WEB CORNER BOX SETTING UP MACHINE AND METHOD


Application March 21, 1952, Serial No. 277,863

13 Claims. (Cl. 93—53)

This invention relates to a machine and method for setting up rectangular box blanks of the type having infolded doubled side walls, flat double end walls and flat webbed corners.

One of the objects of my invention is to provide a machine and method for setting up such blanks, while the blanks are continuously advancing along a paper line at high speed and in a straight line.

Another object of my invention is to provide novel means for unfolding the walls of such blanks that are transverse to the direction of motion while the blanks are continuously advancing.

A further object of my invention is to provide improved means for prefolding and unfolding the end wall and corner web portions of the blanks, on lines of articulation parallel to the direction of motion and to utilize such means for holding the blank down on the conveyor.

Another object of my invention is to provide means for positively infolding each corner web while the side and end walls are being cooperatively unfolded.

Still further objects of the invention are to provide improved means for down folding the terminal portion of each double end wall into doubled, position between the unfolded side walls and to provide setting up mechanism which is completely rotary and capable of accommodating a wide range of blank sizes and shapes.

In the drawings,
Fig. 1 is a side elevation of my new machine.
Fig. 2 is a perspective view of a blank from which the setup box is folded.
Fig. 3 is a perspective view of the blank after the prefolding operation.
Fig. 4 is a plan view of the machine illustrated in Fig. 1.
Fig. 5 is a perspective view of the blank after the side and end walls have been unfolded and the terminal portions of the end walls have been turned in.
Fig. 6 is a perspective view of the box setup from the blank with terminal portions of the double end wall in locking position.
Figs. 7 to 13 are fragmentary end views in section on Fig. 1 showing the various folding stages of my machine.
Fig. 14 is an enlarged fragmentary view, in section, showing the infolding of the corner webs of the blank during the unfolding of the side and end walls thereof.
Fig. 15 is a perspective view showing the cooperative relationship of my end wall and side wall unfolding means.
Fig. 16 is a side elevation in section of the side wall unfolding means of my device.
Fig. 17 is a perspective view of a prefolding unit of my device showing the inner and outer elongated folder bars thereof.
Fig. 18 is a fragmentary side elevation of one of the rotating arcuate folder heads and Fig. 19 is a fragmentary side elevation of the other rotating arcuate folder head of a rotating downfolding unit of my device.

As best shown in Fig. 2, the blank A from which the setup box of Fig. 6 is folded, has infolded doubled side walls 21 and 22, flat double end walls 23 and 24, and flat corners webs 25, 26, 27 and 28. Blank A has a flat bottom wall 20 and each double end wall may have a dust flap 29 or 30 to assist in locking the same in position between the unfolded side walls when the box is set up. It will be obvious that locking tabs and tab slots of various types well known in the art, for example, the tab 930 and slot 931 shown in dotted lines in Fig. 2, may be used if desired.

To use tab 930 and slot 931 the dust flap 29 and 30 would be eliminated. It will be also obvious that a cover 32 may be articulated to a side wall such as 22 or 21, if desired, as shown also in dotted lines in Fig. 2, the cover not interfering with the operation of my device because it is bent backwardly and trailing flatwise behind the advancing blank A.

Each double end wall 23, 24 of a blank A includes a base portion 35, 36 and a terminal portion 37, 38 and each corner web 25, 26, 27 and 28 includes a side wall segment or half 40, 41, 42 and 43 and an end wall segment or half 44, 45, 46 and 47.

The base portions 35, 36 of end walls 23, 24 are articulated to bottom wall 20 on crease or score lines 50, 51, the terminal portions 37 and 38 are articulated to base portions 35 and 36 on score or crease lines 52 and 53 and locking flaps 29 and 30 are articulated to terminal portions 37 and 38 on crease or score lines 54 and 55. Each corner web such as 25 has a diagonal crease or score line 56 while the side wall segment 40 is articulated to side wall 21 on score or crease line 57 and the end wall segment 44 is articulated to the base portion 35 of end wall 23 on a score or crease line 58. Side walls 21 and 22 are articulated to bottom wall 20 on score or crease lines 59 and 60 and suitable cut outs, slits or tabs may also be used on the webs or walls of blank A all well known in the art and forming no part of this invention.

Blank advancing means

As best shown in Figs. 1 and 4, my folding machine includes a rigid frame B, having horizontal support members 100, legs 101, a motor support 102 and a motor 103. A pair of endless chains 104, 105, each having spaced, upstanding lugs 105 are powered by suitable power connections 106, well known in the trade, from motor 103. The upper stretches 107, 107 of chains 104 extend horizontally along the paper line P from the blank feeding device C to the discharge or delivery end H of frame B. The blank feeding device C may be of any well known type which will feed individual blanks A successively onto carrier chains 104 to be engaged by lugs 105 and conveyed along paper line P. As illustrated herein, feeding device C includes a magazine 807 and a reciprocating slide 108 arranged to repeatedly slide the lower blank from under the blank stack in the magazine and forwardly onto the lugs 105. Slide 108 is actuated by an arm 109, the arm 109 being actuated by a cam 110 and returned to position by a spring 111. A tensioning member 112 is provided for each chain 104 and adjacent the upper stretch 107 of each chain 104 I provide a narrow supporting plate 113, 114 (see Fig. 7) extending the full length of the paper line P as well as a shorter and wider plate 115 intermediate of the chains 104. Above plate 115, I provide a plurality of aligned hold down rollers 116 which cooperate with plate 115 to hold the blank down on the chains 104 during the prefolding operation.

The feeding device C is arranged to receive a stack of blanks such as A, in the form best shown in Fig. 2, the doubled side walls 21 and 22 being infolded over the flat bottom wall 20 and the double end walls 23 and 24 extending flatwise from bottom wall 20. Each blank A is thus positioned to be individually and successively fed to the lugs 105 of chains 104 with the doubled side walls 21

2,753,770

Patent No. 2,753,770

Patented June 10, 1956
and 22 transverse to the paper line P and to the direction of motion of the blank through the machine. The lines of articulation 50, 51, and 52 and 53 of the base and terminal portions 35, 36, 37, and 38 of each double end wall 23 and 24, as well as the line of articulation such as 57 of each side wall segments 40, 41, 42, and 43 of each corner web are thus parallel to the direction of motion of a blank A along paper line P.

Operating mechanism

The preforming means D of my mechanism is best shown in Fig. 8 and includes a pair of stationary elongated preforming units 200 and 201, each mounted on an opposite side of paper line P on frame members 202, 203 fixed to frame B. Rods 204, 205 extend inwardly from brackets 202, 203 to overhang the path of the double end walls 23, 24 of blanks A as they advance along the paper line. Each preforming unit such as 200, includes what I call an inner folder bar 206, and an outer folder bar 209, both such bars being carried by depending arms such as 210, 211 adjustable in location on rod 204 by set screws 212, 213. As shown in Fig. 8 inner folder bar 208 is positioned to engage the upper surface of the base portion 35 of a double end wall such as 23 and outer folder bar 209 is positioned to engage the lower surface of the terminal portion 37 of double end wall 23.

As best shown in Figs. 15 and 17, inner folder bar 208 is shaped to gradually prefold base portion 35 and side wall segments 40 and 41 downwardly on the lines of articulation 50 and 57 and then to release the same to assume approximately their normal horizontal or flatwise positions. At the same time, the outer folder bar 209 is shaped to gradually prefold terminal portion 37 upwardly on its line of articulation 52 and then to release the same. Rollers 116 serve to hold the blank down on the paper line during this preforming operation and to prevent any buckling of blanks such as A in the centre.

The initial downward preforming of the side wall segments 40 and 41 on lines such as 57 is of particular importance in the later folding stages of my mechanism since upon raising side walls 21 and 22, the corner webs 25 and 26 tend to easily and properly assume their infolded position rather than opposing the raising of the blank walls. In Fig. 3 I have shown a blank A which has been prefolded by being advanced through the preforming means D on chains 104, the folds being somewhat exaggerated for the purpose of illustration.

End wall upfolding means

The end wall upfolding means E of my mechanism is best shown in Figs. 9, 10, 11, 14 and 15 and includes a pair of stationary, elongated upfolding units 300 and 301 each mounted on an opposite side of the paper line P. Each upfolding unit such as 300, includes a pair of what I call outer elongated folder guides 302 and 304 as well as an inner elongated hold down bar 305. Guide 302 is preferably an elongated angle iron commencing at the level of the undersurface of terminal portion 37 of a double end wall 23 and gradually rising as it extends diagonally of the paper line P to terminate above the path of the line of articulation 50. As terminal portion 37 is advanced along the guide 302, it is thus gradually upfolded on its line of articulation 52 and then turned in to a position substantially parallel to bottom wall 20. Guide 302 is suspended at the lower end of an element 307 which in turn is adjustable positioned by means of a set screw 309 from a rod 309 carried by a bracket 310 on frame B.

Guide 304 is also preferably an elongated angle iron which commences on a horizontal plane at the level of the undersurface of base portion 35 of a double end wall such as 23 and gradually twists until it is on a vertical plane at right angles thereto, thus defining the path of portion 35 as it upfolds on its line of articulation 50. To prevent friction, I prefer to insert between guide 304 and base portion 35 an endless belt 303, trained around pulleys 312, 313 and 314 and traveling at the same speed as blanks A. When a belt such as 303 is used, guide 304 acts as backing strip therefor and the strip and belt together assist guide 302 in upfolding and raise the end wall such as 23 or 24. Each guide 304 is fixed in position on frame B by means of brackets 316 and bolts 317.

The inner hold down bars 305 of my end wall upfolding units, together with the preforming of the side wall segments of the corner webs, both tend to produce a positive infolding of the corner webs. Each bar 305 is mounted at the lower end of a member 320 which in turn is adjustably positioned by means of a set screw 321 on rod 309. Hold down bar 305 is shaped and positioned to engage the end wall segments 44 and 45 of corner webs 25 and 26 close to the line of articulation 52 and without interfering with the infolding of the corner webs on their diagonal lines of articulation. As the outer folder guides 302 and 304 gradually upfold a double end wall such as 23 of each blank A, bar 305 continues to hold the end wall segments 44 and 45 flatwise against the base portion 35 thereof. As will be explained below, and as shown particularly in Figs. 15, this hold down action, occurring cooperatively with the webs also being upfolded, assures a positive infold of the corner webs.

Side wall upfolding means

The side wall upfolding means F of my mechanism is arranged to travel along the paper line P with each blank A rather than being fixed or stationary as are the preforming means D and the end wall upfolding means E. As best shown in Figs. 15 and 16 upfolding means F includes a pair of endless chains or carrier 400 each trained around sprockets such as 401 and 402 which are rotatably mounted on shafts 403 and 404 journaled in frame pieces 406, 407, 408, and 409. I may use only one such chain 400 but, as shown, I prefer to use two chains each positioned on an opposite side of the longitudinal centre line of paper line P.

Spaced around each chain 400, I provide a plurality of pairs of expandable fingers 420, 430, each pair being pivotally mounted at 422 to a link 423 of chain 400. Finger 420 has an outwardly curved lower tip 424 and at its upper end is provided with a short extension 425 upon which a roller 426 is mounted. A stop member 427 is also provided proximate the pivot 422 to prevent excess movement of the finger 420 by contacting chain 400. Similarly each finger 430 is provided with a curved lower tip 434, an extension 435, a roller 436 and a stop member 437. Intermediate of the chain 400 and between sprockets 401 and 402 I provide a roller track 440 having a curved portion 441 and two adjustably mounted straight portions 442 and 443 and I also provide an outer roller track 445 around sprocket 401.

The chains 400 are mounted above the paper line P and extend along and between the end wall upfolding units 300 and 301 of end wall upfolding means E. Each chain 400 is synchronized to carry a pair of expandable fingers 420 and 430 around sprocket 401 and down between the infolded side walls 21 and 22 of each blank A just as the folding units 300 and 301 commence to raise the end walls of the advancing blank. Roller tracks 440 and 445 which comprise members 442 and 443 of track 440 gradually expand the fingers 420 and 430 thus causing them to cooperatively raise the side walls 21 and 22 with the end walls 23 and 24.

As shown in Fig. 4, hold down bar 305 holds the
2,753,770

end wall segments 44 and 45 of the corner webs 25 and 26 flatwise against the base portion 35 of an end wall such as 23, while the side wall segments 40 and 41 are lifted thereby. By the raising of the infolding walls 21 and 22 thus causing the corner webs to positively infold on their diagonal lines of articulation such as 56. The prefolding downwardly of each side wall segment of the corner webs on their lines of articulation such as 57 is of great assistance in producing the desired corner web infold. After expanding sufficiently to raise the side walls to a vertical position, the fingers 420 and 430 continue up and around sprocket 402 to continue their cycle of operations. As shown in Fig. 5 and Fig. 11, the cooperative action of the stationary end wall upfolding means E and the traveling side wall upfolding means F thus results in each advancing blank A having its infolded side walls upfolded, its corner webs infolded, the base portion of the double end walls upfolded and the terminal portion of the double end walls turned in parallel to bottom wall 20.

Rotating down folding means

As best shown in Figs. 12, 13, 18 and 19 my rotating down folding means G comprises a pair of rotating down folding units 500, 550 each unit 500 comprising a pair of arcuate folding heads 502, 503 rotatingly mounted on a shaft 504 and each unit 550 comprising a similar pair of arcuate folding heads 552, 553 rotatably mounted on a shaft 554. Shafts 504 and 554 are journaled in upstanding frame pieces 98 and 99 on opposite sides of paper line P so that the shafts are above end transverse to the paper line P. Each arcuate folding head 502, 503, 552, 553 and 553 thus rotates in a vertical plane above the paper line P. The folding heads 502, 503, of down folding unit 500 are each positioned inwardly on their shaft 504 whereby they will engage an inturned terminal portion 37 or 38 of a double end wall 23 or 24 in an intermediate portion thereof. I provide a disc such as 566, 607 upon which radially extending and oppositely disposed arms 508, 509, 510 and 511 are mounted each arm carrying a folding head such as 502 or 503. The radial length of the arc of arcuate heads 502 and 503 is less than the distance to paper line P so that each folding head engages and forces a terminal portion 37 downwardly only part way between the side walls 21 and 22 of each blank A.

The folding heads 552, 553 of downfolding unit 550 are equally positioned outwardly on their shaft 554 to contact each inturned terminal portion 37 or 38 of a double end wall 23 or 24 nearer to their lines of articulation 52 or 53. Similar discs 556, 557 and arms 558, 559, 560 and 561 are provided in unit 550 each arm carrying an arcuate folding head such as 552, 553. The radial length of the arc of each arcuate folding head 552 or 553 is greater than that of heads 502, 503 whereby the heads 552 and 553 force the terminal portions 37 or 38 of end walls 23 or 24 into locking position flatwise over the corner webs and against the base portions 35. Heads 552 and 553 also fold the locking or dust flaps such as 29 or 30 on their lines of articulation 54 and 55 against the bottom wall 20, thus completing the setting up of the type of box made from blanks such as A, as shown in Fig. 6. I may provide a hold down member 600 to hold the turned in terminal portions 37 or 38 of each end wall 23 or 24 in turned in position between the upfolding means E and F and the down folding means G, and it should be noted that the belt 303 may travel with each blank through down folding means G thus helping the guide 304 to hold the end walls 23 and 24 in upfolded position.

1. A machine for setting up rectangular box blanks, each blank having infolded doubled side walls, flat double end walls and flat webbed corners, said machine comprising means for continuously advancing said blanks through the machine and mechanism operating automatically and successively on said blanks while so advancing, said mechanism including stationary, elongated, pre-folder bar means for pre-folding the double end walls and corner webs of each blank, stationary elongated, folder guiding means, stationary, elongated, hold-down bar means and traveling expandable finger means for cooperatively upfolding the side walls, upfolding the double end walls, turning in the terminal portions of said end walls and infolding the corner webs of each blank and rotative means in tandem for down folding units and positioned on one side wall web of each double end wall over its adjacent web corners into locking position between said upfolded side walls.

2. A machine for setting up rectangular box blanks each blank having infolded doubled side walls, flat double end walls and flat webbed corners, said machine comprising means for continuously advancing said blanks through the machine and mechanism operating automatically and successively on said blanks while so advancing, said mechanism including a pair of stationary, elongated pre-folder units each shaped and positioned to prefold a double end wall and the corner webs adjacent thereto; a pair of stationary, elongated, upfolded pre-folded and positioned to upfold an end wall while turning in the terminal portion thereof; a pair of stationary, elongated hold-down bars for holding the adjacent end wall corner web segments against said end walls during said upfolding; a traveling upfolding unit and including a plurality of pairs of expandable fingers, each pair mounted to advance above and with each blank and operable to upfold the infolded doubled side walls thereof in cooperation with said pair of stationary upfolding units and said pair of hold down bars and a pair of rotating downfolding units, each pair including a pair of arcuate folding heads and each head shaped and positioned to down fold the terminal portion of a double end wall over its adjacent web corners, into locking position between said side walls.

3. In a machine for setting up rectangular box blanks each blank having infolded doubled side walls, flat double end walls and flat webbed corners, as said blanks continuously advance along a paper line with their side walls transverse thereto the combination of stationary pre-folding means comprising a pair of stationary elongated pre-folding units, each pre-folding unit positioned on an opposite side of said paper line and adapted to prefold the longitudinal lines of articulation of a double end wall and of the webbed corners adjacent thereto; stationary end wall upfolding means comprising a pair of stationary, elongated, upfolding units, each upfolding unit positioned on an opposite side of said paper line and adapted to upfold a double end wall and turn in the terminal portion thereof, while holding the adjacent end wall web segments thereagainst; traveling side wall upfolding means, positioned above said upfolding units and adapted to upfold said infolded doubled side walls in cooperation with the upfolding of said end walls by said upfolding units and rotating down folding means comprising a pair of rotating down folding units, each down folding unit positioned on an opposite side of said paper line and adapted to down fold the terminal portion of a double end wall over its adjacent web corners into locking position between said side walls.

4. The machine defined in claim 3 in which each stationary pre-folding unit comprises an inner folder bar shaped and positioned to pre-fold downwardly the base portion of a double end wall and the side wall segments of the corner webs adjacent thereto on their longitudinal lines of articulation and an outer folder bar shaped and positioned to simultaneously pre-fold upwardly the terminal portion of said double end wall on its longitudinal line of articulation.

5. The machine defined in claim 3 in which each stationary elongated upfolding unit comprises a pair of elongated outer folder guides shaped and positioned to slidably upfold the base portion of a double end wall.
and to slidably turn in the terminal portion of said end wall and an elongated inner hold down bar shaped and positioned to slidably hold the end wall segments of the corner webs adjacent to said base portion against said base portion during said unfolding and turning-in operations.

5. The machine defined in claim 3 in which said traveling upfolding means comprises an endless chain, a plurality of pairs of expandable fingers pivotally carried by said chain, and means for expanding each pair of fingers against the infolded double side walls of a blank, thereby upfolding the same, in synchronization and cooperation with said end wall upfolding means.

6. The machine defined in claim 6 in which the means for expanding each pair of fingers includes an arm and roller cam fixed to each finger and an elongated roller cam track associated with the lower stretch of said endless chain, said track extending substantially the length of said stationary end wall upfolding units.

7. The machine defined in claim 3 in which each rotating downfolding unit comprises an arm rotatably mounted, above said paper line, to revolve in a plane perpendicular thereto and an arcuate folding head, carried by said arm, said head being arranged to engage a turned-in terminal portion of a double end wall and push said terminal portion downwardly between the upfolded side walls as the blank advances horizontally beneath the circular path of said head and arm.

8. Apparatus for use in setting up rectangular box blanks, each blank having infolded side walls, said apparatus comprising blank advancing means including a conveyer for continuously advancing blanks individually and successively along a paper line with said infolded side walls transverse thereto and side wall upfolding means including an endless chain mounted independently of said blank conveyer, above and parallel to said paper line; a plurality of pairs of expandable fingers pivotally carried by said chain and cam means for expanding each pair of said fingers to unfold the infolded side walls of a blank while advancing therewith.

9. Apparatus for use in setting up rectangular box blanks, each blank having unfolded double side walls and upfolded double end walls with the terminal portion of said double end walls turned inwardly, said apparatus comprising blank advancing means including a conveyer for continuously advancing blanks individually and successively along a paper line with said upfolded side walls transverse thereto and downfolding means, mounted to rotate above said paper line, said downfolding means including a pair of revolving downfolding units each positioned to engage and downfold the terminal portion of a double end wall into doubled position between said upfolded side walls.

10. Apparatus for use in setting up rectangular box blanks, each blank having infolded double side walls, flat double end walls, and flat webbed corners, said apparatus comprising blank advancing means including a conveyer for continuously advancing blanks individually and successively along a paper line with said infolded side walls transverse thereto, and means for automatically and simultaneously raising the walls and infolding the web corners of each advancing blank, said last named means comprising a pair of fixed elongated end wall upfolding guides each shaped and positioned to upfold an end wall; a pair of fixed, elongated, corner web hold down bars each shaped and positioned to infold the corner web portions articulated thereto, and a traveling side wall upfolding unit, said unit including an endless chain mounted independently of said blank conveyor, above and parallel to said paper line, a plurality of pairs of expandable fingers, pivotally carried by said chain, and cam means for expanding said fingers to upfold said side walls in synchronization and cooperation with the upfolding of said end walls by said fixed end wall upfolding guides.

11. Machine for setting up rectangular box blanks each blank having infolded double side walls, flat double end walls and flat webbed corners said machine comprising means for continuously advancing said blanks along a path through the machine with the infolded double side walls transverse to the direction of motion and mechanism operating automatically and successively on said blanks while so advancing, said mechanism comprising means along the path of said continuously advancing blanks for prefolding the double end walls and corner webs on lines of articulation parallel to the direction of motion; means along the path of said continuously advancing blanks for simultaneously upfolding the infolded side walls, upfolding the double end walls, infolding the corner webs and turning in the terminal portion of the double end walls and means along the path of said continuously advancing blanks for downfolding said terminal portions into doubled position between the upfolded side walls.

12. A method of setting up a box from a blank having a bottom panel, infolded double side walls, flat double end walls and flat webbed corners which method comprises the steps of simultaneously applying downward pressure on the base portion of each end wall and upward pressure on the terminal portion of each end wall to prefold the end wall together with a segment of said webbed corners; then simultaneously applying outward pressure on each double side wall to erect the same, applying inward pressure on the base portion of each end wall to erect the same, applying inward pressure on the terminal portion of each end wall to turn the same in at right angles to said erected base portion and applying outward pressure on the corner web segment adjacent each base portion to cause a positive infold on the corner web and then applying downward pressure on each terminal portion of each end wall to interlock the same between the erected side walls and flatwise against the base portion of a side wall, said three steps being successively accomplished in separate zones along a horizontal path while said blanks are continuously moving therealong supported only under the bottom panels thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

1,784,571 Bergstein 1,974,408 Bergstein 2,125,147 Bergstein 2,217,904 Bergstein 2,331,670 Desch et al. 2,441,372 Quigley et al. 2,491,251 Perilli

1,784,571 Bergstein 1,974,408 Bergstein 2,125,147 Bergstein 2,217,904 Bergstein 2,331,670 Desch et al. 2,441,372 Quigley et al. 2,510,251 Perilli

Dec. 9, 1930 Sept. 25, 1934 July 26, 1938 Oct. 8, 1940 June 20, 1944 May 11, 1948 June 6, 1950