May 5, 1925. 1,536,800

L. E. LA BOMBARD ET AL

BLANK CARRYING MECHANISM FOR PAPER BOX FOLDING MACHINES

Filed Jan. 18, 1924 3 Sheets-Sheet 1

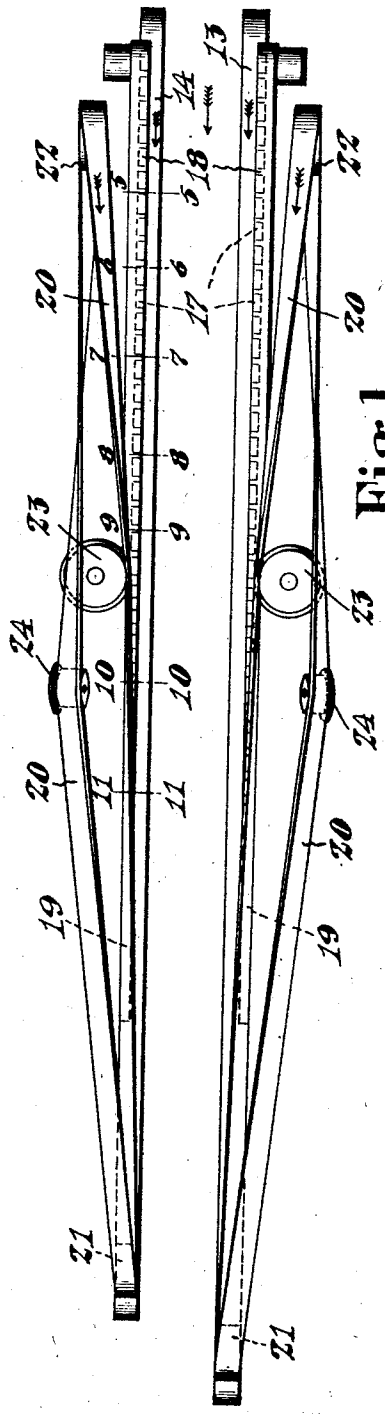


Fig. 1.

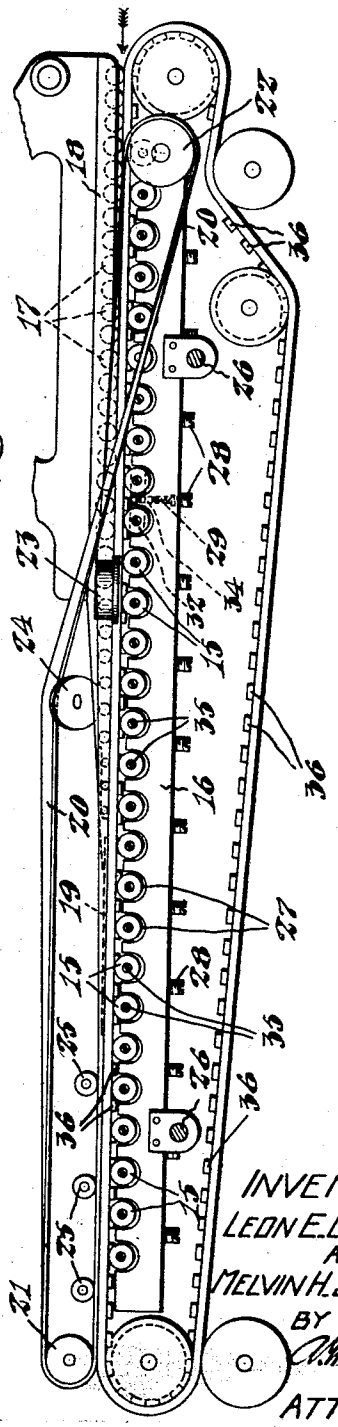


Fig. 2.

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BLANK CARRYING MECHANISM FOR PAPER BOX FOLDING MACHINES

Filed Jan. 18, 1924 3 Sheets-Sheet 2

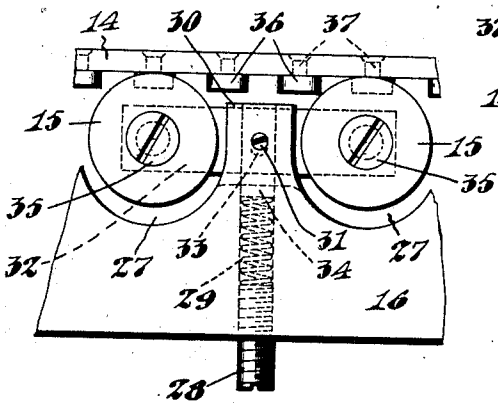


Fig. 3.

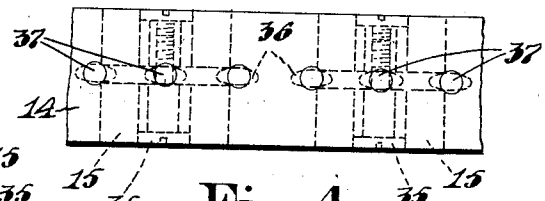


Fig. 4.

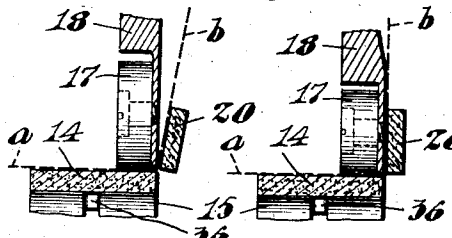


Fig. 8. Fig. 9.

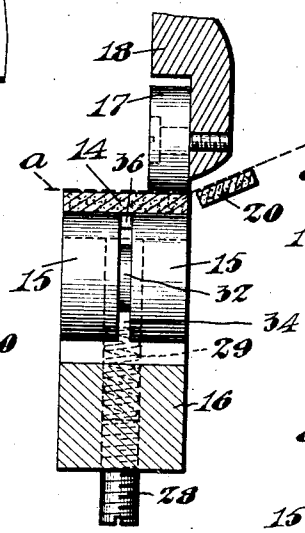


Fig. 5.

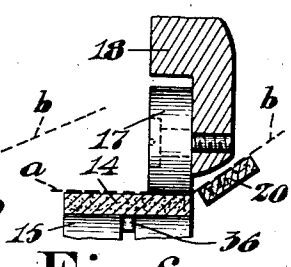


Fig. 6.

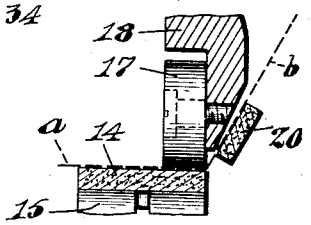


Fig. 7.

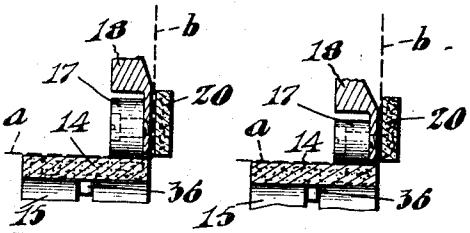


Fig. 10. Fig. 11.

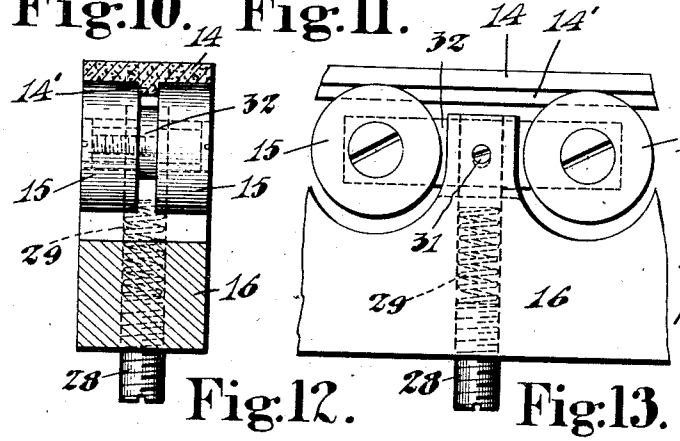


Fig. 12. Fig. 13.

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BLANK CARRYING MECHANISM FOR PAPER BOX FOLDING MACHINES

Filed Jan. 18, 1924 3 Sheets-Sheet 3

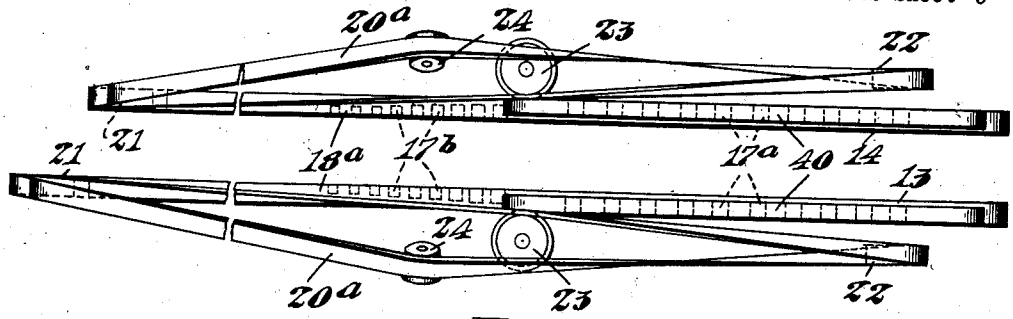


Fig:14.

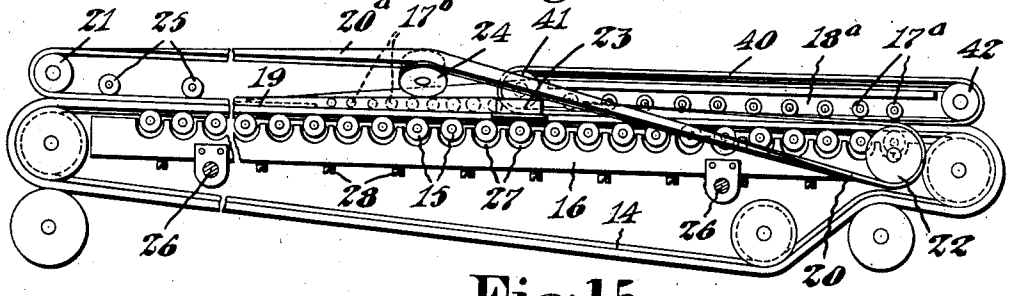


Fig:15.

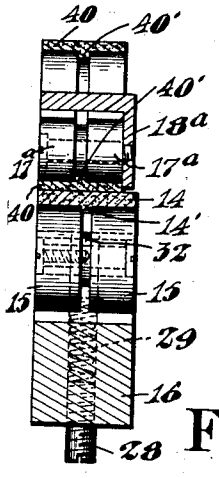


Fig:21.

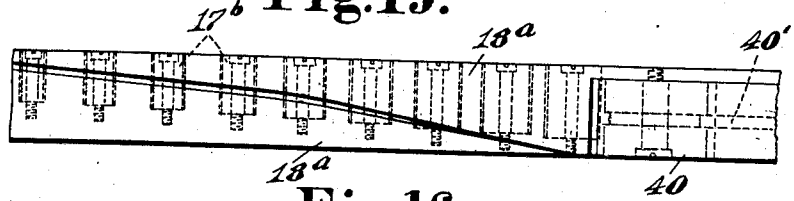


Fig:16.

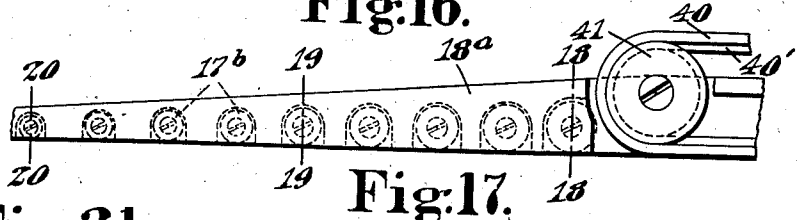


Fig:17.

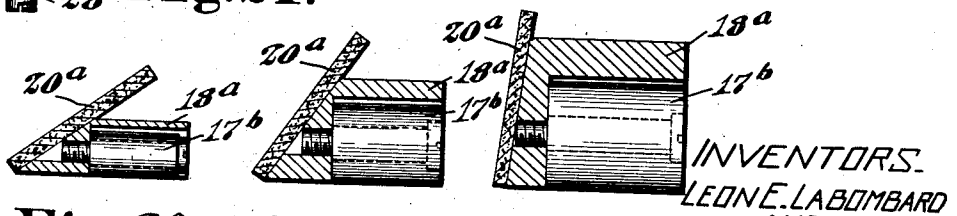


Fig:20. Fig:19. Fig:18.

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Patented May 5, 1925. 1,536,800

UNITED STATES PATENT OFFICE.

LEON E. LA BOMBARD AND MELVIN H. SIDEBOTHAM, OF CHELSEA, MASSACHUSETTS, ASSIGNORS TO SPECIALTY AUTOMATIC MACHINE COMPANY, OF CHELSEA, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

BLANK-CARRYING MECHANISM FOR PAPER-BOX-FOLDING MACHINES.

Application filed January 18, 1924. Serial No. 687,010.

To all whom it may concern:

Be it known that we, LEON E. LA BOMBARD and MELVIN H. SIDEBOTHAM, citizens of the United States, and residents of Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Blank-Carrying Mechanism for Paper-Box-Folding Machines, of which the following is a specification.

This invention relates to the manufacture of boxes and has particular reference to machines for converting creased paper or pasteboard blanks into flat folded boxes frequently referred to as cartons.

At present the majority of paper box folding machines in use are of the type known as rotary because all of the moving parts travel continuously, the blanks being carried through the machine by endless belts. Usually there are two lower carrier belts the operative runs or stretches of which are supported by unyieldingly mounted idler rolls, and two upper belts the operative runs or stretches of which are yieldingly pressed down on the lower belts by spring-actuated idler rolls. Sometimes, however, there are no upper belts, but only spring-actuated rolls. In either case the upper belts or upper rolls are employed to keep the blanks to be folded pressed down against the lower carrier which is mainly relied upon to control the proper carrying of the blanks through the machine, not only while the side panels are turned or "broken" to upright positions but also while said panels are folded inwardly to complete the boxes.

Machines of this rotary type are so rapid in operation that most box makers would need but one machine if that machine is capable of folding the entire range of sizes. All such machines include means for laterally adjusting the belts and whatever devices cooperate therewith in completely folding the blanks, in order that boxes of different widths may be made. Obviously, the total width of the lower carrier belts determines the minimum closeness of adjustment and therefore, if narrow boxes are to be made, said belts must be narrow. But such narrow belts, when mounted to travel over rigidly mounted rolls and coacting with upper belts and rolls which are yieldingly supported, do not always ensure correct travel of wide blanks because the upward pressure exerted by whatever "breaks" the blanks to start the first folding operation has a tendency to cause the upper rolls and belts to yield and so reduce the frictional grip of the belts on the blanks. Wide blanks are usually of much thicker stock than narrow ones and more upward pressure is required to turn or "break" the side panels up.

The chief object of our present invention is to provide a box folding machine which will successfully operate on very narrow blanks and equally as well on wide and heavy blanks, and we attain this object by so mounting the belts that the lower ones instead of the upper ones shall yield, it being understood, of course, that some yielding is always necessary to ensure proper frictional grip of the carrier belts on the blanks.

The most successful machines of this general type heretofore produced have employed stationary metal plates or rods to guide the side panels of the blanks from flat to upright or right-angular positions, but the friction of the blanks against such plates or rods which necessarily exert upward pressure on the panels, is liable to cause inaccuracy of travel of the blanks. Another object of our invention is to avoid the use of such metal plates or rods. We are able to do this because the lower carrier belts are supported on yieldingly mounted rolls, employing inclined portions of the upper belts to effect the upward turn or "break" of the side panels of the blanks, and employing unyieldingly mounted upper rolls adjacent to the said inclined portions of the upper belts to hold the blanks firmly in contact with the

lower carrier belts during the "break" of the side panels.

Another object of our invention is to provide a machine of the character described in which the closest possible relation between the two lower carrier belts can be obtained when very narrow boxes are to be made. Usually such belts are run over idler rolls having flanges to guide the belts. Such flanges add to the space-occupying lengths of the rolls. In the present machine we provide the supporting idler rolls in pairs, each roll of each pair being narrow, a narrow space being provided between the rolls of the pairs, and provide the belts with projecting portions which run along said narrow space, such projecting portions of the belts serving to guide the belts in straight paths.

In box folding machines of the rotary type, and which employ twist belts to complete the folding, it is customary to include a pair of stiff fingers or bars against the outer sides of which the side panels of the blanks are folded. Such fingers or bars as heretofore constructed cause friction which prevents the blanks from travelling without turning askew. To overcome this objection is another object of our invention, and we attain said object by mounting in such bars, that is in the portions thereof which taper, a series of rolls of successively diminishing diameters. And preferably the bars are not only tapered as to vertical thickness but also as to lateral thickness or width, and the rolls mounted therein are of successively diminishing length as well as in diameters.

With the above stated objects in view, our invention consists in the constructions and combinations of parts and the features of the machines substantially as hereinafter described and pointed out in the claims.

Of the accompanying drawings:—

Figure 1 is a plan view of the essential portions of one form of machine embodying our inventions, said figure omitting the frame and parts which are unnecessary to an understanding of said inventions.

Figure 2 is a side elevation of the same.

Figure 3 is a side elevation similar to a portion of Figure 2, on a larger scale.

Figure 4 is a plan view of the parts shown in Figure 3.

Figures 5, 6, 7, 8, 9, 10 and 11 represent sections on the lines having the same numerals in Figure 1.

Figures 12 and 13 are detail sectional and side elevation representations of a slightly different form of carrier belt having a guiding rib at its mid-width.

Figures 14 and 15 are views similar to Figures 1 and 2 but illustrating somewhat different features of construction which are sometimes preferred.

Figure 16 is a plan view of a portion of the machine shown in Figures 14, 15, on a larger scale.

Figure 17 represents a side elevation of the parts shown in Figure 16.

Figures 18, 19 and 20 represent sections on the lines 18—18, 19—19 and 20—20 respectively in Figure 17.

Figure 21 is a view similar to Figure 12 but showing an upper belt guided in a manner similar to the lower belt.

Similar reference characters indicate similar parts in all of the views. That is, where parts shown in Figures 14 to 21 are the same as similar parts shown in Figures 1 to 13, the reference characters are the same.

In practice, the frame of the machine may be of any suitable structure or design. It may be similar to that shown in Letters Patent No. 1,444,347, granted to us February 6, 1923, or it may be of other structure. The machine has pulleys and driving mechanism for one or more lower blank-supporting or carrier belts. When but one lower belt is employed, it is usually quite wide. Two lower belts, which are relatively laterally adjustable, are, however, most commonly employed. In the present machines we employ two such belts. Referring first to Figures 1 and 2, the two lower belts 13, 14, may be driven as illustrated and described in said Patent 1,444,347. As is usual in box folding machines having two blank-carrying belts, the belts 13 and 14 are laterally adjustable to provide for folding blanks of varying widths. Such structure being well known, it is not necessary to illustrate herein means for effecting such adjustment.

The belts 13, 14, run from end to end of the folding machine and their upper stretches travel on rolls 15 which are yieldingly supported as hereinafter described, by cages or bars 16 which are suitably supported by the frame of the machine.

Coacting with the belts 13, 14, for a portion of their length, to ensure forward movement of suitably fed blanks (the direction of movement being indicated by arrows in Figures 1 and 2) are rolls 17 mounted in bars 18 rigidly supported by the frame of the machine. Heretofore it has been customary to yieldingly mount such upper rolls 17 in the bars. For the reasons hereinbefore explained, and referred to hereinafter, neither the bars 18 nor their rolls 17 are capable, in the present machine, of yielding to any material extent. The bars 18 taper at their forward ends, as indicated in Figure 2, and have thin extensions or fingers 19. As shown by comparing Figure 2 with Figures 8 to 11, the rolls carried by the tapering portions of the bars 18 are of successively smaller diameters.

The folding of the blanks is effected by a pair of twist belts 20 mounted on and driven by pulleys 21, 22, and guided in proper paths of travel by idler pulleys 23,

24, which are, in practice, suitably supported by the frame of the machine. As indicated by Figure 2, those portions of the lower runs or stretches of the belts 20 which are beyond the tips of the fingers 19 are so guided by suitably mounted idler rolls 25 as to cause said portions of the belts to bear flatwise on any blanks below them on the main carrier belts 13, 14.

The bars 16 extend from one end to the other of the entire portion of the machine which effects folding of the blanks, and said bars are fixedly mounted as by supporting them on tie rods 26 (Fig. 2). The rolls 15 are located at close intervals throughout the length of each bar 16 which is recessed, as at 27 (Figs. 2 and 3) for each of said rolls.

We will now describe the structure whereby the rolls 15 are caused to exert upward yielding pressure on the stretch or run of each belt 13, 14, running over said rolls. At regular intervals each bar 16 is formed with vertical bores the lower portion of each of which is internally threaded to receive an adjusting screw 28 (Figs. 2, 3 and 5), and the upper end of said screw bears against the lower end of a coiled spring 29 with, preferably, an intervening washer. Between each pair of recesses 27 a crotch 30 is provided, said crotch being, preferably, provided in an upwardly extending portion of the bar 16. Extending across the crotch is a pin 31. Mounted in the crotch is a roll-carrying bar 32, the pin 31 extending through a vertical slot 33 in said bar (see dotted indication, Fig. 3) whereby said bar is capable of tilting or rocking endwise and of moving vertically bodily to a slight but sufficient extent for practical purposes. Interposed between the upper end of each spring 29 and the middle of the lower edge of the bar 32 above said spring is a small flat-faced block 34 which, due to the spring, tends to keep the bar 32 normally in about the position indicated in Figure 3.

Each bar 32 carries four rolls 15, there being a pair at each end with a narrow space between them, the rolls of each pair being mounted to revolve freely on a compound axle stud 35 extending transversely of said bar. Said studs 35 extend through holes in the bar and have heads countersunk within the outer faces of the rolls and serve to prevent said rolls from shifting laterally without adding to the lateral space occupied by said rolls.

In practice, it is preferable that the width of each lower belt 13, 14, shall equal the width or axial length of the pairs of rolls 15 including the narrow space between said rolls. This space is utilized to guide the belt travelling over the rolls 15 instead of providing the rolls with flanges to engage the edges of the belt. To this end, the belts 13, 14, are provided with projections at the mid-width of their inner surfaces. Such projections may consist of studs 36 having tapering ends as indicated in Figure 4, such studs being secured to the belts by rivets 37, or may consist of integral ribs as indicated at 14′ in Figures 12 and 13. By this provision the belts 13, 14, can be run close together side by side, even with their adjacent edges in contact, when very narrow boxes are to be made, such close relationship being impossible when belt-supporting rolls are provided with belt-guiding flanges. The range of the machine is increased by the said provision.

In operation, the belts 13, 14, 20, are driven at uniform speeds as is customary in this type of machine. They travel in the direction of the arrows thereon in Figure 1. In Figures 5 to 11 inclusive, a portion of a blank is indicated by the dotted lines *a*, *b*, each line *a* indicating a portion of the body of the blank held in frictional contact with belt 14 by the rigidly mounted rolls 17, while the line *b* indicates the panel at that side of the blank which is being turned up or "broken" by the belt 20. Of course the panel at the other side of the blank is similarly turned up or "broken". The turning up or "breaking" of the panels from flat outstanding positions to upright or right-angular positions occurs while each blank is travelling from the extreme right in Figures 1 and 2 to a point approximately between the belt-guiding pulleys 23, Figures 5 to 9 inclusive illustrating the action of the inclined portions of the belts 20 during said travel of the blank. Since the rolls 17 are unyieldingly mounted while the rolls 15 are permitted to yield whenever the passage of blanks renders it necessary that the space between the lower carrier belts 13, 14, and the said rolls 17 shall widen, no amount of upward pressure caused by the up-turning of the panels *b* can vary the position of said rolls 17. And since the yielding pressure of the carrier belts is upward, in the same direction as the flap "breaking" pressure and toward something (the rolls 17) which do not yield, such upward pressure of the panels caused by the folding belts 20 can not alter the necessary friction-causing pressure of said carrier belts, which latter are the main elements relied upon to effect control of the blanks throughout the folding operation.

This construction enables the maximum strength to be obtained in a machine occupying a minimum space in width. This is due to the fact that the rolls 17 must, in order to do their work, be located to operate on portions of the blanks inside of or between the score lines of the blanks. If the rolls 17 were mounted to yield, more space would

have to be provided for the springs and co-operating parts required to enable them to yield.

By referring particularly to Figures 8 to 11 inclusive, it will be seen that the rolls 17 toward the tapering ends of the bars 18 are of successively diminishing diameters, and that they are located in a recessed lower edge of the bar, the portion of the bar which supports the axles of the rolls being quite thin. This enables the panel *b* to be turned up on its crease or hinge line exactly under the extreme lower thin edge of the bar 18.

When the side flaps or panels of the blanks pass beyond the upright positions such as indicated in Figure 11, and are then folded in by the portions of the belts 20 running to the delivery end of the machine, the provision of yielding supporting rolls for the lower carrier belts is still advantageous. This is because the rolls 25 must not yield if the belts 20 are to properly fold the panels in, and because few if any such belts are uniform in thickness. With our present structure however, the upward spring-pressure for the rolls 15 along the delivery end of the machine can be adjusted to cause the thinnest as well as the thicker portions of the belts to keep control of the blanks.

In former machines of this general type, some trouble has been experienced in preventing the blanks from slipping, when the machine is run at its highest speed, such slipping often occurring just after the blanks pass beyond the point where the side flaps or panels are turned upright. This is because in such former machines it was impossible to provide for the pressure necessary to prevent slipping at such point and beyond. With our present structure, however, whether there are two lower belts 13, 14, or but one lower belt of any desired width, the necessary pressure can be obtained by the springs 29, in an upward direction, at all points of the machine from one end to the other. Furthermore, no stationary plates, or shoes, or formers, are necessary in order to effect proper "breaking" or complete folding of the blanks accurately on their crease lines.

While it is preferable that the rolls 15 of each pair shall be mounted to freely rotate independently of each other, we do not limit ourselves thereto, as they might be rigidly connected together, or integral, thereby practically forming a roll with a peripheral groove for the mid-width guiding rib of the belt running on such rolls. Such rib may be continuous, as in Figures 12 and 13, or interrupted as in Figures 2, 3 and 4.

While it is preferable, for the reasons hereinbefore mentioned, to provide rolls 15 having no flanges, we do not limit ourselves strictly thereto since in machine requiring no close adjustment of the belts 13, 14, toward each other, said rolls might have flanges as heretofore, without interfering with the advantages inherent in other features of our improved machine.

In Figures 14 to 21 inclusive, we illustrate a machine in which the parts having the same reference numerals as those used in Figures 1 to 13 are, or may be, the same as in the machine hereinbefore described. The chief difference lies in the fact that while in Figures 1 and 2 the rolls 17 bear directly on the blanks carried by the belts 13, 14, in a machine constructed as illustrated by Figures 14, 15, upper carrier belts 40 are employed, said belts being mounted on suitably driven pulleys 41, 42, and their lower stretches running under rolls 17^a mounted on axles supported by bars 18^a, said belts 40 and rolls 17^a extending along that portion of the machine where the blanks are "broken" or first turned up by the folding belts 20.

Preferably the rolls 17^a are arranged in pairs (Fig. 21) slightly spaced to admit between them a rib 40′ of the belt 40 whereby said belt, or each of them is guided in the manner hereinbefore described in connection with Figure 12 and the belt 14.

Since the rolls 17^a can not yield, the belt 40 also is practically unyielding, such yielding as the machine possesses being provided for solely by the spring mounted rolls 15 over which the lower carrier belts run.

Another feature of difference between the machines illustrated by Figures 1, 2 and Figures 14, 16, resides in the structure of the tapering portions of the upper roll-supporting bars and the rolls mounted therein, such difference being clearly shown by comparing Figures 16 to 20 inclusive with Figures 5 to 11 inclusive. The preferred structure is illustrated by Figures 16 to 20 inclusive, in which the portion of the bar 18^a beyond the upper belt 40 not only tapers as to its vertical height, but is also gradually cut away or reduced in width, the rolls 17^b which are mounted on axles supported by said bar being of successively lesser diameters and lengths so that the twisted folding belt 20^a can more directly, or in a lesser length of travel, fold the blank partly over the tops of the tapering bars.

Having now described our invention, we claim:

1. A machine for folding blanks having a yieldingly-supported lower carrier belt, unyielding means in position above and coacting with said belt to effect travel of the blanks, and folding instrumentalities for acting on the blanks while travelling.

2. A machine for folding blanks having a series of lower yieldingly mounted rolls, a parallel series of upper unyieldingly

mounted rolls, and an endless blank carrier having its operative stretch running between said upper and lower series of rolls.

3. In a folding machine having upper and lower blank-forwarding belts, means for guiding the cooperating stretches of said belts to cause them to grip and forward the blanks, the said guiding means for the lower belt being yieldable.

4. In a folding machine having upper and lower blank-forwarding belts, means for guiding the cooperating stretches of said belts to cause them to frictionally forward the blanks, the said guiding means for the lower belt comprising yieldingly-mounted rolls.

5. In a machine for folding blanks, upper and lower coacting belts for causing the blanks to travel and yieldingly-mounted rolls for supporting the upper stretch of the lower belt.

6. In a machine for folding blanks, upper and lower cooperating belts for causing the blanks to travel, yieldingly-mounted rolls for supporting the upper stretch of the lower belt, and unyieldingly mounted rolls for guiding the lower stretch of the upper belt.

7. In a machine for folding blanks, an endless carrier extending from the entrance to the delivery end thereof, means for yieldingly supporting the operative portion of said carrier, and means for folding blanks while travelling with said carrier.

8. In a machine for folding blanks, an endless carrier extending from the entrance to the delivery end thereof, means for yieldingly supporting the operative portion of said carrier, blank-folding belts cooperating with said carrier, means for guiding portions of said belts in an inclined direction, and unyieldingly-mounted rolls above said carrier alongside of the inclined portions of said belts.

9. In a machine for folding blanks, an endless blank-carrier, means for yieldingly supporting the operative portion of said carrier, a pair of twist belts cooperating with said carrier, a pair of rigidly-supported bars extending alongside portions of said belts, and rolls unyieldingly-mounted in said bars above the carrier.

10. In a machine for folding blanks, a pair of elongated rigid supports, a series of short bars yieldingly mounted in said supports, a plurality of rolls carried by each of said bars, blank-carrying belts mounted on said rolls, and blank-folders cooperating with said belts.

11. In a machine for folding blanks, a pair of elongated rigid supports, a series of short bars yieldingly mounted in said supports, a pair of rolls carried by each end of each of said bars, blank-carrying belts mounted on said rolls, and blank-folders cooperating with said belts.

12. In a machine for folding blanks, a pair of elongated rigid supports, a series of springs mounted in said supports, a bar above each spring and free to rock or tilt endwise, rolls carried by said bars, blank-carrying belts mounted on said rolls, and blank-folders cooperating with said belts.

13. In a machine for folding blanks, a series of spring-supported rolls, an endless blank-carrier running over said rolls, means for adjusting the upward pressure exerted by the springs of said rolls, a parallel series of upper unyieldingly-mounted rolls in position to bear on portions of the blank-carrier, and folding belts for acting on blanks supplied to said carrier.

14. In a machine for folding blanks, a yieldingly-supported lower carrier, a rigidly-supported bar above and extending lengthwise of said carrier, a series of rolls of successively diminishing diameters carried by said bar, and means for folding blanks travelling between said carrier and series of rolls.

15. In a machine for folding blanks, a yieldingly-supported lower carrier, a rigidly-supported bar above and extending lengthwise of said carrier, said bar having a recess in one side of its lower edge, a series of rolls mounted in the recessed portion of said bar, and means for folding blanks travelling between said carrier and series of rolls.

16. In a machine for folding blanks, an endless carrier having a rib projecting from its inner surface, a series of supporting rolls each having a peripheral space to receive said rib to prevent lateral displacement of the carrier, and means for folding blanks actuated by said carrier.

17. In a machine for folding blanks, a pair of blank-carrying belts having projections from their inner surfaces, supporting rolls having peripheral spaces for said projections, and means for folding blanks actuated by said belts.

18. In a machine for folding blanks, a pair of blank-carrying belts having projections from their inner surfaces, a series of pairs of yieldingly-mounted supporting rolls for each belt, the rolls of each pair being spaced a distance substantially equal to the width of said projections, and means for folding blanks actuated by said belts.

19. In a machine for folding blanks, an endless lower carrier, a tapering bar above and extending lengthwise of said carrier, a series of rolls of successively diminishing lengths carried by said bar, and means for folding blanks travelling between said carrier and series of rolls.

20. In a machine for folding blanks, an

endless lower carrier, a bar above and extending lengthwise of said carrier, said bar tapering in vertical and lateral thickness, a series of rolls of successively diminishing lengths and diameters carried by said bar, and means for folding blanks travelling between said carrier and series of rolls.

21. In a machine for folding blanks, upper and lower coacting blank-carrying belts having projections from their inner surfaces, supporting or guiding rolls having peripheral spaces for said projections, and means for folding blanks actuated by said belts.

In testimony whereof we have affixed our signatures.

LEON E. LA BOMBARD.
MELVIN H. SIDEBOTHAM.