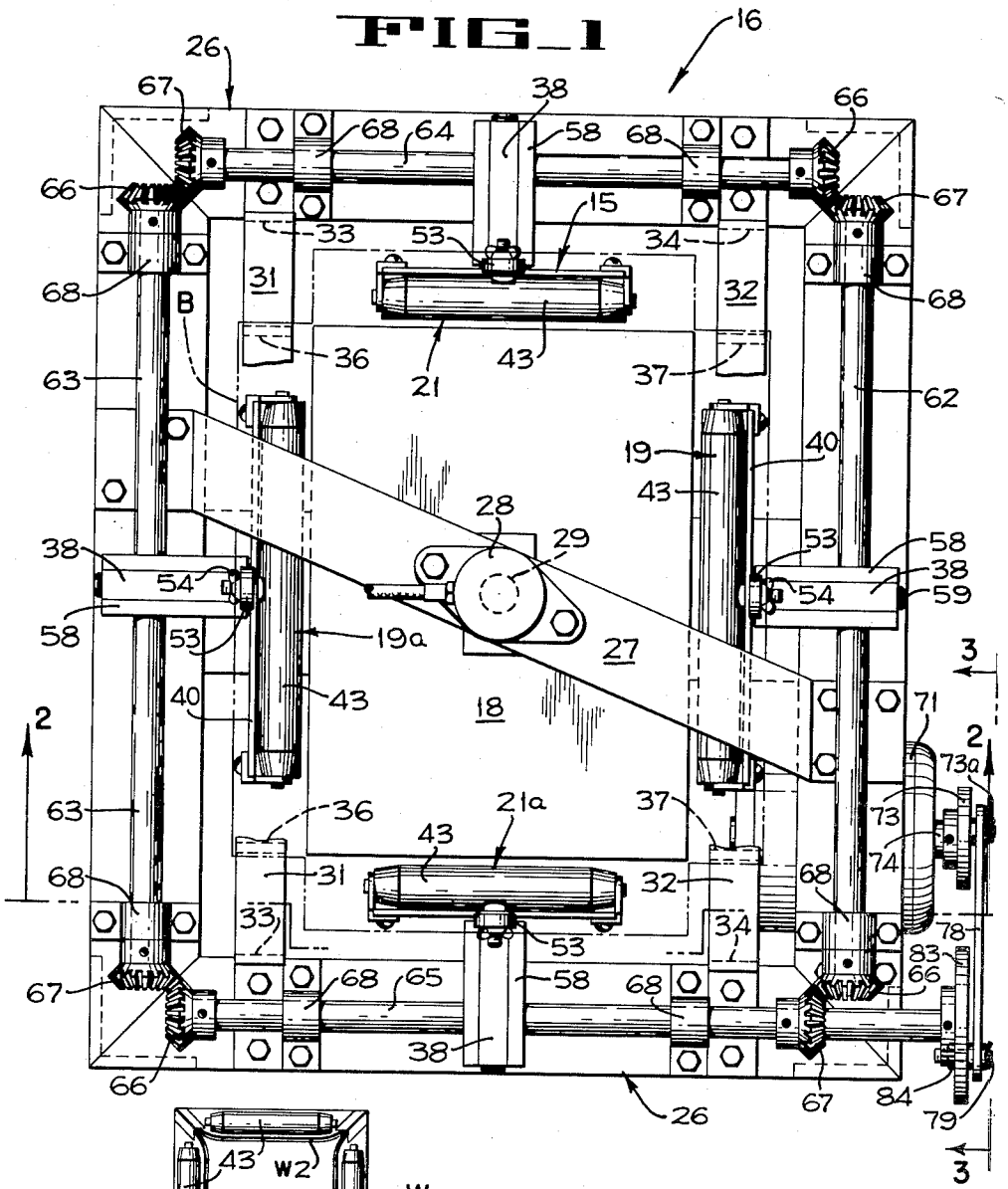
Sept. 3, 1963 E. A. BAILEY 3,102,456

BOX FORMING AND CRIMPING APPARATUS

Filed Jan. 22, 1962 3 Sheets-Sheet 1

FIG_1



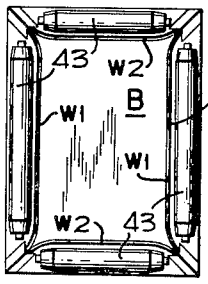


FIG_10

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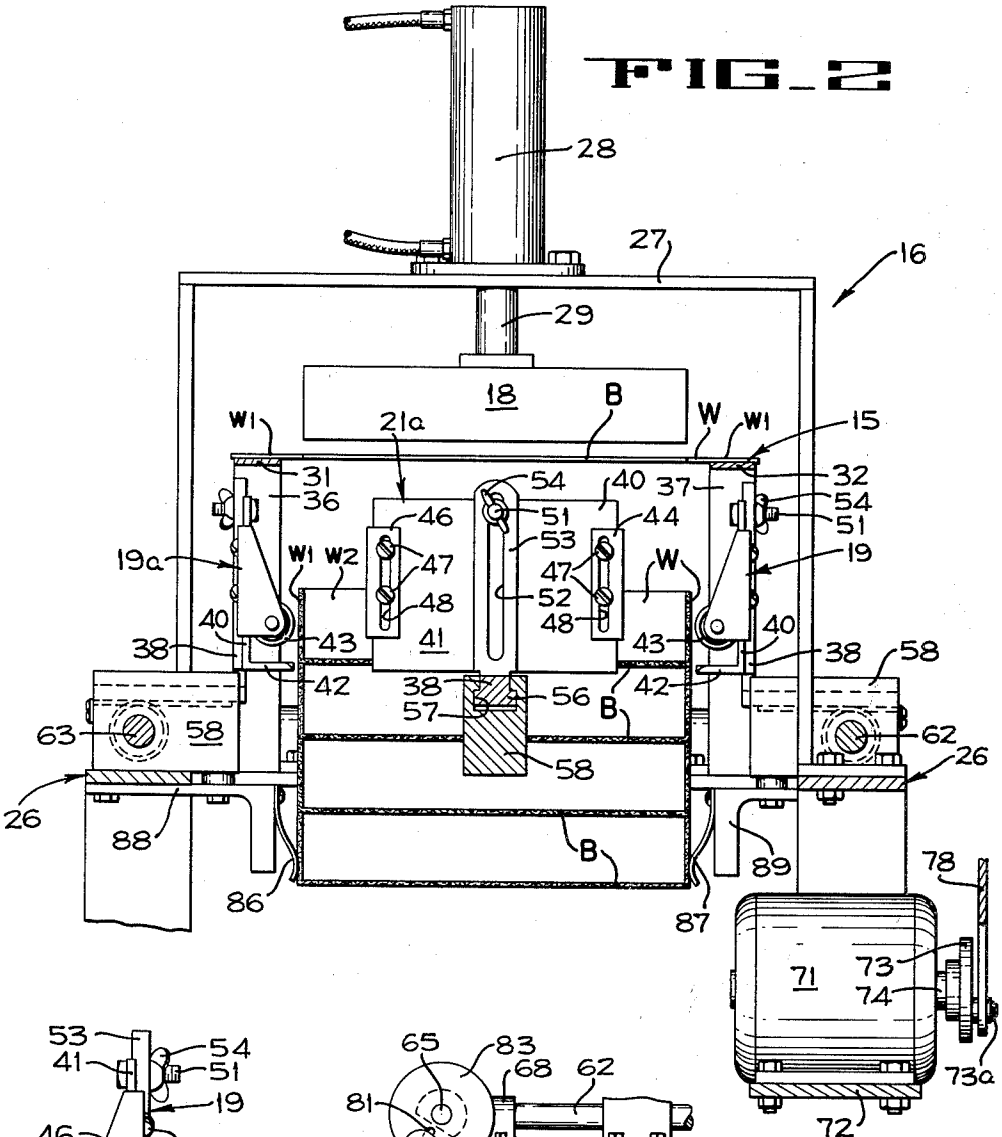
ATTORNEY

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BOX FORMING AND CRIMPING APPARATUS

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FIG_2



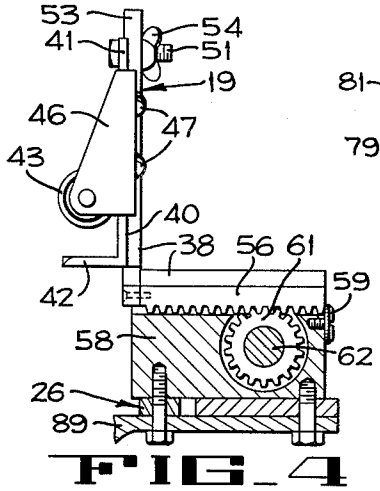


FIG_4

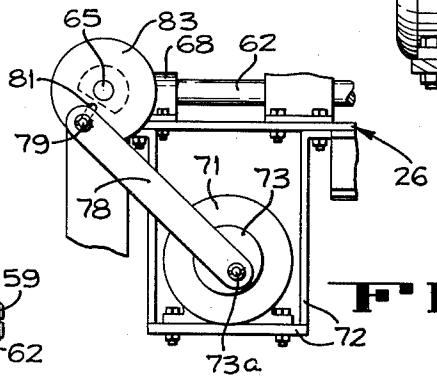


FIG_3

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BOX FORMING AND CRIMPING APPARATUS

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FIG_5

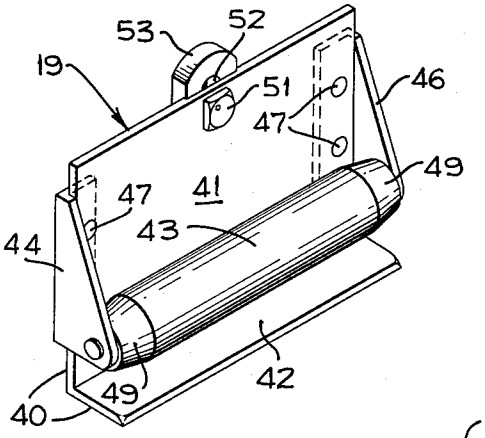


FIG_6

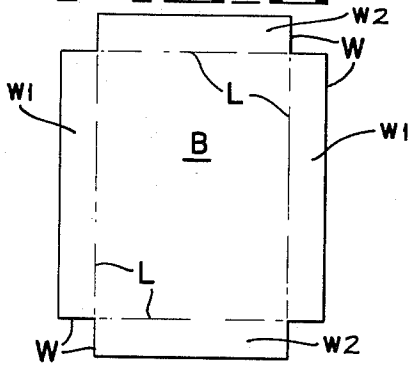


FIG_7

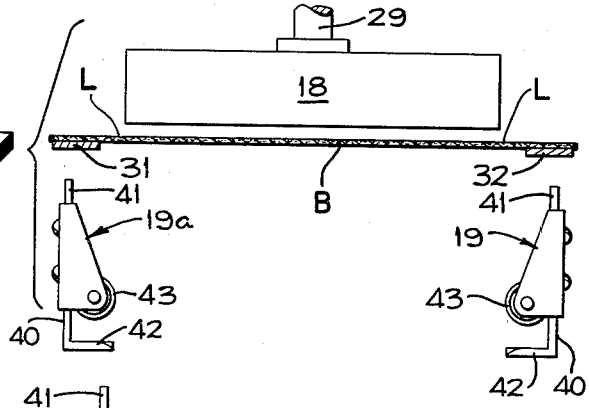


FIG_8

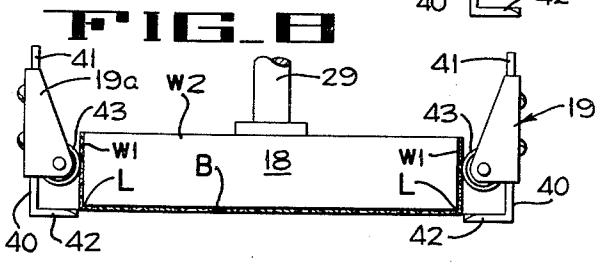
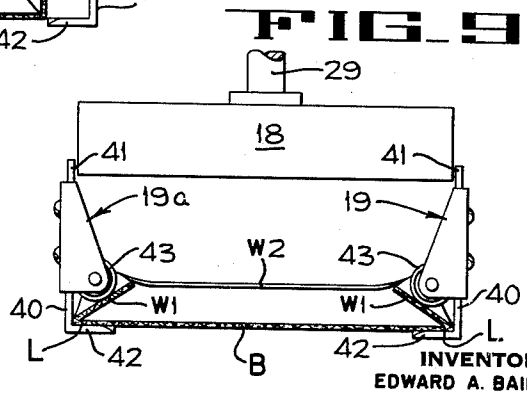


FIG_9



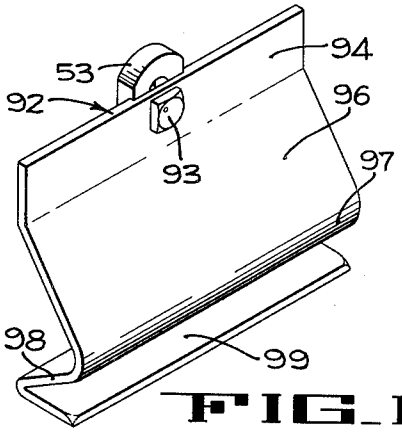


FIG_11

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United States Patent Office 3,102,456
Patented Sept. 3, 1963

3,102,456
BOX FORMING AND CRIMPING APPARATUS

Edward A. Bailey, Contoocook, N.H., assignor to FMC Corporation, San Jose, Calif., a corporation of Delaware

Filed Jan. 22, 1962, Ser. No. 167,781
14 Claims. (Cl. 93—41)

The present invention pertains to box forming and staying machines and more particularly relates to an apparatus for forming and crimping boxes made of paperboard or the like.

The type of box forming machine with which the forming and crimping apparatus of the present invention is associated is of the type disclosed in the United States Letters Patent No. 1,383,697 of Charles C. Davis, dated July 5, 1921. This type of machine receives paperboard blanks, folds side and end panels of the blank upward to form walls, and applies an adhesive paper, fabric, or plastic "stay" strip to each corner to form rigid upstanding corners. Because the paperboard blanks are quite resilient, the upper peripheral edges of the walls of the so formed box tend to bow outwardly. Accordingly, after the above mentioned operations have been completed, it is necessary to over-bend or crimp the walls inward so as to overcome the resilient nature of the paperboard material and provide a completed box having upstanding flat, or planar walls.

Heretofore, crimping blades having stationary box contacting surfaces have been moved inwardly against the box walls to perform the crimping operation. When using crimpers with stationary crimping surfaces, the opposed stationary crimpers must be spaced farther than desired from each other so that the high frictional contact between the side walls and the crimpers will not adversely mark or tear the side wall of the box being formed. The use of existing crimpers to operate upon shallow cardboard items such as boxes with relatively low side and end walls, box tops and trays is particularly difficult because the crimping blades must engage and flex the walls closely adjacent the fold lines, where the walls are best able to resist flexure. Consequently, relatively great pressure must be exerted by the crimping bades to effect the necessary degree of flexure of the walls, thus developing such a degree of friction between the stationary blades and the walls of the cardboard container moving therepast that the walls are apt to be chafed and scratched, torn, and even torn from the remainder of the container. Moreover, the excessive friction between the stationary crimping blades and the container which is being propelled past the blades by a plunger exerting pressure against the bottom of the container, frequently buckles the container bottom and thus renders the container unacceptable.

It is, therefore, one object of the present invention to provide an improved box forming and crimping apparatus.

Another object is to provide a box forming and crimping apparatus which successfully crimps the wall panels of cardboard containers while exerting only minimum frictional force against the container.

Another object is to provide a box crimping apparatus having crimping members which move inward toward the center of the box while in engagement with the box walls.

Another object is to provide roller crimpers which cooperate with a box forming die to form boxes without marking, pinching, or otherwise damaging the walls or other parts of the box.

Another object is to provide roller crimpers which may be adjusted vertically so as to preset the roller at the

optimum position for beginning the bending of the side wall.

Another object is to provide roller crimpers which engage the box walls in a rolling, rather than a scraping or rubbing type of engagement, so as to minimize friction between the box walls and the crimpers.

These and other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings, in which:

FIG. 1 is a schematic plan of a box forming and staying machine incorporating the box forming and crimping apparatus of the present invention.

FIG. 2 is a schematic vertical section taken along line 2—2 of FIG. 1, certain completed boxes being shown in central section.

FIG. 3 is a fragmentary elevation looking in the direction of arrows 3—3 of FIG. 1 and showing certain drive parts for the box forming and crimping apparatus.

FIG. 4 is an enlarged side elevation of one of the roller crimping units showing certain mounting and drive parts in central vertical section.

FIG. 5 is a perspective of one of the crimping units shown in FIG. 1.

FIG. 6 is a plan of an unfolded box blank of the type upon which the apparatus of this invention is designed to operate.

FIGS. 7, 8 and 9 are schematic elevations showing in central sections a box in successive stages of forming and crimping thereof.

FIG. 10 is a schematic plan drawn to reduced scale, showing the rollers and the box in a fully crimped condition.

FIG. 11 is a perspective of a modified form of the crimper of this invention.

One embodiment of the box forming and crimping apparatus of the present invention is indicated at **15** in FIGS. 1 and 2 associated with a box forming and staying machine **16**. Since the box forming and crimping apparatus **15** is intended for use in existing box forming and staying machines of the type disclosed in the aforesaid Davis patent, in place of the crimpers heretofore employed therein, it is to be understood that the particular machine **16** and drive parts schematically shown in FIGS. 1, 2 and 3 are intended only to illustrate one structure for operating the forming and crimping apparatus **15** of the invention. The box staying apparatus has not been shown in the drawings since an understanding of this apparatus is not essential to a full comprehension of the present invention. It will be understood, however, that the box corners are stayed after the walls have been formed but before the box has been crimped.

In general, the box forming and staying machine **16** includes a form **18** (FIG. 2) which moves downward against a box blank B (FIGS. 1, 2 and 6) and causes four walls W, which include side walls **W1** and end walls **W2**, to be bent upward between two side crimping units **19** and **19*a***, respectively, and two end crimping units **21** and **21*a***, respectively. The box corners are then stayed and the form **18** is retracted out of the formed box. The opposed sets of crimping units **19**, **19*a*** and **21**, **21*a*** are then moved inward to contact the box walls **W1** and **W2** to over-bend or crimp the same so that upon outward movement of the crimping units and subsequent release of the box, the box walls W will each lie in a plane which is perpendicular to the bottom of the box.

More particularly, the box forming and staying machine **16** (FIGS. 1 and 2) comprises a horizontally disposed hollow rectangular frame **26** having an upstanding sub-frame **27** of inverted U-shape secured thereto. A hydraulic cylinder **28** is secured to the sub-frame **27** and its piston **29** is connected to the box form **18** for vertically reciprocat-

ing the same. The box blanks B are fed into the machine in a flat condition, being carried by horizontal bars 31 and 32 which are each secured to the frame 26 by upstanding legs 33 and 34, respectively. The bars 31 and 32 carry pairs 36 and 37, respectively, vertically extending guide rails which engage the side walls W1 so as to guide and maintain the box blank centered when the blank is moved downwardly by the form 18. Similar bars and guide rails (not shown) may be used to support and guide the end walls W2 if desired.

As the box blank B moves downward the side walls W1 engage the side crimping units 19, 19*a* and the end walls W2 engage the end crimping units 21, 21*a*. Since the side crimping units 19 and 19*a* and the end crimping units 21 and 21*a* are identical except in the matter of length and since the four carriers 38 for mounting the crimping units are also identical, only the crimping unit 19 and its associated carrier 38 will be described in detail.

The crimping unit 19 (FIGS. 4 and 5) comprises an L-shaped body 40 having an upstanding wall 41 and a horizontal box supporting flange 42. A crimping roller 43 is journalled on a pair of L-shaped roller supporting brackets 44 and 46 which project outward from the wall 41 to support the roller 43 over the box supporting flange 42. The brackets 44 and 46 are secured to the wall 41 by screws 47 which are screwed into the wall 41 and extend through vertical slots 48 (FIG. 2) in the brackets 44 and 46 which permit vertical adjustment of the roller 43 relative to the flange 42. It will be noted that the roller 43 is provided with frusto-conical end portions 49 for reasons soon to be made apparent.

A stud 51 welded to the wall 41 extends through a vertical slot 52 in a vertically extending arm 53 and is secured thereto by a wing nut 54. The lower end of the arm 53 is bolted to a rack 56 which arm 53 and rack 56 together define the associated carrier 38. The rack 56 is of inverted T-shaped cross section and is slidable in a T-shaped groove 57 in a block 58 that is bolted to the rectangular frame 26 (FIG. 4). A screw 59 is threaded into the outer end of the block 58 and its head serves as a stop to limit the extent of outward movement of the rack 56. It will be noted that the outermost position of the rack 56 and the roller 43 may be varied by proper adjustment of the screw 59.

The crimping unit 19 is moved toward and away from the center of the box by a pinion 61 that meshes with the rack 56 and is keyed to a shaft 62 journalled in the block 58. The carrier 38 (FIG. 1) of each of the other crimping units 19*a*, 21 and 21*a* also includes a pinion (not shown) which is keyed on one of three shafts 63, 64 and 65 (FIG. 1). Pairs of bevel gears 66 and 67 interconnect the adjacent ends of the shafts in such a way that rotation of one of the shafts in one direction will simultaneously move each of the crimping units 19 and 21 inward while rotation of the said one shaft in the opposite direction will simultaneously move the crimping units 19 and 21 outward. A bearing 68 is provided near each end of each shaft 62, 63, 64 and 65 and each bearing is bolted to the frame 26.

To provide means for driving the shafts, a motor 71 (FIGS. 1–3), which is preferably a gear motor incorporating a one revolution clutch, is mounted on a bracket 72 secured to the frame 26. A crank 73 is keyed to the output shaft 74 of the motor 71 and has a pin 73*a* which is journalled within an opening in one end of a link 78. The other end of the link 78 is pivotally connected to a shouldered pin 79 which extends through a radial slot 81 in a disc 83 keyed to the shaft 65 and is locked in the desired position in the slot 81 by a nut 84 (FIG. 1). Rotation of the motor 71 through one revolution in a clockwise direction (FIG. 3) will cause the disc 83 to swing through approximately 90 degrees and return to the position shown in FIG. 3. The swinging of the disc 83 causes the crimping units 19 and 21 to move inward

to crimp the box walls and then return to their outer positions as shown in FIG. 1. If it is desired to increase or decrease the stroke of the crimping units, the shouldered pin 79 is moved outward or inward, respectively, in the radial slot 81 and is locked in the desired position by the nut 84.

It will be understood that any suitable means may be provided for controlling the actuation of the hydraulic cylinder 28 in timed relation with the actuation of the motor 71.

As shown in FIG. 2, the finished boxes are held in a stack below the crimping units by leaf springs 86 and 87 which are secured to brackets 88 and 89, respectively, which are secured to the frame 26.

In the operation of the box forming and crimping apparatus 15 of the present invention, the hydraulic cylinder 28 (FIG. 2) is actuated to move the form 18 downward from the position shown in FIG. 7 to the end of its stroke as shown in FIG. 8. During this movement the die 18 engages a box blank B supported by the bars 31 and 32 and forces the blank downward between the guide rails 36 and 37 and thereafter between the rollers 43 of the crimping units 19, 19*a* and 21, 21*a* to the position shown in FIG. 8. Since the rollers 43 engaged by the carton walls W are free to rotate, very little frictional resistance to movement of the box blank is offered by the folding mechanism during this box forming operation. Accordingly, the rollers 43 can be placed so close to the path of movement of the form 18 that the rollers fold the wall panels sharply about the bottom edges of the advancing form 18. Score lines L formed in appropriate positions in the box blank B assist in attaining the desired sharp, square edges of the completed box. Because the rollers 43 rotate freely, there is little danger of marking or otherwise damaging the box walls W even though the rollers are very close to the walls of the form 18.

After the box corners have been stayed and the hydraulic cylinder 28 has been actuated to withdraw the form 18 from the stayed box, all four of the crimping units are simultaneously moved inward as illustrated by the units 19 and 19*a* in FIG. 9. During the initial inward movement of the crimping units, the box being crimped is supported only by the completed boxes therebelow. Accordingly, the crimpers are designed so that the rollers 43 apply little downward force against the box being crimped during the initial inward movement of the crimping units since at this time the axes of the rollers and the line of contact between each roller and the associated wall lie in the same horizontal plane. As the inward movement of the rollers 43 continues, the bottom peripheral edges of the box become supported on the flanges 42 of the associated crimping units, thus preventing downward movement of the box with respect to the crimpers, in spite of the fact that the crimping rollers then exert a considerable force in a downward direction against the inwardly inclined walls W, as clearly indicated in FIG. 9.

It is particularly noteworthy that during the initial inward movement of the crimping units, until the axis of the roller reaches the vertical plane through the bottom edge, the line of contact of each roller 43 with its associated box wall W progressively approaches the associated score line L about which the wall bends. This action is highly desirable since the walls W are more sharply bent at the score line when the bending force is applied near the score line. It will be recognized that when the bending force is applied at a point spaced a considerable distance from the score line, much of this crimping force is lost since the box wall itself will curve between the score line and the point of application of the crimping force. The force tending to buckle the bottom of the box is of small magnitude during the inward movement of the crimping units since the freely journalled rollers 43, roll rather than slide along the walls W of the box.

If shallow boxes, trays or box tops are being formed, the rollers 43 (FIG. 5) are moved closer to the associated

box supporting flanges 42, to more effectively crimp the walls W, this adjustment being made possible by loosening the screws 47. If desired, the extent of inward movement of the crimping units may be changed by repositioning the shouldered pin 79 (FIG. 3).

As mentioned previously, the box is crimped after the corners have been stayed. Accordingly, the box walls are bent inward as indicated in FIG. 10. The frusto-conical ends 49 of the rollers 43 play an important part in crimping the box without adversely marking the box since they conform to the shape of the box walls when the walls are in the fully crimped position.

The modified crimper blade 92 shown in FIG. 11 is of one piece construction and may be used in the machine 16 in place of each of the side crimping units 19, 19*a*, 21 and 21*a*. Each crimper blade 92 is adjustably mounted on the vertical arm 53 of the associated carrier 38 by a bolt 93. The correspondingly modified end crimper blades (not shown) are identical and are the same as the side crimper blades 92 except for differences in length, since they differ from the end crimpers 92 in the same manner that the end crimpers 21 and 21*a* embodiment differ from the side crimpers 19 and 19*a* thereof.

Each crimper blade 92 includes a vertical mounting portion 94, an inwardly and downwardly inclined deflecting portion 96, an arcuate crimping portion 97, an outwardly and downwardly inclined connecting portion 98, and a horizontal inwardly directed box supporting flange 99.

The operation of the crimper blades 92 is substantially the same as that of the crimping units 19, 19*a*, 21 and 21*a* except that the arcuate crimping portion 97 is not rotatable. However, because of the arcuate nature of the crimping portion 97, the line of contact of the arcuate portion 97 does progressively approach the associated score line L about which the associated wall bends during the initial inward movement of the blade.

It is apparent from the foregoing description that the box forming and crimping apparatus of the present invention provides improved crimping units for reducing the frictional force applied to the box walls during both the box forming and crimping operations. The roller crimpers, as well as the blade crimpers, are arranged to continuously move the line of contact of the wall contacting surface of the crimpers toward the plane of the bottom of the box. This results in a better bending operation to effect sharper bending about the score line and a decreased tendency for the side wall of the box to bow. The roller crimpers are also provided with frusto-conical end portions which aid in applying the necessary crimping force to the corners of the box walls without adversely marking the surfaces of the walls.

While two embodiments of the present invention have been shown and described, it will be understood that further changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

Having thus described the present invention, what is claimed as new and desired to be protected by Letters Patent is:

1. In a machine for forming from a box blank a box having a bottom and upstanding planar walls connected to each other; a crimping apparatus comprising means for supporting a formed box in a predetermined position, a carrier disposed adjacent one wall of said box and mounted for movement toward and away from the center of the box, a box supporting flange supported by said carrier in a plane below the plane of the bottom of the box, an arcuate wall contacting member supported by said carrier and spaced above said flange in position to engage said one wall, and drive means for moving said carrier toward and away from the center of the box, movement of said carrier toward the center of the box causing the region of said bottom adjacent said one wall to become supported on the flange and causing the line of contact between said arcuate wall contacting member and said wall to approach said bottom region during the initial inward movement of said carrier.

2. In a machine for forming from a box blank a box having a bottom and upstanding interconnected walls; a crimping apparatus comprising means for supporting a formed box in a predetermined position, a carrier disposed adjacent one wall of said box and mounted for movement toward and away from the center of the box, a box supporting flange supported by said carrier in a plane below the plane of the bottom of the box, a freely journalled roller supported by said carrier and disposed above said flange in position to engage said one wall, and drive means for moving said carrier toward and away from the center of the box, movement of said carrier toward the center of the box causing the region of said bottom adjacent said one wall to become supported on said flange and causing said roller to roll on said one wall with the line of contact between the roller and the wall approaching said bottom region during the initial inward movement of said carrier.

3. In a machine for forming from a box blank a box having a bottom and four upstanding interconnected walls; a crimping apparatus comprising means for supporting a formed box in a predetermined position, four carriers mounted for movement toward and away from the center of said box with each carrier adjacent a different one of said four walls, a box supporting flange supported by each of said carriers in a plane below the plane of the bottom of said box, a freely journalled roller supported by each of said carriers above the associated flange in position to engage the adjacent one of said walls, each of said flanges and its associated roller being shorter than the associated box wall, and drive means for simultaneously moving said carriers toward and away from the center of the box, movement of said carriers toward the center of said box causing said box bottom to become supported on said flanges and causing said rollers to roll on said walls with the lines of contact between the rollers and the associated walls approaching the respectively associated bottom edges of the walls during the initial inward movement of said carriers.

4. In a machine for forming from a box blank a box having a bottom and four upstanding interconnected walls; a crimping apparatus comprising means for supporting a formed box in a predetermined position, four carriers mounted for movement toward and away from the center of said box with each carrier adjacent a different one of said four walls, a box supporting flange supported by each of said carriers in a plane below the plane of the bottom of said box, a freely journalled roller supported by each of said carriers above the associated flange in position to engage the adjacent one of said walls, each of said flanges and its associated roller being shorter than the associated box wall, and drive means for simultaneously moving said carriers toward and away from the center of the box, movement of said carriers toward the center of said box causing said box bottom to become supported on said flanges and causing said rollers to roll on said walls with the lines of contact between the rollers and the associated walls approaching the respectively associated bottom edges of the walls during the initial inward movement of said carriers, each end of each of said rollers being frusto-conical.

5. In a machine for forming from a flat box blank a box having a bottom and four upturned planar walls stayed together at the corners of the box; a forming and crimping apparatus including a box form reciprocated along a predetermined path for engaging and moving the box blank along said path, two pairs of opposed crimping units disposed adjacent the path of movement of said form and having freely journalled rollers in position to be engaged by said walls during movement of said form in one direction for first bending said walls relatively to said bottom as said form moves therepast and

thereafter for firmly supporting said walls between said rollers and the form, a carrier mounting each of said crimping units for movement toward and away from the center of the box after the form has moved out of said box in the opposite direction and after the corners of said box have been stayed, and drive means connected to said carriers for simultaneously moving the rollers over the bottom of the box towards and away from the center of said box for causing said rollers to overbend and crimp the box walls.

6. In a machine for forming from a box blank a box having a bottom and four upstanding planar walls stayed together at their corners; a forming and crimping apparatus including a box form reciprocated along a predetermined path for engaging and moving the box blank along said path, two pairs of opposed crimping units adjacent the path of movement of said form, a roller journalled on each of said carriers in position to be engaged by one of said walls during movement of said form in one direction for first folding said walls relatively to said bottom as said form moves therepast and thereafter for firmly supporting said wall between said rollers and said form as the form approaches the end of its wall folding stroke, each of said rollers being shorter than the associated wall and having frusto-conical end portions for applying pressure near the corners of the box, a carrier mounting each of said crimping units for movement toward and away from the center of the box after said form has moved out of said box in the opposite direction, and drive means connected to said carriers for simultaneously moving said rollers toward and away from the center of the box and over the bottom of the box for causing said rollers to crimp the box walls.

7. In a machine for forming from a box blank a box having a bottom and upturned planar walls describing predetermined angles with said bottom and being stayed together at the corners of the box; a crimping apparatus comprising a plurality of crimping units with each unit being positioned outwardly of and adjacent to one of said upturned walls, each of said units having a box supporting flange and an arcuate wall contacting surface spaced thereabove in contact with the associated one of said walls, carrier means mounting each of said crimping units for movement toward and away from the center of the box, and means for simultaneously actuating all of said carrier means to move said arcuate wall contacting surfaces toward the center of the box and over the bottom of the box to thereby overbend said box walls inward, said box being supported by said box supporting flanges during overbending of said box walls.

8. In a machine for forming from a box blank a box having a bottom and upturned planar walls with each wall describing a predetermined angle with said bottom and being stayed to the adjacent walls at the corners of the box; a crimping apparatus comprising a plurality of crimping units with each unit being positioned outwardly of and adjacent to one of said upturned walls, a box supporting flange on each of said units, a roller freely journalled on each of said units and spaced above the associated flange, each of said rollers being in contact with one of said walls, carrier means mounting each of said crimping units for movement toward and away from the center of the box, and means for actuating said carrier means for moving said rollers toward the center of the box to thereby overbend said box walls inward.

9. In a machine for forming from a box blank a box having a bottom and upturned interconnected planar walls, each of said walls describing a predetermined angle with said bottom; a crimping apparatus comprising a plurality of crimping units with each unit being positioned outwardly of and adjacent to one of said upturned walls, each of said units having a box supporting flange at an elevation below the bottom of the box when the box is in crimping position, which flange is shorter than the length of the associated wall, an arcuate wall contacting surface on each of said units being positioned above an associated flange and being shorter than the length of the associated wall, carrier means mounting each of said crimping units for movement toward and away from the center of the box, and means for actuating said carrier means for simultaneously moving said wall contacting surfaces and said contacted walls a sufficient distance to overbend the walls with respect to the bottom so that upon retraction of said wall contacting surfaces away from the associated walls said walls will lie in planes which describe said predetermined angle with the bottom of the box.

10. In a machine for forming from a box blank a box having a bottom and upturned planar walls with each wall describing a predetermined angle with said bottom and being stayed to the adjacent walls at the corners of the box; a crimping apparatus comprising a plurality of crimping units with each unit being positioned outwardly of and adjacent to one of said upturned walls, each of said units having a lower box supporting flange positioned at an elevation below that of the bottom of the box and being shorter than the length of the associated wall, a roller freely journalled above said flange on each of said units and being shorter than the length of the associated wall, carrier means mounting each of said crimping units for movement toward and away from the center of the box, and means for actuating said carrier means for simultaneously moving said rollers and the associated walls with respect to the bottom so that upon retraction of said rollers away from the associated walls the walls will each lie in a plane which describes said predetermined angle with the bottom of the box.

11. In a machine for forming from a substantially flat box blank a box having a bottom and four upturned planar side walls with each wall describing a predetermined angle with said bottom and being stayed to the adjacent walls at two corners of the box; a crimping apparatus comprising four crimping units with each unit being positioned outwardly of one of said upturned side walls, each of said units having a lower box supporting flange positioned at an elevation below that of the bottom of the box and being shorter than the length of the associated side wall, a roller freely journalled on each of said units above the associated flange and being shorter than the length of the associated side wall, means for vertically adjusting said rollers with respect to said flanges to adapt the apparatus to handle boxes having side walls of different heights, carrier means mounting each of said crimping units for movement toward and away from said associated wall, and means for actuating said carrier means for simultaneously moving said rollers and side walls inward with respect to said bottom so that upon retraction of said rollers the walls will each lie in a plane which describes said predetermined angle with the bottom of the box.

12. In a machine for forming from a flat box blank a box having a bottom and a plurality of upturned planar walls and for applying stays to said walls at the corners of the box; a crimping apparatus comprising arcuate surfaced crimping members positioned adjacent and parallel to each of said walls when the box has been formed and stayed, and means for simultaneously moving said crimping members inwardly over the bottom of the box and for retracting said members to overbend said walls inwardly so that they will be maintained throughout their areas at right angles with the plane of the bottom of the box upon completion of the crimping operation, each of said crimping members being formed with a central section projecting inwardly further than its end sections so that pressure is applied directly against said walls adjacent the corners of the box by said end sections when said central sections of the crimping members have moved inwardly over the box bottom for a sufficient distance to effect engagement of the associated box walls over substantially the entire length of the inwardly facing arcuate faces of the crimping members.

13. In a machine for forming from a flat box blank a box having a bottom and a plurality of upturned planar walls and for applying stays to said walls at the corners of the box; a crimping apparatus comprising freely rotatable crimping rollers positioned adjacent and parallel to each of said walls when the box has been formed and stayed, and means for moving said rollers inwardly over the bottom of the box and for retracting said rollers to overbend said walls inwardly so that they will be maintained throughout their areas at right angles with the plane of the bottom of the box upon completion of the crimping operation, each of said rollers having tapered end sections to provide frusto-conical roller sections at the ends of the roller which engage the associated wall adjacent to the corners of the box, said end sections applying pressure directly adjacent to the corners of the box when the rollers have been moved inwardly over the box bottom for a sufficient distance to effect engagement of the associated box walls over substantially the entire length of the rollers.

14. In a machine for forming from a flat box blank a box having a bottom and a plurality of upturned planar walls and for applying stays to said walls at the corners of the box; a forming and crimping apparatus comprising a box form arranged for reciprocatory motion along a vertical path for engaging and moving a flat box blank along said path, a plurality of freely rotatable crimping rollers

disposed adjacent and parallel to each of said walls when the box has been formed and stayed, said rollers engaging said walls during downward movement of said box form and bending said walls relatively to said bottom as said form is moved therepast, said box blank being retained between said rollers when said box form is moved upwardly and away from said box blank, and means for moving said crimping rollers horizontally and inwardly over the bottom of the box and for retracting said rollers to overbend said walls inwardly so that they will be maintained throughout their areas at right angles with the plane of the bottom of the box upon completion of the crimping operation, each of said rollers having a tapered end section which is tapered inwardly toward the axis of the roller and toward the end of the roller, said end sections applying pressure directly adjacent to the corners of the box when said rollers have been moved inwardly for a sufficient distance to effect engagement of the associated box wall over substantially the entire length of the crimping roller.

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