April 17, 1934. A. W. WERNER 1,955,398

FOLDING MACHINE

Filed Nov. 4, 1929 3 Sheets-Sheet 1

Fig. 1.

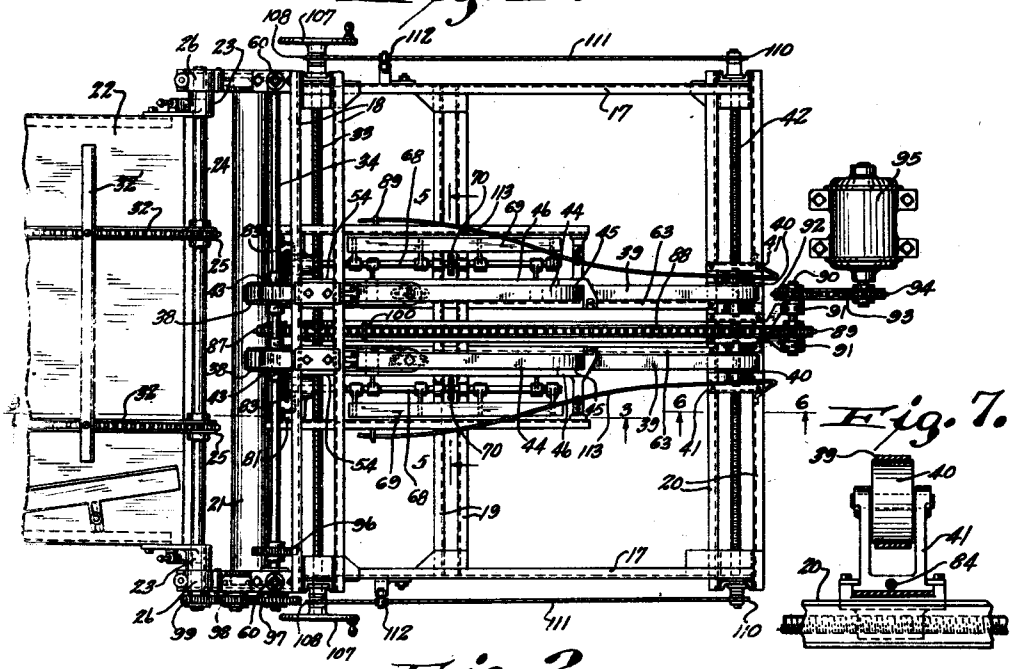


Fig. 7.

Fig. 2.

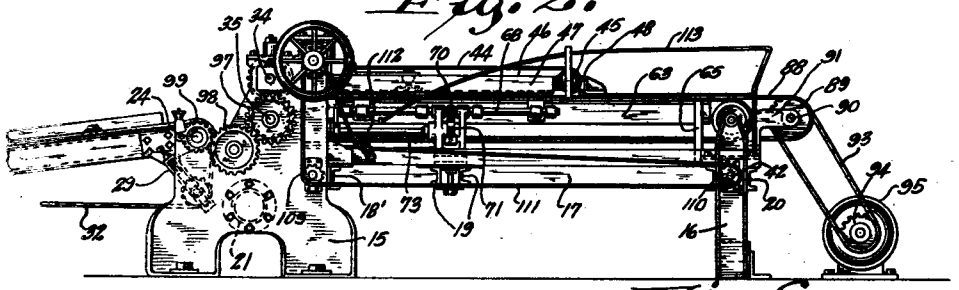


Fig. 5.

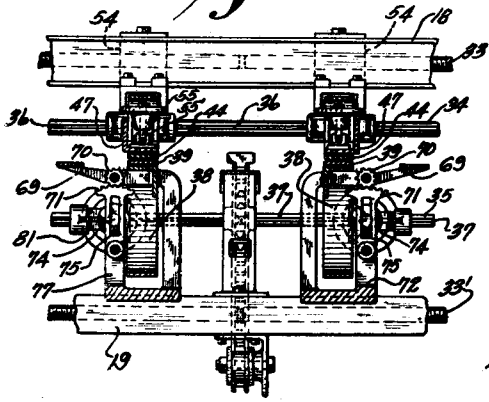
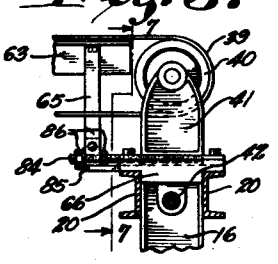


Fig. 6.



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April 17, 1934. A. W. WERNER 1,955,398

FOLDING MACHINE

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Fig. 3.

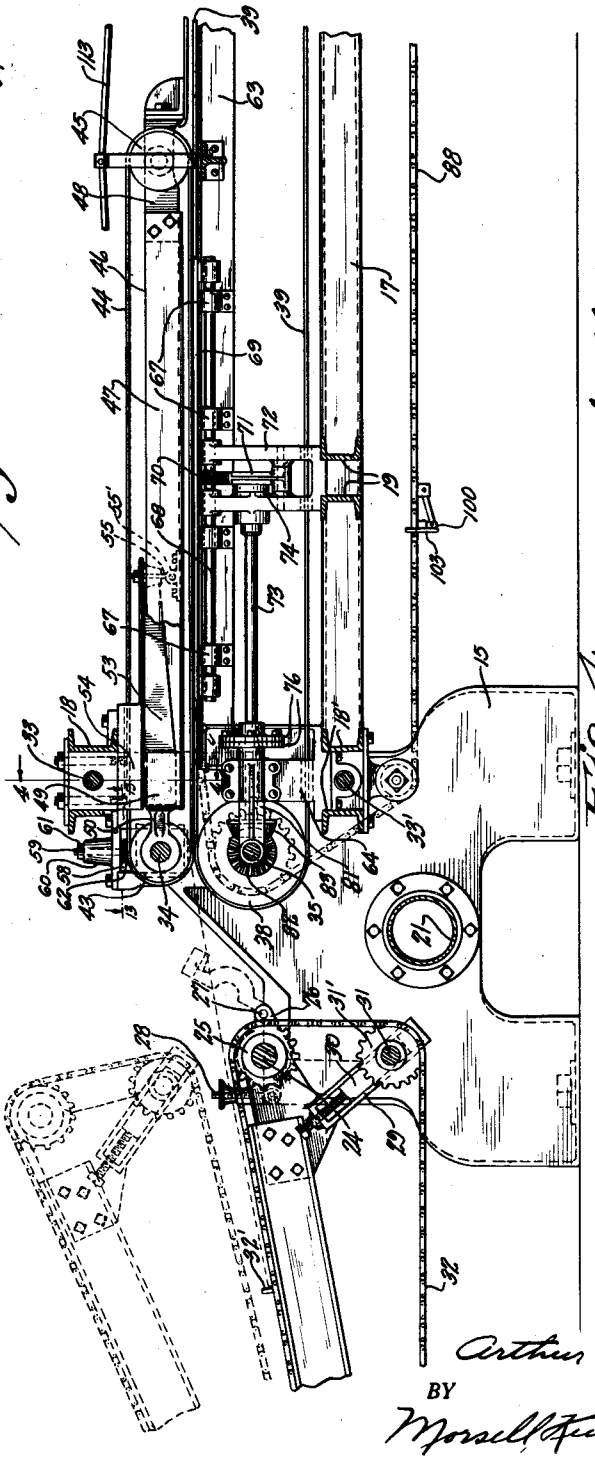


Fig. 13.

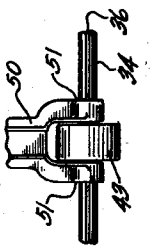


Fig. 14.

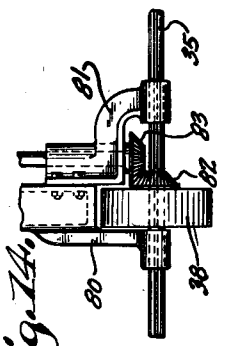
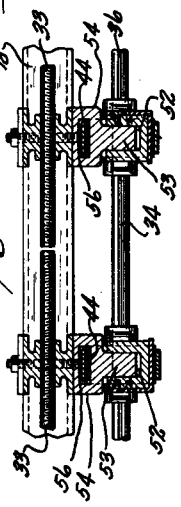


Fig. 4.



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FOLDING MACHINE

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Fig. 8.

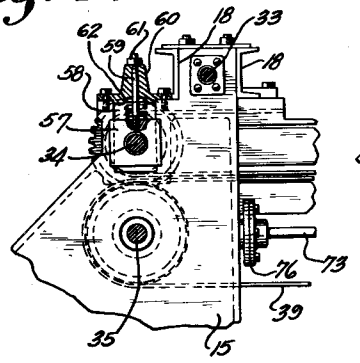


Fig. 9.

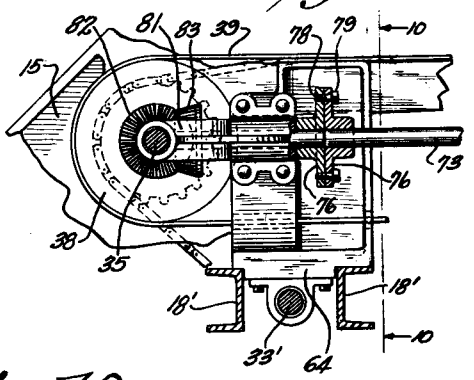


Fig. 10.

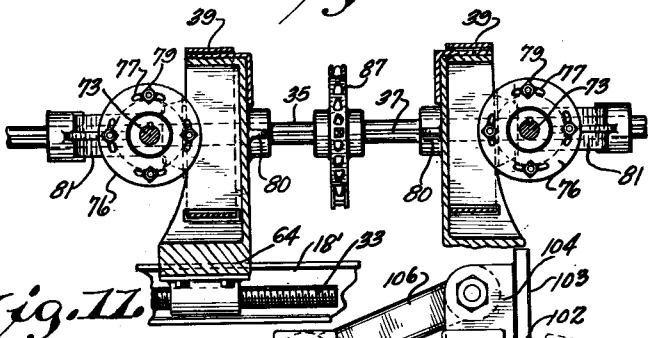


Fig. 11.

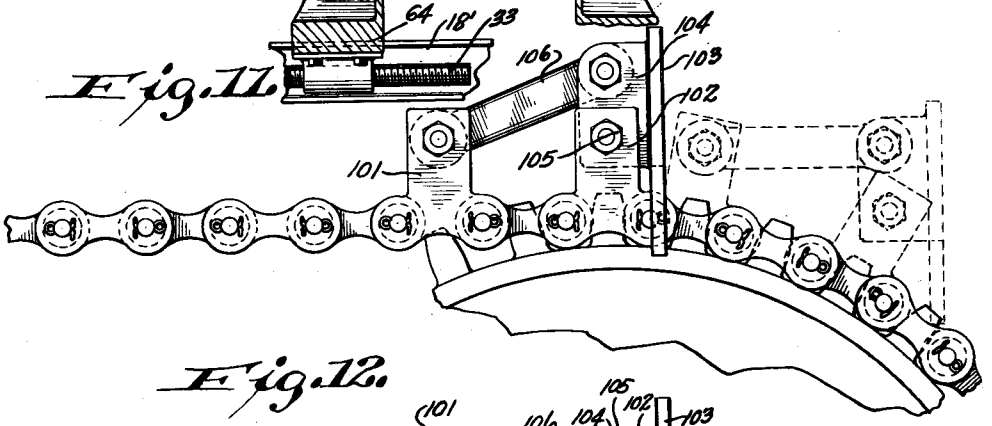
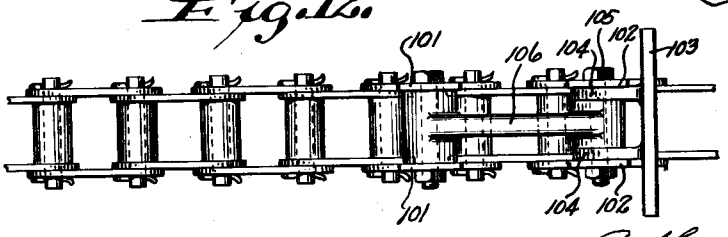


Fig. 12.



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Patented Apr. 17, 1934 1,955,398

UNITED STATES PATENT OFFICE

1,955,398

FOLDING MACHINE

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Application November 4, 1929, Serial No. 404,656

4 Claims. (Cl. 93—49)

This invention relates to improvements in folding machines, and, more particularly, to machines for the folding of blanks in the manufacture of paper boxes.

It is one of the objects of this invention to provide an improved folding machine in which sheets of material, which have been previously scored upon desired lines, are conveyed along the folding machine and are engaged by folding members which operate upon the edges thereof to fold the latter over upon the lines of scoring, there being interrelated driving mechanism for the conveying means and the folding members, so that the latter will be operated at proper time intervals to engage successive sheets which are being conveyed.

A further object of this invention is to provide an improved folding machine having folding means which is laterally adjustable to engage sheets of various widths and sheets in which the folds are at varying distances from one another.

A further object of this invention is to provide a machine of the class described in which the sheets are received between two conveying members, one of said conveying members being yieldingly mounted.

A further object of this invention is to provide a folding machine having means at one end to which the end of a feed conveyer may be detachably connected.

A further object of this invention is to provide a folding machine in which a novel form of sheet conveying lug is used in connection with the conveying chain.

A further object of this invention is to provide a folding machine which is efficient in operation and well adapted for the purpose described.

With the above and other objects in view, the invention consists of the improved folding machine, and all its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating one complete embodiment of the preferred form of the invention, in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is a plan view of the folding machine showing a portion of a feed conveyer in connection therewith;

Fig. 2 is a side elevation thereof;

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 1;

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

Fig. 5 is an enlarged sectional view taken on line 5—5 of Fig. 1;

Fig. 6 is an enlarged sectional view taken on line 6—6 of Fig. 1;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6;

Fig. 8 is an enlarged detail view showing the yielding adjustment for the upper conveyer portion, part being broken away and part being shown in section;

Fig. 9 is an enlarged longitudinal sectional view taken through the lower portion of Fig. 8, parts being broken away and parts being shown in section;

Fig. 10 is a sectional view taken on line 10—10 of Fig. 9, parts being broken away;

Fig. 11 is an enlarged side view of a portion of the conveyer chain showing one sheet conveying lug passing over one of the sprocket wheels, parts being broken away;

Fig. 12 is a plan view of the chain and lug shown in Fig. 11;

Fig. 13 is a view taken on line 13—13 of Fig. 3 to show the mounting of one of the upper pulleys; and

Fig. 14 is a detail plan view showing the mounting for one of the lower pulleys.

Referring to the drawings, the frame comprises front legs 15 and rear legs 16 connected by side members 17. Pairs of channel members 18 and 18', positioned back to back and spaced apart to form guides, extend between the legs 15. Similar channel guides 19 extend between intermediate portions of the side members 17, and other channels 20 connect the rear legs. A tubular reinforcing member 21 also extends transversely between the legs 15.

A feed conveyer 22 (only a portion of which is shown) is provided at its inner end with bearing extensions 23 through which a shaft 24 is journaled. The said shaft carries rigidly mounted sprocket wheels 25 thereon. The ends of the shaft are journaled in bearings 26 of the leg members 15, the upper portions of said bearings having one end hinged as at 27 (see Fig. 3) and having the other end adapted to removably fit over a bolt 28. By this construction the conveyer 22 may be readily attached to, or detached from, the folding machine (see dotted position).

The bearing members 23 of the conveyer are provided with slotted extensions 29, within which adjustable bearings 30 are carried. A lower shaft 31 is journaled in said bearings, and said shaft carries loosely mounted sprocket wheels 31'. Conveyer chains 32, carrying pusher bars 32' are ar-

ranged to travel over the sprocket wheels 25 and 31' to convey sheets of material to the folding machine.

The frame of the folding device is provided at one end with transversely journaled screws 33 and 33', each having one half threaded in one direction and the other half threaded in the opposite direction, and each half being rotatable independently of the other. Shafts 34 and 35, having longitudinal grooves 36 and 37 are also journaled in said end of the frame. Pulleys 38, having keys which fit within the grooves 37 on the shaft 35 are slidably positioned on said shaft. The said pulleys are connected by endless belts 39 with pulleys 40 which are rotatably positioned within bearing members 41 (see Figs. 6 and 7), the latter being movable by a screw 42 at the other end of the frame, as will be hereinafter more fully described, the said screw also having independent oppositely threaded portions. Pulleys 43 are slidably positioned on the upper shaft 34 and are connected by endless belts 44 with pulleys 45.

The pulleys 45 are rotatably mounted in the ends of upper laterally movable frame members 46. The said frame members are spaced apart, and each comprises an elongated angle member 47 having a portion 48, within which the pulley 45 is mounted, secured to one end, and having a block 49 provided with a forked extension 50 secured to its other end (see Fig. 3). The ends of the forked extension embrace one of the pulleys 43 and are formed with openings 51 therein through which the shaft 34 extends, the said forked extension being slidable on said shaft to move the pulley therealong (see Fig. 13). The block 49 is provided with a slot 52 extending downwardly from its upper edge, and within said slot a depending portion 53 of a block 54 is loosely positioned so that the block 49 and frame member 47 may move vertically with respect thereto (see Fig. 4). The said portion 53 extends rearwardly for a distance and has secured thereto a hinge member 55, which is connected by a suitable pintle with a hinge member 55' positioned on the frame member 47. The block 54 has a rectangular opening 56 extending horizontally therethrough, through which one of the belts 44 extends. The upper portion of said block is slidably positioned between the channel members 18 and has a threaded bore through which one section of the screw 33 extends.

The shaft 34 on which the upper pulleys 43 are mounted has its ends journaled in bearing blocks 57 (see Figs. 3 and 8). The said bearing blocks are slidably mounted in slots 58 in the leg portions 15. Rods 59 have their lower end threaded in the blocks 57 and their upper ends extending loosely through bores in cap members 60. Nuts 61 are threaded on the upper ends of said rods, and by turning said nuts, the downward movement of the bearing blocks may be limited as desired. Coil springs 62 surround the rods between the blocks and the caps and permit yielding upward movement of the bearing blocks and the shaft 34 which is journaled therein. When said upward movement occurs, the slots 52 in the blocks 49, heretofore described, and the hinge connections 54 and 55 permit upward movement of the frame portions 47.

The device is also provided with a pair of spaced apart lower laterally movable frame members. Said lower frame members each comprise an elongated angle bar 63 having one end in connection with a slidable member 64 (see Fig. 3), and having its other end in connection by means of rigid straps 65 with a slidable member 66 (see Fig. 6). The slidable member 66 is positioned between the channels 20 and has a threaded bore through which one section of the screw 42 extends. The slidable member 64 is positioned between the channels 18' at the other end of the frame, and has a threaded bore through which one section of the screw 33' extends.

Brackets 67 extending from each of the angle bars 63 have a shaft 68 journaled therein, said shaft having rigidly mounted folding arms 69 extending outwardly therefrom (see Fig. 5). The shaft 68 is also provided with a rigidly mounted gear 70 which engages a rack member 71. The rack member has its lower end pivotally connected to a U-shaped member 72, the latter being connected to the angle bar 63 and the shaft 68, and having its lower portion slidable between the channels 19 (see Fig. 3). A shaft 73 has one end journaled in the U-member 72 and provided with a rigidly mounted disk 74. The said disk has a small block 75 pivoted to an eccentric portion thereof, and said block is slidable in a slot of the rack member 71.

The shaft 73 is formed in two sections as shown in Figs. 3, 9 and 10, and the meeting ends of the two sections are provided with rigidly mounted connecting disks 76. One of said disks is formed with elongated openings 77, and the other is provided with threaded perforations 78 for receiving the inner ends of bolts 79. By loosening the bolts, one of the shaft sections may be turned slightly with respect to the other for adjustment purposes.

The upper portion of the slidable member 64 has arms 80 and 81 extending from each side thereof (see Fig. 14). The said arms embrace one of the pulleys 38 and are provided at their outer ends with bores through which the shaft 35 extends. A bevel gear 82, which is keyed to the shaft 35 meshes with a similar bevel gear 83 which is rigidly mounted on the outer end of the shaft 73.

Each of the bearing members 41 is slidably mounted in the upper portion of one of the members 66 (see Figs. 6 and 7) and is provided with a threaded bore within which an adjustment bolt 84 is threaded. The outer end of the adjustment bolt extends through a bore in an extension 85 of the member 66. Nuts 86 are threaded on the bolt, and by turning of the latter the bearing 41 may be moved slightly with respect to the member 66 to adjust the tension of the belt 39.

Rigidly mounted on the shaft 35 is a sprocket wheel 87 which is connected by an endless chain 88 with a sprocket wheel 89 rigidly mounted on a short shaft 90 at the other end of the frame. The latter shaft is journaled in a projecting bearing member 91. Another sprocket wheel 92 rigidly mounted on the shaft 90 is connected by an endless chain 93 with a sprocket wheel 94 carried by the drive shaft of an electric motor 95. The shaft 35 is provided near one end with a rigidly mounted gear which engages an upper gear 96 on the shaft 34 to drive the latter. The shaft 35 is also provided with another gear 97 which meshes with an idler gear 98. The latter in turn engages a gear 99 rigidly mounted on the shaft 24 of the feed conveyer to drive the latter.

The conveyer chain 88 is provided at intervals with a novel form of sheet conveying lug 100 (see Figs. 11 and 12). At the point of attach-

ment of said lugs the links of the chain are formed with upwardly projecting portions 101 and 102.

A pusher plate 103 having rearwardly extending perforated lugs 104 is pivotally connected to the projecting portion 102 of the chain by a bolt 105. A link 106 has one end pivotally connected between the lugs 104 of the pusher plate, and has its other end pivotally connected between the chain projections 101. By this construction. the pusher plate is maintained in a substantially vertical position even when traveling over the upper portion of a sprocket wheel as shown by the dotted lines in Fig. 11. The ordinary type of lug would assume an angular position and would cause the sheet of material to be torn by the lug due to its increased velocity with respect to the speed of the material being conveyed. On each side of the frame the screw 33 is provided with a hand wheel 107 for moving the folding frames toward and away from the center of the device according to the width of the sheet which is to be folded. Sprocket wheels 108, 109, and 110 are rigidly mounted on the screws 33, 33' and 42 respectively, and said sprockets are connected by an endless chain 111. A chain tightener 112 engages the upper portion of the chain 111. By turning one of the hand wheels, the screw sections on one side of the device are rotated to cause the folding frame on said side to move laterally on the guideways 18, 18', 19, and 20. At the same time, the pulleys 38, 43, and 40, which are mounted to permit sliding movement, are moved laterally. By rotating the hand wheel on the other side of the frame, the folding frame on said side may be moved in a similar manner. The construction of the screws in two sections permits this independent adjustment of each side, this feature being advantageous because of the fact that it permits moving one folding frame a greater distance than the other when folds of unequal distance from the center of a sheet are to be made.

Guide rods 113 each have one end secured to one of the movable frames 63 and have the other end secured to one of the slidable members 66. The said rods hold the edges of the sheets of material in folded position while the sheets are being discharged from the folding device.

In operating the device, it is first adjusted to the requirements of the sheet to be folded in the above-mentioned manner. The motor 95 is then set in operation, and through the driving mechanism motion is imparted to the feed conveyer chains 32 and to the chain 88 and belts 39 and 44 of the folding device. The sheets, which have been previously scored along desired lines, are conveyed to the machine by the pusher bar 32' and then pass between the belts 39 and 44. If the sheet is of unusual thickness, the upper belt carrying members are permitted to give upwardly by reason of the yielding mounting for the shaft 34. and by reason of the hinge connections 55 and 55'. As the sheets are being conveyed the shafts 73 are rotated through the bevel gears 82 and 83. This causes oscillation of the racks 71, and through the gears 70, back and forth movement of the folding arms 69. Inasmuch as the driving means for the endless chain 88, belts 39 and 44, and the folding arms, is interrelated, the latter are caused to be moved in timed relationship with the conveying means, so that the edges of the sheets are engaged and folded over at the proper time during the travel of said sheets. With the sheets thus folded on the lines of scoring, the folded over edges are held in folded position beneath the rods 113 as the sheets are conveyed to the end of the frame. The material is then ready to be fed to a stitching device where the free ends are secured together.

Although only one form of the device has been shown and described, it is not desired to be limited to the exact showing, as the broad concept of the invention includes all changes and modifications as may come within the scope of the claims.

What I claim is:

1. In a folding machine, a rotatably mounted shaft, a gear rigidly mounted on said shaft, a folding arm rigidly connected to the shaft, a pivotally mounted rack member engageable with said gear, and means for causing oscillatory movement of said rack to operate the folding member.

2. In a folding machine, a rotatably mounted shaft, a gear rigidly mounted on said shaft, a folding arm rigidly connected to the shaft, a pivotally mounted rack member engageable with said gear and having a slot therein, a second rotatable shaft, eccentrically mounted means in connection with said shaft and engageable with the slot of the rack member to oscillate the latter, and means for driving said second mentioned shaft.

3. In a folding machine, a rotatably mounted shaft, a gear rigidly mounted on said shaft, a folding arm rigidly connected to the shaft, a pivotally mounted rack member engageable with said gear and having a slot therein, a second rotatable shaft, eccentrically mounted means in connection with said shaft and engageable with the slot of the rack member to oscillate the latter, conveying means for moving sheet material adjacent the folding arm, a driving shaft for said conveying means and a bevel gear connection between said second rotatable shaft and said conveying means driving shaft.

4. In a folding machine, a rotatably mounted shaft, a gear rigidly mounted on said shaft, a folding arm rigidly connected to the shaft, a pivotally mounted rack member engageable with said gear and having a slot therein, a second rotatable shaft, eccentrically mounted means in connection with said shaft and engageable with the slot of the rack member to oscillate the latter, a bevel gear rigidly mounted on said second rotatable shaft, conveying means for moving sheet material adjacent the folding arm, a driving shaft for said conveying means having a splined driving connection therewith, and a bevel gear splined to said conveying means driving shaft and engageable with the bevel gear mounted on the second mentioned rotatable shaft for transmitting motion to the latter while permitting lateral adjustment thereof.

ARTHUR W. WERNER.