Oct. 8, 1935. O. H. SATHER 2,016,298

ROTARY FOLDING MECHANISM

Filed April 30, 1934 2 Sheets-Sheet 1

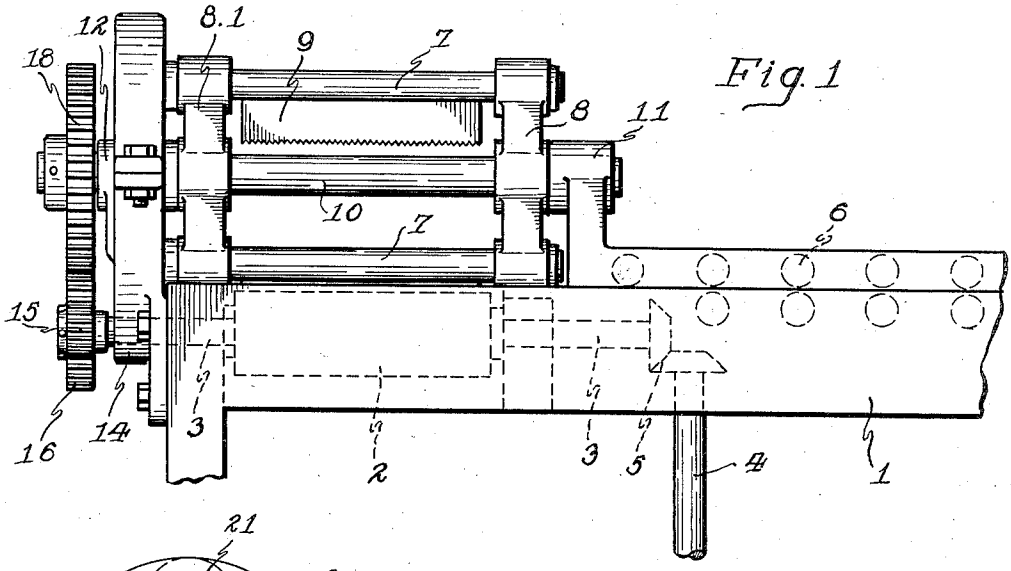


Fig. 1

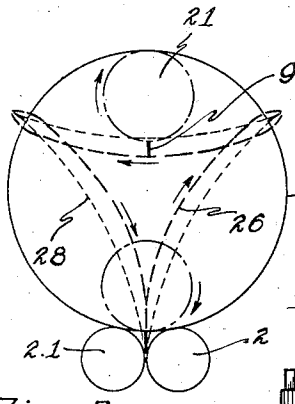


Fig. 5

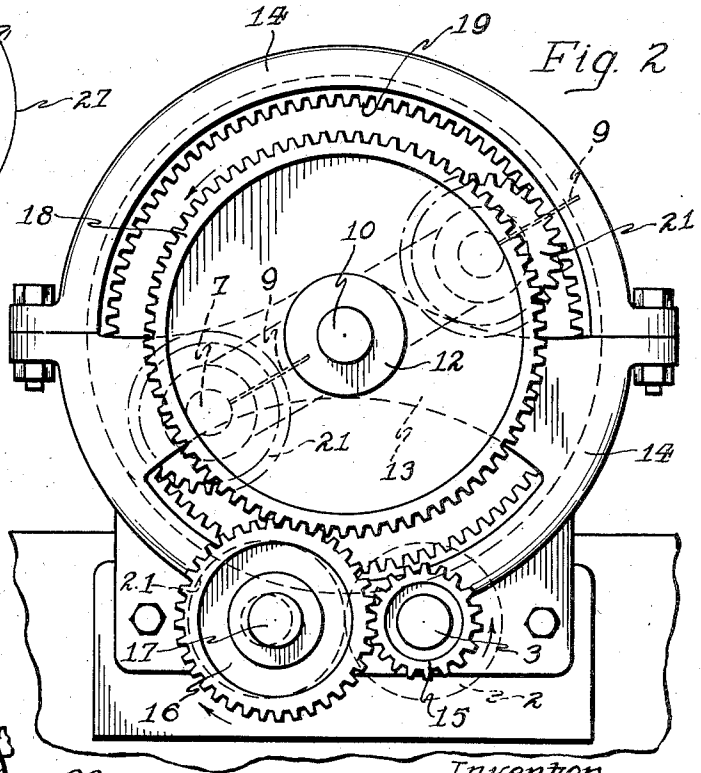


Fig. 2

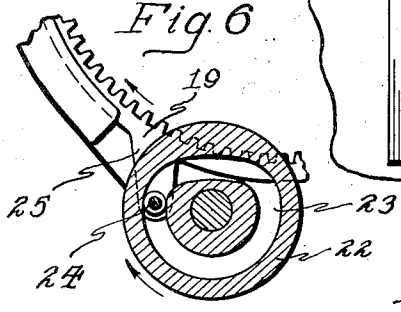


Fig. 6

Inventor
Oliver H. Sather

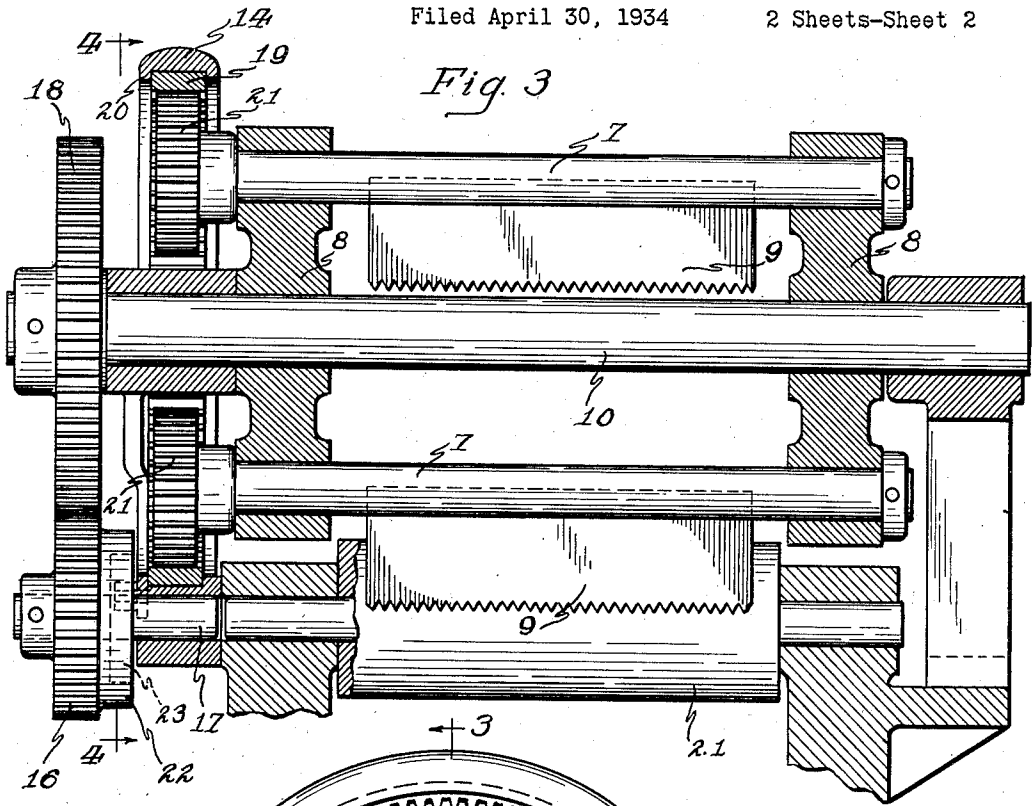
by Rummler Rummler & Woodworth
Attys.

Oct. 8, 1935. O. H. SATHER 2,016,298

ROTARY FOLDING MECHANISM

Filed April 30, 1934 2 Sheets-Sheet 2

Fig. 3



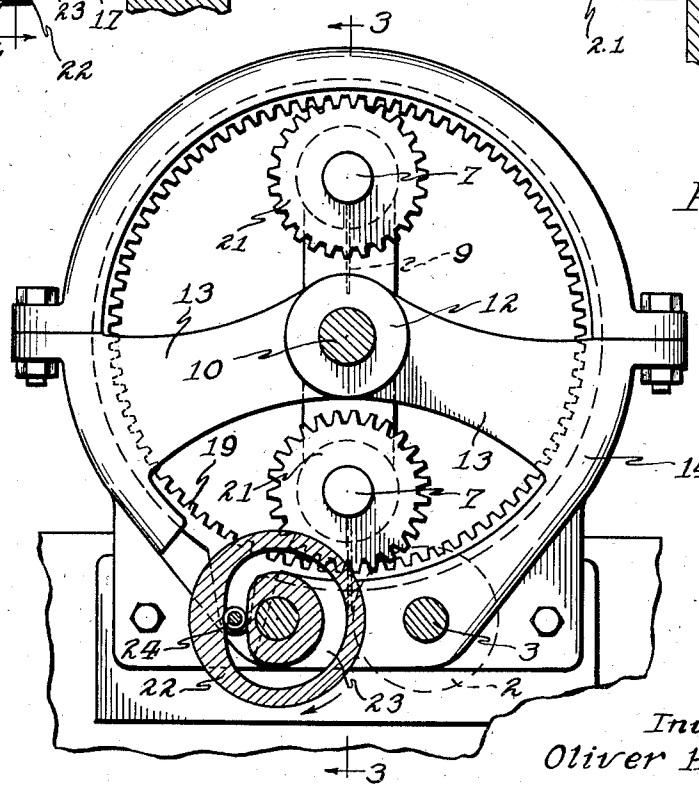


Fig. 4

Inventor
Oliver H. Sather

by Rummler Rummler & Woodworth
Attys.

Patented Oct. 8, 1935 2,016,298

UNITED STATES PATENT OFFICE

2,016,298

ROTARY FOLDING MECHANISM

Oliver H. Sather, Chicago, Ill.

Application April 30, 1934, Serial No. 723,070

5 Claims. (Cl. 270—77)

This invention relates to folding devices and particularly to rotary folding mechanisms used in connection with a printing press and arranged to tuck sheets of paper between opposed pressing surfaces whereby the said sheets are folded on a predetermined line.

The main objects of this invention are to provide an improved rotary folding mechanism arranged to control the path of the edge of the tucking blade whereby the blade strikes a sheet of paper being folded exactly on the line where the fold is desired, and continues in a straight line path to tuck said sheet between the folding surfaces; to provide such a folding mechanism in which the tucking blade extends beyond the periphery of its rotating element, whereby the edge of the blade normally travels in a hypotrochoidal path, and arranged to control the movement of the blade so as to reduce a node of the hypotrochoid to a straight line at the tucking or folding position; to provide an improved rotary folding mechanism having a floating internal gear arranged to control the movement of a rotating tucker blade driven by a planet gear meshed with said internal gear; to provide a floating internal gear in a planetary gear mechanism arranged to control and vary the peripheral velocity of a planet gear having a constant angular velocity; and to provide an improved rotary folding device in which the edge of the tucking blade has a straight line reciprocating motion during the folding operation.

A specific embodiment of this invention is shown in the accompanying drawings, in which—

Figure 1 is a side elevation of a rotary folding apparatus.

Fig. 2 is an enlarged end view of the folding device showing the relationship of the driving gears.

Fig. 3 is an enlarged sectional elevation of the folding mechanism as taken on line 3—3 of Fig. 4.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a diagrammatic view showing the path of the edge of the tucking blade.

Fig. 6 is a fragmentary sectional view taken on the line 4—4 of Fig. 3, showing in detail the cam controlling motion of the internal gear.

In the form shown in the drawings, my improved folding apparatus comprises the usual bed frame 1, in which is mounted a pair of opposed folding or pincher rollers 2 and 2.1, one of which is carried on a shaft 3 connected to a power shaft 4 by means of beveled gears 5. The tucking apparatus is mounted on the upper surface of the bed frame 1 in the usual manner, and sheets of paper are fed thereinto from a printing press, not shown, by means of rollers 6.

The tucking apparatus comprises a pair of horizontal shafts 7 suitably journaled in the ends of spaced arbors or carrying arms 8 and 8.1, each shaft having a radially extending tucking blade 9 fixed thereto. The arbors or carrying arms 8 and 8.1 are fixedly mounted on a rotatable driving shaft 10 and each arbor comprises a hub having a pair of arms extending laterally and oppositely therefrom so that the shafts 7 are positioned diametrically opposite each other. The shaft 10 is journaled in suitable bearings fastened to the bed frame 1, the inner bearing 11 being supported from the upper surface of the bed frame and the outer bearing 12 being carried on bracket arms 13 which form an integral part of a gear housing 14 mounted on the end of the bed frame 1.

The shaft 3 which carries and drives one of the folding or pincher rollers 2 is arranged to extend axially beyond the said roller and project outwardly from the end of the bed frame 1 where it carries, on its outer end, a small pinion 15 by means of which the tucking apparatus is driven. The small pinion 15 is arranged to mesh with an intermediate pinion or gear 16 carried on a stub shaft 17 suitably journaled in the lower part of the gear housing 14.

The shaft 10 which carries the arbors or arms 8 supporting the tucker blades 9 is arranged to extend beyond the outer bearing 12 and has fixed to its outer end a large gear 18 which is arranged to mesh with the pinion or gear 16.

Mounted within the gear housing 14 is a large internal gear 19 which is held in position by means of inwardly turned flanges 20 on the gear housing or casing 14. The internal gear 19 is held by the gear housing 14 against axial movement only and is otherwise arranged to float angularly about its axis within the gear housing 14. Each of the shafts 7 which carry the tucking blades 9, extends beyond the outer arbor 8.1 and carries on its outer end a planet gear 21 which is meshed with the internal gear 19.

It will now be seen that, as power is transmitted through the shaft 3 to the pinion 15 and thence by way of the pinion or gear 16 to the large gear 18, the shaft 10 and the arbors 8 and 8.1 fixed thereon will be rotated, thus imparting an angular motion to the shafts 7 and their respective planet gears 21. Because of the angular motion of the planet gears 21, the same will be caused to rotate as they travel around the inner

periphery of the internal gear 19, thus rotating the shafts 7 and the tucking blades 9 and causing the edges of the tucking blades 9 to follow a hypotrochoidal path.

In the form of my device shown in the drawings, each tucking blade 9 is proportioned so as to extend radially beyond the pitch circle of its respective planet gear 21 and, therefore, with the internal gear 19 in a stationary position, the edge of each tucking blade 9 will normally follow a constant hypotrochoidal path which path will, at certain points on the periphery of the internal gear 19, form loops or nodes which project outwardly beyond the pitch circle of the internal gear 19. With properly adjusted relationship of the various aforementioned geared elements, the points at which such loops or nodes are formed can be located at any predetermined position on the periphery of the internal gear.

In the apparatus shown, the sheets to be folded are fed to the folding mechanism horizontally so that they may pass vertically between the folding or pincher rollers 2 and 2.1. Therefore, the arrangement of geared elements shown is such that a loop or node in the normal hypotrochoidal path of the tucker blade edge would be formed at a position vertically below the axis of the angular motion of the planet gears 21.

In order to accomplish the objects of this invention with the construction shown, it is necessary to shift or rock the interal gear 19 angularly about its axis in order to vary the peripheral velocity of the planet gears 21 and thereby affect the path of travel of the edge of each tucker blade 9 so that, as the edge of the tucker blade enters a loop or node of its normal hypotrochoidal path, its motion is changed so that it moves in a straight line rather than in the usual loop or node. Such rocking or shifting motion of the internal gear 19 is accomplished by means of a cam 22 which is integral on the inner side or face of the intermediate pinion or gear 16.

The said cam 22 is formed with a predetermined groove or cam race 23 in which rides a cam follower 24 carried on an arm or lateral extension 25 projecting from the outer periphery of the internal gear 19.

The cam groove 23 is so formed as to intermittently rock or shift the internal gear in two directions for each complete revolution of the gear 16.

In Figure 4, the cam 22 and cam follower 24 are shown in a position where the internal gear 19 has just completed a counter-clockwise rocking motion and is about to begin a clockwise rocking motion in order to be returned to its normal position.

In Figure 6 the cam 22 and cam follower 24 are shown in a position where the internal gear 19 has just completed its clock-wise motion and is in its normal position; such position in the arrangement shown being held for substantially one-half of one revolution of the cam 22.

The cam 22 is so proportioned and its relation with reference to the other geared elements of the complete device so adjusted that a shifting or rocking motion is imparted to the internal gear as the edge of the tucking blade approaches the position of the lowermost node in the normal hypotrochoid that would be formed if the internal gear remained stationary and such rocking or shifting motion is calculated to change the peripheral velocity of the planet gear so that as the edge of the blade approaches the point in its path where the lower loop or node would normally begin, its motion is so changed that the edge of the blade travels outwardly in a straight line beyond the pitch circle of the internal gear and then inwardly to continue along the curve of a normal hypotrochoid.

The path of the edge of the tucking blades as affected by a rocking motion of the internal gear is shown by line 26 in Fig. 5. Thus it will be readily seen that since the straight line motion of the tucking blade edge at the tucking point begins well within the pitch circle (represented by line 27) of the internal gear 19 and continues outwardly beyond the said pitch circle, the motion of the tucker blade edge is changed from a cycloidal movement to a straight-line movement, and the tucker blade edge will then strike the sheet of paper or other material that is to be folded exactly on the desired folding line and be held on such folding line until the sheet has been tucked between the pincher rollers 2 and 2.1. It should be noted at this point that driving gears 19 and 21 of the folding or tucking blades have a three to one ratio while the driving gears 18 and 16 of the cam 22 have a two to one ratio. Line 28 in Fig. 5 represents the hypocycloidal path of the tucker blade edge that is found in the usual rotary folding devices and is superimposed on the diagram to illustrate the change in the blade motion that is obtained by my improved construction, the line 28 having no other relation to the remaining elements of the diagram.

In the operation of my improved folding device, the sheets to be folded are fed by means of the roller 6 into the folding mechanism and are stopped by suitable means, not shown, in a proper position to be fed into the pincher rollers 2. The tucking blades 9, being positioned diametrically opposite each other and extending in the same radial direction from their respective shafts 7, travel through a common hypotrochoidal path. Therefore, since the relationship of the various elements in the folding device is adjusted so that a node or loop of a normal path of the tucking blade is located centrally on the desired folding line, the edge of each tucking blade will be caused to enter a straight line path prior to striking the sheet to be folded and will continue in such a straight line path until the sheet is tucked between the pincher rollers 2.

This action of the tucking blade is brought about through properly timed rocking or shifting motion in the internal gear 19 and a properly timed and proportioned relationship between all of the geared elements.

The main advantage of my improved rotary folding mechanism resides in the fact that the node or loop of the usual hypotrochoidal path of the tucking blade is converted to a straight line, thereby eliminating sliding motion of the edge of the tucking blade on the sheet being folded, as the said sheet is being tucked between the pincher rollers.

Prior rotary folding devices have attempted to attain this result, such as constructions in which a reciprocating movement is imparted to a tucking blade traveling in a hypocycloidal path, but in none of these devices has the arrangement been such that the blade initially strikes the sheet exactly on the folding line, nor has the loop or node in a hypotrochoidal path of a tucking blade edge been eliminated. In such prior devices a slight sliding motion of the tucker blade edge on the sheet as it is being tucked between the pincher rollers is necessary to obtain proper centering, which motion often causes a sheet to be folded on

a line that is off center from the position at which the fold is desired.

This improved rotary folding mechanism is of particular advantage in the bookmaking art where it is necessary that the folding of the printed sheets be accurate.

Other advantages of my improved mechanism reside in the fact that it is capable of very high speed operation, since the only eccentric elements are the tucker blades and unequal bearing loads are substantially eliminated; also fanning of the sheets to be folded by the tucker blades as they approach the folding point is substantially eliminated because the motion of the tucker blade edge is changed to a straight line reciprocating motion before the blade strikes the sheet and its peripheral velocity is reduced as it approaches the sheet.

Although but one specific embodiment of this invention is herein shown and described, it will be understood that various details of the structure shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims:

I claim:

1. The combination of a floating internal gear, a planet gear meshed with said internal gear, a blade connected to the planet gear, means to impart angular motion of constant velocity to said planet gear, and means arranged to rock said internal gear angularly about its axis to vary the peripheral speed of said planet gear when the edge of said blade is in a predetermined position.

2. A device of the class described, comprising an internal gear, a planet gear meshed with said internal gear and secured on a shaft, a tucker blade on said shaft extending beyond the pitch circle of the planet gear, means to rotate said planet gear around the internal periphery of said internal gear, and means to shift said internal gear angularly about its axis when said planet gear is in a predetermined position to confine the movement of the edge of the blade to a line which is radial to the internal gear.

3. In a device of the class described, the combination of a planet gear arranged to travel around the internal periphery of an internal gear, a shaft fixed to said planet gear and carrying a radial tucker blade, means to impart angular motion to said planet gear and shaft, and means to shift said internal gear angularly about its axis when the edge of said tucker blade reaches a predetermined position to confine the movement of said edge to a line which is radial to the internal gear.

4. In a device of the class described, the combination of a planet gear meshed with and arranged to travel in an internal gear, a shaft fixed to said planet gear and carrying a radial tucker blade, means to impart angular motion to said planet gear whereby said shaft and tucker blade are rotated, the edge of said blade normally moving in a hypotrochoidal path, and means to shift said internal gear angularly about its axis when the edge of said blade reaches a predetermined position to change the path of the edge thereof to a line which is substantially a straight line.

5. In a paper folding mechanism, a drive shaft, a fixed arm on said drive shaft, planet gears mounted on said arm, a tucker blade connected to each planet gear, an internal gear meshing with said planet gears, and means driven by said shaft for shifting the internal gear each time a tucker blade reaches folding position.

OLIVER H. SATHER.