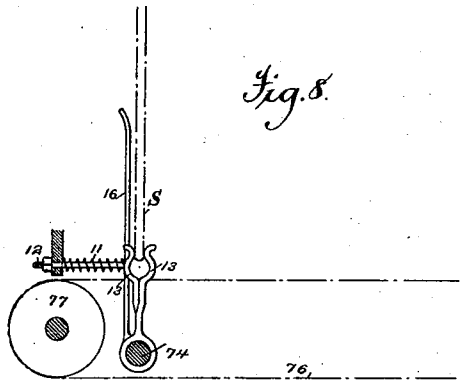


Fig. 7.

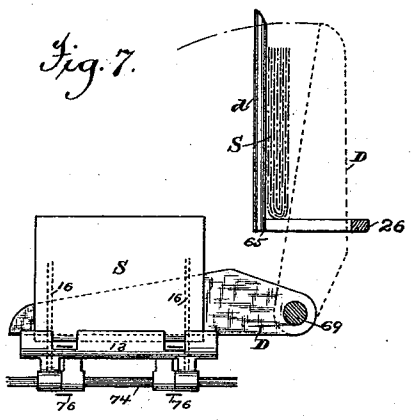
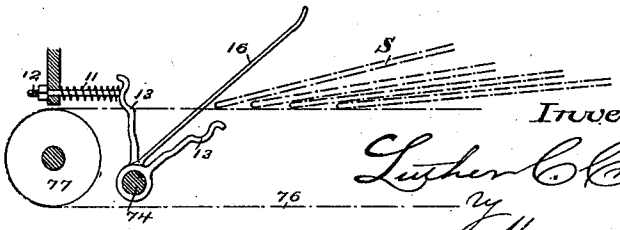


Fig. 9.



Attest:

Geo. H. Graham

J. A. Hovey

Inventor:

Luther C. Crowell

by Munn & Philipp

Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ROBERT HOE, STEPHEN D. TUCKER, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF NEW YORK, N. Y.

FOLDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 510,527, dated December 12, 1893.

Application filed May 28, 1886. Serial No. 203,496. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at 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 a mechanism for folding sheets of paper fed to it either mechanically or by hand, it being especially adapted to operate upon the sheets as they issue from an ordinary cylinder printing press.

As a full understanding of the invention can only be imparted by a description of the construction and operation of a folding mechanism embodying it, all preliminary description of the invention will be omitted and a full description of such a mechanism given, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view (the feed board being omitted) of a folding mechanism embodying the present invention in a form adapted to operate upon sheets fed to it by hand, said mechanism being capacitated to impart four folds to the sheets, the second and fourth folds being at right angles to the first and third. Fig. 2 is an elevation of the same, looking from the side marked E in Fig. 1. Fig. 3 is a similar view, looking from the side marked F in Figs. 1 and 2. Figs. 4 to 9 are diagrammatic views illustrating the operation of the several mechanisms, Figs. 8 and 9 being upon an enlarged scale. Figs. 10 to 13 illustrate details which will be hereinafter referred to, Fig. 11 being upon an enlarged scale; and Fig. 14 is a diagrammatic view illustrating certain modifications which will be explained.

Referring particularly to Figs. 1, 2 and 3 it is to be understood that the folding mechanism therein shown consists principally of four pairs of stationary guides *a b c d* and four folding blades A B C D which are arranged to vibrate in the arc of a circle from a position on one side of said guides between them and to a position on the other side thereof to effect the folding of the paper. These parts, together with the minor parts of the machine, are supported in a suitable frame-work G, at the top of which is arranged the feed board H from which the sheets are fed by hand to the devices which operate to present them to the folding mechanism.

The devices by which the sheets are presented to the folding mechanism consist of a pair of feeding rolls 50, 51 and suitably arranged stationary guides 42, 43, 49. The roll 50 is mounted in the frame G just below and at the front edge of the feed board and is driven through an intermediate 30 which engages with a gear 31 upon one end of a transverse shaft 52, the opposite end of which is provided with a gear 32 which engages with a gear 33 mounted upon a stud extending from the frame G and provided with a pulley 34 which is connected by a belt 53 with a pulley 54 mounted upon the main shaft 60. The roll 51 is supported in the ends of arms 55 extending from a transverse shaft 56 and is driven from a gear 35 upon the shaft 56 which engages with the gear 31 and is provided with a pulley 36 which is connected by a belt 37 with a pulley upon the shaft of the roll. One of the arms 55 is located outside the frame G and is provided with a pivoted rod 57 which is bifurcated at its lower end and straddles the main shaft 60 and is provided with a bowl which is acted on by a cam 58 upon the main shaft in such manner as to periodically lower and raise the roll 51 into and out of nipping contact with the roll 50. The arms 55 which are located inside the frame G are connected by a rod 59, which carries ordinary feed gages 38 against which the forward end of the sheet rests before it is carried off the table by the feed rolls and which, as the rolls are carried into nipping contact, are lowered so as to be removed from in front of the sheet. The guides 42 are supported at their upper ends on a transverse rod 61 and extend from the upper side of the roll 50 partly around said roll and then downward for a distance slightly more than the length of the sheet to be folded and are secured at their lower ends to a horizontal bar 62 which also serves as

a stop against which the sheet is brought to rest just prior to the making of the first fold. The guides 43 are arranged just inside of and a short distance from the guides 42 and extend upward from the bar 62 to a point just below the roll 50, as best shown in Fig. 10. These guides co-operate with the guides 42 to direct the sheet downward in proper position in front of the folding blade which makes the first fold.

The guides 49 are secured to the bar 62 and extend upward from the bar to points near the ends of the rolls 50, 51. These guides are bent outward at their upper ends and serve as side or edge guides to prevent the sheet from moving laterally as it passes downward between the guides 42, 43.

The folding blade A, which operates to make the first fold in the sheet, is, as shown in the present case, arranged vertically with its upper end just below the feed roll 50. This blade is pivoted at its lower end by being fixed to a rock shaft 66 located parallel with and below the bar 62 and is arranged to vibrate in the arc of a circle from the vertical position shown in Figs. 1, 2 and 3 inward to the horizontal position shown in Fig. 4. To impart this motion to the blade A the shaft 66 is provided with an arm 39 to the end of which is pivoted a rod 40 which is bifurcated and straddles the main shaft 60 and is provided with a bowl which is acted on by a cam 41 mounted upon the shaft 60, the cam 41 being so shaped as to impart the necessary rocking movement to the shaft 66 to vibrate the blade A downward, as just stated. The return movement of the blade is effected by a spring 79 on the shaft 66, as shown in Fig. 3.

Located just inside the path of travel of the sheets as they pass downward between the guides 42, 43 is a pair of vertical stationary guides *a*, preferably consisting of simple rods, which are located a short distance apart and in such position that the folding blade A as it is vibrated inward and downward will pass between them.

The bar 62 which supports the guides 42, 43, 49 and the guides *a* is divided at its middle to allow the blade A to be vibrated up to the vertical position shown. In order, however, to give strength and rigidity to the bar its ends are united by a yoke-shaped portion 23 which passes around the blade when in its vertical position.

Located at right angles to the bar 62 and directly in front of the blade A is a horizontal bar 63 which is similar in construction to the bar 62. This bar is located at such a height that it will lie just below the edge of the blade A when the latter is vibrated to its horizontal position. This bar is provided with two pairs of upwardly extending rods 22 which are located in such position that the blade A as it vibrates downward to its horizontal position will pass between the rods of each pair.

The blade B which operates to make the second fold in the sheet is pivoted at its lower end by being fixed to a horizontal rock shaft 67 which is arranged at right angles to the shaft 66 and below the bar 63. This blade is arranged at right angles to the blade A and, like the blade A, is arranged to be vibrated from the vertical position shown in Fig. 4 and by dotted lines in Fig. 5 downward to the horizontal position shown in Figs. 1, 2 and 3 and by full lines in Fig. 5. To give this motion to the blade B the shaft 67 upon which it is mounted is provided with an arm 44 which is connected by a rod 45 with an arm 46 upon a rock shaft 69, which shaft is provided with segmental gear 47 which is engaged by a rack upon a vertically-moving rod 48 which is bifurcated and straddles the main shaft 60 and is provided with a bowl which is acted on by a cam 70 upon the shaft 60, the cam 70 being so formed as to give the proper movement to the shaft 69, 67 to vibrate the blade B downward, as before stated. The return movement of the blade B is effected by means of a spring 80 on the shaft 69, as shown in Figs. 1 and 2. The bar 63 is provided with a pair of vertical guides *b*, similar to the guides *a*, which are so located that the blade B as it is vibrated as just stated will pass between them from one side to the other the same as the blade A. This bar 63, like the bar 62, is divided at its middle to permit the passage of the blade B and is provided with a yoke-shaped portion 24 which passes around the blade. Arranged at right angles to the bar 63 and in front of the blade B is a third horizontal bar 64 which is similar in construction to the bars 62, 63 and is located at such a height as to be just below the edge of the blade B when the latter is vibrated down to its horizontal position. This bar is provided with two pairs of vertical rods 29 which are so arranged that when the blade B is vibrated downward it passes between them, the same as has already been described in connection with the blade A and rods 22.

The blade C, by which the third fold is made, is pivoted at its lower end by being fixed to a horizontal rock-shaft 68 which is arranged parallel with the shaft 66 and below the bar 64. This blade is arranged to have the same vibrating movement as the blades A B. To give the proper movement to this blade its shaft 68 is provided with an arm 71 which is connected by a rod 72 with an arm 73 upon the shaft 66. The bar 64 is provided with two vertical guides *c* which are similar to and arranged the same as the guides *a b* so that the blade C will pass between them in its vibrations. This bar is also divided and provided with a yoke-shaped portion 25 similar to the portions 23, 24 and for the same purpose. Located at right angles to the bar 64 and in front of the blade C is a fourth horizontal bar 65 which is arranged at such a height as to be just below the blade C when the latter is in its horizontal position. This bar is also provided with two pairs of verti-

cal rods 28 similar to the rods 22, 29 and for the same purpose.

The blade D by which the fourth fold is made is pivoted at its lower end by being mounted upon the rock shaft 69 before referred to which is located beneath the bar 65. The bar 65 is provided with two vertical guides *d* which are arranged in the same relation to the blade D as are the guides *a b c* to the blades A B C as already described. This bar is also provided with a yoke-shaped portion 26 similar to the portions 23, 24, 25 and for the same purpose.

The devices thus far described constitute the principal parts of the mechanism for imparting four successive folds to the sheets. The remaining details in the construction of the mechanism will be referred to in describing its operation.

The mechanism for piling or delivering the folded sheets is constructed and arranged as follows: Located at right angles to the shaft 69 and in front of the folding blade D is a rock shaft 74 which is provided with two or more upwardly projecting fingers 16 which when in their vertical position lie on the inside of the folding blade D when in its horizontal position, as shown in Fig. 3. The shaft 74 is provided with an arm 15 which is connected by a rod 75 with an arm 14 on the shaft 68 by which means the shaft 74 is rocked at each vibration of the blades A C so as to throw the fingers 16 forward, as shown in Fig. 9. The shaft 74 is provided with two plates 13 one of which is rigidly secured to the shaft or to the fingers 16, while the other is mounted loosely upon the shaft and is sustained in a vertical position by means of a rod or rods 12 and spring or springs 11. When the fingers 16 are in their vertical position the plates 13 form spring jaws which lie just in front of the fingers 16. The purpose of these jaws will appear when the operation of the mechanism is described.

The piling mechanism is provided with slowly moving tapes 76 passing around pulleys 77, 78, upon which the sheets are piled and by which they are carried out to the side of the machine. The tapes 76 are given the proper amount of movement by means of a pawl 9 upon the arm 15 which engages with a ratchet 10 upon the shaft of the pulleys 77.

It will be observed that the connections which have been described for operating the folding blades are so arranged that the blades A C and B D are respectively connected together so as to be operated simultaneously. The cams 41, 70 for operating the folding blades are so timed with relation to each other that these pairs of blades alternate with each other in their operation, that is to say, the blades A C are vibrated downward and upward while the blades B D are in their vertical position, and vice versa. The cam 58, which operates the roll 51 and feed gages 38, is so timed that the roll and feed gages will be lowered immediately after the blades A C have been vibrated to their vertical position, as shown in Figs. 1, 2 and 3.

Assuming the machine to be in operation and the parts to be in the position shown in Figs. 1, 2 and 3, and assuming also that a sheet has been placed against the feed gages 38, the operation will be as follows: The cam 58 will allow the roll 51 to move downward into nipping contact with the roll 50 and at the same time move the feed gages 38 away from in front of the sheet. The sheet thus nipped between the rolls 50, 51, will be fed forward off the feed board and will be directed downward by the guides 42 and pass between said guides and the guides 43 until its rear edge passes out of the control of the rolls, when it will fall between the guides 42, 43, until it is arrested by its leading edge coming in contact with the bar 62, as shown by broken lines in Fig. 4. As the sheet passes downward between the guides 42, 43 it will be prevented from moving laterally by the guides 49 and will thus be presented in proper position in front of the folding blade A. The bar 62 may, and preferably will, be provided with light spring clips 27 into which the leading edge of the sheet will fall and which will press upon the sheet sufficiently to prevent it from rebounding and becoming distorted as it is arrested by the bar 62. As the sheet passes downward between the guides 42, 43 the cam 70 will operate the bar 48 so as to rock the shaft 67 and raise the blade B from the horizontal position shown in Figs. 1, 2 and 3, up to the vertical position shown in Fig. 4 and by dotted lines in Fig. 5, and immediately after the sheet S has been brought to rest the cam 41 will rock the shaft 66 so as to vibrate the blade A from the vertical position shown in Figs. 1, 2 and 3 and by dotted lines in Fig. 4 inward and downward to the horizontal position shown by full lines in Fig. 4. As the blade A is vibrated from its vertical to its horizontal position as just stated, it will strike the sheet S upon its fold line and double it between the stationary guides *a* and carry it inward and downward between the rods 22 until its folded edge lies along the bar 63 and at right angles to the blade B, as shown in Fig. 4. As soon as the sheet has received its first fold and been carried to this position by the blade A, the cam 41 will allow the spring 79 to rock the shaft 66 in the reverse direction so as to vibrate the blade A back to its vertical position, and at the same time, by means of the rod 72, rock the shaft 68 so as to raise the blade C to its vertical position, as shown in Figs. 1, 2, 3 and 5, and by dotted lines in Fig. 6. In passing back to its vertical position the blade A will pass out from between the sides of the folded sheet, thus leaving the once folded sheet between the rods 22 and between the folding blade B and the guides *b*. Any tendency which the blade may have to lift the sheet out from between the rods 22 upon its upward movement, may be prevented by pro-

viding the bar 63 with one or more spring clips 21, into which the folded edge of the sheet will be carried by the blade and which will grasp the sheet sufficiently to prevent it from being moved upward from the bar 63 by the upward movement of the blade. After the blades A C have been vibrated upward to their vertical position, as just stated, the cam 70 will rock the shafts 69, 67 so as to vibrate the blade B from the vertical position shown in Fig. 4 and by dotted lines in Fig. 5, downward to the horizontal position shown in Figs. 1, 2 and 3 and by full lines in Fig. 5. As the blade B is thus vibrated downward it will strike the sheet S at right angles to the first fold made by the blade A and will double it between the guides *b* and carry it over and downward between the rods 29 until its folded edge lies along the bar 64 and at right angles to the blade C, as shown in Fig. 5. After the sheet S has thus received its second fold the cam 70 will allow the spring 80 to reverse the movement of the shafts 69, 67 so as to vibrate the blade B back to its vertical position, thus leaving the sheet between the rods 29 and the folding blade C and guides *c*. At the same time that this blade B is thus vibrated to its vertical position the blade D will also be vibrated to its vertical position, as shown in Fig. 6, and by dotted lines in Fig. 7. The bar 64 may also be provided with one or more spring clips 8 similar to the clips 21 and for the same purpose. In the meantime and after the blade A has been vibrated back to its vertical position, another sheet will have been drawn off the feed board and passed downward between the guides 42, 43 in front of the blade A. After the blade B has been vibrated back to its vertical position, as just stated, the cam 41 will act to again vibrate the blades A C downward to their horizontal position. This will cause the blade A to fold the second sheet in the manner already described and at the same time the blade C will strike the sheet S upon a line at right angles to its last fold and double it between the guide *c* and carry it over and downward between the rods 28 until its folded edge lies along the bar 65 at right angles to the blade D, as shown in Fig. 6. After this takes place the cam 41 will again allow the spring 79 to reverse the movement of the shafts 66, 68 and vibrate the blades A C back to their vertical position, thus leaving the sheet S between the rods 28 and the folding blade D and guides *d* and the second sheet between the rods 22 and the blade B and guides *b*. The bar 65 may also be provided with one or more spring clips 7 similar to the clips 21 8 and for the same purpose. After the blades A C have been thus vibrated back to their vertical position the cam 70 will again rock the shafts 69, 67 so as to vibrate the blade B downward to its horizontal position, thus imparting a second fold to the second sheet the same as has already been described in connection with the first sheet, and at the same time vibrating the blade D from the vertical position shown in Fig. 6 and by dotted lines in Fig. 7 downward to the horizontal position shown by full lines in Fig. 7. As the blade D is thus vibrated to its horizontal position it will strike the sheet S at right angles to the fold made by the blade C and will double it between the guides *d* and carry it over in front of the fingers 16, as shown in Fig. 7, and by dotted lines in Fig. 8, thus making the fourth fold. As the sheet is carried downward in front of the fingers 16 by the blade D its folded edge will be forced between the spring jaws 13, as indicated in Fig. 8, and these jaws will press upon the paper sufficiently to crease and set the fold and prevent the sheet from unfolding. After the sheet has been carried to this position the cam 70 will again allow the spring 80 to reverse the movement of the shaft 69 and raise the blade D back to its vertical position, leaving the sheet in the bite of the jaws 13. As the blade D is vibrated back to its vertical position the cam 41 will again rock the shafts 66 and 68 to impart the third fold to the second sheet and the first fold to a third sheet which has in the meantime been presented in front of the blade A, and this will cause the rod 75 to rock the shaft 74 so as to open the jaws 13 and vibrate the fingers 16 forward, as shown in Fig. 9, and thus lay the sheet over onto the belts 76. As the shaft 74 is thus rocked the pawl 9 will engage with the ratchet 10 and move the belts 76 a short distance so as to carry the pile of sheets outward toward the side of the machine.

It will be observed that the rods forming the guides *a b c d* are cut away and rounded on one side at their upper ends and also that the vertical rods 22, 29, 28 are bent outward or spread at their upper ends, as best shown in Fig. 11. This will prevent the sheets from being torn by catching on the ends of the rods which might occur if the ends of the rods were left square and abrupt.

The bars 63, 64, 65 are, as shown in the present case, provided with vertical plates 18, 19, 20 which are curved outward at their upper ends and are slotted to receive the ends of the folding blades A B C respectively. These plates are not essential but they serve as side guides for the sheets and prevent them from being moved out of proper position in front of the folding blades B, C, D. A similar plate 17 may be arranged to receive the end of the blade D. It will often be found highly advantageous to provide the blades A B C D upon their folding edges with one or more fine points 2, as shown in Fig. 12, which will impale the paper as soon as the blade comes into contact therewith and thus prevent the sheet from moving lengthwise of the blade. The same result may be effected by providing the blades at their ends with slight projections 3, as shown in Fig. 13, which will pass over the edge of the sheet and thus prevent it from moving along the blade. The bars 63, 64, 65 may be formed or provided

with any suitable means for causing the blades to more perfectly crease the paper so as to set the fold.

The organization as thus far described embodies the invention in its most complete and desirable form, but it may be considerably modified in many particulars without departing from the essential features of the invention.

The rods 22, 29, 28, of which there may be any number of pairs, although they are useful as a support for the sheet, are not in all cases essential and they may therefore be omitted without departing from the invention. So also the clips 27, 21, 8 and 7, although useful, are not in all cases essential and may be omitted without departing from the invention.

It is preferable that the blades A B C D should be made to vibrate through an arc of about ninety degrees, but it is not necessary that the blades should have exactly this range of movement. They may have a greater or less range of movement. It is also preferable that the blades should all vibrate in vertical planes, as shown, but this also is not essential.

The guides *a b c d* will preferably consist of simple rods and will preferably be arranged so as to be parallel or nearly parallel with the folding edges of the blades A B C D when the latter are in their raised position or in the position they occupy when the sheet is presented between them and the guides. This, however, is not essential as the guides may be arranged at any position between the blades and the stop bars 63, 64, 65 so long as they operate to fold or double the sides of the sheet together across the edges of the blades. One of the intermediate positions which the guides may occupy is shown by dotted lines in Fig. 4. So also these guides, instead of consisting of rods may be formed by the edges of parallel or substantially parallel plates 98 which are so arranged that the blades pass between them, as illustrated in Fig. 14. In this case the edges *a* of the plates form the guides for the blade A, and the edges *b* of the slot in the inner plate or the edges of a pair of plates similar to the plates 98 form the guides for the blade B, while the plates also take the place and are the equivalent of the rods 22. It is also to be remarked that the plates 98 instead of being of the form shown by full lines may be of less extent, as for example of the form shown by the dotted line *g*, the part above the dotted line being removed. In this case the upper edges of the plates will still form the guides for doubling the paper across the edge of the folding blade. In this case, however, the upper edges of the plates should be bent or curved outward from each other to prevent the sheet from being torn by being drawn across their edges. In any case the plates need not be continuous but portions of them may be cut out, as for example the portions within the dotted lines *h* may be removed.

Although as herein illustrated the invention is embodied in a mechanism capacitated to impart four folds to the sheet, it is to be understood that this mechanism has been selected merely for the purpose of making the illustration of the invention very full and complete. The number of folds which the mechanism is capacitated to impart is not material. It may be capacitated to impart only one fold or it may be capacitated to impart two or more folds. If desired the mechanism may be so constructed and organized that by slight adjustments it will be capacitated to impart either one, two, three or four folds as may be desired at any particular time. An organization of this character will form the subject matter of a future application for Letters Patent.

The particular form of connections which are herein shown for operating the several folding blades and the piling devices are of course not material. The connections shown are well suited for the purpose but other connections may readily be substituted for those shown, if preferred. Each of the blades and the piling devices may be operated independently and they may be operated in both directions positively, or they may be vibrated forward and downward by springs and returned by cams if preferred.

In conclusion it is to be remarked that the folding mechanism instead of being fed by hand may readily be combined with a printing machine or with another folding machine so that the sheets will be taken mechanically from the printing devices or the previous folding mechanism and presented to the first folding blade.

What I claim is—

1. The combination, with the guides *a* and blade A, of the side guides 49, the stop bar 62, arranged to arrest the sheet in position between the blade and guides, and the clips 27, substantially as described.

2. In a folding machine, the combination with a pair of guides, as *a*, *b* or *c*, of a folding blade, as A, B or C, arranged to vibrate in the arc of a circle from a position on one side of said guides, between them and to a position on the other side thereof, and a stop bar, as 63, 64 or 65, arranged in front of said blade, and provided with clips, as 21, 8 or 7, substantially as described.

3. In a folding machine, the combination with a pair of guides, as *a*, *b* or *c*, of a folding blade, as A, B or C, arranged to vibrate in the arc of a circle from a position on one side of said guides, between them and to a position on the other side thereof, and a stop bar, as 63, 64 or 65, arranged in front of said blade, and provided with the rods 22, 29 or 28, and with clips as 21, 8 or 7, substantially as described.

4. In a folding machine, the combination with a pair of guides, as *a*, *b* or *c*, of a folding blade, as A, B or C, arranged to vibrate in the arc of a circle from a position on one side of

said guides, between them and to a position on the other side thereof, and a stop bar, as 63, 64 or 65, arranged in front of said blade, and provided with the guide 18, 19 or 20, substantially as described.

5. The combination with the guides *d*, of the blade D vibrating from a position on one side of said guides between them and to a position on the other side thereof, and the vibrating fingers 16 receiving the folded sheet from the vibrating blade, substantially as described.

6. The combination with the guides *d*, of the blade D vibrating from a position on one side of said guides between them and to a position on the other side thereof, the vibrating fingers 16 receiving the folded sheet from the blade, and the moving tapes 76 on which the sheets are deposited, substantially as described.

7. The combination with the guides *d*, of the vibrating blade D, the vibrating fingers 16, and the jaws 13, substantially as described.

8. The combination with the guides *d*, of the vibrating blade D, the vibrating fingers 16, the jaws 13 and the moving belts 76, 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.