

June 30, 1931.

J. W. ANTHONY

1,811,871

FOLDING MACHINE

Filed Dec. 13, 1928

2 Sheets-Sheet 1

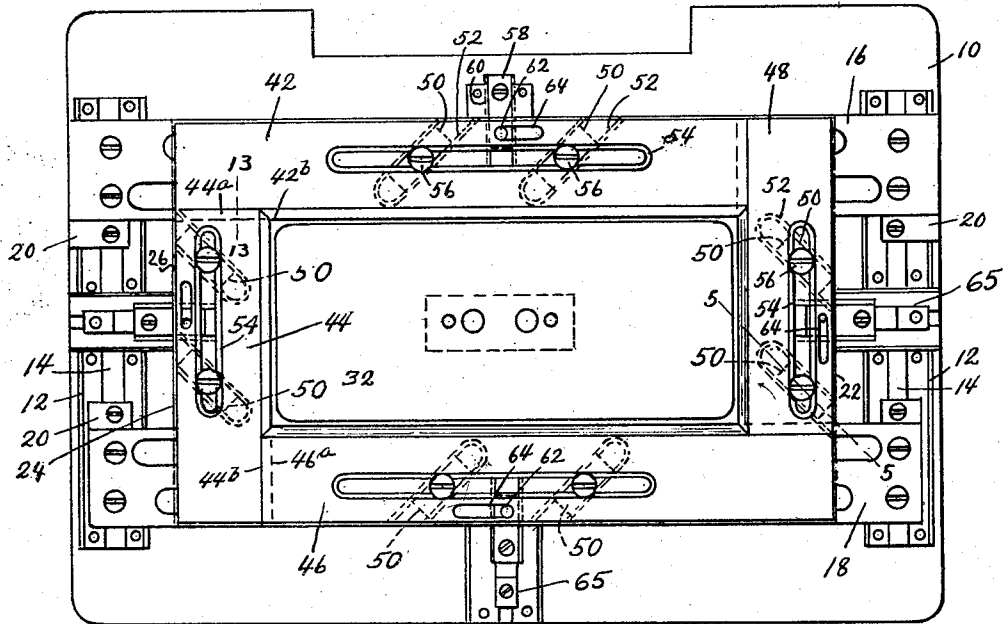


Fig. 1.

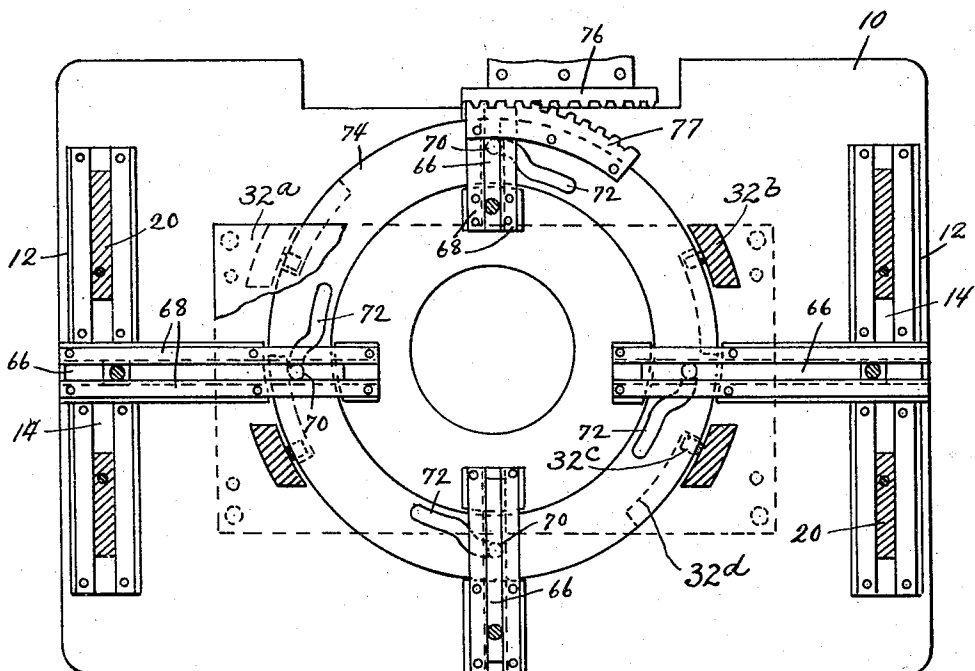


Fig. 2.

Inventor.

Joseph W. Anthony
By Greenwood & Co. Attys

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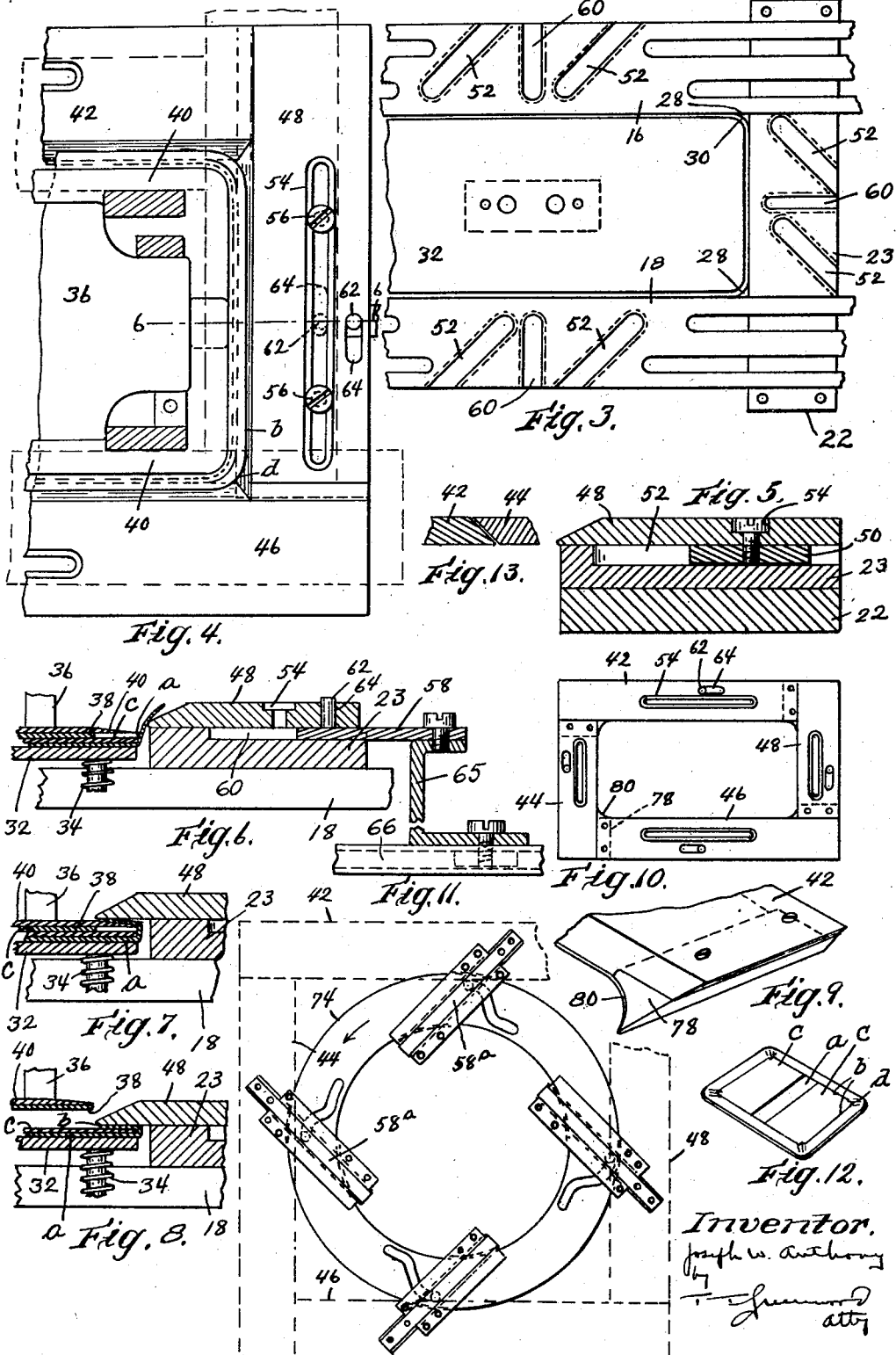
J. W. ANTHONY

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2 Sheets-Sheet 2



Inventor.
Joseph W. Anthony
J. W. Anthony
att'y

UNITED STATES PATENT OFFICE

JOSEPH W. ANTHONY, OF LYNN, MASSACHUSETTS

FOLDING MACHINE

Application filed December 13, 1928. Serial No. 325,826.

This invention relates to machines and devices for folding over the marginal edges and corners of book covers and the like.

A book cover folding machine usually has
5 extensible and retractable fold defining elements which are extended over the cover to define the line of fold and extensible and retractable side and corner folding elements or wipers which are arranged to move over the
10 fold defining elements to fold over the material of the cover at the sides and the corners onto the fold defining elements, which elements are then retracted so that the folded over margin of the edge of the cover can be
15 pressed onto and secured to the body of the cover.

An object of the present invention is the elimination of the separate corner wipers and the provision of wipers or folding elements
20 which at one operation effect the folding of the sides and the corners of the cover, thereby shortening the time required for the complete folding operation and dispensing with a number of parts heretofore required for the separate folding of the corners and in general simplifying the folding machine and the process.

Briefly, the folding elements embodying my invention consists of four straight wipers or plates which are arranged in parallelogram form in practical contact with each
30 other whereby to define a practically continuous folding edge which bounds a rectangular folding space, each plate being inside one adjacent plate and outside the other adjacent plate. The plates are movable simultaneously inwardly and outwardly of said folding space and also laterally thereof while preserving the aforesaid relation of the plates,
35 that is, one plate moves inwardly and towards a corner and the adjacent plate moves inwardly and away from the same corner, thus acting to gather the material at the corner into pleats which are folded over onto the
40 body of the blanks. Thus at one operation of the plates both the sides and corners of the blank are folded over. Such an arrangement of folding elements constitutes a further object of the invention.

50 Another object of the invention is generally

to improve upon folding methods and apparatus.

Fig. 1 is a plan view of the base of a folding machine embodying the present invention.

Fig. 2 is a view similar to Fig. 1 but with the folding elements and die frame removed to show the reciprocable cam ring for operating the folding elements.

Fig. 3 is a partial plan view of the die frame of Fig. 1 with the wipers removed.

Fig. 4 is a plan detail showing one end of the folding elements and also showing the fold defining elements.

Fig. 5 is a section taken along line 5—5 of Fig. 1.

Fig. 6 is a vertical sectional elevation taken along line 6—6 of Fig. 4, and illustrating the folding elements of the machine at the start of the folding operation, the fold-defining elements or forming plates being extended.

Fig. 7 is a detail similar to Fig. 6 but with the marginal edge of the cover folded over the forming plates.

Fig. 8 is a view similar to Fig. 7 but with the forming plates retracted and the presser head withdrawn.

Fig. 9 is a modified construction of one of the wipers.

Fig. 10 is a plan view of the folding elements or wipers having the round corner construction illustrated in Fig. 9.

Fig. 11 is a plan view of a simplified construction for operating the wipers.

Fig. 12 is a perspective view of a book cover folded in accordance with this invention.

Fig. 13 is a sectional detail taken along line 13—13 of Fig. 1.

The folding machine embodying the present invention is constructed mainly as shown in my Patent No. 1,657,911, issued January 31, 1928, to which reference is made for the construction of such elements as are unnecessary for an understanding of the present invention and which are not herein illustrated.

The folding machine of the aforesaid patent and of the present invention includes a bed 10, Figs. 1 and 2, which has uprights 12 ris-

ing therefrom that are provided with grooves 14 in the short upper faces. Parallel die bars 16 and 18 are disposed above and are adjustably connected with said uprights by blocks 20 which are slidable in said grooves 14. Said bars 16 and 18 can be moved inwardly and outwardly away from each other to vary the folding space therebetween and can be secured fixedly to any set position.

End die bars 22 and 24, see Figs. 1 and 3, are located beneath said bars 16 and 18 and can be clamped thereto in any adjusted position whereby also to vary the size of the folding space. Filler blocks 23 and 26 are carried by both of said bars 22 and 24 between said bars 16 and 18 and are terminated substantially flush with the upper faces of said latter bars.

Corner blocks 28, two of which are shown in Fig. 3, are located in the corners of the die frame and have curved inner faces 30 which define the round corners to be folded. The die frame thus bounds a rectangular space, the dimensions of which can be varied and in which all sides and corners of the book cover or blank are adapted to be folded at one operation.

A cover or blank supporting table 32, see Figs. 1, 3 and 6, is located within the folding space and is yieldingly supported on springs 34 so that it can move downwardly during the folding operation. A presser head 36, see Figs. 4 and 6, is located above the die frame and the table 32 and is movable into the folding space by mechanism not herein necessary to illustrate. The presser head carries a presser plate 38 which is adapted to clamp the book cover onto the table 32 during the folding operation. The presser head also carries extensible and retractible fold defining elements or forming plates 40, see Figs. 4 and 6, which are disposed immediately above the presser plate and can be extended beyond the margin of the presser plate 38 as shown in Fig. 6 to define a substantially continuous line of fold and to receive the folded over edge of the book cover.

The construction so far described is essentially as shown in my above named patent.

One form of book cover that is well adapted to be operated on by the present invention is illustrated in Fig. 12 and consists of a body *a* composed of flexible material having a continuous margin or edge *b* that is folded over and is secured adhesively to the body *a* or to the relatively stiff lining pieces *c*. The corners *d* are round.

In accordance with this invention the folding elements which fold over the material at the margin *b* of the cover and at the corners *d* consist of flat plates 42, 44, 46 and 48, see Fig. 1, which plates are located above and are carried by the bars of the die frame and are arranged to wipe the material of the cover at the edges and at the corners over

the extended forming plates. The end 44a of the wiper 44 lies within and practically abuts against or is disposed in close proximity to the inner edge 42b of the wiper 42. The end 46a of the wiper 46 is similarly located with respect to the inner edge 44b of the wiper 44. The same is true of the remaining wipers.

The wipers are thus arranged in a parallelogram, one wiper being inside one adjacent wiper and outside the other adjacent wiper and all presenting a practically continuous inner folding edge.

Means are provided to move the wipers into and out of the folding space, or to contract and expand the parallelogram in such a way as to preserve the aforesaid relation between the wipers. The means provided is such as during the folding over of the material to move the wiper 42 inwardly and toward the left, the wiper 44 inwardly and downwardly, the wiper 46 inwardly and to the right, and the wiper 48 upwardly and to the left. That is, one wiper, as the wiper 42, is moved inwardly and toward the upper left hand corner of the cover, and the adjacent wiper, as the wiper 44, is moved inwardly and away from said corner. It will be apparent that with such motion of the wipers, the wipers preserve their illustrated relation while moving inwardly and outwardly of the folding space. As a result of such movement of the wipers, the material at the side edges of the blank is folded over and the material at the corners is gathered into smooth pleats which are also folded over.

The wipers are supported on pairs of blocks 50 which are slidably received in diagonally inclined dove-tailed slots 52 formed in the upper faces of the four bars of the die frame. Each wiper is formed with a longitudinally extended counter-sunk slot 54 therein through which screws 56 are passed which are threaded into the slide blocks and form means by which the wipers can be clamped in any adjusted position to the blocks for the purpose of operating on cover blanks of various dimensions. The slots 52 are all inclined at the same angle with respect to their respective die-bars so that the wipers are caused to move inwardly and outwardly of the folding space without separating from each other.

The wipers are operated by independent slide blocks 58 which are slidable in dove-tailed grooves 60 formed in the upper faces of the die bars between the inclined grooves 52. Said slide blocks are provided with up-standing cam pins 62 which are received in longitudinally elongated cam slots 64 of the wipers, and serve to reciprocate said wipers when said blocks are reciprocated. Said slide blocks 58 are connected by rigid bars 65, see especially Fig. 6, with slide blocks 66

which are located beneath the die frame and are slidable in ways 68 and have downward projections 70 at their inner ends which are operable in cam slots 72 of a reciprocatory cam ring 74 which ring is reciprocated by means including a rack 76 which is in mesh with a gear-sector 77 carried by said ring 74. It is apparent that as said ring is reciprocated, said blocks 66 and consequently said blocks 58 will be reciprocated.

The wipers have outwardly sloping inner folding edges as shown in Fig. 13, and the ends of the wipers that confront said edges are similarly formed.

Prior to the folding operation the wipers are retracted as illustrated in Fig. 6. The cover is placed on the table 32 with the presser head 36 elevated above the table free from the cover and with the forming plates extended. The presser head is then moved downwardly to press and hold the cover onto the table and to depress the table with the cover downwardly within the folding space of the die frame and into some position as shown in Fig. 6, the margin of the cover being upturned by engagement with the frame and wipers. The wipers are then moved inwardly to fold the margin *b* of the cover over upon the forming plates 40 as shown in Fig. 7. The forming plates are then retracted and the presser head is moved upwardly away from the cover. The table is then forced up to press the folded margin against the under faces of the wipers to cause the margin to adhere to the body of the cover. The wipers are then retracted and the table moves into a further elevated position to carry the cover above the die frame and the folded cover is therefore removed. The dotted lines Fig. 4 illustrate the innermost position of the wipers. The table 32 is carried by a table support 32*a*, see Fig. 2, which has depending lugs 32*b* that are disposed at spaced intervals about the cam ring 74 and have pins 32*c* that are located in cam slots 32*d* of said ring whereby to effect the above described movements of the table, all as described in my above named patent.

In the modification illustrated in Figs. 9 and 10 each wiper has an inset plate 78 at one end which has an arcuate edge 80 to facilitate the folding of the material at the round corners. Experience has indicated, however, that for many materials these plates are not necessary.

In the modification illustrated in Fig. 11, the slide blocks 58*a* are arranged at an angle with respect to each other and with respect to the folding space and the wipers are fixed directly thereto. With this construction, the construction of the machine can be somewhat simplified.

The construction herein shown eliminates the necessity for the separate corner wipers and their operating mechanisms heretofore

employed and permits the sides and the corners of the cover to be folded over simultaneously instead of in two successive steps as was the practice heretofore. The construction is also such that various sizes of book covers can be folded with the same wipers whereas heretofore it was necessary to employ a different set of side wipers for each different size of cover.

I claim:

1. In a folding machine, folding elements for folding over material at the sides and at the included corner of a blank, consisting of two angularly related plates having inner folding edges, with the end of one plate confronting the inner edge of the other plate, and means to reciprocate said plates over the edges of the material while preserving their aforesaid relation.

2. In a folding machine, folding elements for folding over material at the sides and at the included corner of a blank, consisting of two angularly related plates having inner folding edges, with the end of one plate confronting the inner edge of the other plate, and means to reciprocate said plate in directions which are inclined with respect to both plates so as to preserve unchanged the spacing of the plates with respect to each other.

3. In a folding machine, folding elements arranged to fold over the material at the sides and also at the included corner of a blank consisting of a pair of folding plates which bound a folding space and have inner folding edges, the end of one plate closely confronting the inner folding edge of the other plate and means to move said plates simultaneously inwardly of and around the folding space.

4. In a folding machine, folding elements arranged to fold all edges and the included corners of a blank consisting of four folding plates having inner edges which bound a folding space, and means to move all of said plates simultaneously inwardly and also simultaneously outwardly of the folding space at angles inclined with respect to the lengths of such plates.

5. In a folding machine, folding elements operable to fold over the edges of a blank consisting of separate plates which are angularly related with respect to each other, and means to reciprocate said plates and also to move them laterally in different directions at the same time.

6. In a folding machine folding elements operable to fold over the material at the sides and also at the included corner of a blank consisting of angularly related plates which confront each other, and means to move said plates inwardly over the material and also laterally thereover while preserving the aforesaid relation between said plates.

7. In a folding machine, means defining a folding space, a slide block movable at an

inclination with respect to said folding space, a folding plate carried by said slide block and guided thereby for movements inward and also laterally of said folding space, and means to reciprocate said folding plate.

8. In a folding machine, folding elements consisting of plates which are movable inwardly and outwardly of a folding space to fold over the marginal portion of a blank, said plates having inner folding edges which are inclined, and the end of one folding plate having an inclined end face which overlies the inner folding edge of an adjacent folding plate.

9. In a folding machine, angularly related folding plates movable inwardly and outwardly of a folding space, slide blocks carrying said folding plates guided for movement in directions which are inclined with respect to said folding space, and reciprocating means for said plates which are guided for movement at an angle to the movement of said slide blocks and which have pin and slot connections therewith.

10. In a folding machine, a folding plate having a straight folding edge for the major portion of the length of the plate and a curved folding edge at the end of the plate for folding over the material at the round corner of a blank.

11. In a folding machine, four folding plates bounding a rectangular folding space, said plates being reciprocable along and also laterally of said space, the end of one plate closely confronting the inner edge of an adjacent plate, the confronting ends of said plates having arcuate inner folding edges for folding the material at the round corners of a blank.

12. In a folding machine, folding elements consisting of plates which define a folding space and are reciprocable into and out of said space, the end of one plate closely confronting the inner folding edge of an adjacent plate, and means whereby said plates can be moved into various positions with respect to the folding space while preserving their aforesaid relation for the folding of blanks of various dimensions, and means for reciprocating said plates inwardly and out of the folding space while preserving the aforesaid relation between them.

13. In a folding machine, a pair of angularly related folding plates, the end of one plate being contiguous with the side edge of the other plate whereby to provide a substantially continuous folding line between said plates and means to reciprocate said plates inwardly and out of the folding space while preserving the aforesaid relation therebetween.

14. In a folding machine, a pair of angularly related folding plates, the end of one plate being contiguous with the side edge of the other plate whereby to provide a substan-

tially continuous folding line between said plates, said plates being adjustable outwardly and inwardly of the folding space whereby to condition them for folding blanks of various dimensions, and means to reciprocate said plates inwardly and outwardly of said folding space and also laterally thereof while preserving the aforesaid relation between said plates.

15. A folding machine having folded elements comprising four folding plates that are arranged at right angles with respect to each other and define a rectangular folding space, the end of each plate being abutted against the folding edge of the adjacent plate and means to reciprocate said plates inwardly and outwardly of the folding space and also laterally.

16. A folding machine having folding elements comprising four separately-movable folding plates that are arranged at right angles with respect to each other and define a rectangular folding space, the ends of said plates being in confronting relation, means to reciprocate said plates inwardly and outwardly of the folding space and also laterally.

17. In a folding machine adapted to fold over the material at the edges and corners of a blank, folding plates which are adapted to be moved over the edges of a blank to fold over the material thereat, said plates being angularly related to each other and between them presenting a practically continuous fold-defining edge, whereby to fold over the material at both the sides and the included corner of the blank, said plates being one inside and one outside the other, both plates being simultaneously movable inwardly over and also laterally of the blank, the lateral movements of the plates being such that they maintain their practically continuous fold-defining edge at all times.

18. In a folding machine adapted to fold over the material at the edges and corners of a blank, folding plates which are adapted to be moved over the edges of a blank to fold over the material thereat, said plates being angularly related to each other and between them presenting a practically continuous fold-defining edge, whereby to fold over the material at both the sides and the included corner of the blank, and means to guide said plates for movement inwardly and outwardly over the blank and also to guide one plate for movement toward the corner of the blank and the adjacent plate at the same time away from the corner.

19. In a folding machine, separate angularly related folding plates bounding a folding space, and means to guide said plates for movement into and at the same time and in the same direction around the folding space.

20. In a folding machine, angularly related contiguous folding plates bounding a

folding space and presenting between them a practically continuous folding edge, and means to move said plates simultaneously into and also circumferentially of the folding space while preserving the aforesaid relation between them.

21. In a folding machine, angularly related contiguous folding plates bounding a folding space and presenting between them a practically continuous folding edge, and means to move said plates simultaneously into the folding space and one plate toward and the other away from the angle between said plates while preserving the aforesaid relation between them.

22. In a folding machine adapted to fold over the material at all sides and corners of a rectangular blank, folding plates arranged in parallelogram form one inside and one outside the other and presenting between them a practically continuous fold-defining edge, and means to move said plates inwardly and outwardly over the blank while preserving their aforesaid relation.

23. In a folding machine adapted to fold over the material at all sides and corners of a rectangular blank, folding elements forming a closed parallelogram which bounds a folding space, said closed parallelogram being expansible and contractile to vary the dimensions of said folding space, and said folding elements being movable inwardly and outwardly of said folding space while maintaining said parallelogram closed.

In testimony whereof, I have signed my name to this specification.

JOSEPH W. ANTHONY.