

Aug. 9, 1932.

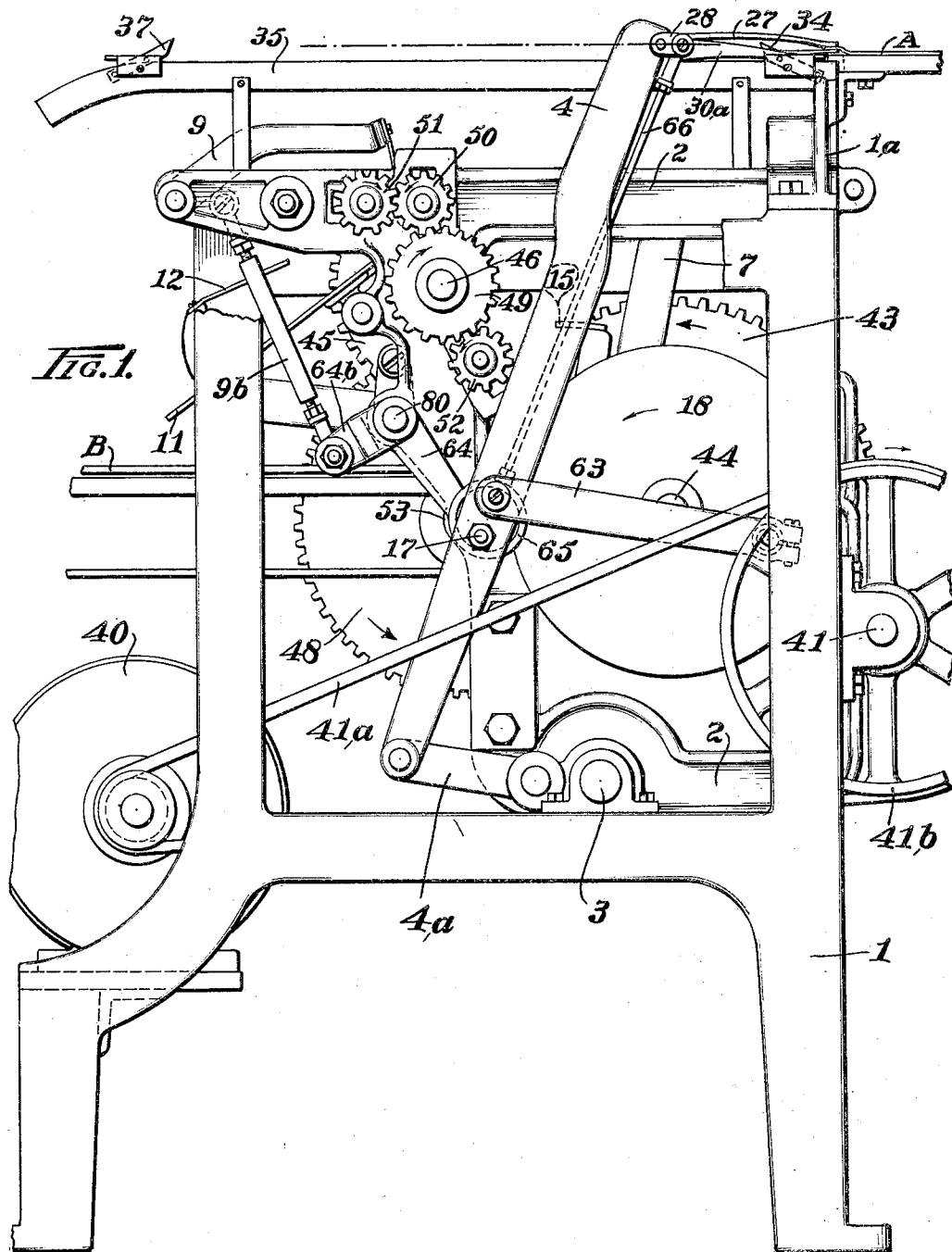
O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 1



Inventor:
Otto C. Schulz,

By: Spear, Donaldson & Hall
Att'y's.

Aug. 9, 1932.

O. C. SCHULZ

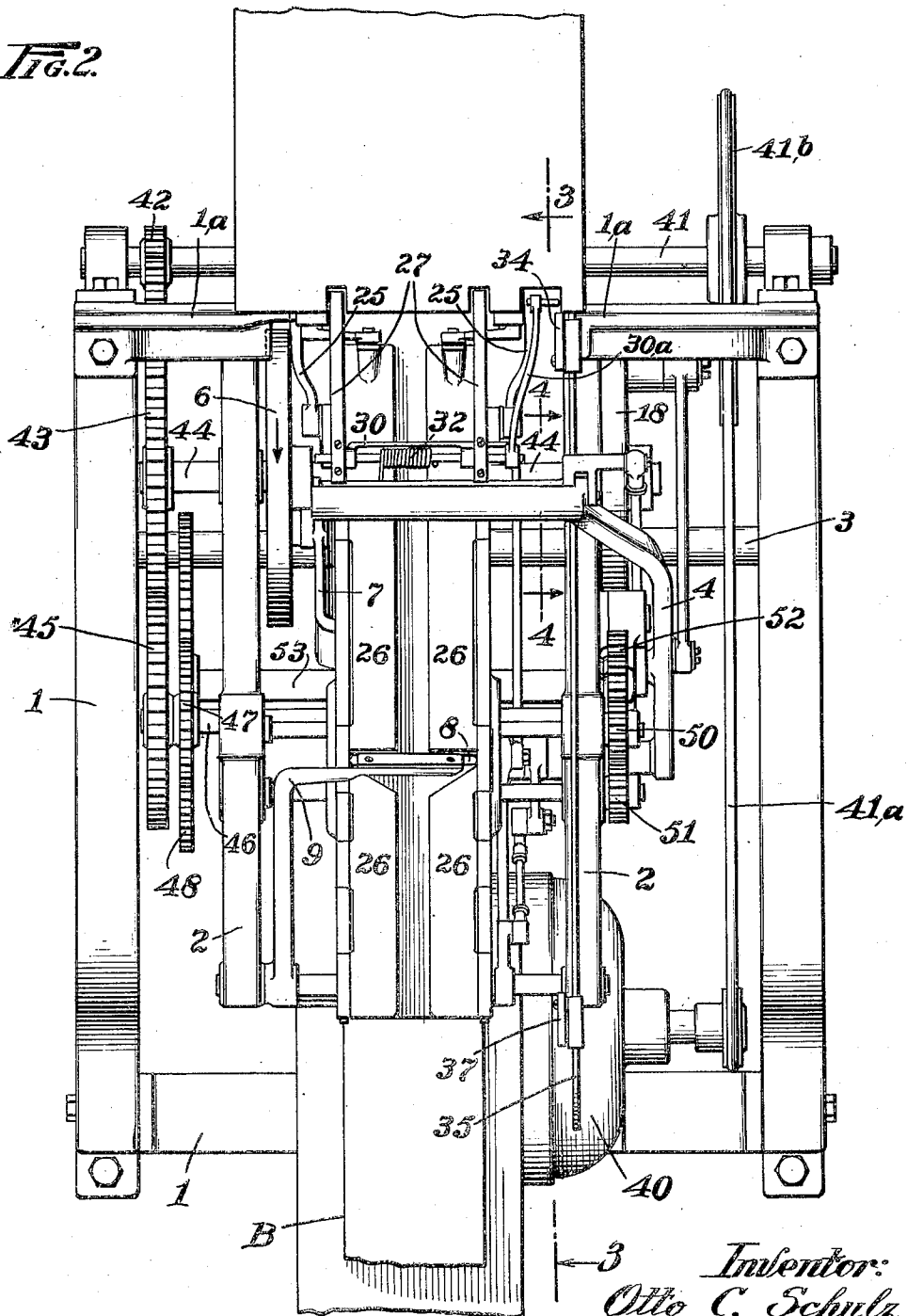
1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 2

Fig. 2



Inventor:
Otto C. Schulz

By: *Spears, Donaldson & Hall*
Attys.

Aug. 9, 1932.

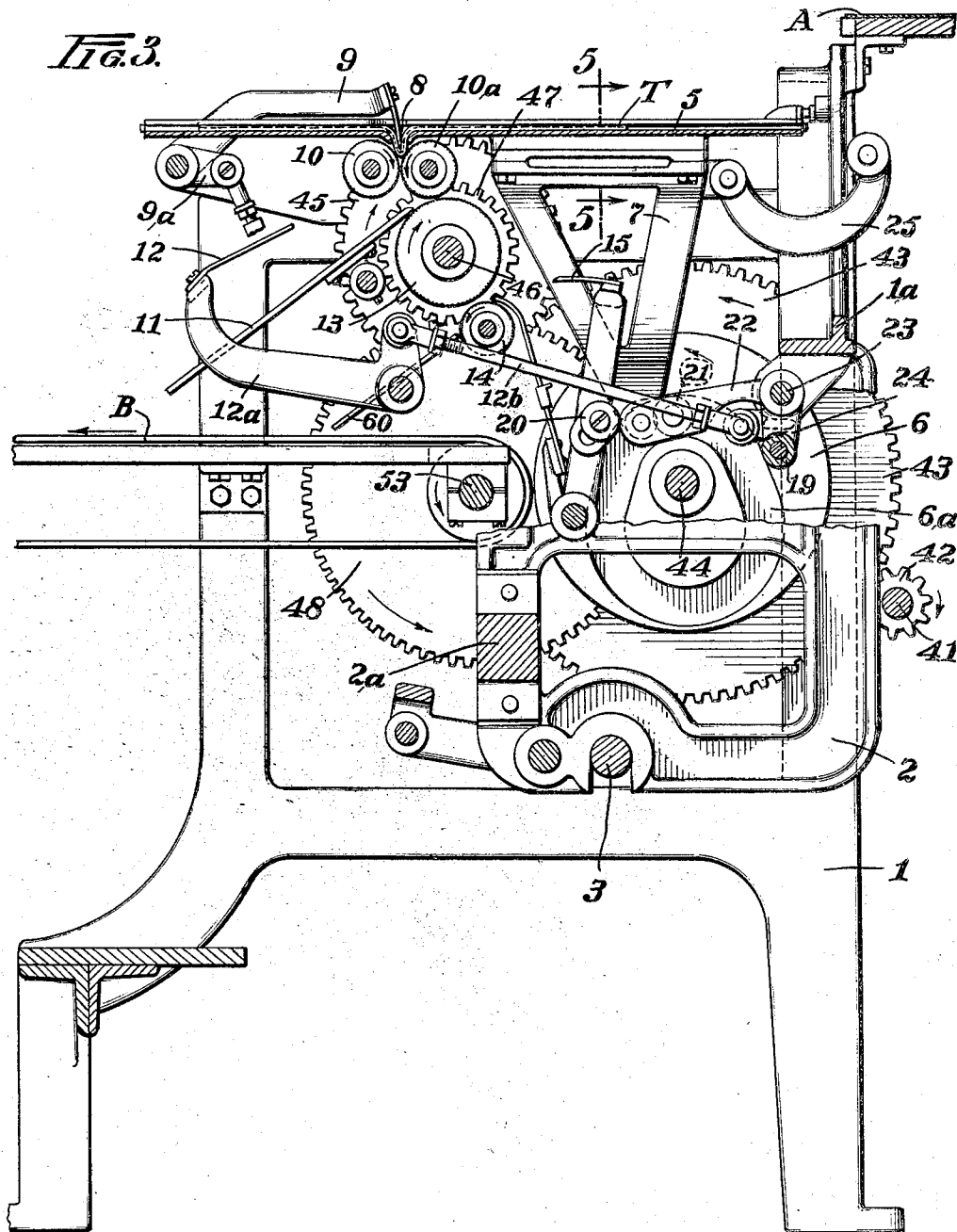
O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 3



Inventor:
Otto C. Schulz,
By: Spear, Donaldson & Hall
Atty's.

Aug. 9, 1932.

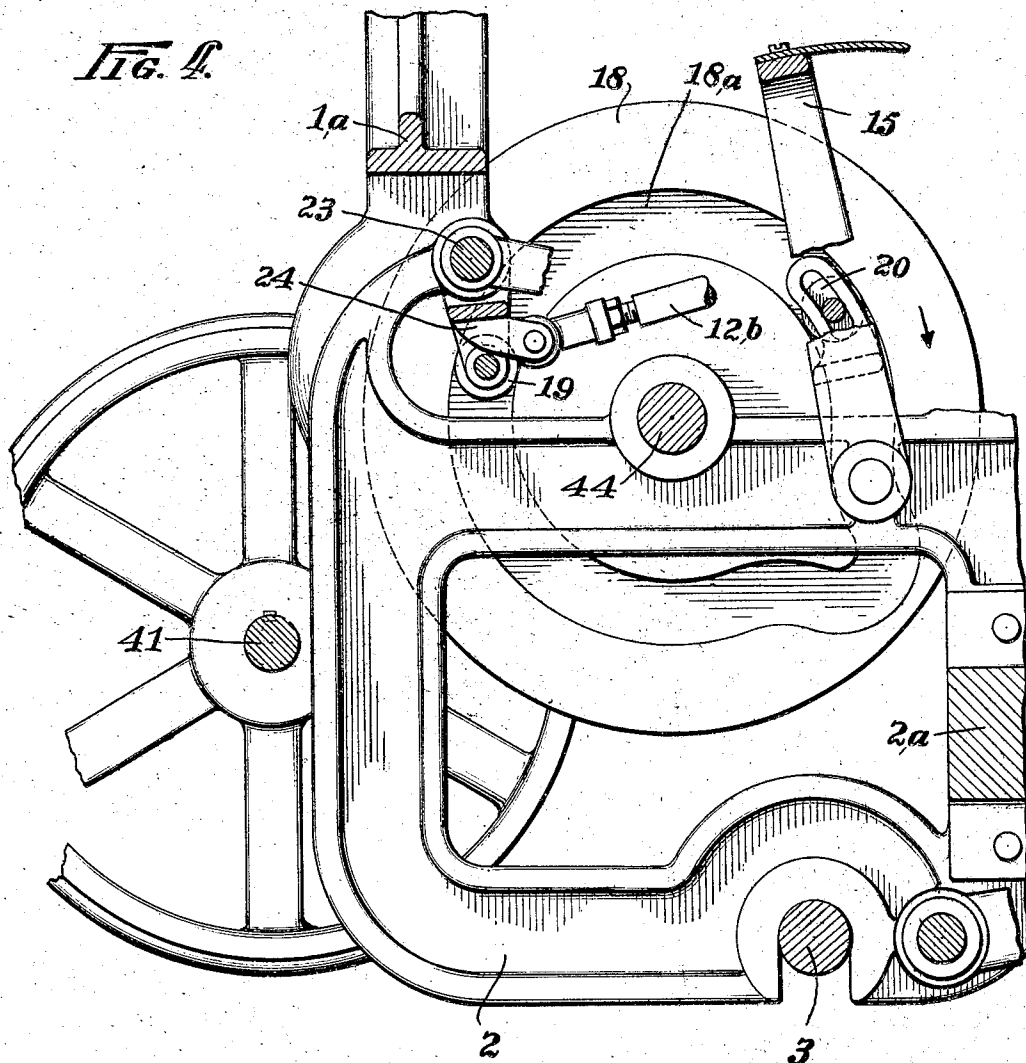
O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 4



Inventor:
Otto C. Schulz,

By: Spear, Donaldson & Hall
Att'ys.

Aug. 9, 1932.

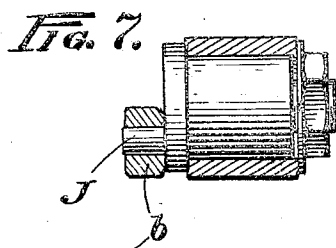
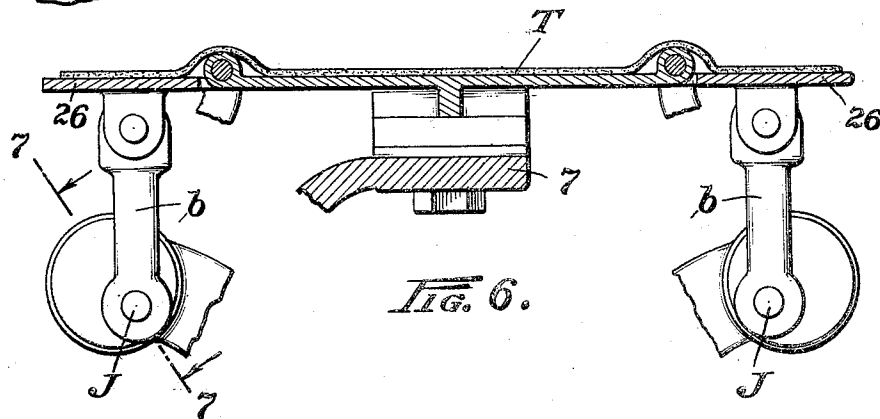
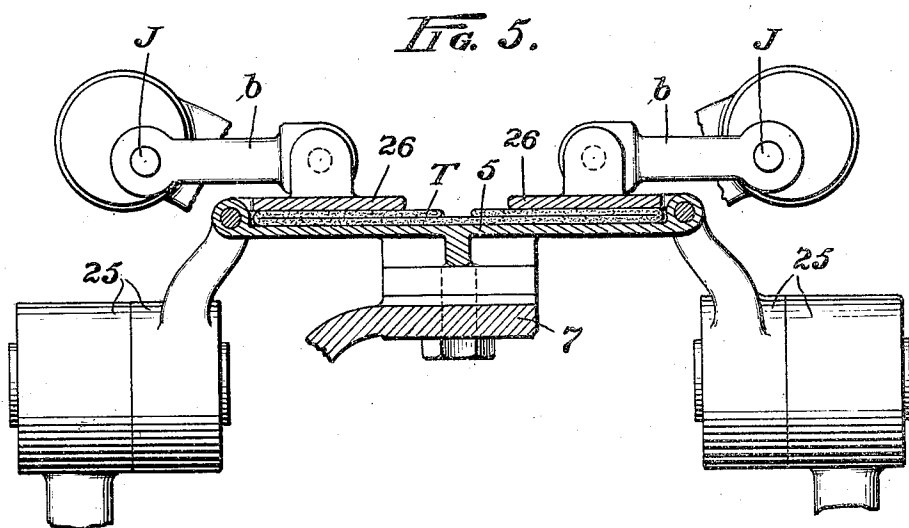
O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 5



Inventor:
Otto C. Schulz,
By: Spear, Ronaldson & Hall
Attys

Aug. 9, 1932.

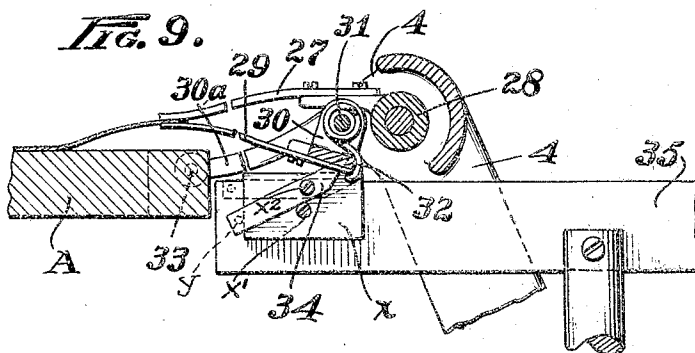
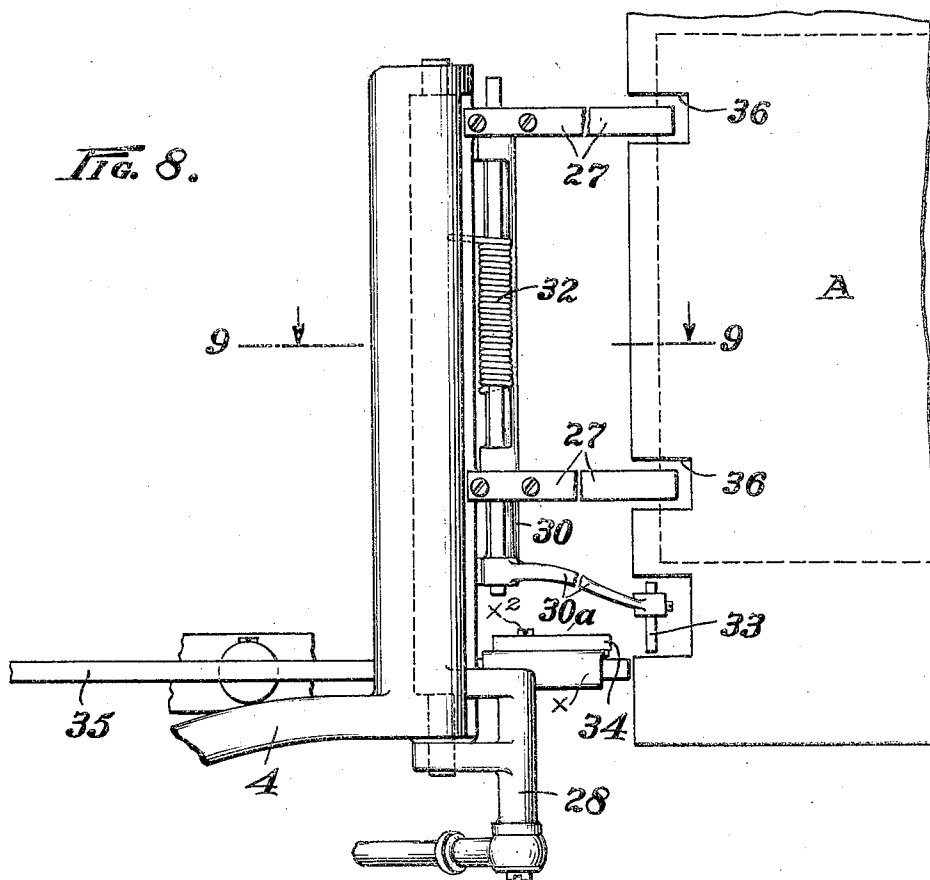
O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 6



Inventor:
Otto C. Schulz,

By: Spear, Donaldson & Hall
Att'y's

Aug. 9, 1932.

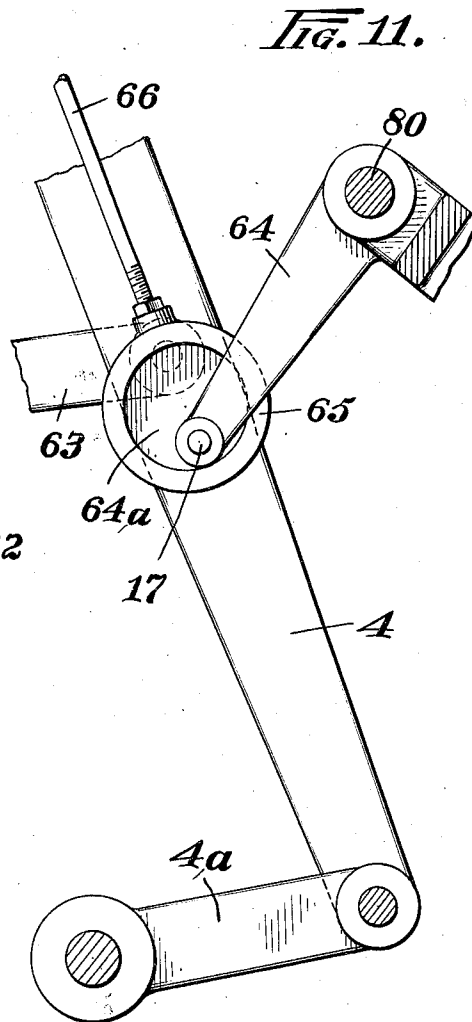
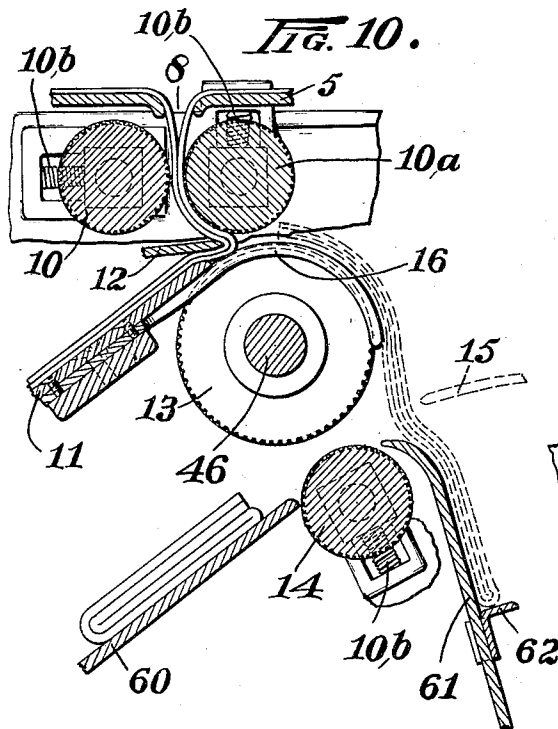
O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 7



Inventor:

Otto C. Schulz,

By: Spear, Donaldson & Hall

Attys.

Aug. 9, 1932.

O. C. SCHULZ

1,870,754

APPARATUS FOR FOLDING SHEET MATERIAL

Filed Dec. 10, 1930

8 Sheets-Sheet 8

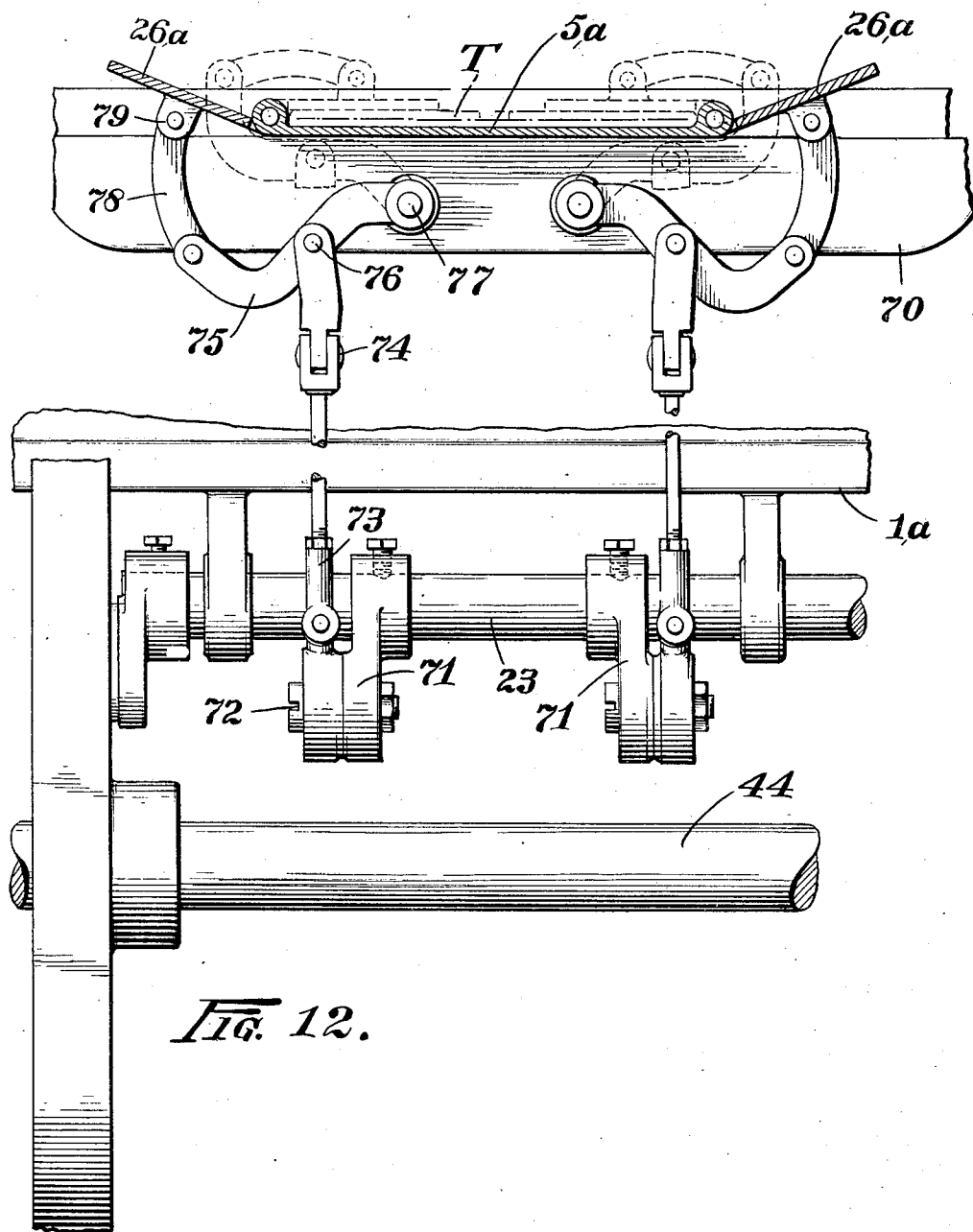


FIG. 12.

Inventor:

Otto C. Schulz,

By:

Spear, Donaldson & Hall

Attys

UNITED STATES PATENT OFFICE

OTTO CARL SCHULZ, OF CHICAGO, ILLINOIS

APPARATUS FOR FOLDING SHEET MATERIAL

Application filed December 10, 1930. Serial No. 501,371.

My present invention relates to improvements in machines for folding sheet material, and more particularly relates to a folding machine for towels, napkins, handkerchiefs or similar articles.

An object of the invention is to provide a machine of novel construction designed to feed, and fold the article of sheet material with two longitudinally extending folds and with one or more cross folds, and to discharge the folded articles from the machine.

The invention further aims to provide a construction in which the article may be folded crosswise, one, two, or three times as desired, by means of adjustment of the machine.

Other objects will appear from the following description, drawings and appended claims.

The invention consists in the features, combination, and arrangement of parts hereinafter described and particularly pointed out in the claims.

In the drawings,

Fig. 1 is a side elevation of my folding machine construction.

Fig. 2 is a plan view of the machine in the position shown in Fig. 1.

Fig. 3 is a section substantially on line 3—3 of Fig. 2.

Fig. 4 is a sectional view substantially on line 4—4 of Fig. 2.

Fig. 5 is a section on line 5—5 of Fig. 3 showing the action and construction of the folding table.

Fig. 6 is a view of the parts of Fig. 5 in raised or elevated position.

Fig. 7 is a section on line 7—7 of Fig. 6 showing the means of adjustment of the pivotal connection of the main frame 2 to the folding leaves 26 of the table 5.

Fig. 8 is a detail plan view showing the means for gripping, feeding, and releasing the towels or other sheet articles.

Fig. 9 is a section substantially on line 9—9 of Fig. 8 showing the pick-up fingers or jaws in gripping or closed position.

Fig. 10 is a detail view showing the cross-folding processes performed upon the sheet material.

Fig. 11 is a detail view showing the connection of the lever 4 to the bell crank or rocker arm controlling the fold feeding lever 9. Fig. 11 is a rear view of rocker arm 64 together with eccentric and yoke, with the arm 64b controlling feeding lever 9 broken away.

Fig. 12 shows a form of my invention in which the folding table is operated without the substantially vertical movement thereof.

Referring to the drawings, A represents a table to which the towels T or similar articles to be folded are manually delivered in unfolded condition, and are fed one by one by the gripping or feeding jaws 27, 29 carried by the feed lever 4, to table 5. The table 5 is moved up and down with respect to the machine framework designated at 1, 2, and controls longitudinal folding leaves 26 connected by links *b, b* to stationary centers J, J mounted across frame 1*a* so that when the table is in uppermost position, the leaves 26 are open as shown in Fig. 6. Each time that the table reaches this upper position, a towel T is delivered thereto.

The table then descends to lower position and the leaves 26 are closed as shown in Figs. 5 and 1, forming two lengthwise folds in the towel T. At the same time transverse fold forming lever 9 swings down and into engagement with the towel T at opening or slot 8 in the table 5 so that the towel is pushed through the opening in cross-folded condition as shown in Fig. 3 and is passed between knurled rollers 10 and 10*a* which are spring cushioned as shown at 10*b*.

The towel may then be delivered to the conveyor B by means of slide 11 (Figs. 3 and 10) by disconnecting the fold lever 12. If lever 12 is not put out of operation, it will additionally fold the towel as shown in Fig. 10 and will pass it between roller 10*a* and roller 13. Still another fold is produced by fold lever 15 which passes the twice cross-folded towel or other article between the roller 13 and spring cushioned roller 14 for a third fold before its delivery to the discharge slide 60 and the conveyor B. Members 16 are disposed in grooves in roller B to prevent the towels from sticking to the rolls and to guide them to position for the final

fold, the towels passing over guide member 61 and against abutment 62 before being engaged and folded by the fold lever 15.

As illustrated in Figs. 1, 2 and 3, there is an outer framework 1, and inner frame members 2 supported on transverse shaft 3 which in turn bears at its ends on the outer frame 1.

The inner frame members 2 notch over this shaft and are also bolted to frame spreader member 1a which extends down and across between them and acts as a spreader. This member 1a also extends outward to connect with frame 1 and forms a support for the inner frame and mechanism. Frames 2, 2 are further held in their proper relationship to each other by spreader 2a.

The source of power is indicated at 40 which represents a motor supported on the frame 1 of the machine, the motor driving shaft 41 by means of belt 41a and drive pulley 41b. (Figs. 1 and 2.) Referring to Fig. 2, the opposite end of shaft 41, which has its bearings bolted to frame 1, is provided with drive pinion 42 meshing with gear 43 to drive cam shaft 44 to which gear 43 is secured. Cam shaft 44 has its bearings in inner frame 2. Gear 43 also meshes with gear 45 on shaft 46 which also carries spur gear 47. Shaft 46 is mounted in frame 2 also. Gear 47 meshes with gear 48, the latter being fixed to the conveyor shaft 53 mounted in frame 2, which operates the belt conveyor B to carry away the folded article, all as shown in Fig. 3.

A gear 49 is carried by the shaft 46 at the opposite side of the machine, this gear driving roller gears 50 and 51 secured to rollers 10a and 10, respectively. Gear 49 also meshes with gear 52 secured to roller 14, all as shown in Fig. 1. All of the shafts and gearing are mounted in the inner frame 2 with the exception of drive shaft 41.

The cam shaft 44, at one side carries a cam wheel 6 provided with cam groove 6a, as shown best in Figs. 3 and 2.

The table 5 on which the folding is performed, is mounted upon depending frame members 7. The frame members 7 are linked for substantially vertical movement to the frame spreader portions 1a by upper and lower link members 25 and 22. The lower link member 22 is pivotally mounted on a shaft 23 secured to a frame portion 1a.

A roller 21 is carried by the link 22 and operates in the cam groove 6a, whereby the table is raised and lowered with the rotation of the cam shaft.

Also pivotally secured to the shaft 23 is a bifurcated lever 24 carrying the roller 19 on one arm and the other arm being pivotally secured to a link rod 12b for operating the bell crank lever 12a, which carries folding blade 12. The link rod 12b is preferably adjustable, and may be disconnected to put the folding blade 12 out of operation, if desired, so that the towel will be delivered to

the conveyor B by means of slide 11, with only the single cross-fold formed therein.

Motion is imparted to the fold lever 12a by means of the roller 19 riding in groove 18a of cam wheel 18, as shown in Fig. 4. Fold lever 15 is pivoted to frame 2 and is provided with roller 20 mounted in a slot therein as shown in Figs. 3 and 4. The roller 20 is disposed within cam groove 18a and motion is thus imparted at the proper time to actuate fold lever 15. Cam wheel 18 is mounted at the other end of shaft 44 from cam wheel 6, as shown in Fig. 1.

Cam wheel 18 also serves to impart motion to the feed lever 4, which is linked at its lower end to the frame 1 as shown at 4a in Fig. 1. The lever 4 is connected to the cam wheel 18 by crank connection 63, so that it is swung backward and forward upon rotation of the wheel 18, to effect the feeding of the towels or other articles from table A to folding table 5.

Fold lever 9 is pivoted to the frame 2 and is provided with an arm 9a to which is secured adjustable connecting rod 9b. The other end of the rod 9b is secured to an arm 64b of bell crank lever 64 also pivoted at 80 to frame 2. The bell crank lever or rocker arm 64 pivoted at 80 has an eccentric 64a cast integral therewith, and the rocker arm 64 also has a pivotal connection with the arm 4 as shown at 17.

This eccentric 64a integrally carried by the rocker arm 64, rotates throughout the stroke relative to the yoke 65 which surrounds it, as the feed arm 4 moves. This changes the position of the yoke 65 relative to the feed arm 4 and rod 66 being connected to the yoke and to rocker 28 of the gripping mechanism, the rocker 28 is maintained in a substantially horizontal position during the movement of arm 4. Thus, the rocker arm 64 with its integral eccentric 64a serves as an equalizer which keeps the rocker 28 substantially level. It also serves as an equalizer in its pivotal connection at 17 with the arm 4 to constrain the upper end of the arm 4 to substantially horizontal or straight line motion. This is shown in Fig. 11.

Figures 8 and 9 illustrate the pick-up or gripping fingers on the upper portion of the feed lever 4. The rocker 28 carries upper gripper fingers 27 fixed thereon. The rocker 28 also carries rocker member 30 pivoted thereto at 31. The lower gripper fingers 29 are fixed on the rocker 30 and are adapted to be swung into and out of gripping engagement with fingers 27 about pivot 31 of rocker 30.

The coacting gripper fingers 27 and 29 are normally held in closed or gripping condition by coiled spring 32 which bears upon rocker 30 and urges fingers 29 toward fingers 27.

The rocker 30 also carries an arm 30a hav-

ing a pin 33 at its end which is adapted to engage and ride under the cam dogs 34 and 37 at the ends of the reciprocating movement of the gripper assembly imparted by the feed arm 4.

These dogs are mounted upon members of U-shaped section (x) held in place on the bar 35 by set screws (x'). These dogs are mounted on pivot pins (x^2) (x^2) and are held in position as shown by gravity. A stop pin (Y) limits their movement.

The pin 33 rides under the dog 34 on approaching the material receiving end of the machine, and the gripper fingers are opened, fingers 29 being swung downwardly and away from level fingers 27 about pivot 31, and against the action of the spring 32.

The grippers then pass the dog 34 and snap closed on the cloth or other limp sheet material received from feed board A, the sheet material having been previously placed upon feed board A so as to overhang slots 36.

The sheet material is thus drawn onto the folding table 5 by the gripper assembly as the feed arm moves to the rear or toward the delivery end of the machine. At this end of the stroke, the pin or roller 33 on arm 30a rides under cam dog 37 which causes the gripper fingers to open and the sheet material to be dropped upon the folding table in flat condition ready for the folding action of the longitudinal folding leaves 26 and the cross-fold levers.

Referring to Fig. 12, an embodiment of my invention is shown in which the operating means for the folding table are not dependent upon the substantially vertical reciprocatory motion of the table. In this form the folding table 5a is not mounted upon the vertically movable frame 7 as in the form first described, but is held in place by a cross bar 70 mounted on the side frames 2. Folding levers or leaves 26a are pivotally connected to the table 5a, these pivots being fixed and not moved vertically as in the form first described.

Connecting means are provided from the folding leaves 26a to the shaft 23 of the machine, so that motion imparted to the shaft 23 by means of roller 19 actuated by cam wheel 18, is transmitted to the folding members or plates 26a to open them to receive a towel or to close them to fold the towel at the proper time. The said connecting means includes a cam lever 71 for each member 26a secured to the shaft and having pivotal connection at 72 with link member 73. Link member 73 which has an intermediate transverse pivotal connection 74, is pivotally connected to lever 75 at 76. The lever 75 is pivotally secured to the cross-bar 70 at 77. A link 78 connects lever 75 with the lug 79 or fold member 26a.

The table 5a with its folding members is shown in Fig. 12 in partially open position.

The closed or folded position is indicated in dotted lines in Fig. 12 with the towel or other limp or flexible sheet material indicated in folded condition at T.

I claim:

1. Apparatus for folding sheet material including a supporting frame, a folding table carried by said frame and having longitudinal side portions in pivotal relation to a central table portion and adapted to form two longitudinal folds in the sheet material, means for operating said side portions to swing them over upon the top of the central portion to form the fold and to swing them outwardly to lie substantially in the plane of the central portion to receive the sheet material to be folded, and means for cross-folding the longitudinally folded sheet material.

2. Apparatus for folding sheet material including a supporting frame, a folding table carried by said frame, said table having a movable portion pivoted to a relatively fixed portion thereof for swinging movement to lie substantially in the same plane to receive the sheet material, or to be folded over upon said fixed portion to fold the sheet material, and means for cross-folding the folded sheet material.

3. In a machine for folding individual sheets of material and in combination, means for forming a fold in the sheet of material and means for forming a cross-fold in the folded sheet of material, said first named means coacting to hold the folded sheet in place while the cross-fold is formed.

4. In a machine for folding individual sheets of material and in combination, means for forming a plurality of parallel folds in the individual sheet of material and means for forming a cross-fold in the folded sheet material, said first named means coacting to hold the folded sheet against lateral displacement while the cross-folding is performed.

5. In a folding machine for individual sheets of material and in combination, means for forming a plurality of parallel folds in the individual sheet of material and means for forming a plurality of cross-folds in the folded sheet material, said first named means coacting to hold the folded sheet against lateral displacement while the cross-folding is performed.

6. A folding machine for individual sheets of material according to claim 5 in which said cross-folds are formed successively upon the material as folded by the preceding folding action.

7. In a folding machine for individual sheets of material and in combination, foldable plate means for receiving and folding the sheet material, and tucker means for transversely folding the folded sheet material, said foldable plate means co-acting to hold the folded sheet against lateral dis-

placement while the transverse folding is performed by said tucker means.

8. In a folding machine for sheet material and in combination, foldable plate means for receiving and folding the sheet material and comprising a central portion and parallel side portions pivoted thereto, said foldable plate means being provided with a transverse slot through which the sheet material is exposed, and tucker means including a tucker arm having a blade adapted to enter said slot and engage the folded sheet material to form a transverse fold therein, and means for successively operating said foldable plate means and said tucker means, said operating means including a common power shaft and cam means for operating said foldable plate means and connection for operating said tucker means.

9. In a folding machine for sheet material and in combination, foldable plate means for receiving and folding the sheet material and comprising a central portion and parallel side portions pivoted thereto, said foldable plate means being provided with a transverse slot through which the sheet material is exposed, and tucker means including a tucker arm having a blade adapted to enter said slot and engage the folded sheet material to form a transverse fold therein, and means for successively operating said foldable plate means and said tucker means, said operating means including a common power shaft and cam means for operating said foldable plate means and connection for operating said tucker means, a pair of rollers disposed beneath said transverse slot to receive between them the folded material from the folded plate and to convey it to a delivery guide plate, and means connected to said power shaft to drive the said rollers.

10. Apparatus according to claim 9 including a third roller disposed adjacent one of the pair of rollers beyond the upper end of the delivery guide plate, a second tucker arm positioned for tucking the folded material on said delivery guide plate between the third roller and the said one of the pair, a fourth roller disposed adjacent said third roller, a second delivery guide plate leading from this juncture, a third tucker arm positioned for tucking the folded material between the third and fourth rollers and onto said second delivery guide plate, said rollers and tucker arms being driven by connections from said common power shaft.

11. In a folding machine for folding sheet material, and in combination, foldable plate means for receiving and folding the sheet material and comprising a central portion and parallel side portions pivoted thereto, a support, lever means pivoted to said support and operatively connected to said side portions, and cam drive means for actuating and

controlling said lever means to open and close the side portions.

12. A folding machine according to claim 11 in which said cam drive means includes a grooved cam wheel, and a substantially vertically movable supporting frame for said foldable plate means, said frame having a portion riding in said cam groove.

13. In a folding machine for folding sheet material, and in combination, a support, a folding table, a delivery table adjacent the folding table, a feed lever connected to said support, means for moving the upper end of said feed lever toward and away from said delivery table and along the folding table, material gripping means carried by the upper end of said lever and extending over said table, said gripping means including a rocker pivoted to the upper end of the feed lever and having a gripping jaw secured thereto, a second rocker pivoted to the first and carrying a second gripping jaw, a spring engaging said rockers to urge the jaws together, and eccentric means connected to said first rocker for equalizing the effect of the swinging movement of the lever and maintaining said first rocker substantially level during such movement.

14. Apparatus according to claim 13 in which said equalizing means includes an equalizing arm pivoted to said support and to said feed lever, said equalizing arm carrying an eccentric, and a rod pivotally connected to said first rocker and having a yoke engaging said eccentric to be operated thereby.

15. A folding machine according to claim 13 in which a link connects the lower end of said feed lever with said support, and said equalizing means includes an equalizing arm pivoted to said support and to said feed lever, said equalizing arm carrying an eccentric, and a rod pivotally connected to said first rocker and having a yoke engaging said eccentric to be operated thereby to maintain the rocker substantially horizontal during movement of said feed lever, said equalizing arm also acting to constrain the upper end of the feed lever to a substantially horizontal path.

16. Apparatus according to claim 13 including an arm extending from said second rocker, and cam dogs pivoted to said support at the ends of the stroke of the feed lever, said arm having a pin to ride beneath said pivoted cam dog to open the gripping jaws by moving the lower jaw away from the upper jaw, said jaws closing upon the pin passing the cam and allowing return of the arm and second rocker to normal position by means of said spring.

17. In a folding machine for sheet material and in combination, foldable plate means for receiving and folding the sheet material, and tucker means for transversely folding the folded sheet material, said foldable plate

means having a slot through which the sheet material is exposed, and said tucker means including a tucker arm having a blade adapted to enter said slot and engage the folded sheet material to form a transverse fold therein, and means for successively operating said foldable plate means and said tucker means.

18. Apparatus according to claim 9 including a third roller disposed adjacent one of the pair of rollers beyond the upper end of the delivery guide plate, a second tucker arm positioned for tucking the folded material on said delivery guide plate between the third roller and the said one of the pair, a fourth roller disposed adjacent said third roller, a second delivery guide plate leading from this juncture, a third tucker arm positioned for tucking the folded material between the third and fourth rollers and onto said second delivery guide plate, said rollers and tucker arms being driven by connections from said common power shaft, a grooved cam wheel provided on said power shaft, and members disposed to ride in said cam groove and connected to said second and third tucker arms, and crank and lever connections from said cam wheel to said first mentioned tucker arm.

19. A folding machine according to claim 13 in which a link connects the lower end of said feed lever with said support, and said equalizing means includes an equalizing arm pivoted to said support and to said feed lever, said equalizing arm carrying an eccentric, and a rod pivotally connected to said first rocker and having a yoke engaging said eccentric to be operated thereby to maintain the rocker substantially horizontal during movement of said feed lever, said equalizing arm also acting to constrain the upper end of the feed lever to a substantially horizontal path, a lever on said support for forming a fold in material placed upon said table, said equalizing arm being in the form of a bell crank, one member of which is connected as set forth and the other member of which is connected to said fold lever to operate the same to form a fold when the feed lever is adjacent said delivery table.

In testimony whereof I affix my signature.

OTTO CARL SCHULZ.