Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 1

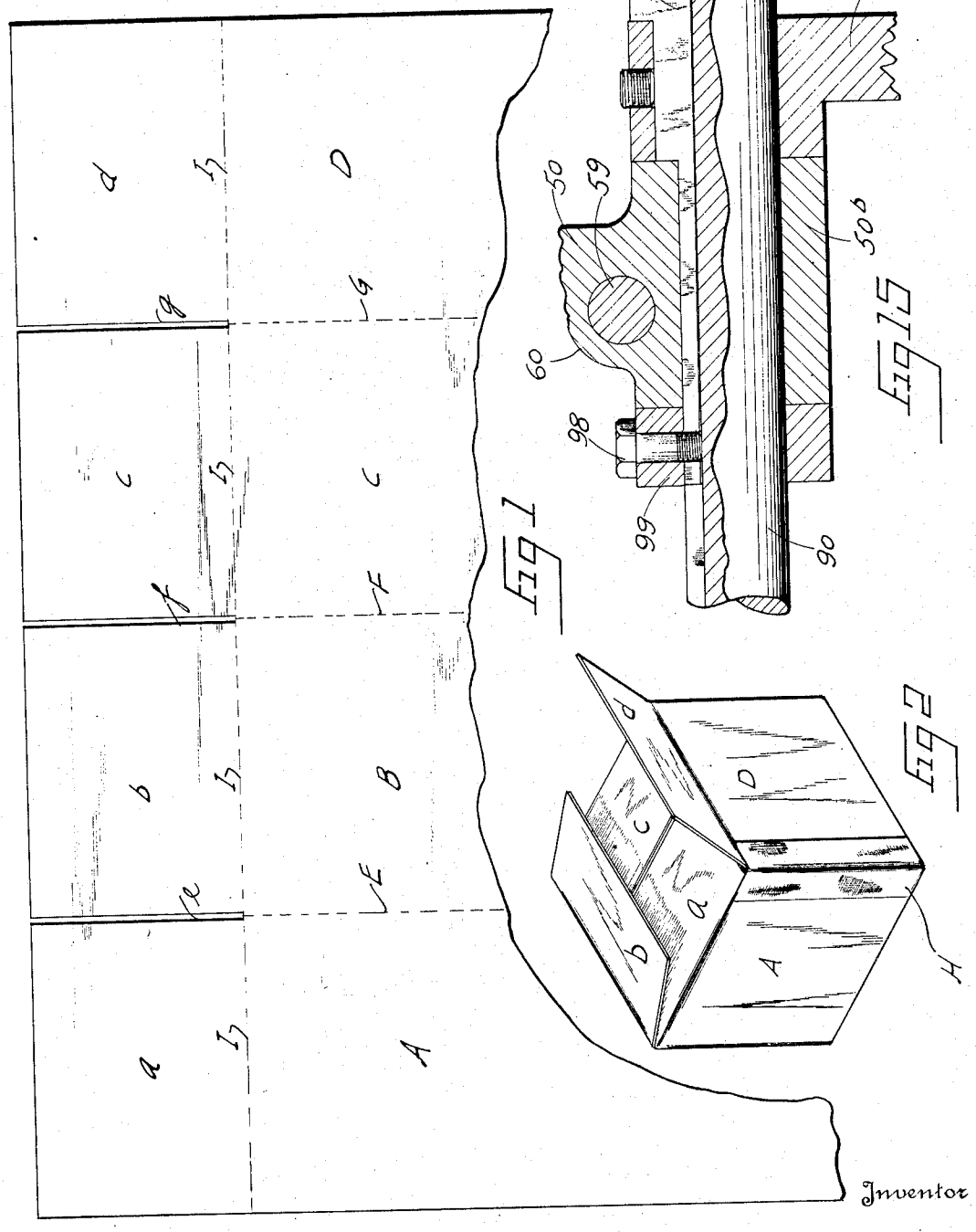


Fig 1

Fig 1.5

Fig 2

Inventor

HARRY L. WOOD.

By Richey & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 2

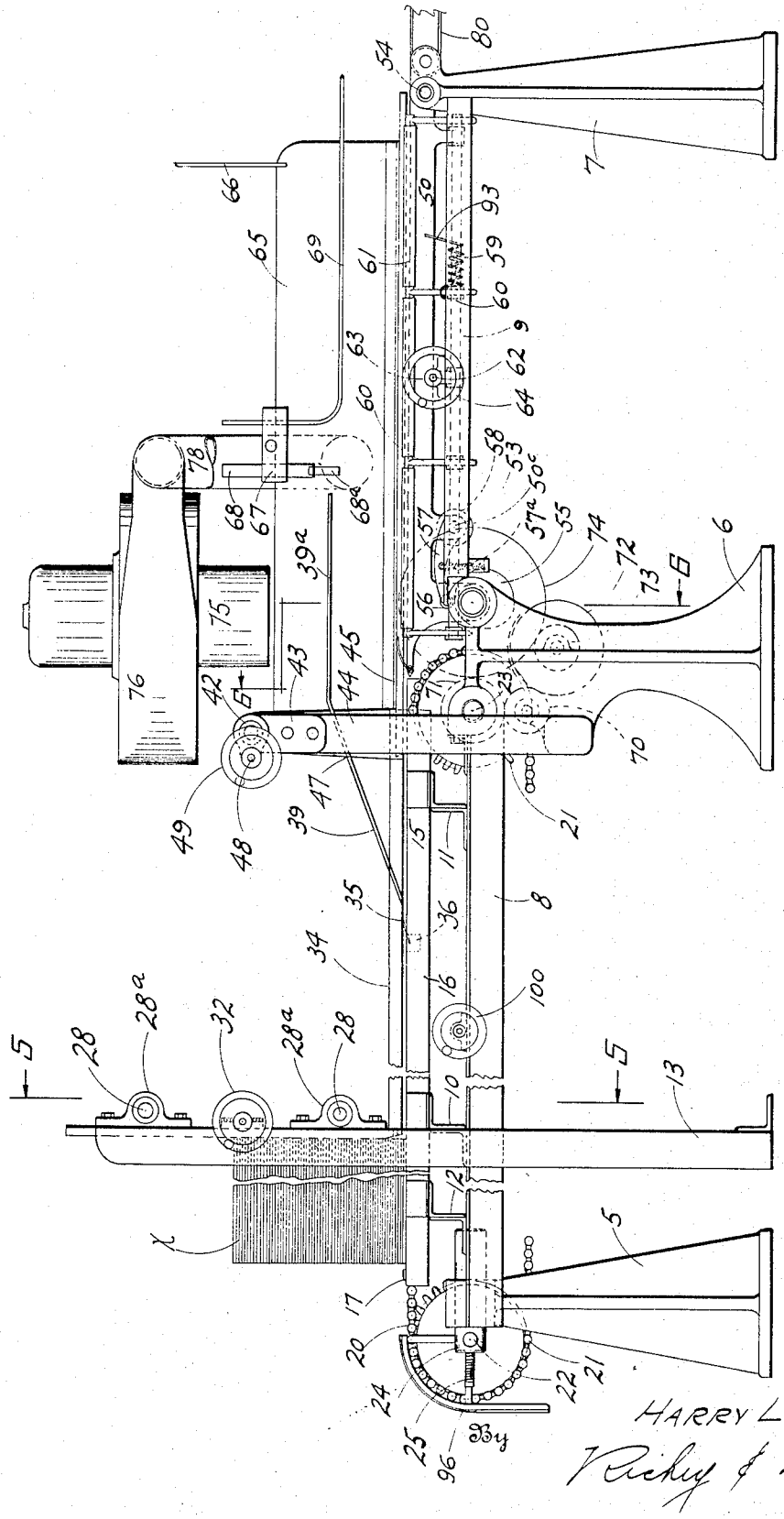


Fig 3

Inventor

HARRY L. WOOD

By Ricky & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 3

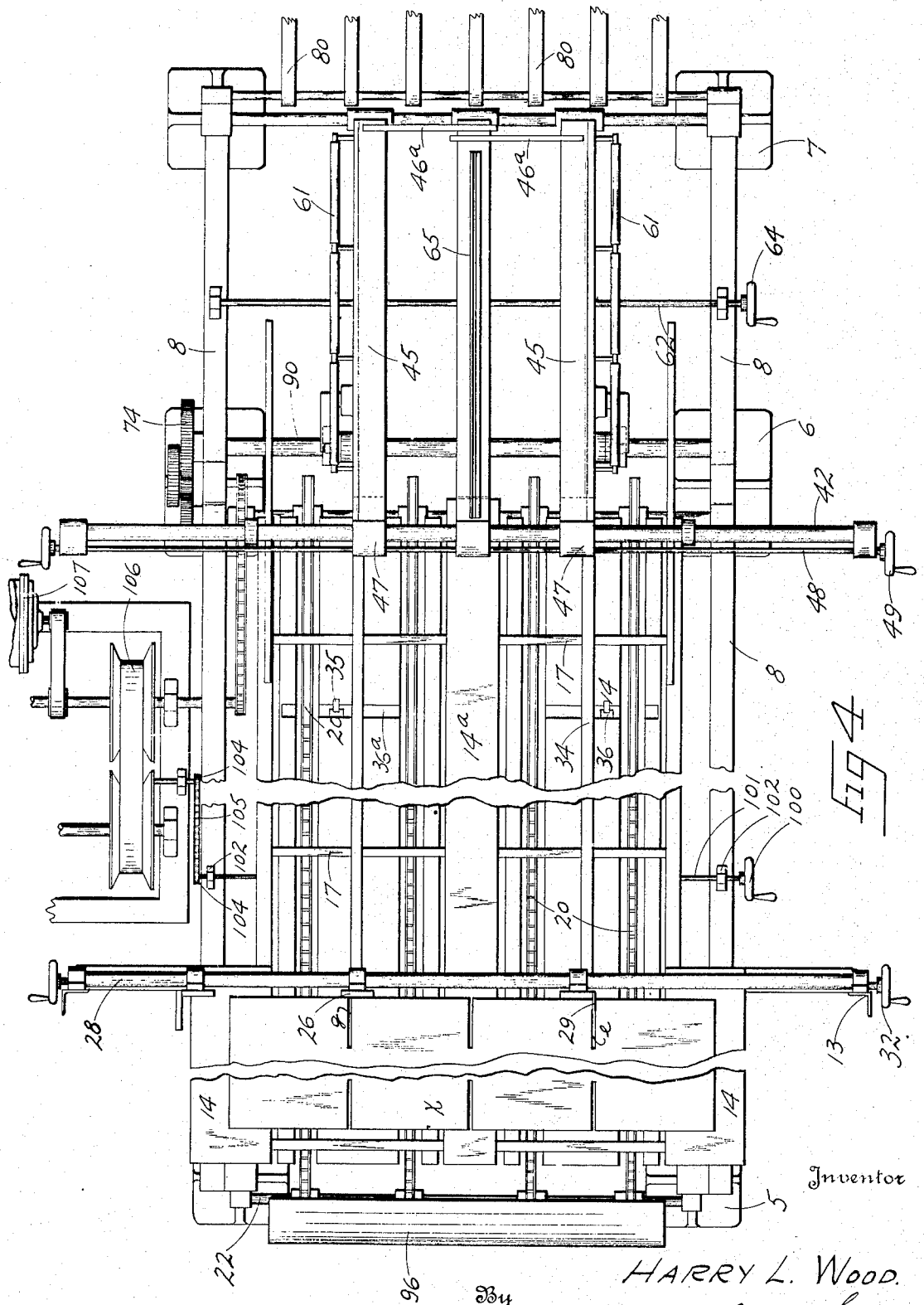


FIG 4

Inventor

HARRY L. WOOD.

By Ricby & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 4

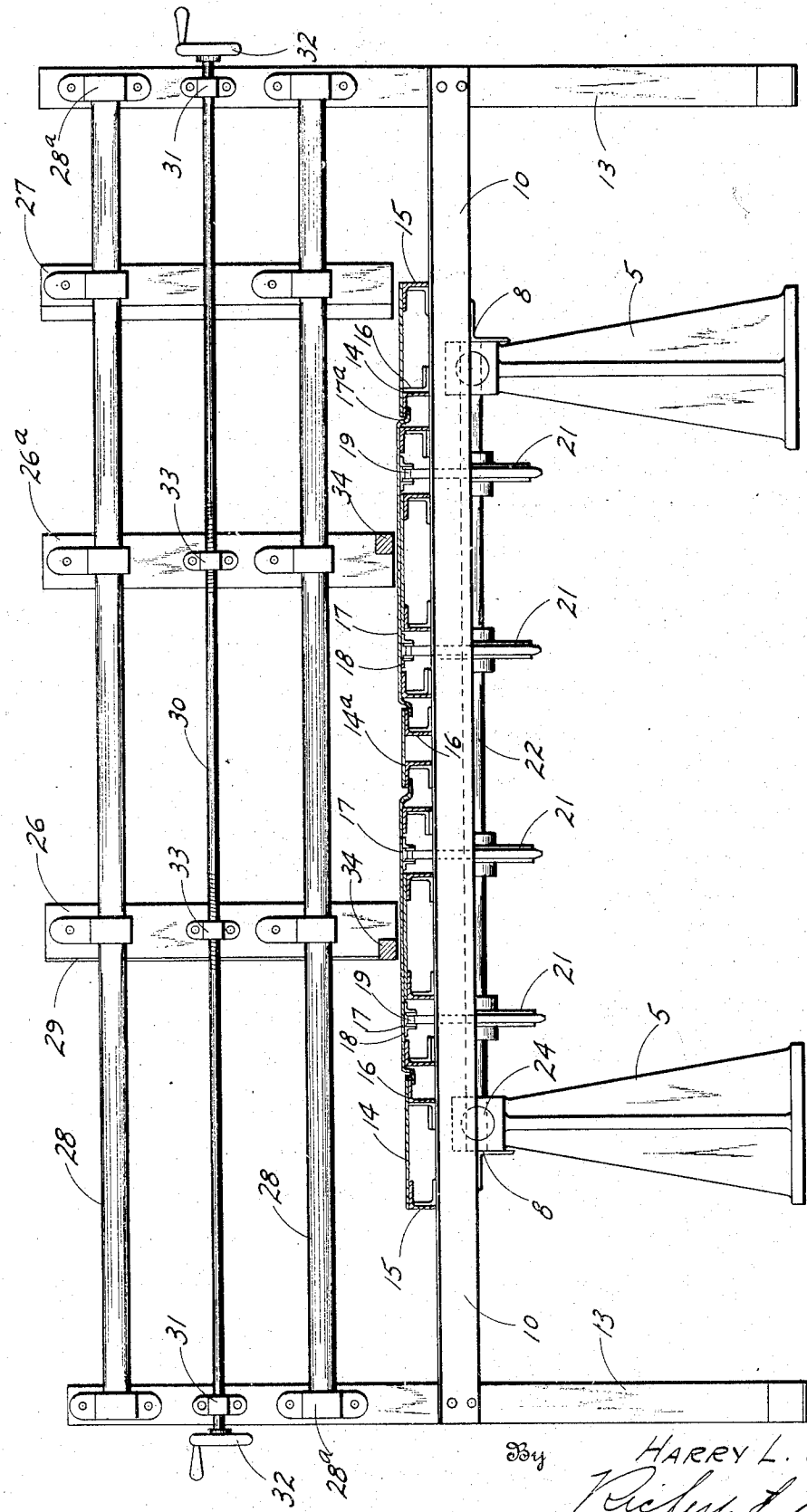


Fig 5

Inventor

By HARRY L. WOOD

Ricley & Watts Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 5

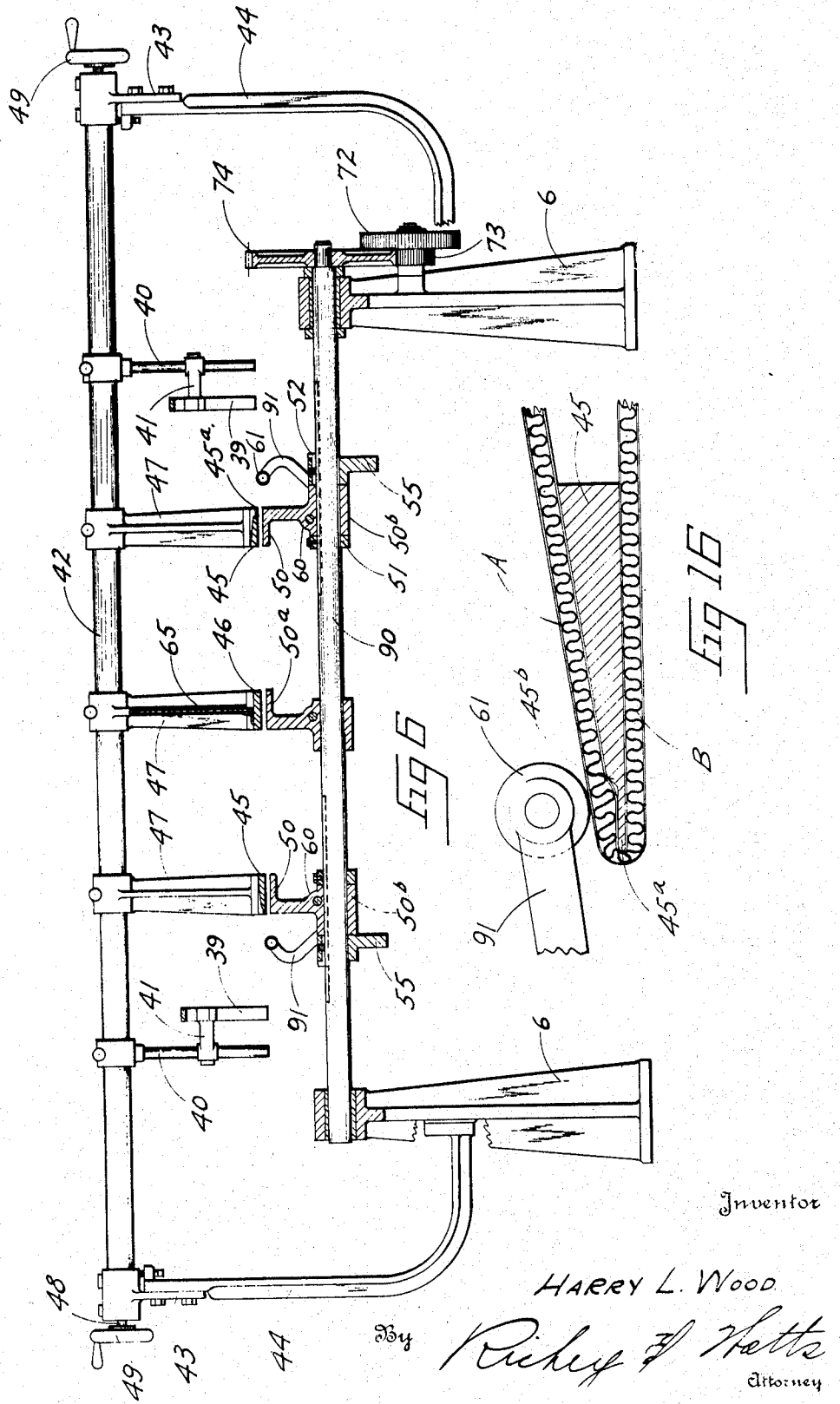


Fig 6

Fig 16

Inventor

HARRY L. WOOD

By Richey & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 6

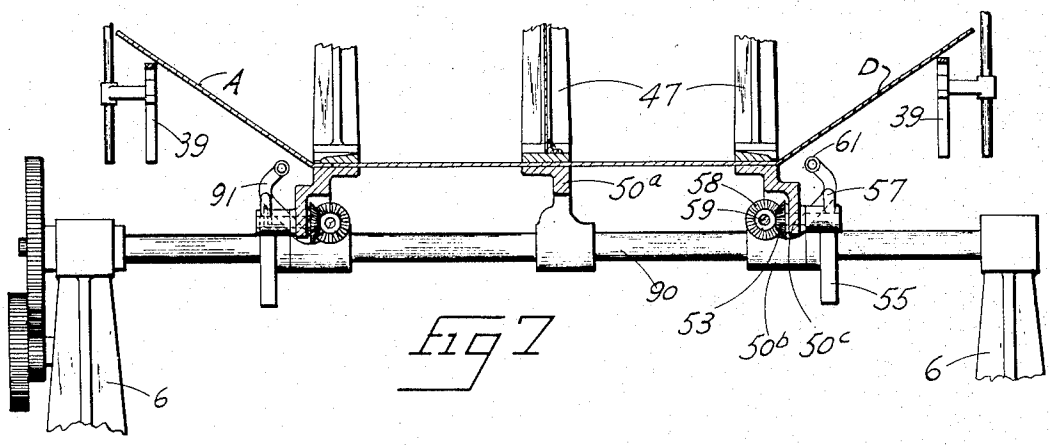


Fig 7

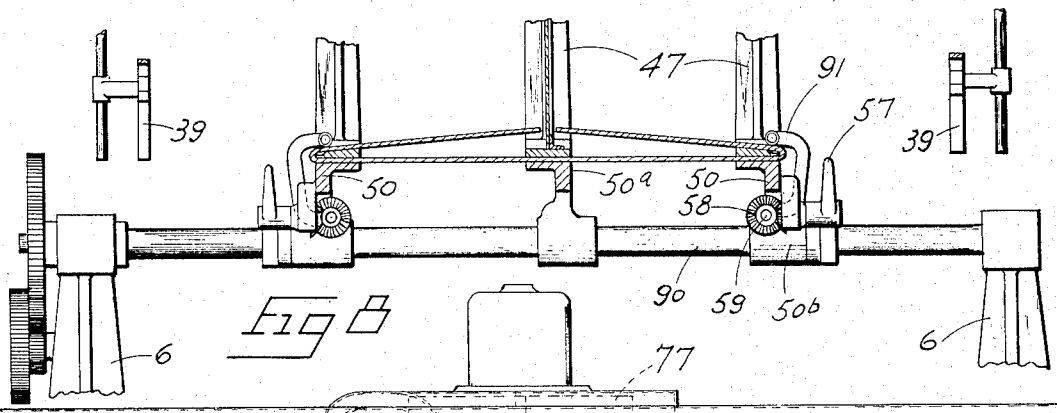


Fig 8

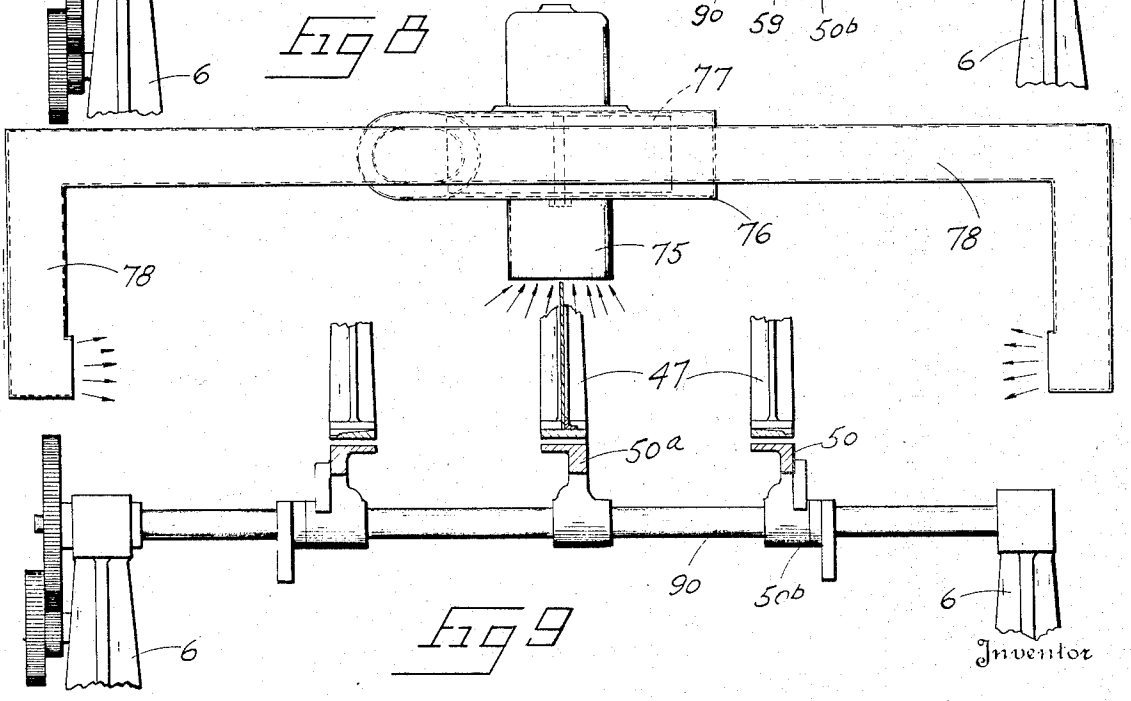


Fig 9

Inventor

HARRY L. WOOD.

By Ricley & Watts

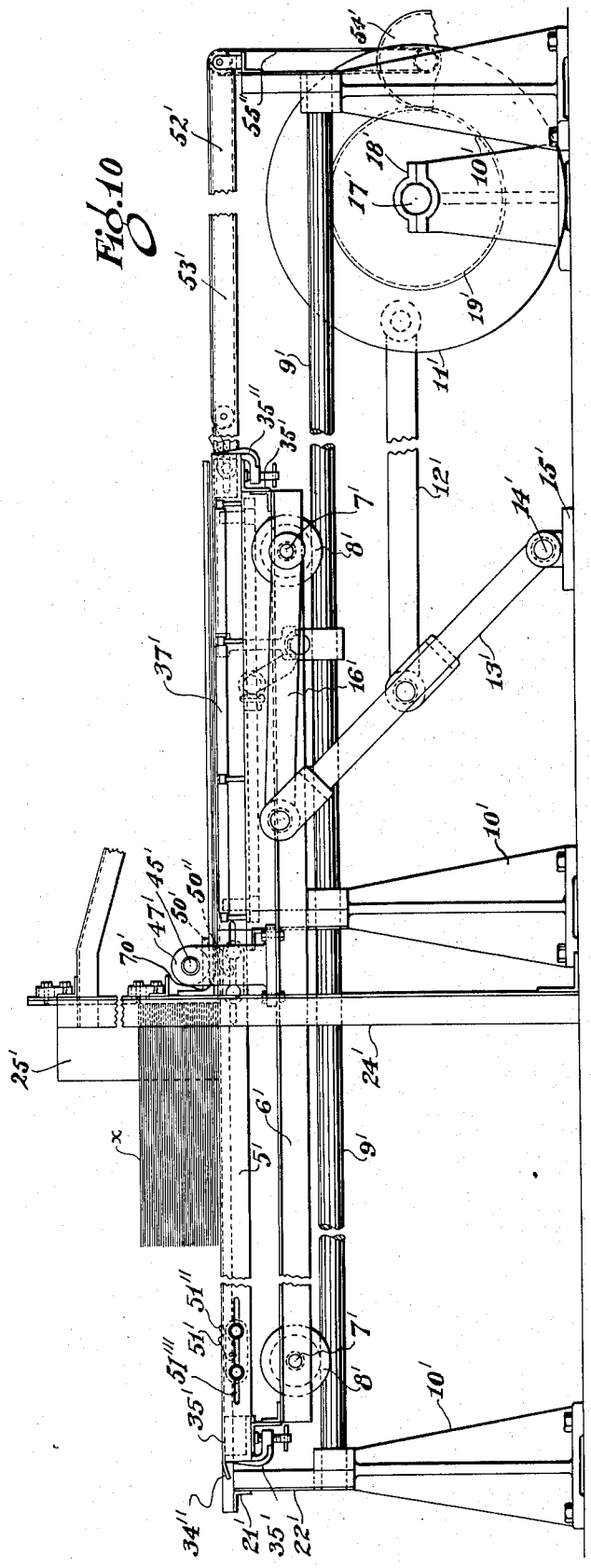
Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 7

Fig. 10



Inventor

HARRY L. WOOD.

By Ricley & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 8

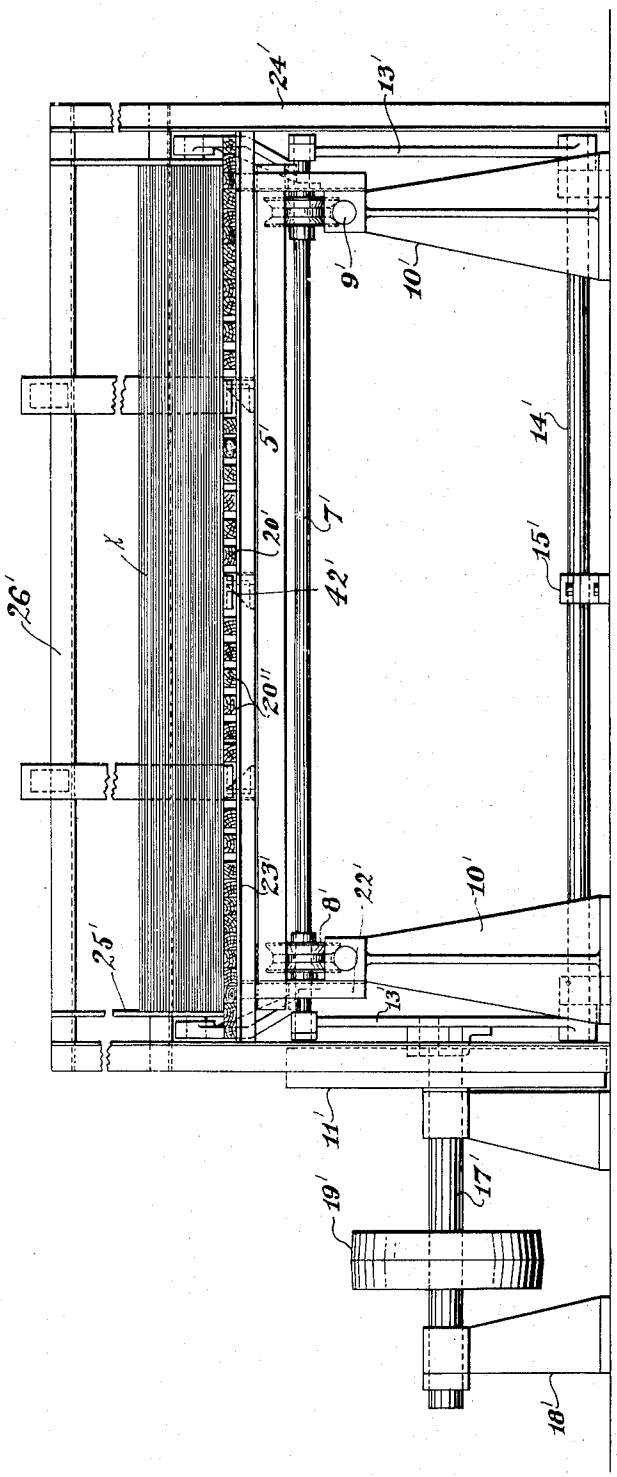


Fig. 11

Inventor

HARRY L. WOOD

By Richey & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 9

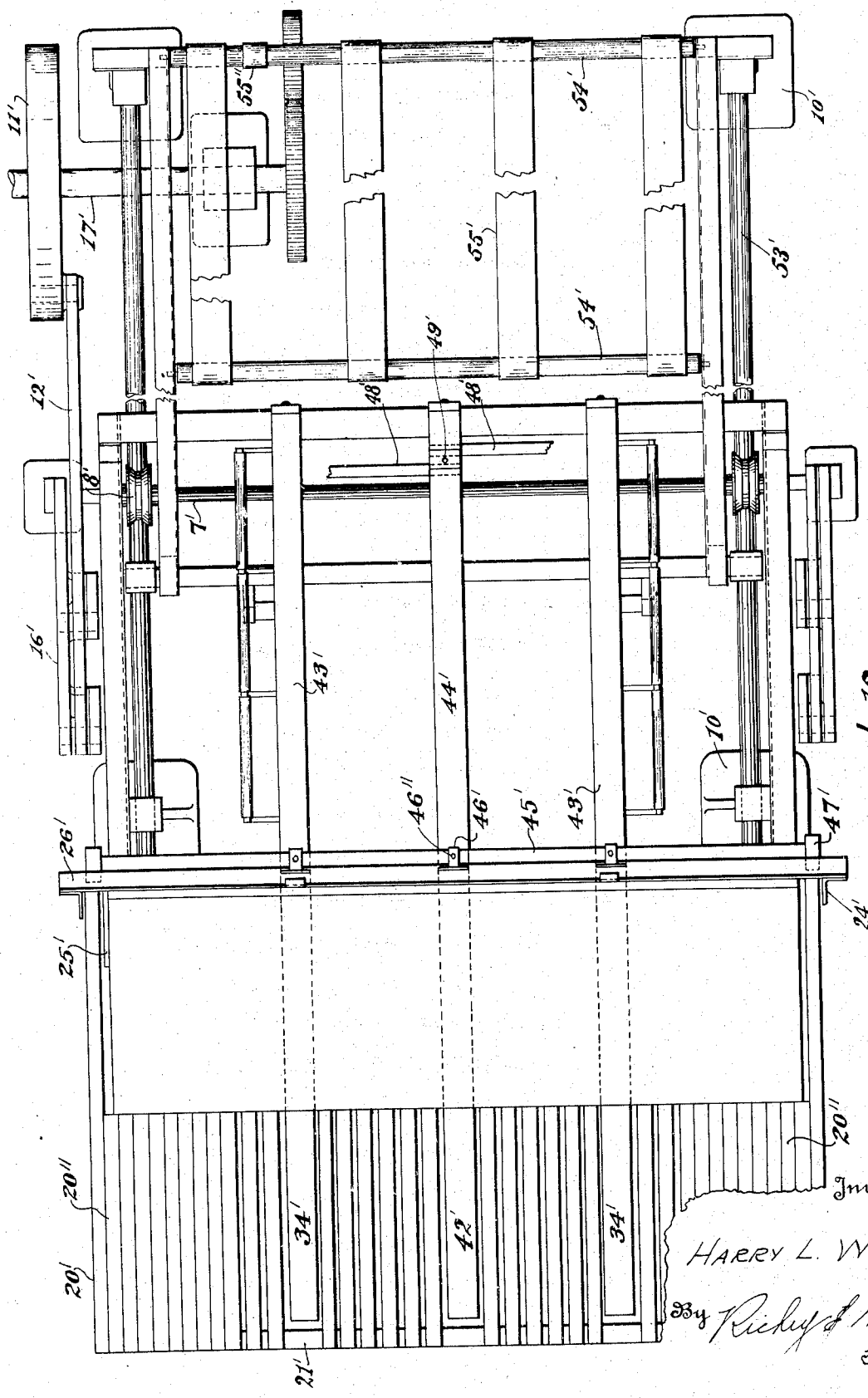


Fig. 12

Inventor

HARRY L. WOOD

By Richey & Watts

Attorney

Dec. 4, 1934. H. L. WOOD 1,982,848

FOLDING MACHINE

Filed Dec. 29, 1931 10 Sheets-Sheet 10

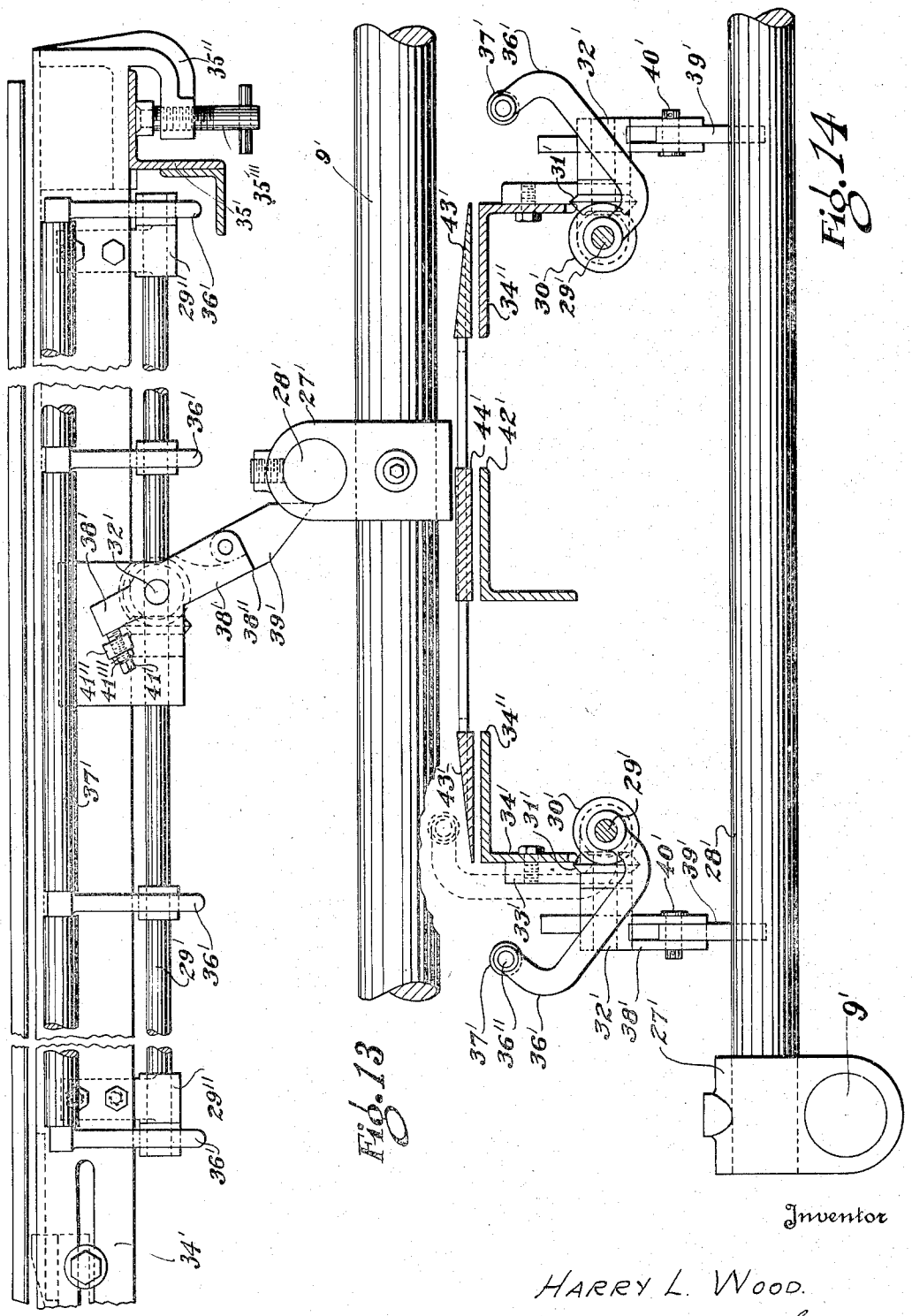


Fig. 13

Fig. 14

Inventor

HARRY L. WOOD.

By Ricky & Watts

Attorney

Patented Dec. 4, 1934 1,982,848

UNITED STATES PATENT OFFICE

1,982,848

FOLDING MACHINE

Harry L. Wood, Lakewood, Ohio, assignor to Charles D. Wood & Sons, Inc., Cleveland, Ohio, a corporation of Ohio

Application December 29, 1931, Serial No. 583,633

11 Claims. (Cl. 93—49)

This invention relates to folding machines broadly and more particularly to a machine for automatically folding blanks for corrugated boxes.

It is customary in making boxes of this type to first cut a blank of the required dimensions from stock material, then print the blank, if desired, and score or crease the blanks along the folding line, after which the blank is folded and a strip of adhesive applied to the joining edges. The box in flat form is then ready for shipment to the consignee of empty boxes.

A blank, ready for folding, is shown in Fig. 1. The side walls of the box are designated A, B, C and D and the top or bottom flaps *a*, *b*, *c*, and *d*. The blank as shown has been scored or creased between the proposed side walls at E, F, and G and slotted at *e*, *f*, and *g*. The score marks or creases E and G are the lines of fold and at which point the sides or side flaps A and D will be folded over and laid flat on the sides B and C and a strip of adhesive H, (note the completed box in Fig. 2), applied to the meeting edges. The top and bottom flaps are folded on the lines I when the box is set up for use. The score lines E and G are generally made when the blank is printed and are almost invariably accurate, so that if the sides are accurately folded along these lines, the meeting edges of the sides A and D will be in alignment and the box will assemble without distortion. These score marks, however, obviously do not always follow a groove in the corrugated filler of the blank and thus a very difficult problem of folding is presented because the very nature of the corrugations tends to distort and misalign the fold.

The present invention is primarily concerned with the folding of the box blank along the score lines E and G. This operation has most generally been performed manually, as machines heretofore proposed for this work have proved unsatisfactory, so far as known, due to their inaccuracy in folding along the score line which results in distortion of the box. Manual folding is also objectionable, not only from the standpoint of greatly increased expense of production, but also in view of the tendency of the worker to fold the box along the lines of least resistance regardless of the score line.

The present machine has a capacity greatly exceeding that afforded by manual labor and folds the blanks automatically and accurately along the line of fold without distortion regardless of the grooves in the corrugations of the blank, and furthermore, it is not necessary to score or mark, although this may be done if desired.

The various features of novelty and advantage resident in the improved machine will become apparent in view of the following description taken in conjunction with the drawings wherein:

Figure 1 is a plan view of a corrugated box blank;

Figure 2 is a perspective view of a box folded from the blank of Fig. 1;

Figure 3 is a view in side elevation of a machine constructed in accordance with the teaching of my invention;

Figure 4 is a plan view thereof;

Figures 5 and 6 are sectional views taken, respectively, on the lines 5—5 and 6—6 of Fig. 3;

Figures 7 and 8 are sectional elevational views of the folding mechanism of Fig. 3;

Figure 9 is a similar view showing an air circulating system at the same place intended to give pneumatic aid in the folding process;

Figure 10 is a view in side elevation of a modified form of machine embodying features of my invention;

Figure 11 is a view in end elevation of the machine in Fig. 10.

Figure 12 is a partial plan view thereof;

Figures 13 and 14 are detail views in front and side elevation of folding mechanism; and

Figure 15 is an enlarged section showing the key and collar mounting on the shaft 90 of Fig. 6.

Figure 16 is an enlarged sectional view of the folding shoe, showing the position of the blank and folding mechanism at the termination of the folding operation.

Referring to Figs. 3 to 9, inclusive, of the drawings, the main frame of the machine comprises supporting pedestals 5, 6, and 7, side rails or angle beams 8, connector rails 9, cross rails or supports 10, 11 and 12 and upright supports 13.

The blanks X are stacked at one end of the machine (the left end as viewed in Fig. 3) on a platform or table comprising side portions 14 and a central portion 14*a*, said portions being spaced laterally of the machine and resting on supports 15 and combined supports and guide members 16, (Fig. 5). Between these table portions 14, 14*a* move feed bars 17 which are secured, as by welding or otherwise, to clips 18 mounted on links 19 forming part of a flexible conveyor or chain 20. The feeder bars 17 are spaced from each other and move horizontally along the table 14, 14*a*, and are laterally adjustable of a conveyor 20 to accommodate various size blanks. At their ends the bars 17 are offset to provide

guide flanges 17*a* which engage under and are guided by the members 16.

The conveyor 20 as shown is in the form of a sprocket chain which is trained over sprockets 21 secured on shafts 22 and 23. The shaft 22 is mounted in bearings in adjustable supporting members 24 movably mounted in the pedestals 5 and adjustable by screws 25, whereby the conveyor chain may be tightened or loosened as desired. The member 24 also has affixed thereto and supports the conveyor guard member 96.

The stack of blanks resting on the table 14, 14*a* are normally urged by the action of the feeder bars 17 against retainer members 26 and 26*a* and a guide member 27 all of which are supported by cross shafts 28, the members 26, 26*a* being mounted for lateral shifting movement with respect to the machine on upright supports 13 while the member 27 may be adjustably secured thereto. The ends of the cross shafts are also fixed in brackets 28*a* on the upright supports 13.

In order to accurately align the blanks for movement through the machine to the folding mechanism (to be described), an aligning device or slot guide 29, said device being preferably formed with a tapered edge which registers in the slots *e* or *g* of the blanks. To further ensure accurate alignment and hold the stack of blanks against displacement, the guide member 27 is of angle shape, the corners of the blanks being capable of fitting in the angle formed thereby. It will thus be seen that the blanks are aligned at the point where the slots are formed and it is on this line that the blanks are folded. This is of advantage in that regardless of whether or not the blanks are cut uniformly to specified rectangular dimensions, they will always register with the folding mechanism.

The guide and retainer members 26, 26*a* are adjustable with respect to one another, and the member 27, by means of an adjusting rod or shaft 30 which is rotatably mounted in bearing brackets 31 fixed to the upright supports which is provided with a hand wheel 32. The members 26 and 26*a* have secured thereto interiorly threaded adjusting brackets 33 which are threaded on right and left hand threaded portions of the rod 30. Thus by turning the hand wheel 32, the above noted adjusting action may be readily accomplished. An important advantage of this adjustment feature is that the parts may be adjusted while the machine is in operation as well as while at rest from a point easily accessible exterior of the machine.

As the feeder bars 17 advance in their cycle under the stack of blanks, each bar engages the lowermost blank and urges it forward between the table 14, 14*a* and hold-down bars 34 secured at one end to the members 26, 26*a* and extending longitudinally of the machine with their outer edges on the line of fold, the opposite ends of said bars resting on folding shoes to be described. These bars 34 are preferably doweled at their ends and inserted in holes formed in the members 26, 26*a* so that in case the blanks should, for any reason, jam at this point, the bars 34 may be readily removed and the blanks freed without damage thereto. As the blanks advance, the side panels A, D, Fig. 1, are engaged by panel lifters 35, which are in the form of flexible clips fixed in a holder 36, these holders are adjustable transversely of the machine in opening 36*a* provided in the table, said clips being normally in lifting position, and are pressed down by the passing feeder bars 17 and immediately resume their normal position after the bars clear and lift the next successive panels A, D into engagement with fold starter shoes 39, note Figs. 3 and 6, which, as here shown, are in the form of bars which are suitably inclined at an angle for a portion of their length and are adjustably supported, both as to their angular, lateral and vertical positions, by means of laterally adjustable hanger brackets 40 which in turn have secured thereto vertically adjustable starter-holding brackets 41, the entire assembly being secured to a transverse shaft 42 which is supported at opposite extremities by means of brackets 43 in turn secured to main supporting brackets 44 which are attached to the pedestals 6.

When the blanks reach a point some distance in advance of where the side panels A, D begin to ride on the horizontal portions 39*a* of the starter shoes 39, the intermediate panels B, C pass beneath folding shoes 45 and a center supporting piece or bar 46. The folding shoes 45 are preferably shaped in cross section as shown in Fig. 16, tapering generally to the folding edge 45*a* and being of substantial thickness remote from the folding edge for the sake of rigidity and strength.

Adjacent the folding edge of the shoes and preferably in the proportion shown in Fig. 16, there is formed a longitudinally extending recess or depression extending the full length of the shoe and terminating laterally in the shoulder 45*b*. Without this groove, I have found that the inner sheet of the corrugated blank tends to wrinkle on the top side of the shoe adjacent the folding edge and by providing the recess as indicated, space is provided for the excess material on the inside of the turn or fold by virtue of which the inner and outer sheets of the blank are not torn from the inner corrugated material and the tendency of the blank to bind on the folding shoe is substantially eliminated. Furthermore, by eliminating the crowding of the excess material at this point I also eliminate the tendency of the folds to be other than perfectly straight whereby I insure the production of uniformly square cartons which are formed from blanks folded in my machine.

Figure 16 illustrates how with my folding shoe, recessed as described, acting in conjunction with the folding bar or roller which is shown to be substantially at its extreme folding position, I am able to fold the blank about a relatively sharp folding edge, compensate for the changed shape and position which must be taken by the inner and outer sheets of the blanks and provide for displacement or movement of inner material of the blank without disruption of that material or separation from the inner and outer sheets of the blank. It will be appreciated that the benefits illustrated in connection with corrugated paper board are also available for folding solid stock.

The shoes 45 and center bar 46, as here shown, are carried at one extremity by hanger brackets 47 supported from the shaft 42, the shoe brackets being preferably mounted to have a sliding fit on said shaft. To provide for ready lateral adjustment of the shoes 45, both while the machine is in operation and while at rest, their supporting brackets 47 are interiorly threaded and extend out and engage right and left hand screw threads formed on an adjusting rod 48, which passes through said brackets and is journalled at opposite ends in the brackets 43, said rod being provided with a hand wheel 49. The rear extremities of the shoes 45 are supported by the center sup-

porting bar 46, the latter being formed with lateral dove tail grooves which slidably receive dove tail bars 46a attached to the bars 45. The bar 46a is supported at its rear extremity in a manner to be described.

As the blanks advance farther, they ride on lower side supporting and folding bars 50 and a center supporting bar 50a, which supports the blanks when the final folding action takes place over the shoes 45. The folding bars 50 are formed with bracket extensions 50b at one extremity which are mounted on the cam shaft 90. These bars 50 are also formed with bracket extensions 50c in which pinion shafts 53 are mounted. At their rear ends, the bars 50 and 50a are slidably supported on a shaft or bar 54 carried by the pedestals 7.

The shaft 90 has slidably keyed thereto folding cams 55 carried by the extensions 50b by means of a step down key 52 passing therethrough and retained in position by a set screw 98 in the collar 99 on the opposite side of said extension 50b (Fig. 15). These cams are adapted to contact with rollers 56 mounted on cam levers 57 retracted by springs 57a, said levers being secured on the stub shafts 53, the latter having a geared connection by means of gears 58 with folding shafts 59. The shafts 59 are also mounted and have bearing in bracket extensions 60 formed integral with the bars 50.

Adjustably secured on the shafts 59 are folding arms 91 which have rotatably mounted thereon folding rolls 61, adapted to engage the side panels A and D and fold them over the shoes 45. A coil spring 93 is telescoped over the shaft 59 engaging the arm 91 which is adapted to return the folding mechanism to its original position.

It will be seen that the folding bars 50 carry the entire folding assembly comprising the cam levers 57, pinion shafts 53, gears 58, shafts 59, arms 91 and rolls 61, and that the cams 55 on the shaft 90 move with the said bars. This assembly is held in position and may be adjusted as a unit laterally of the machine, both while the machine is in operation and while at rest, by means of a rod or shaft 62 which is journalled at opposite ends in bearing brackets 63 fixed to the rails 9 and is provided with a hand wheel 64. This rod is provided with right and left hand threads and threaded through interiorly threaded holes in the shoes 50. By turning the hand wheel 64, the above noted adjustment may be effected from a convenient point exterior of the machine.

The numeral 65 designates a center guide member which is shown in the form of a strip or sheet but may be in any form found suitable, said member being attached at one end to the center hanger bracket 47. At its opposite extremity it is preferred to support the member 65 in such manner so that it, together with the folding shoes 45 and center bar 46, will have a floating action. In the instance shown, the center guide member 65 has attached thereto the center bar 46 which in turn supports the rear extremities of the shoes 45, and said member is supported by a rope or cable 66 which may be secured to any convenient support. At an intermediate point the guide member 65 has fixed thereto brackets 67 which in turn adjustably receive holding brackets 68, the latter carrying flap catchers 68a, which may be in the form of resilient rods bent at an angle or diverging outwardly from the member 65. These rods 68a catch the panels or flaps A, D as the latter pass from the fold starter shoes 39a. The brackets 67 also adjustably support fold setter rods 69, which set or retain the flaps in their folded position after they have been acted on by the rolls 61.

The drive on the conveyor 20 and cam shaft 90 may be applied through change speed gears 70, 71, 72, 73 and 74. The speed of the machine may be varied to suit the requirements dependent upon the size of the blanks to be folded, to this end a hand wheel 100 is affixed to the cross shaft 101 supported on the rails 8 in bearing blocks 102, sprockets 104 and chain 105 connects this shaft with a speed control unit 106 directly connected with the power source 107. Thus it will be seen that the speed of the machine may be adjusted while it operates or at rest, as desired.

As the folding operation takes place rapidly when the machine is operating at normal capacity, considerable air resistance is encountered by the side flaps A, D, as they advance through the machine and are acted on by the rolls 61. As the box blanks being folded are generally of relatively large size, this resistance may reach a point, (in stepping up the speed of the machine), where the flaps will bend or become distorted by the folding rolls 61. To insure against this contingency, I have provided a means for reducing the pressure in the path of the inturning flaps A, D, and increasing the pressure on the outer side of said path, such means as here shown (Fig. 9) consisting of a suction conduit 75, at the upper extremity of which is a housing 76 in which is mounted a suction and blow fan 77. Diverging from the housing and terminating on the outside of the path of the flaps are pressure conduits 78. It will be seen that a cycle is thus established, which materially reduces the air resistance encountered by the inturning flaps A, D.

The operation of the machine in general is as follows:

Assuming a stack of blanks X to be in position on the table 14, 14a and that the various parts have been adjusted in accordance with the lines of fold E and G, Fig. 1. When the feeder bars 17 forming part of the conveyor 20 advance in their cycle, each bar engages the lowermost blank and urges it forward over the table and beneath the hold-down bars 34, which are in alignment with the lines of fold E, G. As each blank advances, its side flaps A, D are kicked up by the panel lifters 35 and gradually turned upwardly and inwardly by the fold starters 39, 39a preparatory to being acted on by the folding rolls 61. Upon further advance of the blank, it passes under the shoes 45 with the fold lines E, G in alignment with the folding edges 45a. The flaps are now partly started on their inturning movement and are ready for the comparatively sudden action of the folding rolls 61, which oscillate inwardly and completely fold the flaps A, D while the blanks are passing between the shoes 45 and the bars 50.

As there is more or less friction set up between the advancing blanks and the shoes 45 and bars 50, it is desirable that the latter be given a smooth finish. This may be accomplished by machining, chromium plating or the like.

As the folded blanks pass from the machine, the fold setter bars or retainers 69 bear down on the flaps and aid in setting the latter.

Any suitable method of disposing of the folded blanks may be adopted. In the present instance, I show a conveyor, generally indicated at 80, connected up and driven in synchronism with the machine, the folded blanks passing onto the conveyor and thence to a point where further opera-

tions may be performed thereon, or to a point of loading or deposit.

Referring to the modifications shown in Figs. 10 to 14 inclusive, of the drawings, the machine comprises a reciprocating carriage, generally indicated at 5', which is provided with a truck chassis or frame 6', having axles 7' mounted therein, on which wheels 8' are journalled, the latter being adapted for travel on tracks or rails 9' which are supported on pedestals 10'.

The carriage 5', as here shown, is reciprocated through the medium of a crank wheel 11', to which is pivoted a connecting rod 12', said rod in turn being pivoted to levers 13', which are secured at one end to a cross shaft 14' supported in bearing blocks 15', and at their opposite ends said levers 13' are pivotally connected to the ends of links 16', the opposite ends of the latter connecting with the rear axles 7'. Crank wheel 11' is secured on a shaft 17' which is mounted in bearing pedestals 18', a drive pulley 19' being mounted on shaft 17', the drive being applied to pulley 19' and through the shaft 17', crank wheel 11', connecting rod 12', levers 13' and links 16' to the carriage 5', to thereby impart reciprocatory motion to the latter.

It will be understood that any suitable reciprocating means for the carriage may be adopted and that the various parts may be rendered adjustable so that the extent of reciprocation or speed of travel of the carriage may be regulated as desired.

The corrugated blanks, indicated at X in Figs. 10 and 11 are disposed in stacked relation on a table generally indicated at 20' and comprising bed bars 20'' which are supported at one end on a cross brace 21', secured to uprights 22', the latter being supported by the pedestals 10'; and at their opposite ends, said slats are supported on a cross piece 23', (see Fig. 11) which is secured at opposite sides of the machine to standards or like stationary frame members 24'. The bed bars or slats 20'' which comprise the table 20' extend only partially the length of the machine, as will be noted, and are held stationary with respect to the reciprocating carriage. These slats, or any desired number thereof, may be removably and adjustably mounted on their supports for a purpose which will be later apparent.

The stack of blanks is held in vertical stacked position by an adjustable aligning device such as the plate 25', (see Fig. 12), which is adjustably secured to a cross beam or frame member 26', so that it may be positioned laterally of the machine in accordance with the size of the blanks being folded.

Means are provided in this machine, also, for folding each blank on the lines E and G accurately regardless of the corrugations of the blank, as will now be described. Secured on each of the side rails 9' are brackets 27', (note Fig. 13). These brackets are secured on said rails on each side of the machine out of the range of the travel of the truck wheels 8' and are adapted to support the cross shaft 28' which serves as a tripper bar in a manner as will later be apparent. It will be noted that this shaft 28' is held stationary relatively to the carriage 5'. The folding mechanism is mounted on and travels with the carriage and comprises shafts 29' having adjustably secured thereon mitre or bevel gears 30' which are adapted to mesh with gears 31' secured on stub shafts 32', said shafts being mounted in bearing brackets 33' secured to angle beams 34', the horizontally extending flanges of which serve as supporting and feed members or bars 34'' in a manner to be described. The shafts 29' are mounted at opposite ends in bearing brackets 29'' which are also secured to the angle beams 34'. The members 34'—34'' as shown extend the full length of the carriage and are adjustably clamped at opposite extremities to cross supports or angle bars 35' by means of clamp brackets 35'' and screws 35'''. By loosening the screws 35''' the members 34' may be adjusted laterally of the carriage 5'. The supports 35' may form part of the end frame of the carriage.

Also secured on the shafts 29' are folding arms 36' which terminate at one extremity in holding brackets or bosses 36'' on which are rotatably mounted tubular rolls 37'. These arms are adapted to oscillate and fold the blanks in a manner which will later be described. Motion is imparted to these arms through the medium of trip members or arms 38' which are adjustably secured on the stub shafts 32' and terminate in bifurcated portions in which are mounted trip levers 39' by means of pins 40'. These trip levers are adapted to contact with the shaft or tripper bar 28'. The trip levers 39' have a limited pivoted action on the pins 40'. Thus as the carriage moves forward the tapered ends of the levers 39' engage the tripper bar 28' and through the medium of the gears 31' and 30' rotate the shafts 29', but on the return motion of the carriage these levers slide over the tripper bar 28' and drop by gravity to their original position, backward movement of the tripper bars being limited by contact with the bifurcated ends of the arms 38' forming a limited joint connection as at 38'', (Fig. 13).

The gravitational position of rest of the arms 38' and levers 39' is adjustable through the medium of screws 41' threaded through brackets 41'' and adapted to contact with the upper extremities of the arms 38', lock nuts 41''' being provided for these screws. The rolls 37' may be made of seamless tubing and preferably extend a suitable distance along the length of the machine so that when they contact with the corrugated blanks there will be an extended surface contact, and as these rolls rotate when they contact with blank, frictional resistance is reduced to a minimum. This structure also avoids marring or distortion of the blank.

It will be seen that the folding assembly just described is carried by the feed members or bars 34', and that these members are adjustable laterally of the machine to any desired position in accordance with the fold lines of the blank, the bed blocks or slats 20'' being removable or shiftable to permit such adjustment. At the front end of the carriage 5', the member 34' on which the corrugated board rests during the folding operation is bent down or is formed with a guide portion 34'' for a purpose to be specified.

Between the members 34', a support 42' is provided. This support as shown is shaped substantially similar to the members 34' and may also be adjustably supported in a like manner, its purpose being to serve as a support and also a feed bar for the corrugated blanks at a point intermediate of the members 34'. This member may not be desired in certain types of machines where an intermediate support is not required and its use is optional.

The corrugated blanks are fed in between the members 34' and cooperating shoes or edge form-

ing members 43' and 44' in a manner to be described, the members 43' being mounted on each side of the carriage 5' above the members 34' and the member 44' being mounted intermediate of the members 43' above the member 42'. The shoes or members 43' are in the form of substantially flat strips which taper towards their outer edges, at which point the corrugated blanks are folded upwardly thereover by the arms 36'. At one end these strips 43' and 44' are adjustably secured to a cross support or shaft 45' by means of brackets 46' and screws 46''. The bar 45' is mounted at the opposite extremities in brackets 47' which are secured to the side beams or structural members 6' of the carriage 5'. The ends of the strips 43' and 44' at this point are tapered as at 70' so that the corrugated blanks will be guided in between the members 43' and 34'. At their opposite ends, the strips or members 43' and 44' have a vertically floating mounting and are connected for lateral adjustment by means of cross pieces 48' which are dovetailed into the strips 43' and 44' and are adjustably clamped by screws 49'. By loosening the screws 46'' and 49' the members 43' and 44' may be adjusted laterally in alignment with the cooperating bottom members 34' and 42'.

The corrugated blanks are fed forward when the carriage is advanced by means of a dog or kicker 51' which may extend across the width of the machine, or any suitable distance, and is adjustably secured to the members 34' by means of bolts 51'', which pass through slots 51''' formed in said members 5'. Thus as the carriage moves forward the kicker or dog 51' engages the lowermost corrugated blank and urges it forward over the bed blocks 20'' until its rearmost edge reaches a point adjacent the upright 24'. On each side of the machine at this point stop-dogs or latches 50' are mounted, these dogs being pivotally mounted on the brackets 46', or any convenient support which is stationary with respect to the carriage 5', and drop by gravity onto the blanks as they advance thereunder. When the rear edge of the blank reaches a point beyond these dogs and the carriage moves back, the ends 50'' of said dogs engage the blank and prevent it from moving backwards with the carriage, the blank being fed between the members 34' and 43' when the carriage is retracted.

A conveyor, generally indicated at 52' is mounted in rear of the machine and driven in synchronism therewith. The conveyor is provided with side frames 53' which at the receiving end of the conveyor, are connected to the rear frame members of the machine and at their opposite ends said frames are supported on the rear pedestal 10'. Rolls 54' having conveyor belts 55' thereon are mounted and have bearing in the side frames 53', the folded blanks being taken from the rear of the machine by said belts and conveyed to a suitable point for further operations, either manual or automatic. The conveyor or drive may be synchronized with the machine drive in any suitable manner, such as by a sprocket gear 54 and sprocket chain 55'' shown in dotted lines at the rear of the conveyor.

The operation of the machine in general is as follows: Assuming a pile of blanks X to be in position on the table 20' and that the members 43' and 34' have been adjusted in accordance with the lines of fold E and G, (Fig. 1). When the carriage moved forward the kicker 51' engages the lowermost blank and advances it with the carriage to a point in advance of the dogs 50', at which point the said dogs drop by gravity over the rear edge of the blank. In this position the blank is resting on the members or feed bars 34' and the ends of the members 43' are just in advance of the front edge of the blank. The carriage then retracts or moves back while the blank is held stationary with respect thereto, the blank being fed in between the members 34' and 43' as the carriage is retracted. During this entire movement before the initial or lower blank of the stack X has been fed in between the members 34' and 43', the folding mechanism, does no work. However, when the first blank has been fed in between the members 34' and 43' and the carriage again moved forward, the trip lever 39' engages the tripper bar 28', and through the gears 31' and 30' causes the folding arms 36' to swing upwardly and engage the sides A and D of the blank and fold them over the edges of the members or shoes 43'. During this forward motion another blank has been moved to an advanced position while the blank between members 43' and 34' is being folded. When the carriage moves back the members or shoes 43' are pulled free of the folded blank and another blank is fed in between said members 43' and 34' and the cycle of operation above specified is repeated.

As the folding operation takes place while the folding mechanism is travelling with the blank and while the latter is held in a rigid position between the members 43' and 34', the line of fold is accurate regardless of points of least resistance along the blank. For instance, should the score marks E and G be off center with respect to any particular corrugation or groove in the blank, the line of fold will be at the point desired regardless of the said groove. The members 43' and 34' may be readily adjusted to any desired width, so that all that is necessary when starting the machine is to adjust said members in alignment with the line of fold and start the machine in operation. Furthermore, it is not necessary to score or mark the blanks in the first instance, although this may be done as a matter of convenience in adjusting the members 34' and 43'.

It will be understood that the folding mechanism as particularly shown in Figs. 13 and 14 could be mounted to operate at both ends of the machine and thus fold a blank upon both the forward and backward stroke of the carriage and thereby increase the output of the machine, the drawings in the present instance only illustrating one assembly.

It will also be understood that taping machines of any known type may be mounted to operate in conjunction with both of the types of folding machines herein shown.

The machines may be used for folding unslotted as well as slotted boxes, this slotting feature being referred to only incidently for the purposes of description.

It will be noted that both of the machines have many features in common, especially with respect to the folding mechanism and cooperating parts. Obviously various modifications may be adopted to suit different conditions of installation and manufacturing requirements without departing from the scope of the invention, the machines as shown being simply examples of preferred types.

While the foregoing illustrates and describes a preferred form of my invention with certain modifications, I do not care to be limited by the

specific showing herein or in any other manner than by the claims appended hereto.

What I claim is:

1. A machine for folding corrugated blanks, comprising a support for one or a plurality of blanks, means for feeding the blanks in series in a substantially rectilinear plane into folding position, and folding mechanism for automatically folding the blanks; said mechanism including folding shoes extending parallel to the direction of movement of the blanks and acting on the line of fold on the upper side of the blank, folding and supporting bars positioned on the line of fold on the lower side of the blank, substantially cylindrical folding members extending substantially parallel to said shoes and bars, and means for moving said members transversely of said folding shoes.

2. In a machine of the class specified, a support for one or a plurality of blanks, means for feeding the blanks in series in a substantially rectilinear plane into folding position, and folding mechanism for automatically folding the blanks; said mechanism including folding shoes adapted to bear on the line of fold on one side of the blank, folding and supporting bars positioned on the line of fold on the other side of the blank, folding arms carried by said bars, substantially cylindrical folding rolls carried by said arms and extending parallel to the direction of movement of the blanks, and means for actuating said arms to move said rolls transversely of the direction of movement of the blank.

3. A machine for folding corrugated blanks comprising a support for one or a plurality of blanks, means for advancing the blanks in series in a substantially rectilinear plane into folding position, hold-down bars extending in alignment with the line of fold of said blanks, folding shoes and folding bars mounted in horizontal alignment with said hold-down bars, the blanks being advanced in series beneath said hold-down bars and then between said shoes and folding bars and in a direction substantially parallel to said shoes and bars, folding rolls mounted adjacent said shoes and in substantially parallel relation therewith, and means for moving said rolls transversely of said blanks.

4. In a machine of the class specified, a support for a stack of blanks, a conveyor for said blanks folding mechanism mounted in advance of said support, fold starters positioned on an inclined plane between said support and said folding mechanism, and means for raising the side flaps of said blanks to bring them into engagement with said starters, said means being controlled by said conveyor.

5. In a machine of the class specified, a table for supporting a stack of blanks, folding mechanism mounted to act on said blanks in advance of said table, a conveyor for advancing said blanks from beneath said stack in a substantially rectilinear plane into operative position with respect to said folding mechanism, fold starters mounted to act on said blanks prior to reaching said mechanism, and means for raising the side panels of said blanks into engagement with said starters, said means being controlled by said conveyor.

6. In a machine for folding blanks, folding mechanism comprising a folding shoe acting on the line of fold on one side of the blank, means for advancing the blanks in a direction parallel to the line of fold, a folding roll extending along an axis substantially parallel to the line of fold, and means for moving said folding roll transversely of its axis and over said folding shoe.

7. In a machine for folding corrugated paper blanks, the combination of mechanism for engaging a blank to produce a fold therein and means for directing a blast of air against a portion of the blank to assist in the folding operation the fold being initiated by the blank engaging mechanism.

8. In a machine of the class described, folding mechanism for blanks of fibrous sheet material including shoe plates having a relatively thin edge over which portions of the blanks are folded, said shoe plates having a longitudinal recess adjacent the folding edge to receive the excess material developed on the inner side of the fold, folding rolls extending parallel to the edges of said shoe plates and adapted to move transversely of said shoe plates to fold the material thereover, and means for moving said blanks in a direction parallel to said folding rolls.

9. A machine for folding corrugated blanks, comprising a support for one or a plurality of blanks, means for feeding the blanks in series in a substantially rectilinear plane into folding position, and folding mechanism for automatically folding the blanks; said mechanism including folding shoes extending parallel to the direction of movement of the blanks and acting on the line of fold on the upper side of the blank, folding and supporting bars positioned on the line of fold on the lower side of the blank, fold starting members adapted to engage the under side of the blank and to initiate the folding operation, substantially cylindrical folding members extending substantially parallel to said shoes and bars, and means for moving said members transversely of said folding shoes.

10. In a machine of the class specified, a support for a stack of blanks, a conveyor for said blanks, folding mechanism mounted in advance of said support, said folding mechanism comprising a folding shoe, a folding roll extending along an axis substantially parallel to the line of fold and means for moving said roll transversely of its axis and over said folding shoe, fold starters positioned on an inclined plane between said support and said folding mechanism, and means for raising the side flaps of said blanks to bring them into engagement with said starters, said means being controlled by said conveyor.

11. In a machine for folding blanks, folding mechanism comprising a fold starting member for engaging the blank to initiate the folding operation, a folding shoe acting on the line of fold on one side of the blank, means for advancing the blanks in a direction parallel to the line of fold, a folding roll extending along an axis substantially parallel to the line of fold, and means for moving said folding roll transversely of its axis and over said folding shoe.

HARRY L. WOOD.