May 17, 1938. E. G. STAUDE 2,117,460

PAPER BOX MAKING MACHINE AND METHOD OF FOLDING

Filed Dec. 19, 1936 5 Sheets-Sheet 1

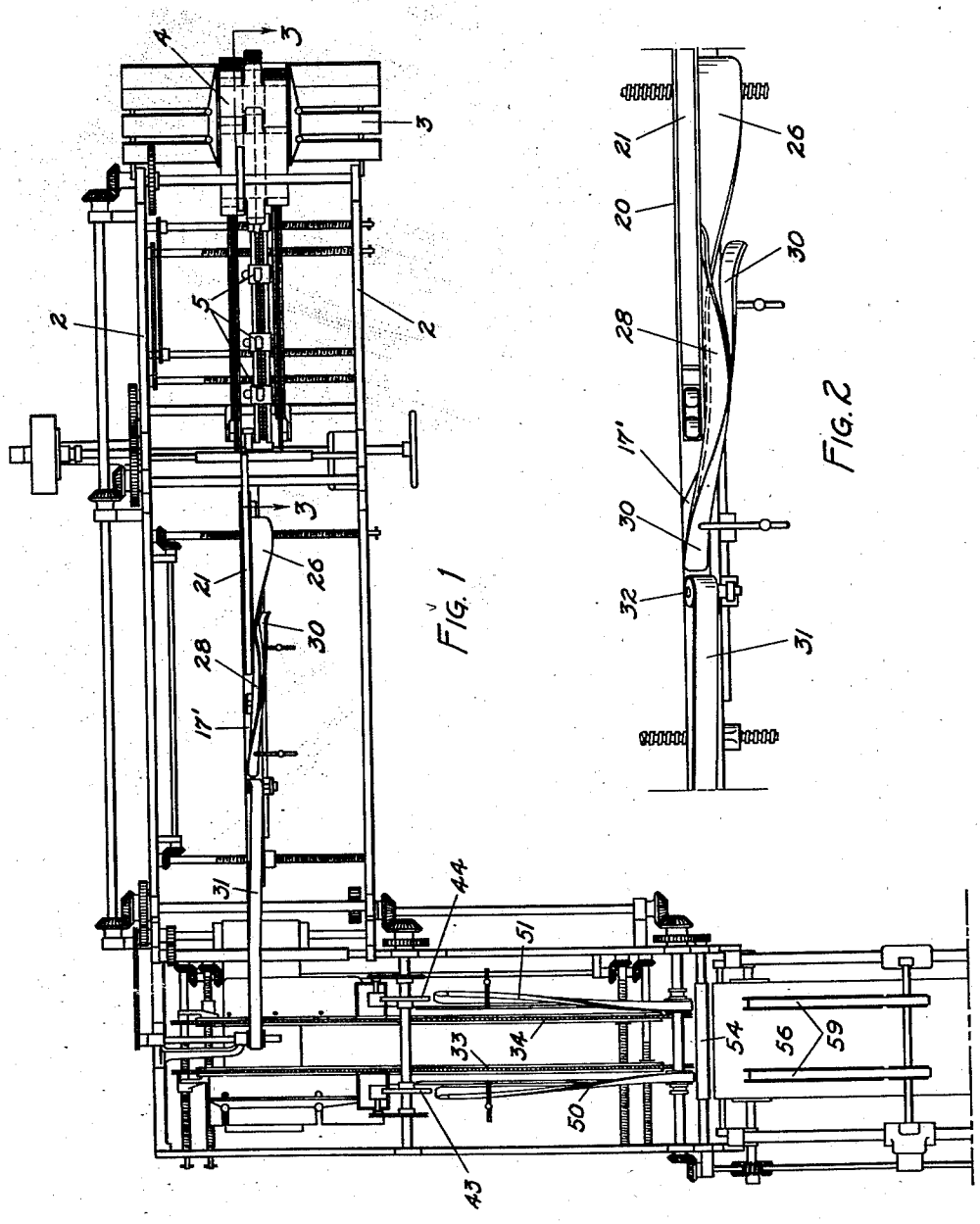


FIG. 1

FIG. 2

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PAPER BOX MAKING MACHINE AND METHOD OF FOLDING

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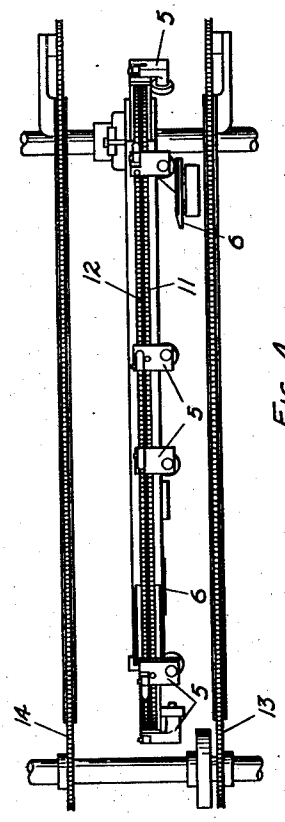


FIG. 4

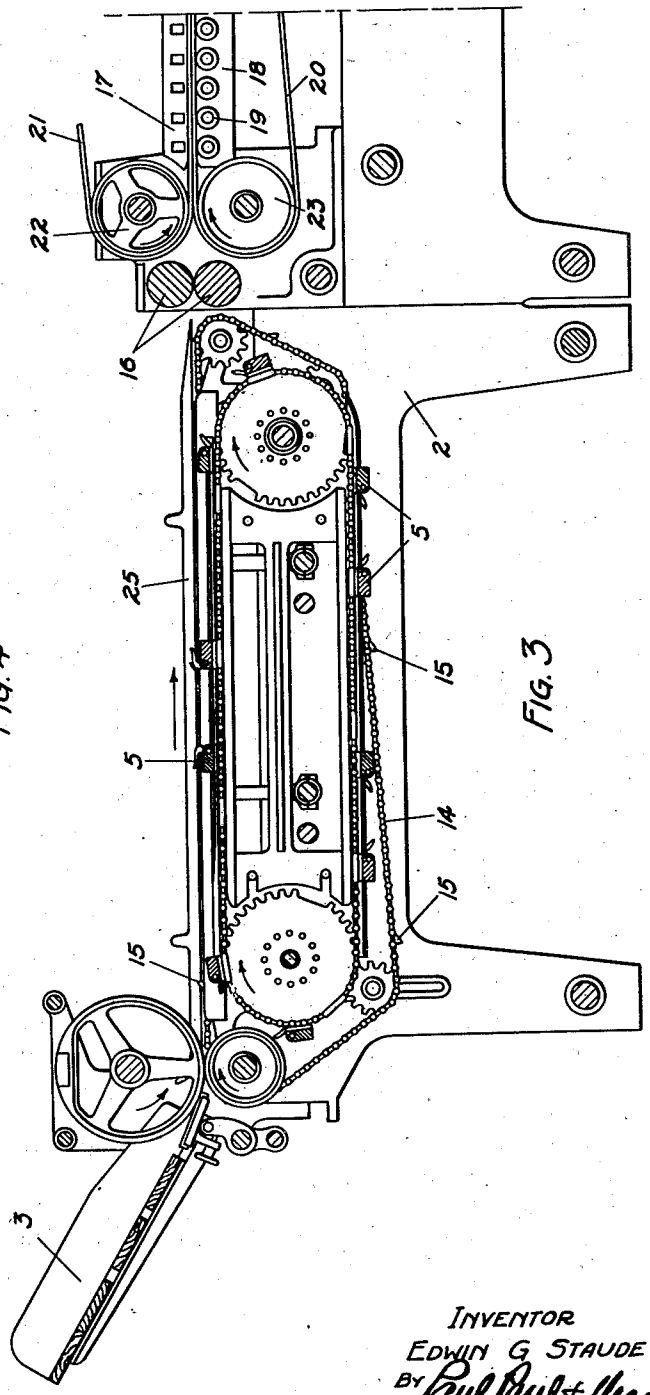


FIG. 3

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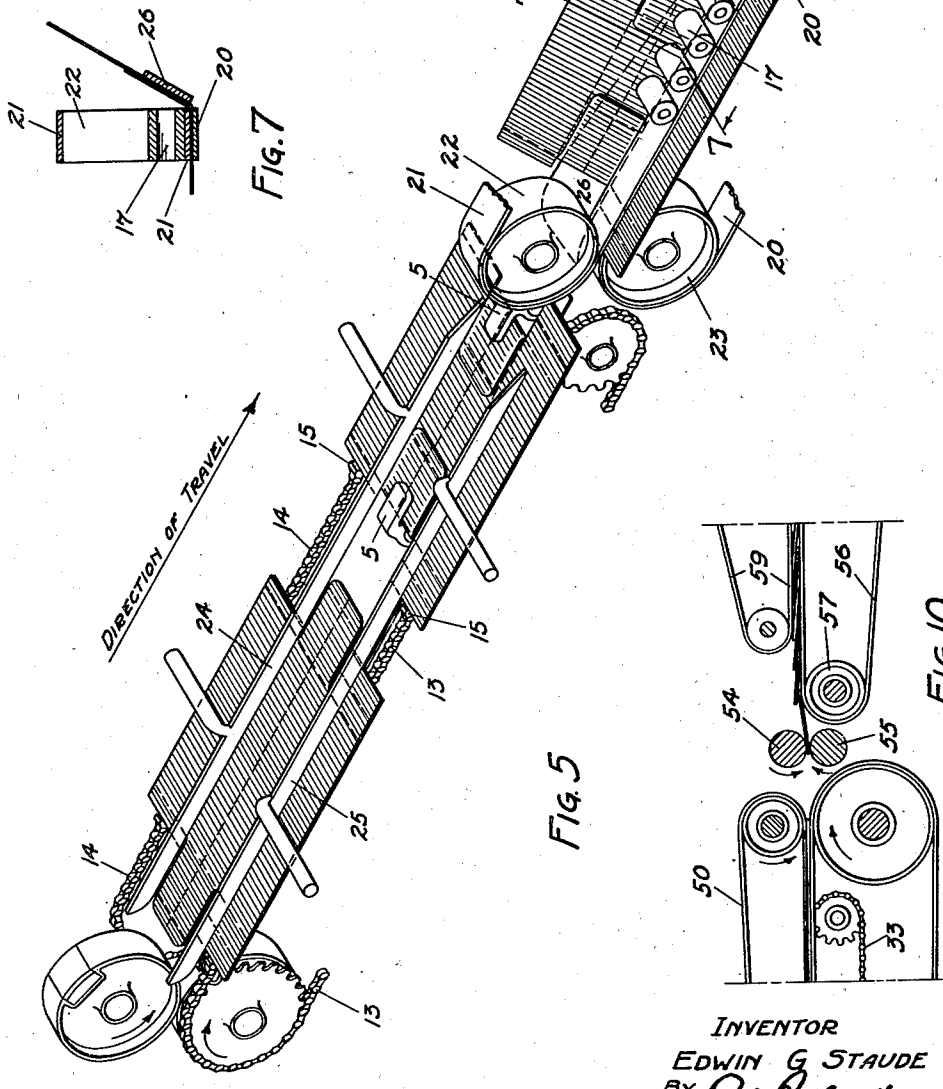


FIG. 5

FIG. 7

FIG. 10

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PAPER BOX MAKING MACHINE AND METHOD OF FOLDING

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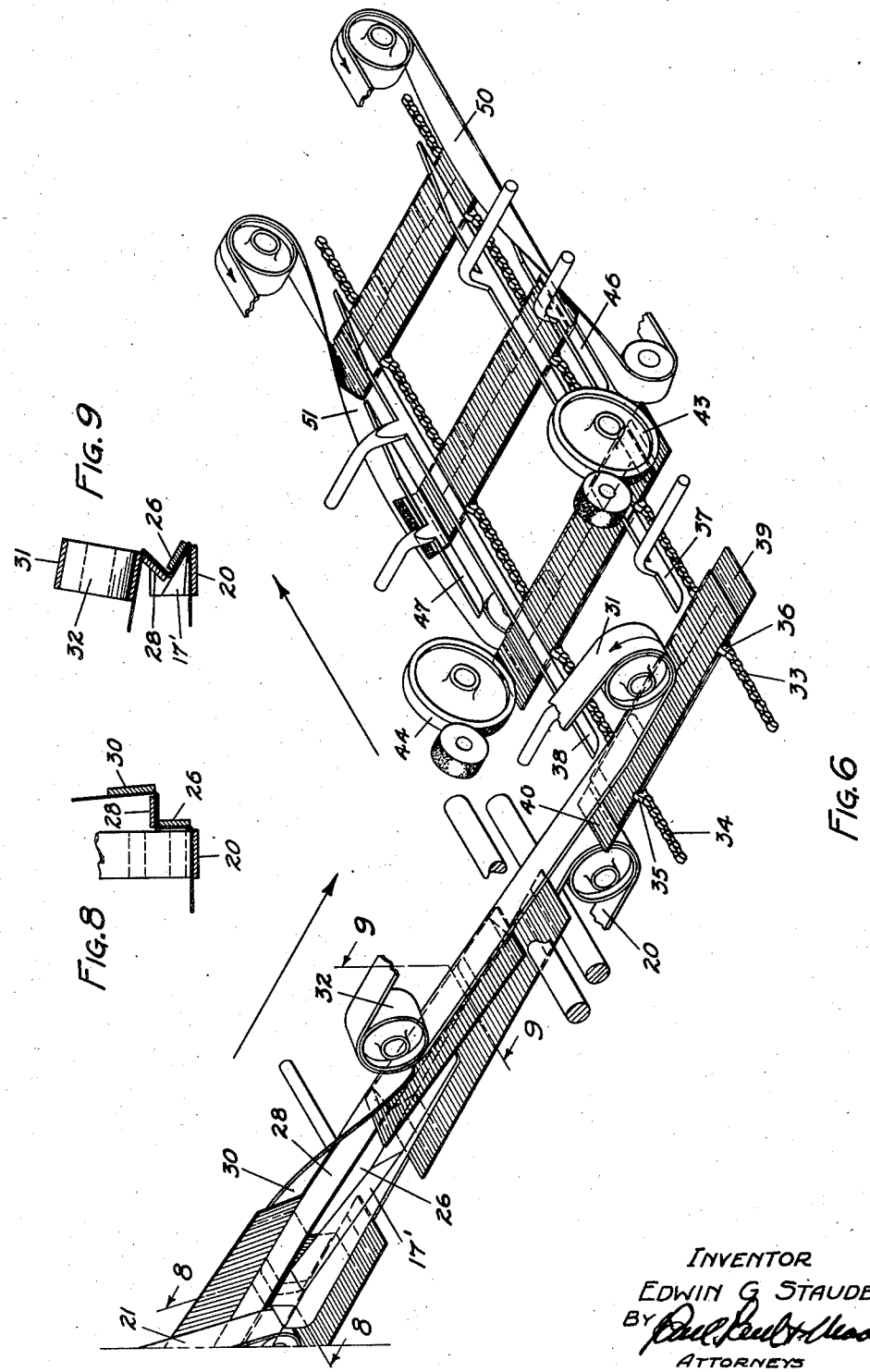


FIG. 6

FIG. 9

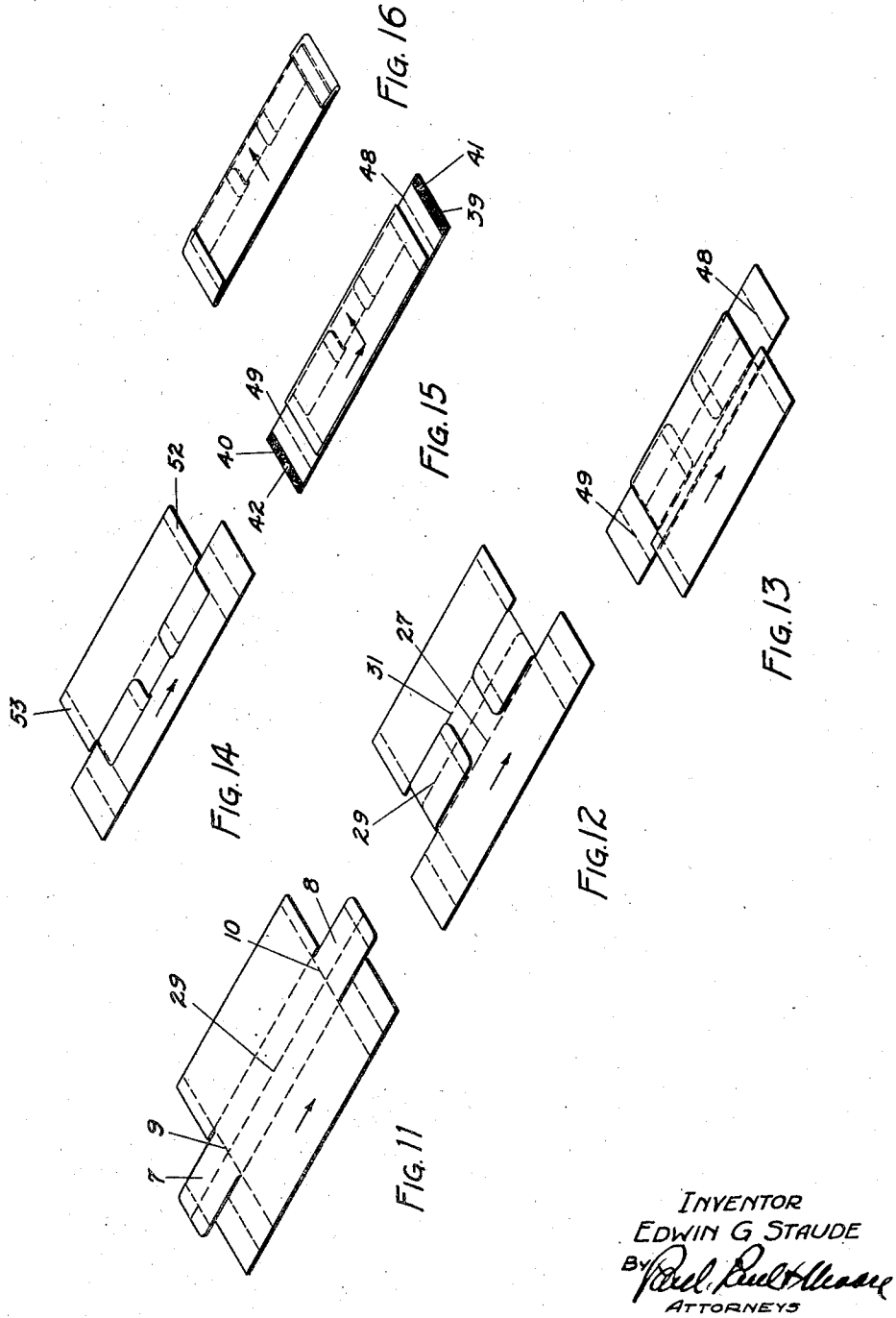
FIG. 8

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PAPER BOX MAKING MACHINE AND METHOD OF FOLDING

Filed Dec. 19, 1936 5 Sheets-Sheet 5



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Patented May 17, 1938 2,117,460

UNITED STATES PATENT OFFICE

2,117,460

PAPER BOX MAKING MACHINE AND METHOD OF FOLDING

Edwin G. Staude, Minneapolis, Minn.

Application December 19, 1936, Serial No. 116,725

17 Claims. (Cl. 93—52)

This invention relates to improvements in folding machines and has among its objects to produce a machine in which the folding operations are performed while the blank moves without pause.

A very important feature of my invention is the provision of a machine for making what is known as a "center fold" collapsible paper box, at high speed and in which all the operations shall be continuous and rotary, and at the same time produce an accurately folded box. Another feature is the method of up-and-in folding. I am aware that other machines have been built for folding "center fold" boxes both outwardly and inwardly, but in no case have these machines been commercially successful because of the large amount of waste and slow production.

The particular feature of my invention is a machine which will fold the so-called "center fold" upwardly and inwardly, and which will deliver the box in collapsed form.

This method of folding has a marked advantage over a box which is center folded downwardly and outwardly, because in setting the box up, where the bottom is folded downwardly and outwardly said bottom will sag downwardly and not provide a rigid surface, whereas where the box is folded inwardly and/or upwardly, as contemplated herein, then in setting the box up the attendant merely presses the bottom down from the inside to a flat position, which is then rigid and presents a square appearance without any sag in the bottom.

My invention therefore includes the important feature of providing folding means for folding the so-called "center fold" upwardly and inwardly, doing same in a continuous operation and without pause. Features include all details of the folding mechanism for making the accordion fold, in combination with accessory mechanisms disclosed.

Other objects of my invention will appear from the description and drawings forming a part of this specification, and in said drawings,

Figure 1 is a plan view of a machine embodying my improved folding mechanism;

Figure 2 is an enlarged plan view of the folding mechanism for doing the infolding;

Figure 3 is a longitudinal section on the line 3—3 of Figure 1, looking in the direction of the arrow;

Figure 4 is a detail plan view of the folding and blank carrying mechanism of Figure 3;

Figure 5 is a perspective view illustrating the blank feeding wheels and carrying mechanism, and the manner of making the first front and rear folds in the blank, and of beginning the side folds;

Figure 6 is a continuation of the perspective of Figure 5, showing the manner of completing the folding of the blank and the manner of advancing the blank at right angles to its original line of travel, and the gluing of the end flaps;

Figure 7 is a view on the line 7—7 of Figure 5, looking in the direction of the arrow;

Figure 8 is a section on the line 8—8 of Figure 6, showing the method of center folding;

Figure 9 is a section on the line 9—9 of Figure 6 further illustrating the center folding scheme;

Figure 10 is a detail vertical section of a portion of the delivery end of the machine; and

Figures 11, 12, 13, 14, 15 and 16 are perspective views illustrating the successive foldings which the blank undergoes, while continuously moving.

The general form of the machine herein is like that of my Patent 1,144,506, that is, of the right-angle type.

In the drawings, 2 represents the side frames of a right angle machine used for folding this particular type of box. 3 represents the feed hopper, and 4 a stack of blanks in the hopper, the upper forwardmost blank being the one which is first advanced into the infolding mechanism 5. This infolding mechanism for the end flaps is quite similar to flap-folding means shown in my Patent No. 1,910,413 except that the traveling folding fingers are pivoted on axes which are at right angles to the line of travel instead of at forty-five degrees to that line as shown in the patent.

The infolding mechanism 5 includes the opposing traveling folding carriages carrying the fingers which are operated by closing and opening rails 6. These fingers are adapted to fold the flaps 7 and 8 along the crease lines 9 and 10, to the position shown in Figure 12. One pair of folding units for folding the front ends of the blank are mounted and carried by a sprocket chain 11, see Figure 4, and the other pair for folding the rear ends of the blank are mounted on the sprocket chain 12. These sprocket chains are adjustable for blanks of different sizes, and since means for this purpose is described in my Patent No. 1,910,413, further description is thought unnecessary.

The blank is fed forwardly by the chains 13 and 14, the same being provided with lugs 15 which engage the rear edge of the blank to advance it to the first pair of speed rolls 16, thence under a pressure carrier 17. The carrier is pro-

vided with a nosing 17' see Figures 1, 2, 6 and 9, for advancing and guiding the blank, and the nosing is supported on a rail 18, carrying anti-friction rollers 19. Belts 20 and 21, between which the blanks are fed, serve to advance the blank through the machine. The belt 21 is driven by the pulley 22, and the belt 20 by the pulley 23.

Suitable bars 24 and 25, see Figure 5, are provided for holding the blank down on the carrier chains 13 and 14, to assure that the end flaps of the blanks will engage the lugs 15. A wide plow-share folder 26 is provided, which, see Figures 2, 7, 8 and 9, next folds the blank along the line 27 (see Figure 12). Another plow-share folder 28 (see Figures 6, 8 and 9) is arranged following the plow-share folder 26, to fold the blank upwardly, inwardly and downwardly along the center line 29 (see Figures 2 and 12). A third plow-share folder 30 is provided to fold ahead on the line 31. The action on the blank at this point is as shown in the cross section of Figure 8, and on further advance the blank is delivered to a folding belt 31, (see Figure 6) mounted on an adjustable pulley 32. The blank is now collapsed inwardly, as shown in Figure 9, to finally assume the folded condition shown in Figures 6 and 15.

It is obvious that these various folding operations may be performed simultaneously or sequentially. After the blank is folded as shown in Figure 15, it is delivered to the right angle transfer section to be engaged by lugs 35 and 36 of chains 33 and 34. The belt 31 is extended to a point between the two chains to prevent the collapsed box from opening up before it passes under the hold-down bars 37 and 38. Proper driving synchronizing between the first and second sections of this machine is of course provided, and may be of the character shown in my Patent 1,144,506, or combined if desired with that of my Patent 1,910,413.

The end flaps 39 and 40 are adapted to receive glue at 41 and 42 from the glue wheels 43 and 44 having the usual glue supply, not shown. Additional hold-down bars 46 and 47 are provided to act inside of the creases 48 and 49 along which the final fold is made by the twisted folding belts 50 and 51, to cause these flaps to overlap on the extended flaps 52 and 53. After this all the flaps are securely pressed together and delivered between pressure or "squeeze" rolls 54 and 55 (see Figure 10), from which speed rolls the collapsed boxes are delivered underneath the rearmost and bottom-most box of a stack of overlapped boxes, on a wide canvas conveyor belt 56 which passes around a pulley 57. To keep the boxes under pressure until the adhesive has set, I provide the usual pressure device or belt 59, which pressure device is adjusted over the glue seam and adapted to hold same firmly in contact.

While I have shown stationary plow-share folding devices to infold the center or bottom of the collapsible box, I may also provide twisted folding belts or revolving disc folders or, in fact, any folding device suitable for this purpose. A very important feature is the provision of means for center-folding a box, and completing such folding while the box continues to travel, in other words, without pause. In so far as I am aware I am the first to accomplish this very important object in a center-fold box and I claim it broadly.

I claim as my invention:

1. A paper box machine for folding collapsible set-up box blanks having an inward fold in the center of the box bottom, comprising means for constantly feeding the blank, means for folding the ends on the bottom, means for folding the bottom over the first side wall, means for folding back one-half of the bottom, and means for folding the other side wall over the bottom and the first side wall to produce an accordion fold for said bottom.

2. A paper box machine for folding collapsible set-up box blanks having an inward fold in the center of the box bottom, comprising means for constantly feeding the blank, means for folding the ends on the bottom, stationary spiral shaped means for folding the bottom over the first side wall, stationary spiral means for folding back half of the bottom, and stationary spiral means for folding the other side wall over the bottom and the first side wall to produce an accordion fold for said bottom.

3. A paper box machine for folding collapsible set-up box blanks having an inward fold in the center of the box bottom, comprising means for feeding the blank, means for folding the ends on the bottom, means for folding the bottom over the first side wall, means for folding back half of the bottom, means for folding the other side wall over the bottom and the first side wall to produce an accordion fold for said bottom, and traveling means for gradually compressing all of the folds together.

4. A paper box machine for folding collapsible set-up box blanks having an inward fold in the center of the box bottom, comprising means for feeding the blank, means for folding the ends on the bottom, means for folding the bottom over the first side wall, means for folding back half of the bottom, means for folding the other side wall over the bottom and the first side wall to produce an accordion fold for said bottom, traveling means for gradually compressing all of the folds together, means for moving the partly folded blank at right angles from its initial travel, and means associated with the last mentioned means for respectively gluing and folding the ends on the one side wall over on to the other side wall, and means for delivering said folded box blanks and holding same under pressure.

5. A paper box machine for folding collapsible set-up box blanks of the center fold types including means for continuously feeding the blanks, and a plurality of stationary means for making the center fold by moving parts of the blank upwardly, inwardly and over another part of the blank.

6. A paper box machine for folding collapsible set-up box blanks of the center fold type comprising, means for continuously feeding the blanks, means for folding the ends on the bottom, and plural stationary means for making the center fold by moving parts of the blank upwardly and inwardly from a point laterally of the feeding plane of the blank.

7. A paper box machine for folding collapsible set-up box blanks of the center fold type comprising means for continuously feeding the blanks, means for folding the ends on the bottom, and stationary means of the plow-share type for making the center fold by moving parts of the blank upwardly and inwardly.

8. In a machine for folding a box blank which has first, second and third sides, the second side having end flaps, means for consecutively advancing the blanks, means for infolding the end flaps of the second side upon that side, and plu-

ral means acting while the blanks are advanced without pause respectively to fold the folded end flaps, fold the second side upon the first side, reverse fold said folded end flaps and second side, and fold the third section upon the reverse folded portions of said folded end flaps and second side.

9. In a machine for folding a box blank which has first, second and third sides defined by fold lines, the second side having end flaps, means for consecutively advancing the blanks in direction of their fold lines, means for infolding the end flaps of the second side upon that side, while the blanks are advancing without pause, and plural means extending in direction of feed and acting while the blanks advance without pause respectively, to fold the folded end flaps, fold the second side upon the first side, reverse fold said folded end flaps and second side, and fold the third section upon reverse folded portions of said folded end flaps and the second side.

10. In a machine for folding a box blank which has first, second and third sides defined by fold lines, the second side having end flaps, means for consecutively advancing the blanks in direction of their fold lines, means movable with said advancing means for infolding the end flaps of the second side upon that side, and plural stationary means acting while the blanks are advanced without pause respectively, to fold the folded end flaps and the second side upon the first side, reverse fold said folded end flaps and second side, and fold the third section upon reverse folded portions of said folded end flaps and second side.

11. In a machine for folding a box blank which has first, second and third sides defined by fold lines, each side having end flaps, first means for consecutively advancing the blanks in direction of their fold lines, means for infolding the end flaps of the second side upon that side, plural means acting while the blanks are advanced without pause respectively, to fold the folded end flaps and the second side upon the first side, reverse fold said folded end flaps and second side and fold the third section upon reverse folded portions of said folded end flaps and the second side, second means for receiving the moving folded blanks and advancing them without pause in a direction at right angles to the direction of motion of first advancing means, and means associated with the second advancing means for successively and respectively applying adhesive to the end flaps of the first section and folding the last mentioned flaps into adhesive relationship with the end flaps of the third section.

12. In a machine for folding a box blank which has first, second and third sides defined by fold lines, each side having end flaps, first means for consecutively advancing the blanks in direction of their fold lines, means for infolding the end flaps of the second side upon that side, while the blanks are advancing without pause, and plural stationary means respectively acting while the blanks are advancing without pause, to fold the folded end flaps and the second side upon the first side, reverse fold said folded end flaps and second side, and fold the third section upon reverse folded portions of said folded end flaps and the second side, second means for receiving the moving folded blanks and advancing them without pause in a direction at right angles to the direction of motion of first advancing means, means associated with the second advancing means for successively and respectively applying adhesive to the end flaps of the first section, and folding the last mentioned flaps into adhesive relationship with the end flaps of the third section.

13. In a machine for folding a box blank which has first, second and third sides defined by fold lines, each side having end flaps, first means for consecutively advancing the blanks in direction of their fold lines, means movable with said advancing means for infolding the end flaps of the second side upon that side, plural stationary means extending in direction of feed and acting respectively, to fold the folded end flaps and the second side upon the first side, reverse fold said folded end flaps and second side, and fold the third section upon reverse folded portions of said folded end flaps and the second side, second means for receiving and advancing the folded blanks in a direction at right angles to the direction of motion of first advancing means, means associated with the second advancing means for successively and respectively applying adhesive to the end flaps of the first section, and folding the last mentioned flaps into adhesive relationship with the end flaps of the third section, and means for synchronizing the motions of the advancing means for causing the blanks to move without pause.

14. In a machine for folding a box blank which has first, second and third sides the second side having end flaps, means for infolding the end flaps of the second side upon that side means including stationary plow-share folders, for folding the folded end flaps and second side upon the first side, means for reverse folding the second side and folded end flaps thereof, and means folding the third side upon reverse folded portions of the folded end flaps and second side against the first side.

15. In a machine for folding a box blank which has first, second and third sides each having end flaps, means for infolding the end flaps of the second side upon that side, means including stationary plow-share folders, for folding the folded end flaps and second side upon the first side, means for reverse folding the second side and folded end flaps upon themselves, means folding a third side upon reverse folded portions of the folded end flaps and second side against the first side, means for applying glue to the end flaps of the first side, means for folding the last mentioned flaps into adhesive relation with the end flaps of the third, and means for receiving and holding the adhesively attached and folded blanks to allow the adhesive to set and thereby prevent opening of the glued flaps.

16. A method for folding a set-up box blank of a center fold type which consists, in holding one part of the blank flat and moving the blank and making the center fold by folding unheld parts of the blank upwardly and inwardly upon the part that is held.

17. A method for folding a set-up box blank of a center fold type which consists, in holding one part of the blank flat and moving the blank and making the center fold by folding unheld parts of the blank upwardly and inwardly upon other parts and making such folds from a point laterally of the line of feed of the blank.

EDWIN G. STAUDE.