

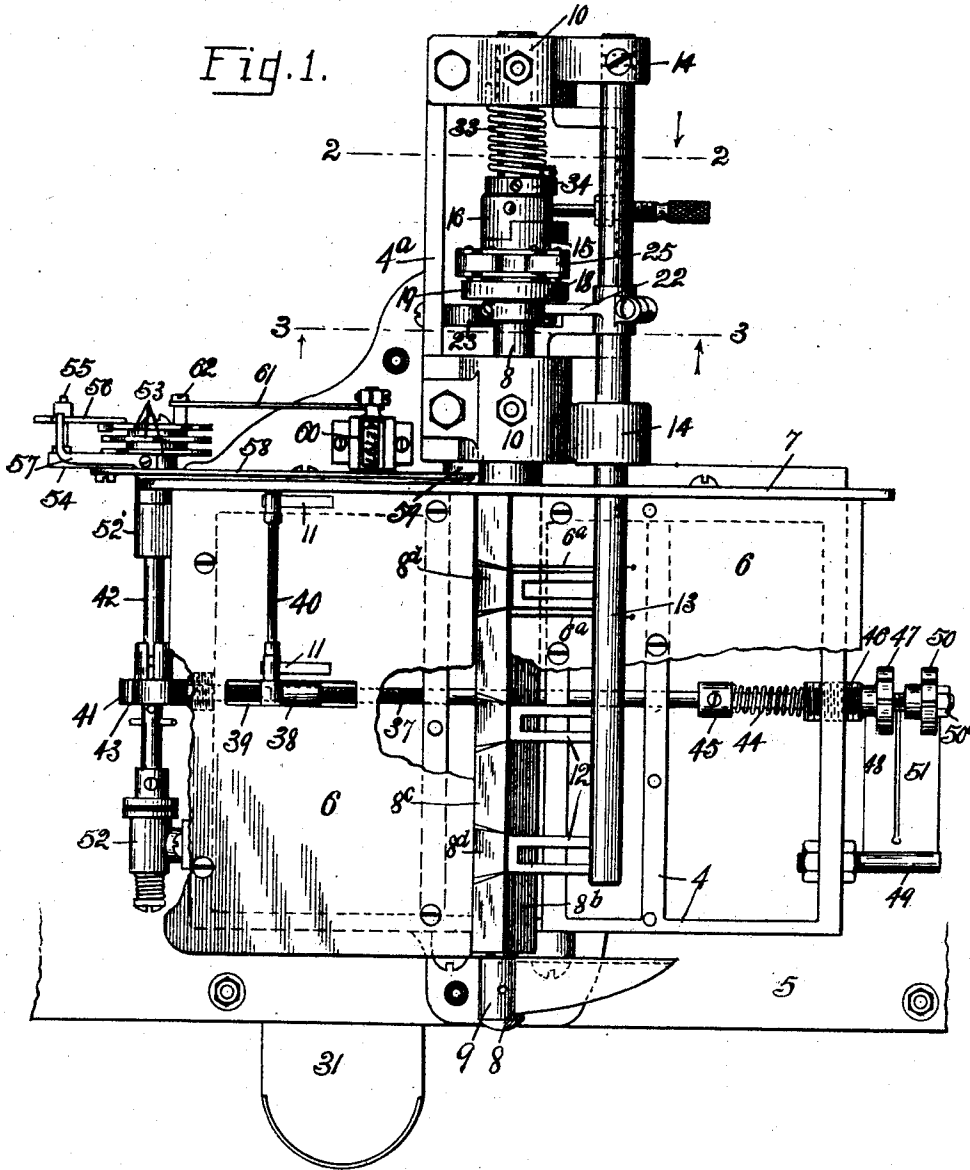
No. 866,746.

PATENTED SEPT. 24, 1907.

F. W. THOMAS.
FOLDING MACHINE.

APPLICATION FILED APR. 13, 1907.

3 SHEETS—SHEET 1.



WITNESSES:

D. C. Walter
Hazel B. Hiett

INVENTOR.

Frank W. Thomas
By *Quinn & Quinn*
his attys.

F. W. THOMAS.
FOLDING MACHINE.
APPLICATION FILED APR. 13, 1907.

3 SHEETS—SHEET 2.

Fig. 2.

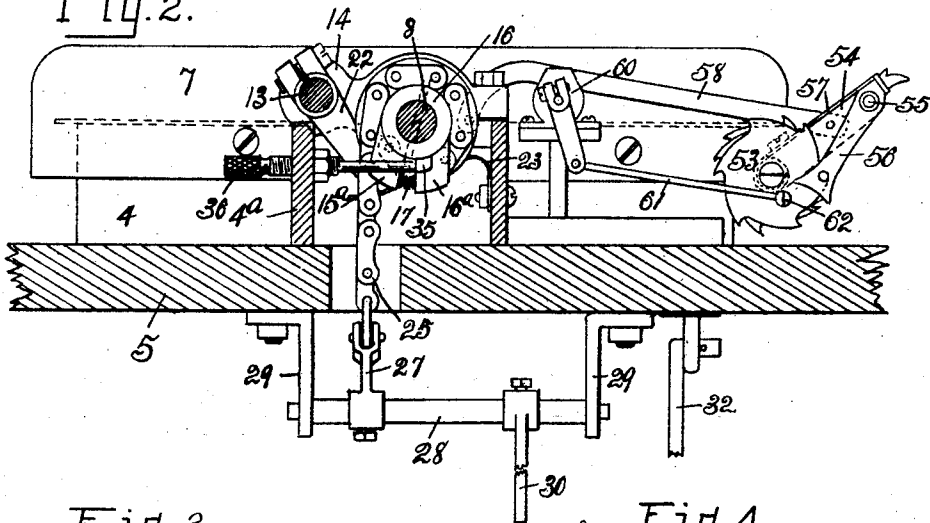


Fig. 3.

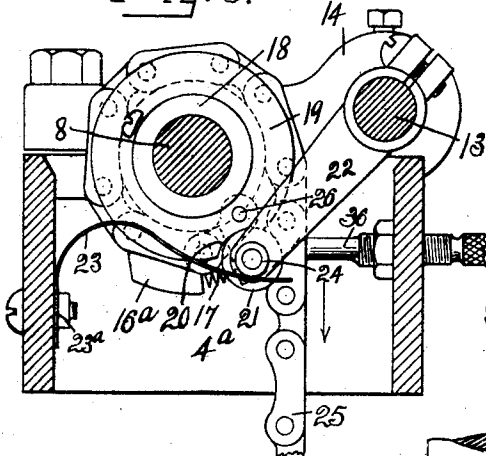


Fig. 4.

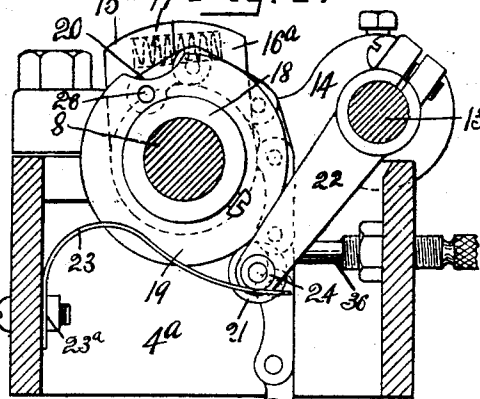
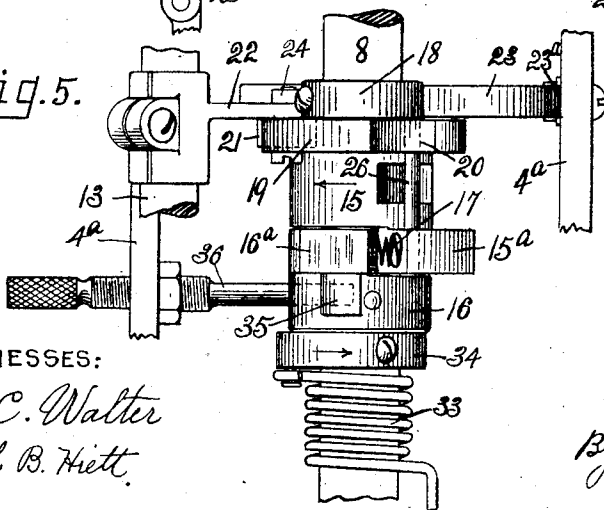


Fig. 5.



WITNESSES:

D. C. Walter
Hazel B. Hiett.

INVENTOR.

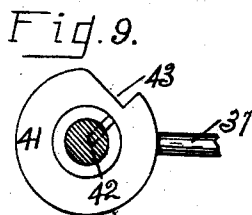
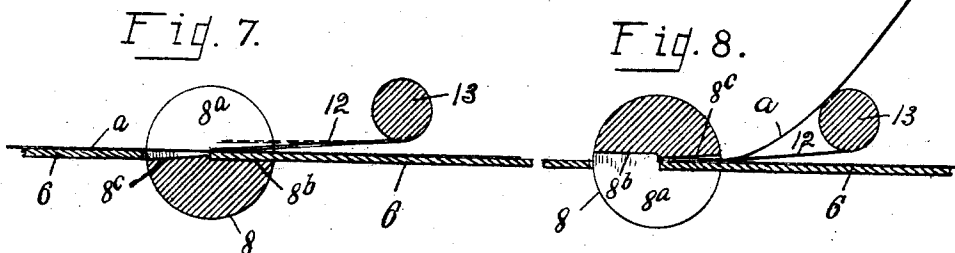
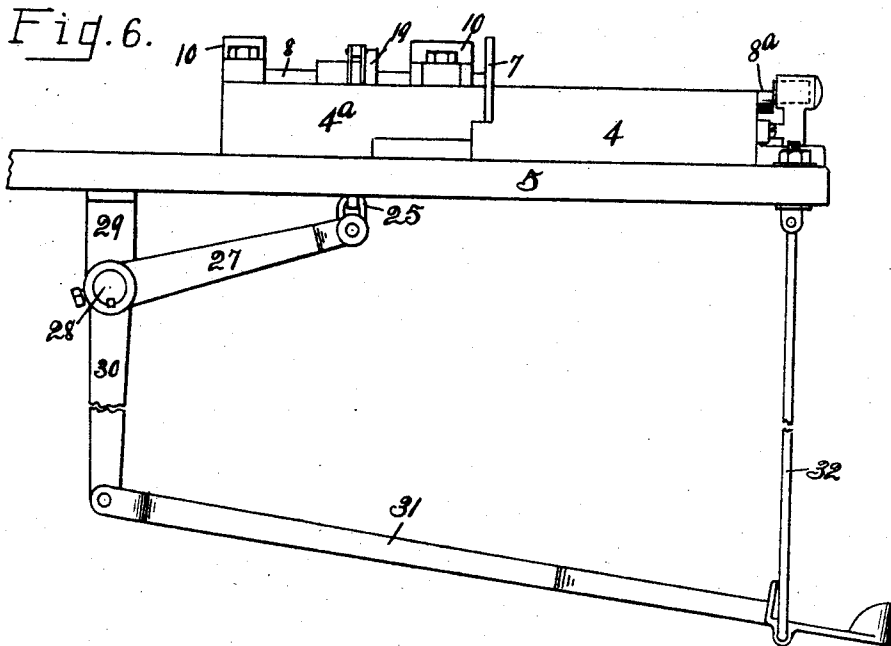
Frank W. Thomas
By Owen & Owen
his attys.

No. 866,746.

PATENTED SEPT. 24, 1907.

F. W. THOMAS.
FOLDING MACHINE.
APPLICATION FILED APR. 13, 1907.

3 SHEETS—SHEET 3.



WITNESSES:

S. C. Walter
Hazel B. Kirt

INVENTOR.

Frank W. Thomas
By Owen & Owen,
his attys.

UNITED STATES PATENT OFFICE.

FRANK W. THOMAS, OF TOLEDO, OHIO.

FOLDING-MACHINE.

No. 866,746.

Specification of Letters Patent.

Patented Sept. 24, 1907.

Application filed April 13, 1907. Serial No. 367,913.

To all whom it may concern:

Be it known that I, FRANK W. THOMAS, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Folding-Machine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to folding machines, and particularly to the class of such machines employed for making a single fold and which are manually manipulated for such purpose.

It has heretofore been found impracticable to mechanically fold the inner and cover sheets of single-fold pamphlets due to the cover sheets usually being of larger size than the inner sheets to provide an extended cover edge, thus necessitating either a folding of the cover and inner sheets on different machines or at different times on the same machine, which manner of folding is undesirable, inasmuch as it is preferable to fold the inner and cover sheets in successive order and place them one inside of another until a suitable number of books have been folded, when the books are removed from the pile, one after another, in inverse order to their folding, and the sheets and covers of each sewed or otherwise secured together.

The primary object of my invention is the provision of a simple and highly efficient machine of this class, which is operative to fold successive sheets with mechanical precision and accuracy without breaking the paper on the line of fold, and which is provided with mechanism for automatically adjusting the feed-gages after a predetermined number of inner sheets have been folded, whereby to adapt the machine to centrally fold a cover sheet of larger size than the inner sheets, after which the feed-gages are returned to their inner-sheet folding positions.

Further objects of my invention, as well as the operation, construction and arrangement of the parts thereof, will be apparent by reference to the following description and to the accompanying drawings, in which,—

Figure 1 is a top plan view of the machine embodying the features of my invention, with the parts shown in normal position and portions of the table-plates broken away. Figs. 2 and 3 are transverse sections taken, respectively, on the dotted lines 2-2 and 3-3 in Fig. 1 and looking in the directions indicated by the arrows. Fig. 4 is a section similar to Fig. 3 showing the position of the parts when the foot-treadle is at its limit of folding movement. Fig. 5 is an enlarged top plan view of the forward portion of the folding-shaft

and associated parts with said shaft and parts in the position shown in Fig. 4, except that the operating chain is removed and the clutch parts shown in open position. Fig. 6 is a side elevation of the machine with the feed-gage adjusting mechanism removed. Figs. 7 and 8 are diagrammatical views, showing, respectively, the positions of the folding shaft before and after a sheet has been folded, and Fig. 9 is a detail of a part of the feed-gage adjusting mechanism.

Referring to the drawings, 4 designates the feed-table frame of the machine, which is mounted on a table, or other support 5 in any suitable manner. Secured to the top of the frame are the two transverse surface plates 6, 6 and the vertical plate 7, which latter rises above the plates 6, 6 at their forward ends and serves as a stationary feed guide for the forward edge of the sheets fed to the machine. Extending through the frame 4 between the contiguous edges of the spaced plates 6, 6 is the folding-shaft 8 of the machine, the rear end of which is journaled in a bearing 9 at the rear of the frame while the forward end thereof is journaled in the spaced bearings 10, 10, which are carried by the forwardly extended portion 4^a of the frame. The portion of the shaft 8 disposed between the inner faces of the bearing 9 and vertical plate 7 is approximately half cut-away, as shown at 8^a in Figs. 7 and 8, to form the two longitudinally-extending plane surfaces 8^b and 8^c, the former abutting against the under surface of the right-hand plate 6 of the table when the shaft is in normal position, and the latter forming the folding surface of the shaft and radiating approximately from the axis thereof in substantially the surface plane of the plates 6 when the shaft is in normal position. The shaft 8 is so positioned relative to the right-hand fold-plate 6, Figs. 1, 7 and 8, that its axis approximately coincides with the upper inner edge of said plate, thus enabling the folding surface 8^c, when the shaft is given a half revolution, to seat flat on the registering marginal surface of the plate for the purpose of creasing a sheet *a* after making a fold. The sheet *a*, which is fed from the right, Figs. 1, 7 and 8, to suitable feed-gages 11, 11, at the left of the shaft, is held to the fold-plate 6 by a plurality of resilient gripping-fingers 12, which are carried by a rock-shaft 13, and have their free ends terminating in position to grip the sheet at the point of intended fold, so that the sheet will be folded thereover when the shaft is rocked. To enable the folding-surface 8^c of the shaft to seat on the plate 6, it is provided with depressions 8^d, which register with and receive the fingers 12 when the shaft is turned. The plate 6 is also slit from its inner edge on each side of a gripping-finger 12, as shown at 6^a, to permit the portions of the plate beneath the fingers to spring down with the fingers as the shaft 8 is turned thereon, so that the upper surface of the fingers at their terminals will stand in a plane with the surfaces of the

plate. The shaft 13 is journaled in bearing-bosses 14, 14, which project laterally from the bearings 10, 10, and has its rear end projected over the fold-plate 6 in spaced relation thereto, as shown.

- 5 Mounted on the shaft 8 intermediate the bearings 10, 10 are the loose clutch-collar or member 15 and the fixed clutch-collar or member 16, which have clutch-jaws 15^a and 16^a projecting from the contiguous ends of the respective collars in position to coact after the
10 loose collar has had an initial turning movement relative to the fixed collar, thus causing the fixed collar and shaft to turn with the loose collar during the remainder of its forward movement. The clutch-jaws are normally held open by the action of the coiled
15 compression-spring 17, which has its ends mounted in opposing sockets in the jaws as shown in Figs. 4 and 5. The loose clutch-collar is prevented from sliding on its shaft by the collar 18 fixed to said shaft, and has the side thereof contiguous to said collar formed with an
20 annular flange or shoulder 19. This flange or shoulder has its periphery provided with a depression 20, which, when the clutch-collar 15 is in normal position, registers with the idler-roll 21 carried at the free end of the arm 22, which arm projects from the rock-shaft 13. It
25 is thus apparent that during the initial movement of the clutch collar 15 relative to the clutch-collar 16 the depression 20 in the flange or shoulder 19 is revolved away from the idler-roll 21, thereby effecting an oscillation of the rock-shaft 13 sufficient to cause the grip-
30 ping-fingers 12 carried thereby to hold the sheet *a* to the plate 6 during the folding movement of the shaft 8. The idler-roll 21 is yieldingly held to its seat in said depression by the flat spring-finger 23, which is secured, as at 23^a to the frame-part 4^a and has its free
35 end bearing upwardly against an idler-roll or projection 24 on the arm 22.

- The clutch-collar 15 is forwardly rotated by a chain or other suitable flexible member 25, which has one end secured to a pin 26 carried by said collar and its
40 other end projected downwardly through an alining opening in the table or support 5 and attached to the free end of the horizontally-disposed arm 27, which is carried by the rock-shaft 28. This shaft is journaled in brackets 29 secured to the underside of the table 5
45 and carries, in addition to the arm 27, the downwardly extending arm 30, thus combining with said arms to form a bell-crank or angled lever. To the free end of the arm 30 is pivoted the forward end of the swinging foot-treadle 31, which has its rear end formed with a
50 suitable foot seat and swingingly suspended by a suitable suspensory member 32 from the table 5, as shown in Fig. 6.

- After a folding movement has been imparted to the shaft 8 by a forward movement of the treadle 31, it is
55 actuated to return to its normal position by the coiled spring 33, which encircles the shaft and has one end secured to the forward bearing 10 and its other end secured to a collar 34, which is fixed to the shaft. The shaft is stopped at the proper point on its return move-
60 ment due to the coaction of a lug 35 on the clutch-member 16 with the end of an adjusting-pin 36 carried by a portion of the frame-part 4^a, as shown.

- Mounted for reciprocatory movement transversely of the frame 4 beneath the plates 6, 6 is a plunger or rod
45 37, to which a sleeve 38 is adjustably threaded at the

left of the shaft 8. This sleeve has a part projecting through an elongated slot 39 in the associated plate 6 and carrying the laterally projecting shaft or rod 40 to which the feed-gages 11, 11 are suitably secured. The left end of the plunger 37 is intended to engage the
70 periphery of a disk 41, which is mounted on the shaft 42 at the side of the frame 4, and to move into a notch 43 in said disk as it is moved into register therewith by a rotation of the shaft 42, the movement of the plunger being actuated by the coiled compression-spring 44
75 thereon. This spring coacts at its ends with a collar 45 and sleeve 46 on said plunger, the latter being loose thereon and threaded through a portion of the frame 4. Formed at the outer end of the sleeve 46 is a periph-
80 erally-notched head 47, the notches of which are normally engaged by a spring-finger 48, projecting from a pin 49, to retain the sleeve in adjusted position. Carried by the plunger 37 without the sleeve 46 is a periph-
85 erally-notched nut 50, which is engaged by a spring-finger 51 to retain it in adjusted position. This nut is intended to coact with the head of the sleeve 46 to limit the reciprocatory movement of the plunger, and is also for the purpose of regulating the adjustment
90 of the feed-gage carrying sleeve 38 on the plunger, as a turning of said nut, when secured by the lock-nut 50^a, will effect a turning of the plunger within the sleeve 38.

The shaft 42, carrying the disk 41, is mounted in suitable bearings 52 projecting from the side of the frame 4 and carries at its forward end one or more
95 ratchet-wheels 53 and the loose arm 54, as shown in Figs. 1 and 2. Projecting laterally from the free end of the arm 54 is a pin 55, which carries a pawl 56 having a pin or lug projecting from the side thereof in position to engage the teeth of the ratchet 53 with which it is
100 intended to coact. This pawl is slidable on the pin 55 to adapt it to be positioned to engage any of the ratchets 53, which are provided with different numbers of teeth, as for instance, one has 4, another 5, and another 6, for the purpose of imparting different fractions of a revolution to the shaft 42 from the movement of the pawl
105 56. A spring 57 is carried by the arm 54 and coacts with the pawl 56 to normally retain it in engagement with the periphery of the registering ratchet 53. The arm 54 is connected by a link or member 58 to an arm 59 fixed to the shaft 8, whereby a rocking movement is
110 imparted from the latter to the former arm.

60 designates a counting mechanism which is connected by a link 61 to a pin 62 on the outer ratchet 53, thus causing a count to be made at each revolution of the shaft 42.

The operation of my machine is as follows:—The feed-gages 11 being properly adjusted to suit the size of the sheet to be folded, a sheet *a* is passed from the right over the plates 6, 6 beneath the grip-fingers 12 and fed to the vertical plate 7 and said feed-gages. The sheet being
120 thus positioned, the operator swings the treadle 31 with a slight forward movement of his foot, thus causing the chain 25 to be pulled down by the rocking of the attached bell-crank lever and imparting a consequent partial revolution to the clutch-collar 15 and shaft 8. As the collar 15 is revolved it has an initial movement
125 relative to the shaft 8 sufficient to cause the depression 20 in the shoulder 19 to move out of register with the idler-roll 21 and effect a gripping of the sheet *a* by the fingers 12 before the fixed clutch-collar 16 is engaged by
130

the collar 15 and a folding movement thereby communicated to the shaft 8. As the shaft 8 is revolved the sheet is held firmly to the table by the gripping-fingers 12 and the surface 8^c thereof is turned over upon said fingers and the contiguous edge of the fold-plate 6, causing the sheet to be folded upon itself along a line which approximately coincides both with the axis of the shaft and the terminals of the fingers 12 and creased. When the driving stress is released from the chain 25 the shaft and attached parts are actuated to return to their normal positions by the spring 33. On each forward or folding movement of the shaft 8 the arm 54, which is connected thereto through the medium of the link 58 and the shaft-arm 59 is oscillated and causes the pawl 56 to engage one of the teeth on the coating disk 53 and impart a partial revolution thereto and to the shaft 42 equal to the distance between two teeth. It will thus be apparent that if the pawl-coating disk has five teeth, the notch in the disk 41 will register with and permit the end of the plunger or rod 37 to move therein, at each fifth folding movement, thereby adapting the machine to the folding of a four sheet and cover pamphlet, inasmuch as the movement of the plunger automatically adjusts the feed-gages 11 to accurately gage the feed of a cover which is of larger size than the inner sheets. On the folding of the cover the plunger is again moved out of the notch in the disk 41 to adjust the feed-gages to gage the feeding of the succeeding inner sheets. The length of movement of the plunger 37 as it is forced into the notch 43 of the disk 41 is regulated by a turning of the adjusting-sleeve 46 in the frame so as to vary the normal space between it and the nut 50, said sleeve serving as a stop for limiting the inward movement of the plunger. The sleeve 38 is moved longitudinally of the plunger 37 to effect an adjustment of the feed-gages 11 relative to the shaft 8, by a proper turning of the nut 50 when locked to the plunger by the lock-nut 50^a. Should the pawl 56 be positioned to engage the ratchet-wheel 53 having six teeth it will be apparent that the engagement of each tooth by the pawl will move the shaft 42 one-sixth of a revolution, thus adapting the machine to successively fold five inner sheets and a cover, or should the ratchet have five teeth the machine will be adapted for the folding of four inner sheets and a cover. Should it be desired to fold only one size of sheets the disk 41 may be slid on its shaft out of register with the plunger 31 for such purpose.

While I have shown and described a particular construction of folding-machine, I wish it understood that I do not restrict myself to the exact details of such construction, for obvious modifications will occur to a person skilled in the art.

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

1. The combination with the feed-table, and the folding mechanism of a folding-machine, of a feed-gage, and mechanism for effecting an adjustment of the feed-gage when a predetermined number of folds have been made, whereby the same gages serve to gage sheets of different sizes.
2. The combination with the feed-table, and the folding-mechanism of a folding-machine, of feed-gages movable relative to the table and in the plane of the feed of the work, and mechanism for effecting an automatic adjustment of the feed-gages when a predetermined number of sheets have been folded.
3. The combination with the feed-table, and the folding-

mechanism of a folding-machine, of feed-gages, and mechanism operative by an operation of the folding mechanism to effect an automatic adjustment of the feed-gages at predetermined periods in the operation of the machine, said gages having their adjusting movements in parallelism with the table.

4. The combination with the feed-gages, and folding-mechanism of a folding-machine, of mechanism automatically operative at predetermined folding-operations to effect an adjustment of the feed-gages, said gages serving both in the normal and adjusted positions to gage the work.

5. The combination with the feed-gages, and the folding-mechanism of a folding-machine, of mechanism automatically operative at predetermined folding-operations to effect an adjustment of the feed-gages in the plane of the feed of the work to gage a sheet of different size than the preceding sheet and to return said gages to their normal position.

6. In a folding-machine, the combination with the feed-gages and folding-mechanism, of mechanism automatically operative to effect an adjustment of the feed-gages at predetermined periods in the operation of the machine, and means for regulating the adjusting movement of the gages.

7. In a folding-machine, the combination with the feed-gages, and the folding-mechanism, of a reciprocatory element carrying the feed-gages, and mechanism movable to effect a reciprocatory movement of said element whereby to adjust the gages.

8. In a folding-machine, the combination with the feed-gages, and the folding-mechanism, of a reciprocatory element carrying the gages, and rotatable means coacting with said element and operative by the folding-mechanism to effect a reciprocatory movement of said element at predetermined periods in the operation of said mechanism whereby to adjust the gages.

9. In a folding-machine, a folding-shaft, means for operating said shaft, feed-gages, and mechanism automatically operative to effect an adjustment of the gages at predetermined operations of the shaft, whereby the same gages serve to gage sheets of different sizes.

10. In a folding-machine, the combination with the folding-mechanism, of feed-gages, a plunger adjustably carrying said gages, means coacting with and movable relative to the plunger to effect a reciprocation thereof, and mechanism operative to move said means whereby a properly timed movement is imparted to the plunger and an adjustment of the gages effected.

11. In a folding-machine, a feed-gage, a movable member carrying said gage, means for effecting a relative adjustment of said gage and member, and mechanism operative to effect a movement of said member and gage at predetermined periods in the operation of the machine.

12. In a folding-machine, the combination with the folding-mechanism, of a feed-gage, a movable member carrying said gage, means for effecting a relative adjustment of said gage and member, and mechanism operative by the folding mechanism to effect an intermittent movement of said member.

13. In a folding-machine, the combination with the folding-mechanism, of feed-gages, a reciprocatory member carrying said gages, a shaft, a notched element carried by said shaft and having its notched surface engaged by the end of said member, a ratchet-wheel carried by the shaft, a pawl engaging said ratchet-wheel, and means connecting the pawl and folding mechanism for moving the pawl whereby an intermittent movement is imparted to the notched element and a reciprocatory movement is imparted to the member from said element.

14. In a folding-machine, the combination with a folding-shaft and mechanism for rocking said shaft, of a reciprocatory plunger, feed-gages carried by the plunger, a shaft, a member mounted on said shaft and having a depression into which the end of the plunger moves as they come in register, means for moving the plunger in the depression, and means for imparting a partial revolution to said latter shaft each time the folding-shaft is rocked.

15. In a folding-machine, a plate forming a folding-surface, an oscillatory folding-member having its axis approximately coinciding with one edge of the plate and

provided with a folding-surface which radiates from said plate edge and coacts with the folding surface of the plate when said member is oscillated, and means for oscillating said member.

- 5 16. In a folding-machine, a plate forming a folding surface, an oscillatory folding-member mounted at an edge of said plate and having a folding surface normally lying in the plane of the plate and movable to coact with the folding surface thereof, gripping-fingers
- 10 positioned for their terminals to grip the plate approximately along a line coinciding with the axis of said member, and mechanism for imparting the gripping movement to said fingers and the folding movement to said member.
- 15 17. In combination, a folding-shaft having a radial folding surface, a fixed folding-plate, a rock-shaft, gripping-fingers carried by the rock-shaft to grip the work at the point of fold, and mechanism operative to rock said rock-shaft to cause the fingers to grip the work and to impart
- 20 a folding movement to the folding-shaft.
18. In combination, a folding-shaft, a plate with which the shaft coacts to form a fold, a rock-shaft, gripping-fingers carried by the rock-shaft, a loose clutch-collar mounted on the folding-shaft and having an annular
- 25 flange provided with a depression, an arm carried by the rock-shaft and yieldingly resting in said depression when the parts are in normal position, a fixed clutch-collar mounted on the folding-shaft and positioned to permit the loose collar to have a relative initial movement sufficient to move the depression out of register
- 30 with the cooperating portion of said arm whereby to effect a gripping movement of said fingers and then to engage the fixed collar to impart the folding movement to the shaft, means for imparting forward rotation to the

loose collar, and means for returning the folding-shaft 35 and said collars to normal position.

19. The combination with a rock-shaft and the part with which it coacts to make a fold of a flexible member having one end fixed to said rock shaft and partially encircling the same, a bell-crank lever having the free 40 end of a horizontal arm attached to the other end of said member, a treadle having its forward end pivoted to the free end of the vertical arm of the lever and its rear end swingingly suspended, whereby a horizontal swinging movement of the treadle will cause the bell 45 lever to pull the flexible member and rock the shaft.

20. In a folding-machine, an oscillatory folding-shaft, a fixed object with which the shaft coacts to form a fold, members movable to grip the work during the making of a fold, and mechanism for oscillating the 50 shaft and moving said members.

21. In a folding-machine, an oscillatory member having a radial folding surface, a part cooperating with the member to make a fold, gripping members movable to grip the work during the making of a fold, and mechanism 55 for moving the oscillatory and gripping members.

22. In a folding-machine, a rock-shaft having a folding-surface beginning at and radiating from its center, members movable to hold the work while being folded, and mechanism for rocking the shaft and moving said 60 members.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

FRANK W. THOMAS.

Witnesses:

C. W. OWEN,
HAZEL B. HIETT.