C. S. MARSHALL.

FOLDING MACHINE.

APPLICATION FILED DEC. 17, 1906.

1,013,414.

Patented Jan. 2, 1912.

6 SHEETS—SHEET 1.

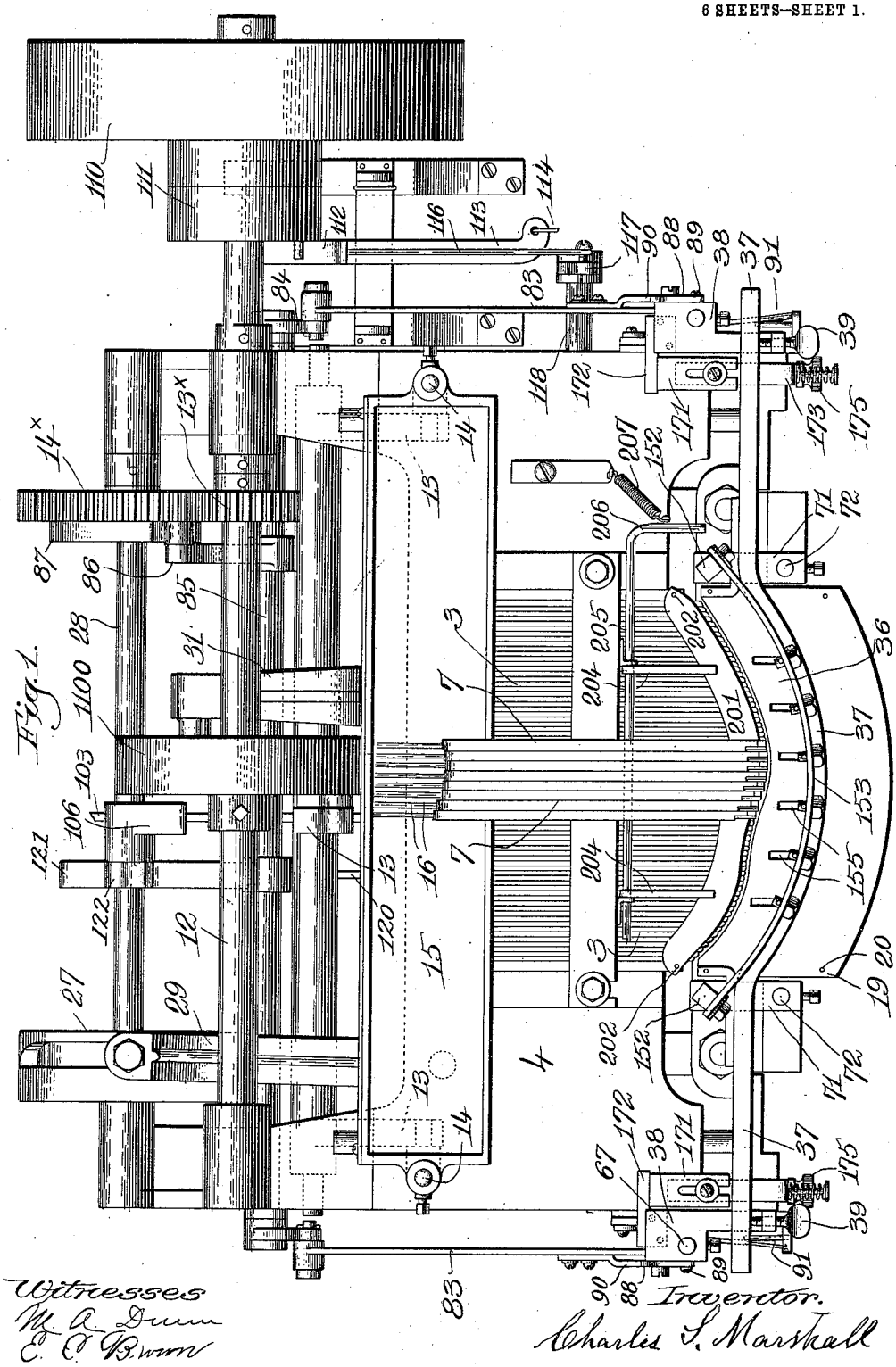


Fig. 1.

Witnesses
W. A. Dunn
E. C. Brown

Inventor.
Charles S. Marshall

C. S. MARSHALL.

FOLDING MACHINE.

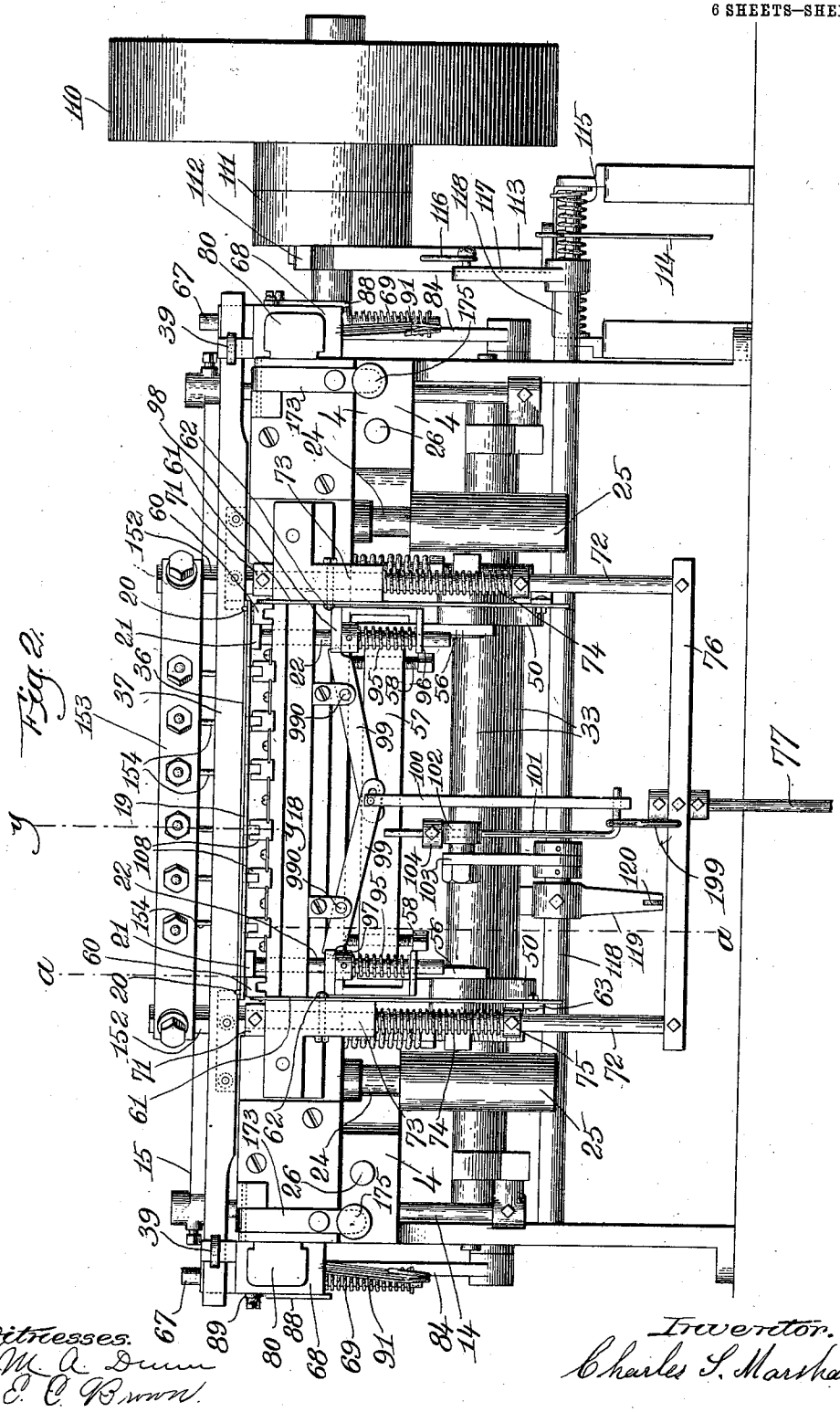
APPLICATION FILED DEC. 17, 1906.

1,013,414.

Patented Jan. 2, 1912.

6 SHEETS—SHEET 2.

Fig. 2.



Witnesses.
W. A. Dunn
E. C. Brown.

Inventor.
Charles S. Marshall

C. S. MARSHALL.

FOLDING MACHINE.

APPLICATION FILED DEC. 17, 1906.

1,013,414.

Patented Jan. 2, 1912.

6 SHEETS—SHEET 3.

Fig. 3.

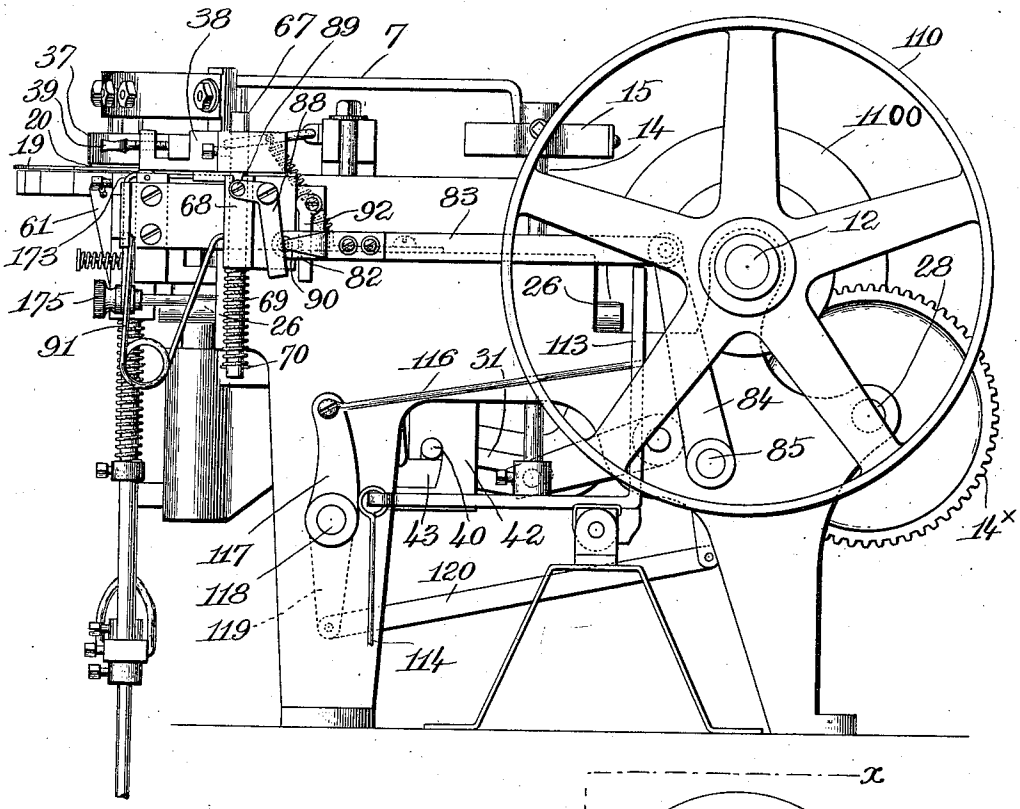
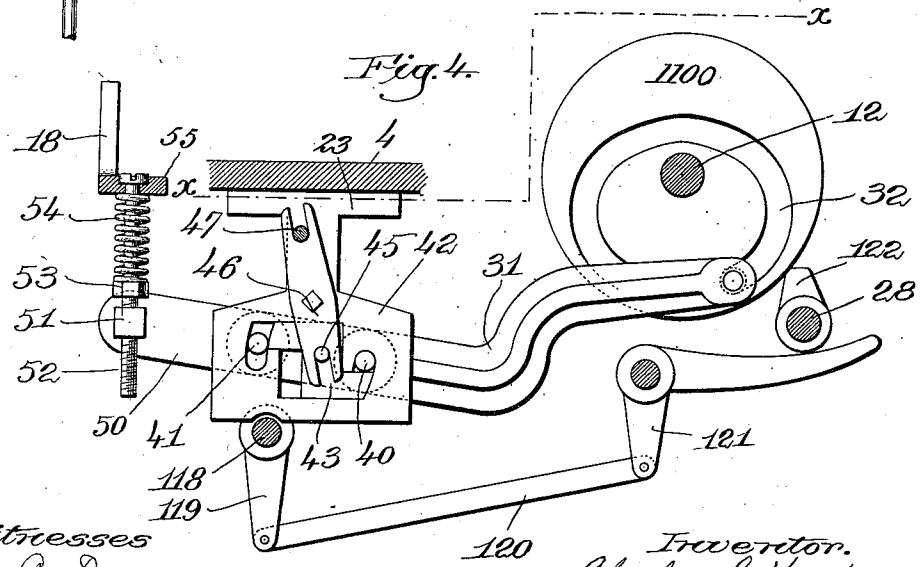


Fig. 4.



Witnesses

M. A. Dunn

E. C. Brown

Inventor.

Charles S. Marshall

C. S. MARSHALL.

FOLDING MACHINE.

APPLICATION FILED DEC. 17, 1906.

1,013,414.

Patented Jan. 2, 1912.

6 SHEETS—SHEET 4.

Fig. 5.

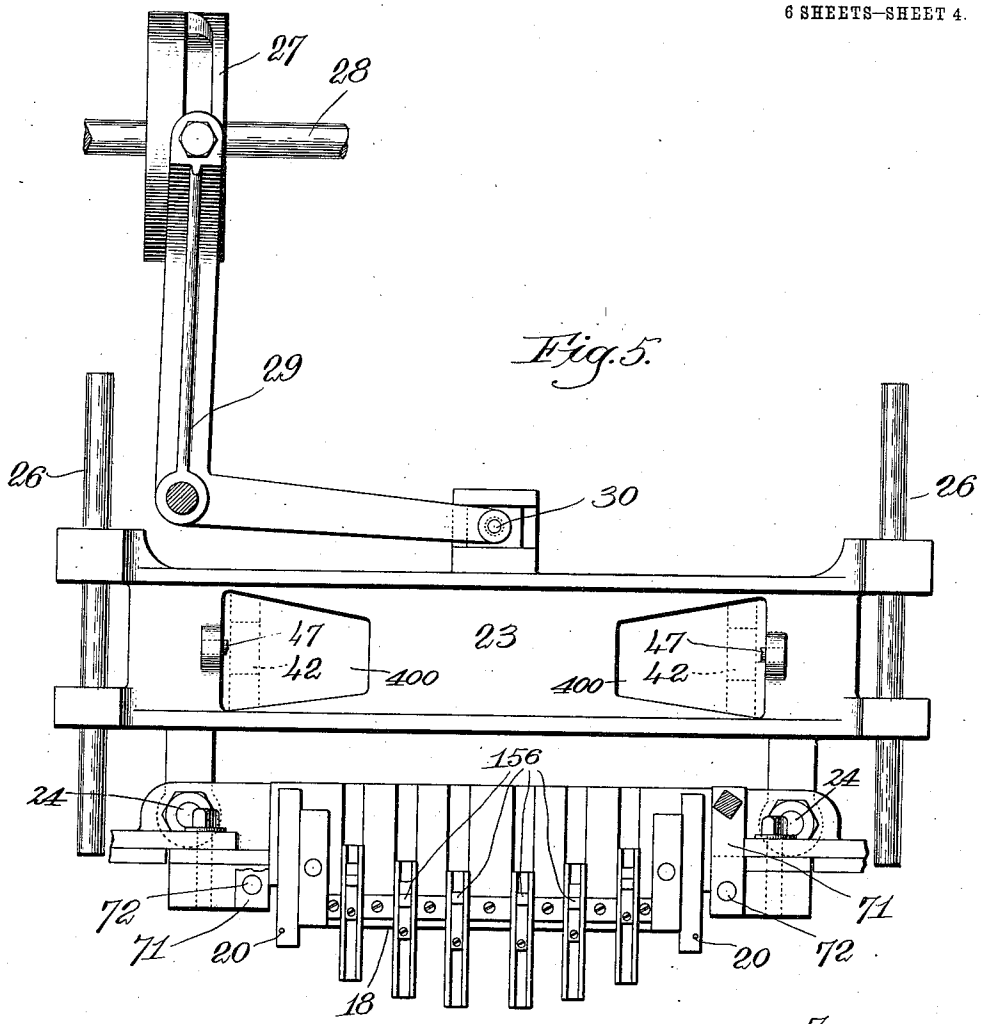
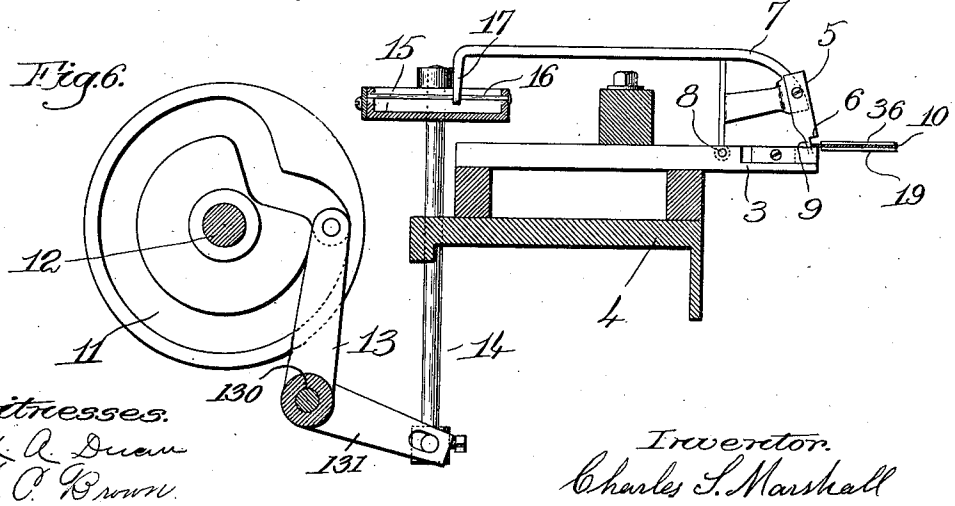


Fig. 6.



Witnesses.

M. A. Drew

E. C. Brown.

Inventor.

Charles S. Marshall

C. S. MARSHALL.

FOLDING MACHINE.

APPLICATION FILED DEC. 17, 1906.

1,013,414.

Patented Jan. 2, 1912.

6 SHEETS—SHEET 5.

Fig. 7.

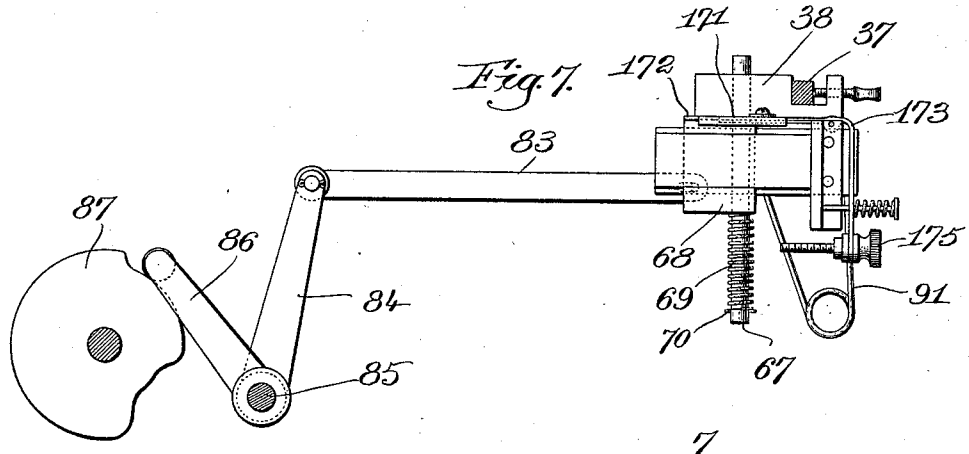


Fig. 8.

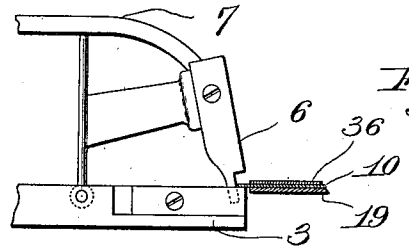


Fig. 9.

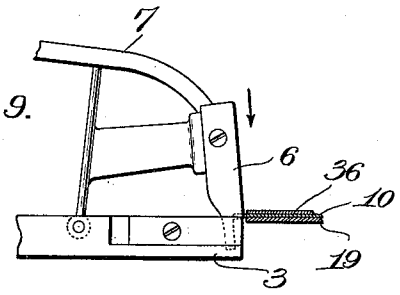


Fig. 10.

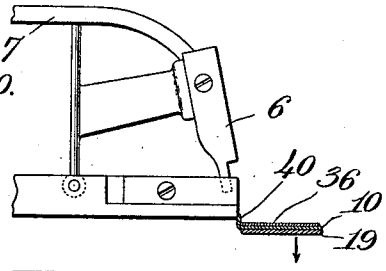


Fig. 11.

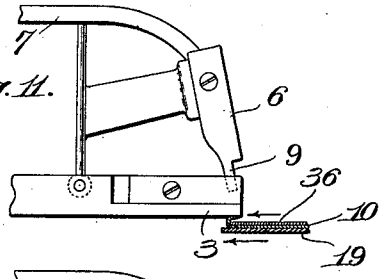


Fig. 12.

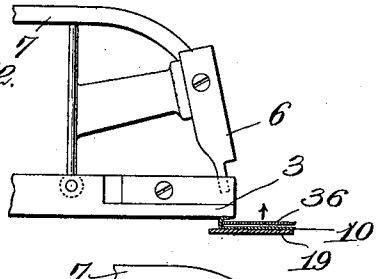


Fig. 13.

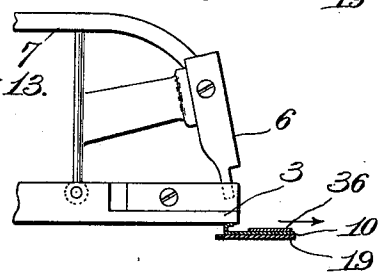
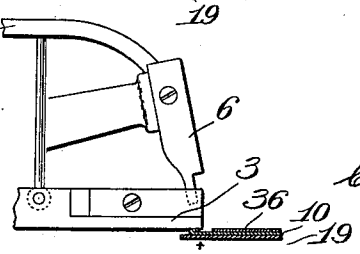


Fig. 14.



Witnesses.

M. A. Dunn

E. C. Brown

Inventor.

Charles S. Marshall

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

C. S. MARSHALL.

FOLDING MACHINE.

APPLICATION FILED DEC. 17, 1906.

1,013,414. **Patented Jan. 2, 1912.**

6 SHEETS—SHEET 6.

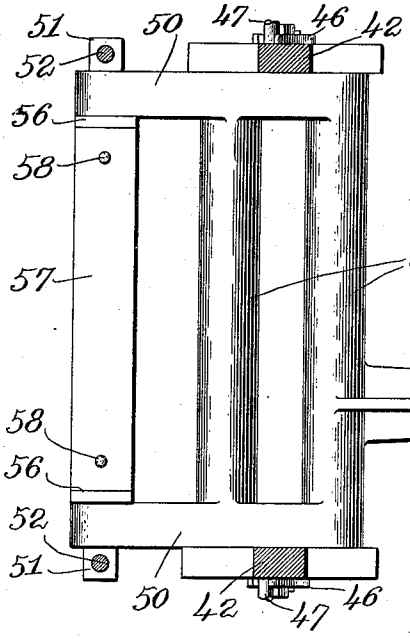


Fig. 15.

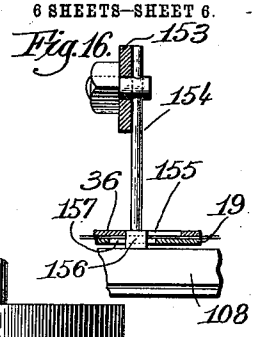


Fig. 16.

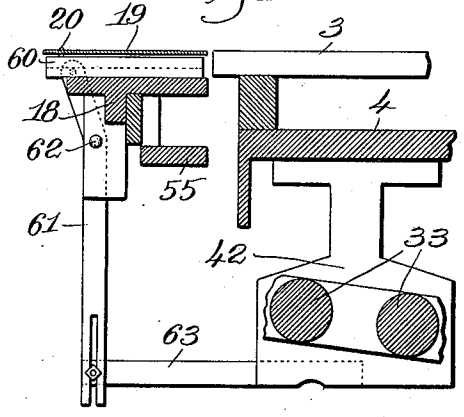


Fig. 17.

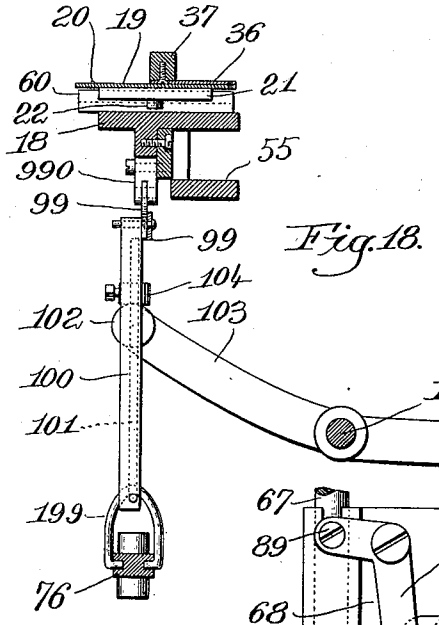
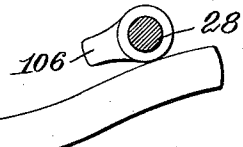
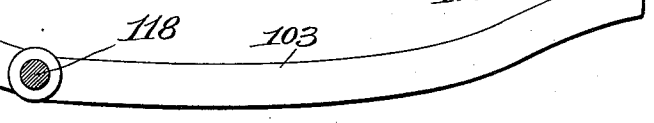


Fig. 18.





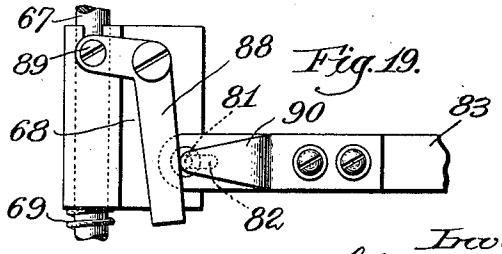


Fig. 19.

Witnesses.
M. A. Dunn
E. C. Brown

Inventor.
Charles S. Marshall

UNITED STATES PATENT OFFICE.

CHARLES S. MARSHALL, OF BROCKTON, MASSACHUSETTS, ASSIGNOR TO BOSTON MACHINE WORKS COMPANY, OF LYNN, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

FOLDING-MACHINE.

1,013,414. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed December 17, 1906. Serial No. 348,094.

To all whom it may concern:

Be it known that I, CHARLES S. MARSHALL, a citizen of the United States, residing at Brockton, in the county of Plymouth and State of Massachusetts, have invented a new and useful Improvement in Folding-Machines, of which the following is a specification.

This invention relates to folding machines of that class which are constructed to perform the two operations of snipping or slitting the edge of sheet material to be folded, and subsequently folding said slitted edge. A machine of this general class is shown in my Patent No. 750,872, dated February 2, 1904.

The present invention however differs from the invention shown and described in my former patent in many particulars which will be hereinafter more fully described and then pointed out in the claims.

Referring first to the drawings in which I have shown one embodiment of my invention, Figure 1 is a top plan view of a selected form of the invention; Fig. 2 is a front view thereof; Fig. 3 is a side view; Fig. 4 is a detail of some of the operative parts which will be more fully hereinafter described; Fig. 5 is a detail showing the means for giving the table its horizontal movement; Fig. 6 is a sectional view showing the means for operating the snipper; Fig. 7 is another sectional view showing the cam for withdrawing the creaser-plate; Figs. 8 to 14 are detail views showing the various steps of the snipping and folding operation as performed by this machine; Fig. 15 shows in plan view the rocking arm for elevating and lowering the table, said view being a section on substantially the line *x*—*x*, Fig. 4; Fig. 16 is a vertical section on an enlarged scale on line *y*—*y*, Fig. 2; Fig. 17 is a vertical section on substantially the line *a*—*a*, Fig. 2; Fig. 18 is a detail view showing the means for unclamping the work; Fig. 19 is an enlarged detail view showing a mechanism for lifting the creaser-plate.

The present embodiment of my invention comprises a work-supporting table on which the work is supported, a slitting device to slit the edge of the work, and a folder to fold the slitted edge over on the body of the work.

The folder is designated by reference numeral 3, and it is supported in any suitable way upon the bed or frame 4 of the machine. The folder may be made in one piece or it may be made in the form of adjustable fingers or blades, such, for instance, as shown in my former patent, and it is a folder of this latter class which I have chosen to illustrate herein.

The slitting device is designated generally by 5, and it is shown as comprising a plurality of slitting knives or blades 6 which are movably mounted so as to be moved toward and from the folder to accomplish the slitting operation.

There will be as many knives 6 as necessary to properly slit the curved portion of the edge of the material to be folded, and in the present embodiment of the invention each slitting knife is carried by a rocking member 7 which is pivoted to the folder as at 8, so that by rocking the members 7 the cutting edges of the knives are moved toward the folder to accomplish the slitting operation. Each of the slitting knives is shown as having a foot portion 9 which extends into a slot in the folder, said foot portion constituting a gage against which the edge of the material 10 to be folded may be placed when said material is put into the machine.

The rocking movement of the members 7 to which the slitting knives are attached is accomplished by means of a knife-moving cam groove 11 formed in a cam 1100 which is mounted on the driving shaft 12 of the machine, which groove is hereafter termed cam 11, said cam acting on an arm 13 rigid with the rock-shaft 130 which has rigid therewith two arms 131 pivotally secured to two plungers 14 movable vertically in the frame 4 and carrying at their upper ends a head 15 adapted to act on the rear end of the members 7.

I have shown the head 15 as having a plurality of rods 16 thereon, each of which extends through an aperture in the tail 17 of a member 7, by means of which construction the up-and-down movement of the head 15 caused by the cam 11 will result in rocking the members 7 and thereby performing the slitting operation. The work 10 to be folded is supported upon a work-table and said work-table and the folder are arranged so that they have both an up-and-down and a horizontal movement relative to each other. Where the folder is stationary, as herein shown, this relative movement is accom-

plished by giving the work-supporting table both an up and down and a horizontal movement, but this specific manner of securing the necessary relative movement between the work-supporting table and the folder is not essential to my invention. The work-supporting table may have any suitable construction and in the present embodiment of my invention it comprises a table body 18 and a face plate 19 on which the work 10 is supported. Said face plate is preferably removable from the table body so that face-plates of different shapes may be used according to the shape of the curved edge being folded. This face-plate 19 is shown as held in place by means of two pins 20 rising from the table body, and it rests directly on the heads 21 of two spring-pressed plungers 22 which are carried by said table body as will be presently described. A creaser-plate or former 36 which has a curved edge over which the work is folded is yieldingly held against the work 10 and operates to hold the work in position on the table, said creaser-plate acting both as a former to give definite shape to the fold, and as a holding means for the work. This creaser-plate is shown as carried by a head 37 which extends across the front of the machine, and in the present embodiment of the invention said head is made removable so that different heads having associated therewith creaser-plates of different shapes may be used. The ends of the head are herein shown as received in recesses in blocks 38, and as held in said recesses by means of thumb-screws 39.

Before proceeding further to describe in detail the mechanism herein shown for giving the operative parts their movement, I will refer briefly to Figs. 8 to 14 wherein the essential parts of the folding machine are shown in the different positions assumed by them during the folding operation. In Fig. 8 the slitting knife 6 is in its normal position and the work 10 is shown as in place in the machine resting on the face-plate 19, and with its edge resting against the feet 9, said work being held in place by the creaser-plate 36. The first movement of the mechanism is to slit the edge, this being done by rocking the members 7 to lower the slitting knives, as shown in Fig. 9. After the slitting knives have moved toward the folder to cut the work and then away from the folder, work-supporting table, with its face-plate 19 and the folder are given a vertical movement relative to each other, and when the folder is fixed this is accomplished by lowering the table into the position shown in Fig. 10, during which operation the slitted edge of the work is turned up, as shown at 40 in said figure. The next step in the folding operation is to give the folder and the table the relative movement in a horizontal direction to fold the edge 40 of the work over on the body thereof. And where the folder is fixed, as herein shown, this relative movement is secured by giving the table a horizontal movement thus bringing the parts into the position shown in Fig. 11. During this movement the face-plate 19 of the table is advanced relative to the work to carry the edge thereof beyond the folded edge of the work, as plainly seen in Fig. 11, this being for the purpose of preventing a bead being formed on the folded edge when the fold is set. After the parts have assumed the position shown in Fig. 11, the creaser-plate 36 is withdrawn, as shown in Fig. 13, and subsequently the folder and table are given a vertical movement relative to each other to press the fold, as shown in Fig. 14. In order to prevent the creaser-plate from pulling the work back as it is withdrawn I have provided means for lifting said creaser-plate slightly to relieve its pressure on the work prior to the withdrawal thereof, as shown best in Fig. 12. Fig. 14 shows how when the fold is pressed or set the face-plate 19 extends beyond the folded edge thereby preventing the possibility of any bead forming as might be the case if the edge of the face-plate came exactly in line with the folded edge. After the fold has been set, as shown in Fig. 14, the parts are returned to their normal position, as shown in Fig. 8, ready for another operation.

Having now described briefly the cycle of operations I will proceed to describe the mechanism employed to effect these operations. The table body has depending therefrom two studs 24 which are adapted to play up and down in sleeves 25 carried by a carriage 23 and said carriage is supported for horizontal movement on the frame 4 by two guide pins 26 which are rigid with the carriage and are adapted to play back and forth in apertures in the fixed frame 4. The horizontal movement of the work supporting table is effected by reciprocating the carriage 23 relative to the fixed frame 4, and the vertical movement of the table is effected by reciprocating said table vertically with reference to the carriage 23, said table being guided in its vertical movement by the studs 24. For reciprocating the carriage 23 I have shown a cam 27 mounted on the countershaft 28 which is driven from the main shaft 12 by means of suitable gearing 13^{x}, 14^{x}, which cam 27 acts upon one arm of an elbow lever 29, the other arm of which has a pivotal connection with the carriage 23, as at 30. The cam 27 is provided with a cam groove shaped to give a reciprocating movement to the carriage 23 at proper times during the cycle of operations. For raising and lowering the table body 18 relative to the carriage 23 I employ a rocking lever 31 (see Figs. 4 and 15) the front end of which has the two arms 50 that are pivotally con-

nected to said table body and the other end of which is acted upon by a cam groove 32 which may be formed in one face of the cam 1100 or in a separate cam as desired and which groove is hereafter termed cam 32. The lever 31 has integral therewith a double rock-shaft 33 which acts as the fulcrum about which the lever turns.

The cams 27 and 32 are so timed with reference to each other that the cam 32 first operates to lower the table into the position shown in Fig. 10, and then the cam 27 acts to move the table horizontally to carry the work under the folder, as shown in Fig. 11, and then the cam 32 again acts to raise the table to press the fold, as shown in Fig. 14, after which the cam 27 moves the table horizontally toward the front of the machine and the cam 32 then raises the table to the initial position shown in Fig. 8.

The work-supporting table thus has two vertical movements, a comparatively long movement when the table is in its forward position, to carry it from the position shown in Fig. 8 to that shown in Fig. 10 and vice versa, and a shorter movement when it is in its rearward position to carry it from the position shown in Figs. 10 and 11 to that shown in Fig. 14. I employ however the same cam 32 for giving both the long and the short vertical movement to the table, and as there are two vertical movements of the table to one horizontal movement, and as the cam 32 is mounted on the shaft 12 while the cam 27 is mounted on the shaft 28 I make the gears $13^{\times}$ and $14^{\times}$ two-to-one gears, so that the shaft 12 will rotate twice during each rotation of the shaft 28. Since the cam 32 has a fixed throw it is necessary to provide some means for varying the effective movement thereof to give the long and short vertical movement to the table. In the present embodiment this is accomplished by shifting the fulcrum about which the lever 31 turns at proper times thereby to vary the relative lengths of the two arms of said lever. As herein shown the lever 31 has rigid therewith a rock-shaft 33 which carries at each end two fulcrum pins 40 and 41. These fulcrum pins are received in slots in fulcrum brackets 42 fixed to the frame 4, and extending through apertures 400 in the carriage 23 (see Fig. 5) and the fulcrum pins at each end of the rock-shaft are adapted to work against a sliding fulcrum block 43. Each of the fulcrum members 43 is Z-shaped, as shown best in Fig. 4, and has extending therefrom a pin 45 which enters a slot in one end of a rocking arm 46 pivoted to the bracket 42, the other end of said arm having a slot in which is received a pin 47 extending from the carriage 23.

When the fulcrum blocks 43 are in the position shown in Fig. 4 the fulcrum pins 40 have engagement therewith, and the turning movement of the lever 31 will be about said pins 40 as an axis, the fulcrum-pins 41 during such movement of the lever 31 playing up and down in slots in the fulcrum-brackets 42. If, however, the fulcrum-blocks are shifted to the left, Fig. 4, so as to be projected over the fulcrum pins 41 and to be withdrawn from the fulcrum pins 40 then the turning movement of the lever 31 will be about the pins 41 as an axis. Obviously when the lever 31 fulcrums about the pins 40 the left hand end of said lever, which is that attached to the table body 18, will have a greater up and down movement than when said lever fulcrums about the pins 41, and the mechanism is so arranged that when the table moves from the position shown in Fig. 8 to the position shown in Figs. 10 and 11, or oppositely, said lever 31 fulcrums about the pins 40 while when said table moves from the position shown in Fig. 11 to that shown in Fig. 14, or oppositely, said arm fulcrums about the pins 41. The fulcrum-blocks 43 are shifted by the horizontal movement of the table, such horizontal movement operating through the pins 47 to turn the levers 46 and thus effect the required movement of the blocks 43.

The connection between the lever 31 and table body 18 is preferably a resilient one. The form of lever 31 and rock-shaft 33 herein shown is illustrated in Fig. 15, from which it will be seen that said lever 31 has at its front end the two arms 50. Each arm 50 has pivoted thereto a stud 51 into which is screw-threaded a thrust-pin 52, the upper end of each thrust-pin extending loosely through the horizontal flange 55 of the table body 18. Surrounding each thrust-pin is a spring 54 which bears at one end against said flange 55, and at the other end against a collar 53 rigid with the thrust-pin 52. The lifting movement of the arms 50 is thus transmitted to the table body through the springs 54. In order to firmly set the fold, however, it is desirable to apply a positive pressure thereto, and accordingly I have provided means so that when the table and its face-plate 19 are elevated into the position shown in Fig. 14 to set or press the fold, the first pressing movement of the table is transmitted through the springs 54, while the final movement is a positive one which will be effected after the springs 54 have been compressed to a certain amount. Various ways of thus effecting this positive movement may be adopted, but I have herein shown each of the arms 50 as having secured thereto and rising therefrom at their ends a thrust-member 56, said thrust-members being connected at their upper ends by a bar 57 in which are mounted two adjusting screws 58. The adjusting screws are normally set so that the upper ends thereof are separated somewhat from the horizontal

flange 55, as best seen in Fig. 2, so that the first upward movement of the table is transmitted through the springs 54. When, however, the pressure is being applied to the fold to set the same, as shown in Fig. 14, the springs 54 are compressed until the adjusting screws are brought into engagement with the flange 55 of the table 18 when further rocking movement of the lever 31 will bring a positive pressure to bear on the fold.

I will now describe the means for advancing the face-plate portion of the table from the position shown in Fig. 10 to that shown in Fig. 11. As above stated, this face-plate is held in place by the pins 20. These pins are carried by sliding blocks 60 which are mounted on the table body 18 so as to slide back and forth thereon. Each block 60 has pivoted thereto the upper end of a lever 61, which levers are pivoted to the table body 18, as at 62. The lower end of each lever is pivoted to a fixed support 63 herein shown as extending from the fulcrum-bracket 42 (see Fig. 17). With this construction it will be obvious that as the table is moved inwardly from the position shown in Fig. 10 to that shown in Fig. 11, or to the right Fig. 17, the upper ends of the levers 61 will have a greater inward movement than the body of the carriage, and as a result the blocks 60 with the face-plate 19 will be advanced ahead of the table body, thus carrying the edge of the face-plate completely by and beyond the fold of the material. The object of this construction is to absolutely prevent any bead being formed on the fold due to the material being squeezed beyond the edge of the face-plate as the fold is set. By this means a smooth fold is always secured. The head 37 carrying the creaser-plate 36 is secured to and supported by the blocks 38, as above described. Each of these blocks has rigid therewith and depending therefrom a guide-pin 67 which extends down through a guide-way 68 at the side of the table, said pin projecting below the guide-way and being surrounded by a suitable spring 69, said springs by acting against said guide-way and collars or stops 70 carried by the guide-pins 67 serve to yieldingly hold the head against the table and the creaser-plate against the work.

Situated beneath the head 37 at each side thereof is a lifting head 71, see Figs. 1 and 2, and each lifting head has rigidly secured thereto and depending therefrom a rod 72 which plays up and down in a bearing 73 carried by the table body 18. Surrounding each rod 72 is a spring 74 which bears at one end against the bearing 73 and at the other end against a collar 75 carried by the rod. The two rods 72 are connected together by a yoke 76 to which is attached a rod 77 extending to the treadle, not shown. The treadle is so arranged that by pressing the same, the rod 77 is elevated and the elevation of this rod 77 elevates the yoke 76 and the rods 72 against the action of the springs 74, thereby lifting the lifting heads 71, said lifting heads acting against the underside of the head 37 thereby to elevate it and the creaser-plate 36 carried thereby against the action of the springs 69. This is the position of the parts when the work is inserted in the machine, and after it has been placed the treadle is released, thereby allowing the head 37 and the creaser-plate 36 to descend to bring said creaser-plate against the work and thereby clamp it onto the face-plate 19 of the table.

The blocks 38 for the head 37 and the bearing 68 are slidably mounted on ways 80 at the sides of the table so as to permit said head and the creaser-plate 36 to move relative to the table to effect a withdrawal of the creaser-plate just prior to the setting of the fold. Said bearings are acted on by springs 91 which tend to keep the creaser-plate in its normal position, said springs yielding to permit the creaser-plate to be withdrawn, as shown in Fig. 13. I have provided also means other than the springs 91 to carry the head 37 forward positively when the table is moved under the folder into the position shown in Fig. 11 so as to insure that the creaser-plate 36 shall have the correct position to properly shape the fold. For this purpose the table body has rigid therewith and preferably adjustably mounted thereon pushers 171 each of which is adapted to engage an arm 172 on a member 173 pivoted to one of the blocks 38 or one of the bearings 68. Normally each arm 172 is in alinement with its pusher 171 so that when the table moves horizontally into the position shown in Fig. 11, the pushers by their engagement with the arms 172 positively carrying the creaser-plate with the table. In order to permit the creaser-plate to be withdrawn before the table I have provided means to disengage the arms from the pushers just when the table has reached the limit of its inward movement. The members 173 are substantially ⅂-shaped, as shown in Fig. 7, and the vertical arm of each member carries an adjusting screw 175 which is adapted to engage the frame 4 just prior to the time when the table and creaser-plate reach the limit of their inward movement. As soon as the set-screws 175 engage the frame 4 the pivoted members 173 are turned about their pivots thereby to carry the arms 172 below and out of line with the pushers, so that at the proper time said creaser-plate may be retracted against the action of the springs 91.

The means for retracting the creaser-plate will now be described, and in connection therewith the means for elevating said

creaser-plate to take the pressure off from the work, as shown in Fig. 12. Each bearing 68 has extending therefrom a pin 81 which is received in a slot 82 in one end of the link 83, see Fig. 19, the other end of said link being connected to an arm 84 extending from a rock-shaft 85. This rock-shaft 85 has fast thereto an arm 86 which is provided with a roll to be actuated by a cam 87 fast on the countershaft 28, see Fig. 7. The cam 87 is so timed that it operates to rock the shaft 85 and thereby to force the link 83 toward the front of the machine at the time when it is desired to withdraw the creaser-plate 36. The connection between the links 83 and the blocks 68, 38, however, is such that the creaser-plate is first lifted slightly before it is retracted. For this purpose I have shown an elbow-lever 88 pivoted to each bearing 68, one arm of which elbow-lever has a pivotal engagement with the rod 67, as at 89, and the other arm of which stands in position to be engaged by a finger 90 adjustably carried by the link 83. Normally each pin 81 is at the left-hand end of its slot in the link, and the first movement of the links 83 toward the left Fig. 3 brings the fingers 90 against the elbow-levers 88 and rocks said levers, thereby raising slightly the rods 67 and the blocks 38 which carry the head 37 and the creaser-plate.

After the lost motion in the pin-and-slot connection of the links 83 with the blocks 68 has been taken up, then further movement of the links to the left Fig. 3 will slide the blocks 68 on the ways 80, thereby to retract the creaser-plate and head into the position shown in Fig. 13. The rocking of the arms 88 during the initial movement of the links 83 is such as to elevate the creaser-plate against the action of the spring 69 sufficiently to relieve the work 10 from any pressure due to said spring, so that when said creaser-plate is withdrawn there is no liability of the work being dragged back with it. To further guard against any liability of the work being dragged back by the creaser-plate when the latter is moved from the position shown in Fig. 12 to that shown in Fig. 13 I have provided other means than the creaser-plate to hold the work in place on the table during the retracting movement of said creaser-plate. As herein shown each of the lifting heads 71 has extending upwardly therefrom a post 152, and said posts are connected by a bar 153 from which depends a series of holding pins 154. These holding-pins 154 extend through slots 155 in the creaser-plate and cooperate with projections 156 carried by the table body 18. The projections 156 extend through slots 157 in the face-plate 19, said slots permitting the face-plate to move forwardly with relation to the table when the table is moved inwardly under the folder as above described. Since the holding pins 154 are carried by a member which rises from the lifting-heads 71 it will be observed that said holding pins are pressed downwardly by the tension of the springs 74, and when the creaser-plate is withdrawn the grip on the work between the holding-pins 154 and the blocks 156 is sufficient to absolutely prevent the work from being withdrawn with the creaser-plate. These holding-pins, however, are not essential to the invention but I employ them as a precaution. These holding pins 154 also prevent the work 10 moving forward with the face-plate 19 when the parts move from the position shown in Fig. 10 to the position shown in Fig. 11.

92 designates a stop which limits the sliding movement of the bearings 68 to the right Fig. 3. Said stop is herein shown as a cam-stop pivoted to the table so that by adjusting it the normal position of the creaser-plate may be adjusted. In some instances it may be desirable to have the edge of the creaser-plate situated nearer to the edge of the folder than on other occasions, and this normal position may be readily determined by adjusting the cam-stops 92, as stated above. I have also provided means for unclamping the work after the fold has been set and while the parts are returning to their initial position, so that by the time the parts have returned to the said initial position, as shown in the drawings, the folded piece is free to be removed and a fresh piece inserted for the folding operation.

As stated above the face-plate 19 is supported on the yielding heads 21 and the creaser-plate is yieldingly held against the work on the face-plate by means of the springs 69. Furthermore, the holding-pins 154 are yieldingly held against the work by the springs 74. For unclamping the work I have provided means for relieving the spring pressure on the under side of the face-plate and for elevating the pins 154 after the fold has been set and while the parts are returning to their initial position, it being understood that the creaser-plate has already been elevated slightly and thus unclamped from the work.

As stated above the face-plate 19 is held in position by the pins 20 which extend from the sliding-blocks 60, and said face plate normally rests directly on the yieldingly-mounted heads 21. These heads 21 have pins 22 depending therefrom which extend through the flange 55 of the table body 18 and are acted upon by suitable springs 95 whcih encircle said rods, one end of each spring resting on a shelf 96, and the other end acting against a collar 97 fast on the rod 22.

98 are stops which by their engagement with the collars limit the upward movement

of the yielding heads 21. For removing the spring pressure of the heads 21 against the underside of the face-plate I employ two levers 99 which are pivoted to the table body 18 as at 990, the outer ends of which levers are adapted to engage the upper side of the collars 97, and the inner ends of which are connected to the upper end of a link 100. The lower end of the link 100 has pivotally connected thereto a link 101 which extends through a projection 102 on one arm of a lever 103, said link 101 having a collar or shoulder 104 thereon above the projection 102. The lever 103 is pivotally or loosely mounted on the rock-shaft 118 and is adapted to be engaged by a cam 106 fast on the countershaft 28. This cam 106 is so timed and positioned that just when the pressure is relieved after the fold is set, and just as the table is withdrawn from under the folder, said cam engages the lever 103, lowers the rear end thereof and elevates the front end, thereby elevating the link 100 and through the levers 99 depressing the rods 22 and the heads 21. The face-plate 19 then drops slightly into contact with the blocks 60 and the spacing blocks 108 which are carried by the table body, and thus all pressure against the underside of the work is removed.

For elevating the pins 154 so as to carry them entirely out of contact with the work I have connected the link 101 to the yoke 76 by a connection 199 so that as the link 101 is raised by the lever 103 the yoke 76 will be elevated, elevating thereby slightly the holding-pins 154 and removing them entirely out of contact with the work.

The driving shaft 12 is shown as driven by a suitable driving pulley 110 which is loosely mounted thereon. Any suitable clutch device may be employed for clutching this pulley to the driving shaft, but I prefer to use a clutch which will be automatically thrown out of operation after a certain cycle of operations. In the present embodiment of my invention I have shown at 111 a one-revolution clutch which is normally held out of operation by the arm 112 engaging the upper end of a suitable lever 113. I have not illustrated in detail this form of clutch because it forms no part of my present invention and any suitable one-revolution clutch might be employed.

For starting the machine it is simply necessary to rock the stop-lever 113 so as to carry the upper end thereof out from under the arm 112. As herein shown, said stop-lever is L-shaped, and has connected thereto a link 114 which extends to a suitable treadle and by which said lever may be rocked to start the clutch. The lever is acted upon by a suitable spring 115 which tends to return it to the full line position Fig. 3. During the first complete revolution of the driving shaft 12 the table is depressed, carried under the folder and elevated to set the fold, as shown in Fig. 14, and during the second revolution of the driving shaft said table is lowered, moved toward the front or from beneath the folder and then elevated to its initial position.

If the clutch 111 is arranged to be disengaged after one revolution of the shaft 12 the machine will be stopped with the fold under pressure, as shown in Fig. 14. And if it is desired to bring the machine to rest at this point so as to give time to set the fold the clutch will be arranged to throw out and stop the machine after one revolution of the driving shaft. In making some folds, however, it is not necessary to leave the fold under pressure for any length of time, and I have, therefore, provided means for preventing the clutch from throwing out until after two complete revolutions. To accomplish this the arm 113 has connected thereto a link 116 which connects to an arm 117 secured on the end of rock-shaft 118, and said rock-shaft has extending therefrom an arm 119 pivotally connected to one end of a link 120, the other end of said link being pivotally connected to an elbow lever 121 loosely hung on shaft 85. The countershaft 28 has thereon a cam 122 which is adapted to engage the elbow lever 121 just at the time when the main shaft has made one revolution, thereby to withdraw the stop-lever 113 from under the arm 112 so as to permit the clutch to remain in engagement during the second revolution of the main shaft. With this construction the clutch is not disengaged except at the end of the second revolution when the parts have been restored to their operative position. Thus when the cam 122 is used or is operative, the main shaft will make two revolutions after the machine has been started, or the machine will go through a complete cycle of operation. By disconnecting the cam 122, which may be done by sliding the same along the shaft 28, or by disconnecting the link 120, the shaft 12 will make one revolution when the starting treadle is operated, which will put the fold under pressure, as shown in Fig. 14. After the fold has been under pressure a sufficient time, the operating treadle is again operated, which will allow the main shaft 12 to make another operation which will bring the parts back to starting position.

Although in the above description of the various parts I have to some extent detailed the operation, yet in order to give a better understanding of the invention I will now briefly describe in full the complete cycle of operations.

The machine is shown in the drawings in the position ready to receive the work, in which position the table is elevated as shown in Fig. 8. The operator first actuates the

treadle thereby to raise the yoke 76 and lifting heads 71 and lift the head 37 and the creaser-plate 36 bodily to separate them from the face-plate 19 after which the work may be inserted between the creaser-plate and the table with its edge resting against the gage 9, all as shown in Fig. 8. The operator then releases the treadle when the springs 74 lower the lifting heads and the springs 69 come into play to bring the creaser-plate down onto the work thereby clamping it onto the face-plate 19 of the table. The operator then depresses the treadle which controls the clutch thereby throwing the stop-lever 113 out of its operative position and permitting the clutch to be automatically engaged. As the main shaft 12 rotates the cam 11 first acts on the lever 13 thereby raising the head 15 and causing the slitting knives to slit the edge of the material, as shown in Fig. 9. The cam 11 is shaped to give the slitting knives both a movement toward the folder and then a movement away from the folder, and when the said knives have resumed their initial position the cam groove 32 operates the lever 31 thereby lowering the table into the position shown in Fig. 10, the rock-shaft 33 at this time rocking about the pins 40. After the table has been lowered the cam 27 then comes into play to move the carriage 23 and with it the table backwardly or inwardly, and during such movement the pins 47 rock the lever 46 and thereby shift the fulcrum member 43 as above described. Furthermore, during this movement the levers 61 give the face-plate of the table an increment of movement over the table body thereby carrying the face-plate into a position relative to the work shown in Fig. 11. The cam 87 then operates on the arm 86 thereby rocking the shaft 85 and carrying the links 83 forwardly and during the initial forward movement of these links the creaser-plate is elevated, as shown in Fig. 12, by means of the elbow levers 88, and during the latter part of said forward movement said creaser-plate is withdrawn into the position shown in Fig. 13, the work at this time being held by the holding pins 154 and blocks 156. The cam 32 then acts to depress the inner end of the lever 31 and to elevate the outer end, the lever at this time rocking about the fulcrum pins 41, thereby carrying the table and its face-plate upwardly to set the fold, the first part of this movement being through the springs 54 and the latter part being a positive pressure applied through the bridge-piece 57, as above described. The cam 106 then acts on the lever 103 and depresses the heads 21 and elevates the holding pins 154. The cam groove 32 then operates the lever 31 to depress the table slightly after which the cam 27 advances the carriage 23 and table to remove it from under the folder 3. And during this movement of the table the lever 46 is again rocked by the pins 45 thereby shifting the fulcrum-block 43 into the position shown in Fig. 4. The work can now be removed. The cam groove 32 now depresses the inner end of the lever 31 thereby elevating the table and restoring it to its initial position at which time the clutch is thrown out and the machine is brought to rest.

201 is a rest against which the portion of the work outside of and beyond the slitting knives is held during the slitting operation. In the embodiment herein shown the slitting knives extend along a small portion only of the edge of the material to be folded, and also the slitting knives have associated therewith the projections 9 which constitute a gage; yet in order to insure that the work will be held in proper position I may employ the rest 201 as an auxiliary gage mounted on the folder and which gage 201 is preferably removable therefrom so that different shapes of auxiliary gages may be used. As herein shown the folder has extending therefrom the pins 202 which extend through the ends of the auxiliary gage, and said gage is held down by the spring-pressed fingers 204 which rest thereon. These fingers are rigid with the rock-shaft 205 and the latter has a cranked arm 206 which is acted upon by a spring 207. The rock-shaft may be readily turned to swing the fingers back out of the way when it is desired to remove the auxiliary gage.

By the term "table" as used in the claims, I mean the portion of the device which supports the work or on which the work rests of whatever construction it may be. In the embodiment of the invention illustrated, the table comprises not only the table body but also the face plate.

Although I have described herein one embodiment of my invention only it will be understood that the various operations described may be performed by mechanism different from that herein shown. I do not wish to be limited in any way except by the terms of the claims appended.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a folder, the combination of a work-supporting table, a folder, and means for moving one of said elements vertically up and down and horizontally to fold the edge of the work and press the fold, the means for effecting the vertical part of the movement comprising a lever, a cam for oscillating the same, and means for shifting the fulcrum of the lever.

2. A folding machine, comprising a folder, a work-supporting table, means for effecting relative movements between the folder and table to fold the edge of the work and press the fold, and means for pro-

jecting a supporting surface relatively to the work beyond the fold to support the same during the pressing operation.

3. A folding machine, comprising a folder, a work-supporting table having a face plate, means for effecting relative movements between the folder and table to fold the edge of the work and press the fold, and means for projecting the face plate relatively to the work and beyond the fold to support the same during the pressing operation.

4. A folding machine, comprising a folder, a work supporting table having a face plate, means for effecting relative movements between the folder and table to fold the edge of the work and press the fold, means for projecting the face plate relatively to the work under the fold to support the same during the pressing operation, and means for holding the work against movement during the movement of the face plate.

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

CHARLES S. MARSHALL.

Witnesses:
J. M. McClellen,
J. M. Ward.