

Dec. 8, 1959

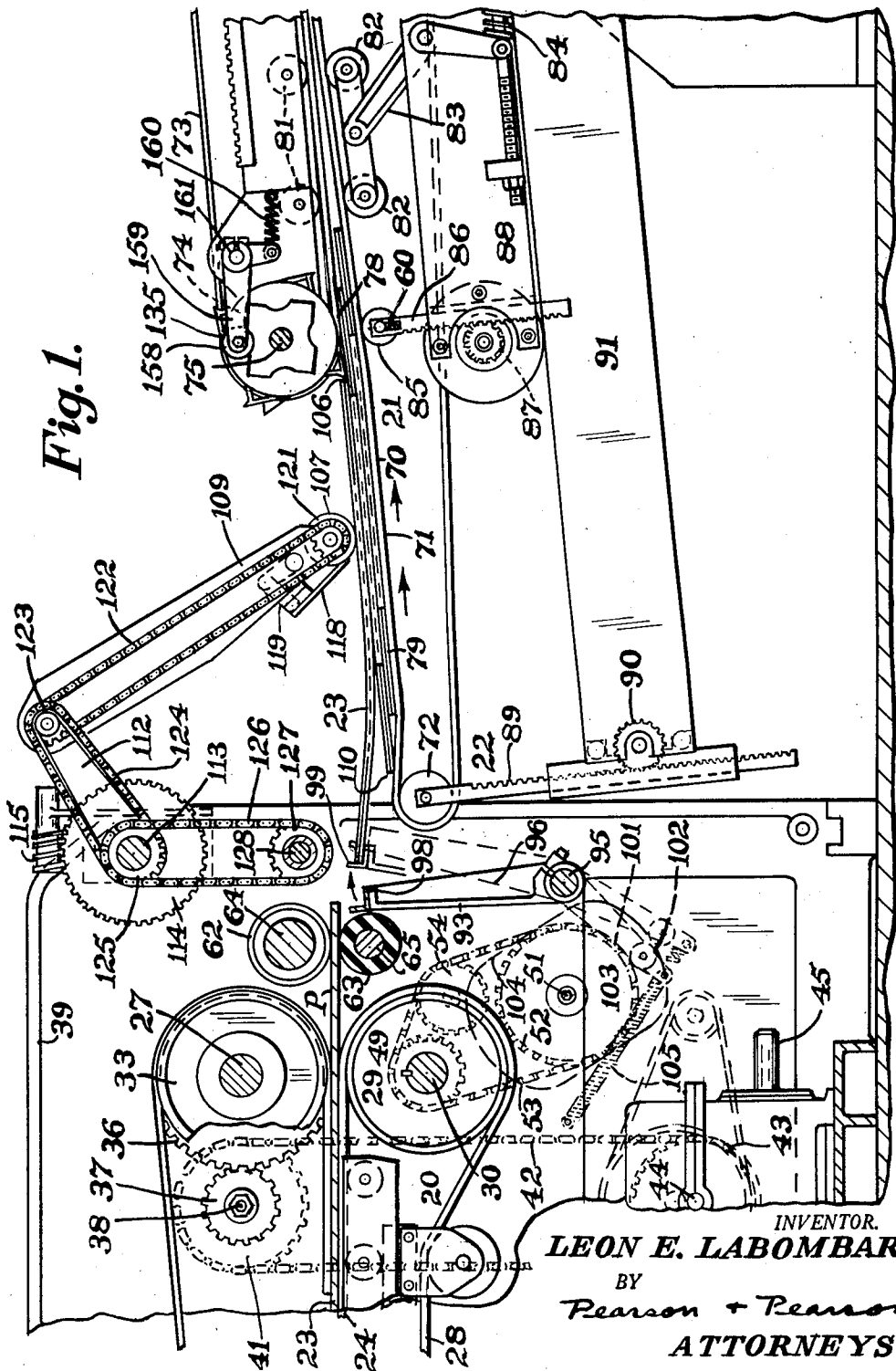
L. E. LA BOMBARD

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METHOD AND MECHANISM FOR SQUARING-UP BOXES

Filed April 21, 1958

4 Sheets-Sheet 1



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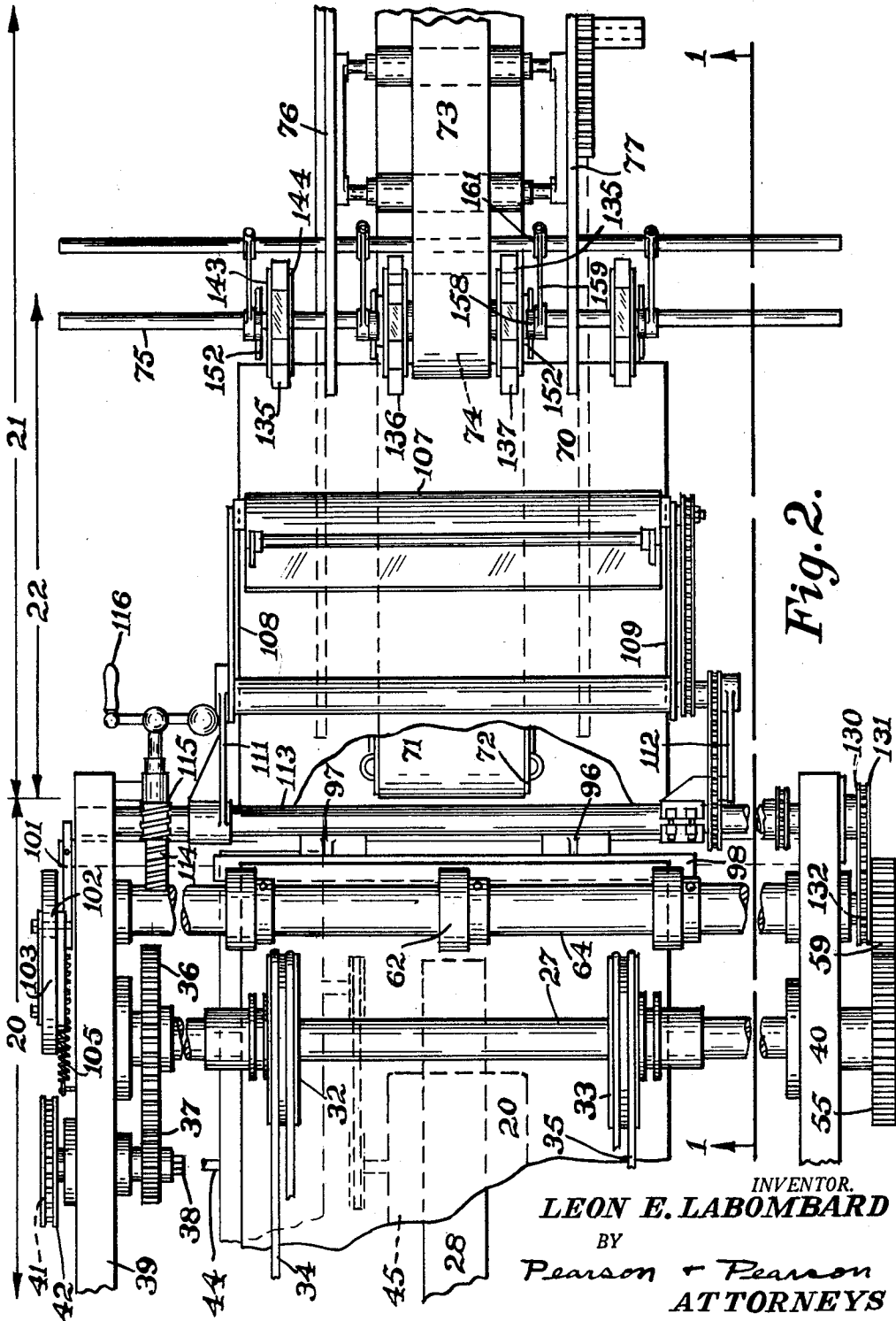
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Fig. 3.

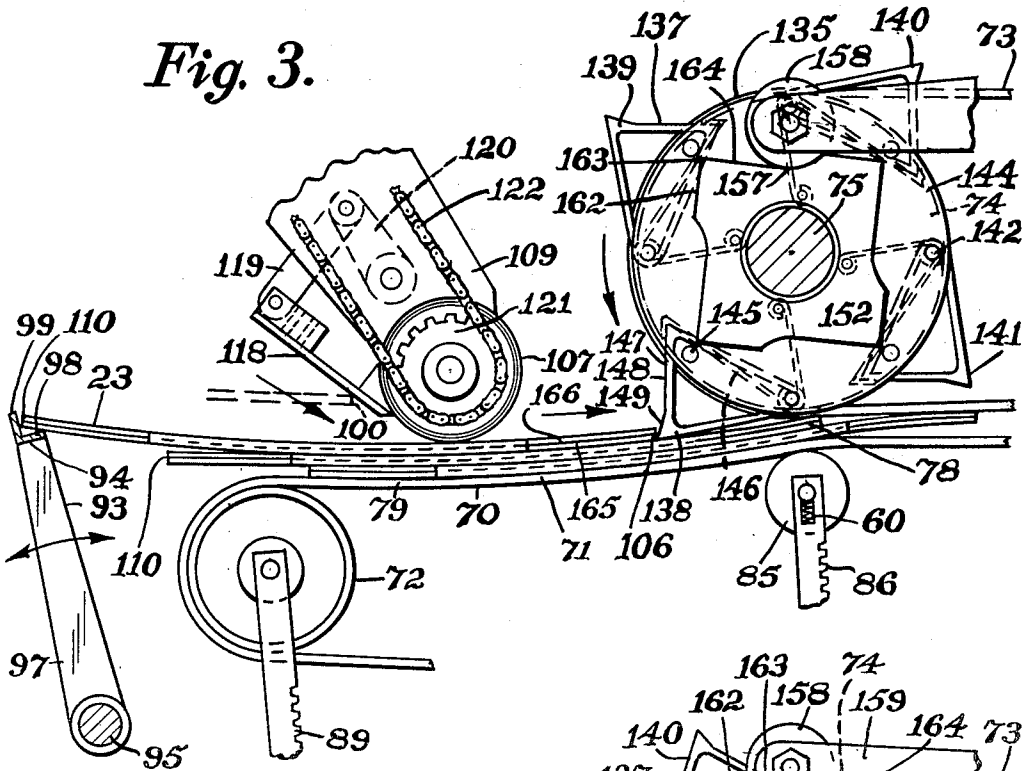
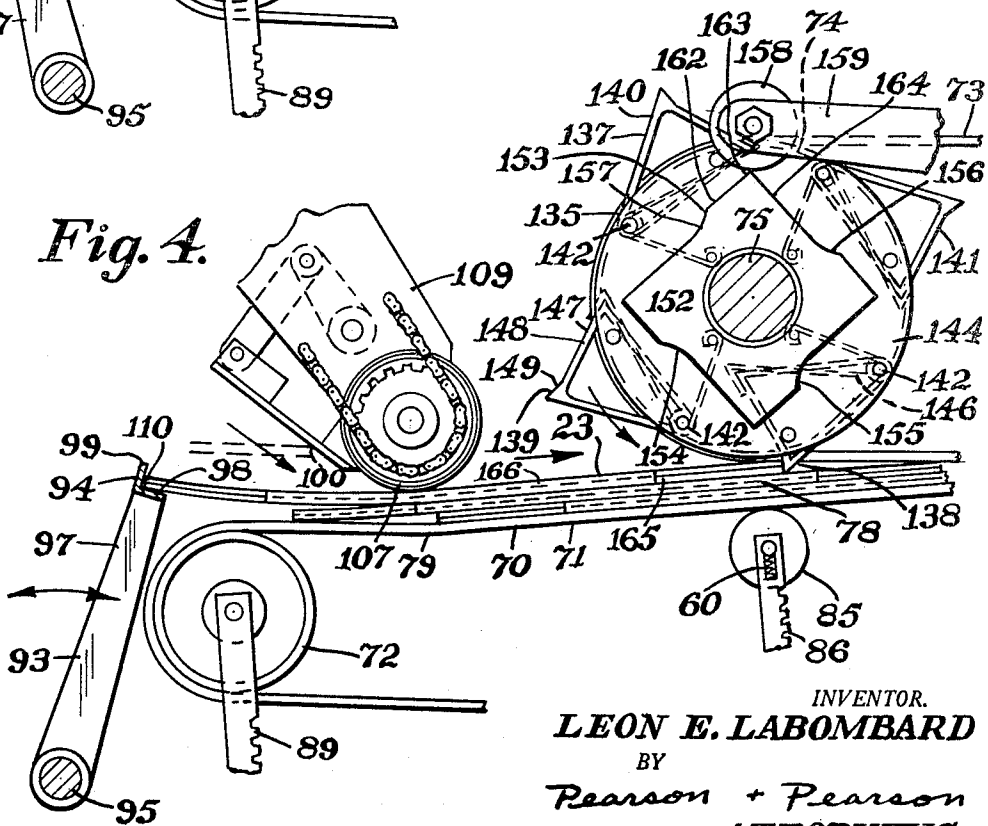


Fig. 4.



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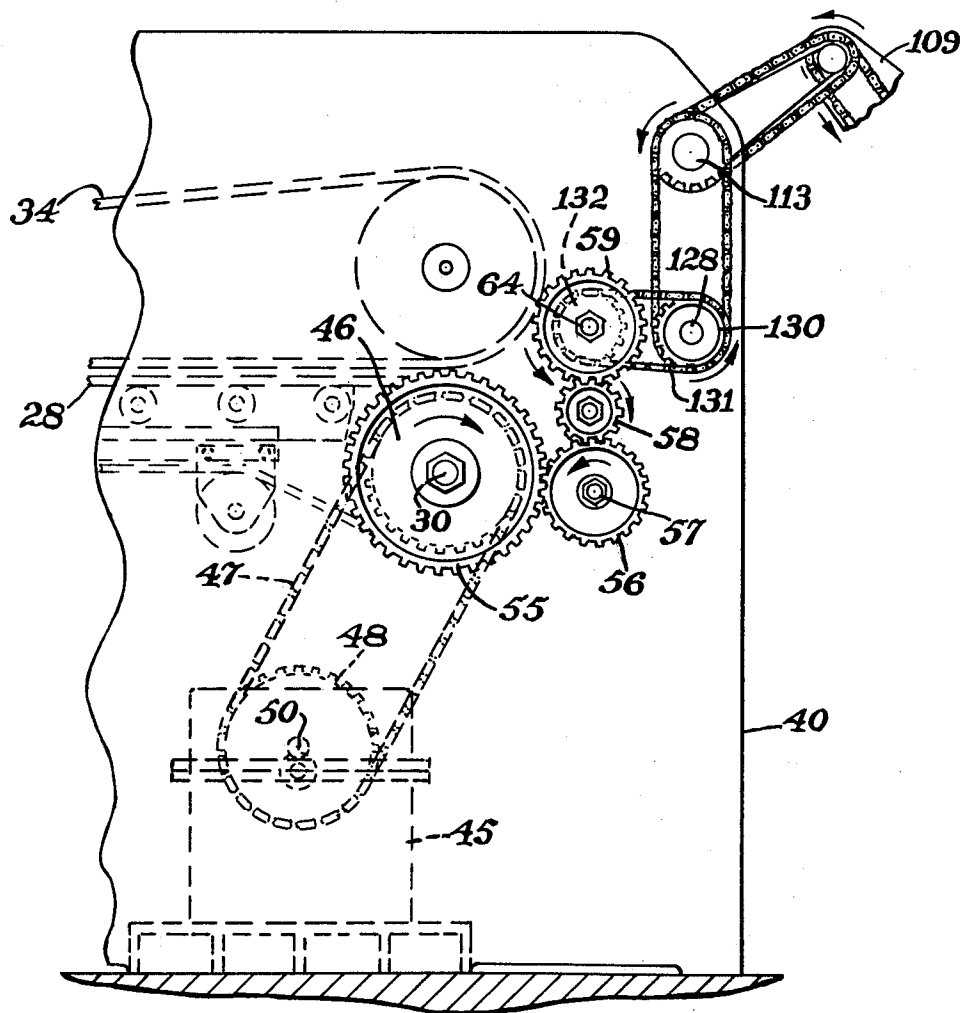


Fig. 5.

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METHOD AND MECHANISM FOR SQUARING-UP BOXES

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13 Claims. (Cl. 93—36)

This invention relates to the making of paper boxes and especially to a method and mechanism for squaring-up collapsed, folded paper boxes to assure that each box is commercially acceptable.

It has long been customary to make folded, collapsed paper boxes by feeding box blanks individually and successively from a magazine onto the paper line of a folding machine. The blanks are then advanced along the paper line by friction belts, or registration chains, through various folding elements whereby each blank is folded into a collapsed tubular box. Adhesive may be applied to the glue flap in the folding zone of the machine or the boxes may be glue taped, stapled or stitched near the end of the folding operation or just prior to the stacking operation. Stacking is usually accomplished by delivering the folded boxes to a slower moving conveyor whereby the boxes are caused to shingle and overlap each other.

It will be understood that blanks of ordinary paperboard or small blanks of corrugated paperboard tend to fold on the desired longitudinal fold lines with the leading and trailing edges flush and aligned with each other. Large blanks of paperboard and large blanks of corrugated board however, are much more difficult to fold true and a deviation from the proper fold line may occur which results in an unsquared box not acceptable in the trade. If the adhesive has already been applied, the unsquared box must be squared before it is stacked or it will set in unsquared condition. The adhered surfaces will slide into squared condition if pressure is promptly applied to the leading and trailing edges thereof and the squared box must be gripped immediately thereafter to prevent the surfaces from sliding back to unsquared condition before the adhesive sets.

Many devices have heretofore been proposed for squaring up boxes by application of pressure to the leading and trailing edges thereof after folding the same but such devices have usually been operable only with the boxes in spaced relation. Thus floor space, which is at a premium in box making plants, has been occupied by a longitudinal zone of the machine devoted only to squaring up and located between the folding and stacking zones of the machine. Usually such devices have included a barrier fixed in the path of the leading edges of the spaced apart boxes which temporarily stops the box while a pusher applies pressure on the trailing edge of the box. The barrier then moves out of the path of the box to permit it to resume advancing.

The principal object of this invention is to provide a squaring up mechanism and method which is operable while the boxes are being shingled and overlapped on stacker means and does not require the boxes to be in spaced relation thereby saving several feet of floor space and considerable expense of manufacture.

Another object of the invention is to provide squaring-up mechanism which is operable while the boxes are continuously advancing at an average predetermined speed and does not require the boxes to be halted during the squaring-up operation.

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A further object of the invention is to provide squaring-up mechanism of the type having a barrier in the path of the leading edges of the advancing boxes but wherein the barrier is yieldable and merely resists the advance without actually halting the advance.

Still another object of the invention is to provide squaring-up mechanism operable on collapsed glued boxes while the boxes are advancing and being shingled and arranged to deliver the squared up boxes into the entrance nip of stacker means in squared-up condition and before the adhered flaps can slideably revert to unsquared condition.

A still further object of the invention is to provide a novel oscillatory truing element below the path of the trailing edges of boxes and a novel rotatory, box actuated, resistance member above the path of the leading edges of boxes, the resistance member having pivoted, spring loaded lugs arranged to present a substantially vertical advancing barrier to the leading edges of shingled boxes.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawings and from the drawings in which

Fig. 1 is a side elevation of the invention on line 1—1 of Fig. 2.

Fig. 2 is a plan view, with parts broken away, of the invention.

Fig. 3 is an enlarged, fragmentary, side sectional elevation of the squaring-up mechanism at the beginning of a stroke.

Fig. 4 is a view similar to Fig. 3 of the mechanism at the end of a stroke, and

Fig. 5 is a view similar to Fig. 1 of the opposite side of the machine illustrating portions of the drive mechanism.

In the drawing only the rearward portion of the folding and gluing zone 20 and the forward portion of the stacking zone 21 of a box making machine are shown, the remaining portion of the machine not being required to illustrate the invention herein. For convenience the folding and gluing apparatus illustrated is the same as shown in my copending applications Serial No. 698,868, filed November 25, 1957, entitled "Apparatus and Method for Feeding Sheets" and Serial No. 709,977 filed January 20, 1958, entitled "Method and Apparatus for Creasing Blanks," and the squaring-up mechanism of this invention is especially useful with the machine of said applications as well as with machines of other types.

It should be noted that, instead of a separate elongated squaring-up zone, in this invention the squaring-up zone 22 is coextensive with the forward portion of the stacking zone 21 and the squaring-up operation takes place in stacking zone 21. A plurality of folded, collapsed boxes such as 23 are folded and glued in zone 20 and are delivered individually and successively in spaced relation at a predetermined speed into stacking zone 21 by the endless carrier means 24. Carrier means 24 at the end of the machine illustrated comprises the lower friction belt 28 trained around lower carrier roll 29 keyed to transverse shaft 30. Upper shaft 27 carries suitable pulleys 32 and 33 for the folder belts 34 and 35 and a gear 36 meshed with a gear 37 fixed to a stub shaft 38 on the frame 39 of the machine. Shaft 38 carries a sprocket 41 driven by chain 42 and a sprocket 43, the sprocket being rotated by shaft 44 of gear reducer 45.

The transverse shaft 30 carries a sprocket 46 driven by a chain 47 and a sprocket 48 carried on shaft 50 of reducer 45. Transverse shaft 30 also carries a sprocket 49 which drives the cam shaft 51 by means of sprocket 52, chain 53 and the idler tension sprocket 54. Transverse shaft 30 also carries a gear 55 meshed with gear 56 on stub shaft 57, in frame 40, the shaft 57 driving a train of gears 58 and 59 for rotating the upper de-

livery pressure roll 62 and the lower delivery pressure roll 63 on their respective shafts 64 and 65.

The stacker means 70 includes an endless stacker apron 71 trained around a roll 72 at the forward end thereof and advancing in the direction of the arrows on an inclined plane to the end of the stacking zone 21 not shown. An upper endless carrier belt 73 is trained around a roll 74 rotatable on shaft 75 journaled in the frame pieces 76 and 77 of the stacker means 70. The apron 71 and upper carrier belt 73 form an entrance nip 78 for boxes shingled and overlapped on the uncovered portion 79 of apron 71 and the shingled boxes travel along the apron through zone 21 in a well known manner forming no part of this invention. The drive means for the apron 71 and carrier belt 73 may be connected to the power train of the main machine for example, to the reducer 45 but conventionally is a separate electric motor and power train located at the delivery end of the stacker and therefore not shown. The stacker apron 71 is driven at less speed than the predetermined speed of delivery of the boxes from carrier means 24 in order to cause each box to overlap the preceding box in shingle fashion. Suitable upper presser rolls 81 and lower presser rolls 82 are provided the latter being carried on bell crank supports 83, loaded by coil springs such as 84 to exert a predetermined uniform pressure. A yielding lower pressure roll 85 loaded by spring 60 is located below and opposite to upper pressure roll 74 to create a pressure at the entrance nip for frictionally gripping the shingled boxes entering nip 78. Roll 85 is supported on a gear rack member 86 meshed with a gear 87 journaled in the frame 88 of the stacker means 70 for adjusting the nip pressure. The forward roll 72 of apron 71 is similarly mounted on a gear rack member 89 meshed with a gear 90 journaled in frame 91 to adjust the height and incline of the forward uncovered portion 79 of the apron.

The squaring-up mechanism 93 of the invention includes a trueing element 94 oscillatably mounted on a transverse shaft 95 below the path of the advancing boxes such as 23. Element 94 includes a pair of laterally spaced kicker arms 96 and 97 connected by a laterally extending platform 98 and an upstanding wall 99 at the upper terminal ends thereof. Kicker arm 96 includes an integral arm 101 having a rotary cam follower 102 thereon in engagement with a cam 103 mounted on cam shaft 51. Cam 103 oscillates the trueing element 94 rearwardly, holds the element rearwardly during the flat dwells 104 of the cam and then releases the element to kick forwardly under the pressure of the coil spring 105 fixed to the arm 101. Because the forward uncovered portion 79 of apron 71 is below the straight line path of the boxes 23 along the paper line P, the leading edges 106 of the first box through the machine engages the portion 79 intermediate thereof while the trailing edges 110 fall downwardly onto platform 98 and in front of the upstanding wall 99. The machine is so timed that the first box 23 is immediately propelled forwardly at a speed greater than the predetermined speed of apron 71 by the pressure of wall 99 on the trailing edges. The next successive box, because of the greater speed of carrier means 24 is meanwhile delivered from the rolls 62 and 63 to overlie and overlap the first box and this sequence continues with the boxes being shingled and overlapped at the same time that they are impelled forwardly by kicker arms 96 and 97. Because the trailing edges 110 of each successive box are deflected downwardly out of the normal path of the boxes, the trueing element 94 is able to secure a firm grip on the trailing edges and does not interfere with the succeeding box on its return stroke, that box being arched over its arcuate path.

Squaring-up mechanism 93 preferably includes a deflector roll 107 for supplementing the action of gravity and assuring a rapid positive downward deflection and

separation of the trailing edges of each box. Roll 107 is rotatably mounted at the lower terminal ends of a pair of laterally spaced arms 108 and 109, the arms 108 and 109 being each pivotally connected to one of a pair of arms 111 and 112 affixed to a lateral shaft 113 journaled in the frame 39. A gear 114 is fixed to shaft 113 and meshed with a worm gear 115 turnable by a handle 116 whereby turning handle 116 causes the arms 111 and 112 to be raised or lowered to move deflector roll 107 toward and away from trueing element 94. The arms 108 and 109 apply pressure on the advancing boxes by gravity and slightly bow the intermediate portions of each box as it travels thereunder on apron 71. The trailing edges 110 thus are snapped down into trueing element 94 to secure a firm seat therein. A baffle 118 adjustably supported on links 119 and 120 extends transversely in advance of roll 107 to guide the leading edges 106 of each successive box 23 down below deflector roll 107. Roll 107 is driven in order to assist in the advance of the boxes, at a speed equal to that of the incoming collapsed boxes, by means of the articulated train of chains and sprockets 121, 122, 123, 124, 125, 126 and 127, the shaft 128 of sprocket 127 being rotated in timed relation with the other mechanism of the machine by the sprocket 130, chain 131 and sprocket 132 on shaft 64 of delivery roll 62.

Squaring-up mechanism 93 also includes the box actuated resistance member 135 arranged to engage the leading edges 106 of each box 23 impelled forwardly by the trueing element 94 and yieldably resist the advance thereof while forming an advancing wall which forces the upper and lower edges of box into alignment with each other. Member 135 comprises a pair of rotatable supports 136 and 137, coaxially mounted above the path of the boxes 23 on each opposite side of the upper roll 74 of stacker means 70 on shaft 75. The rotatable supports 136 and 137 are identical and each includes at least one, and preferably four identical, spaced resistance lugs such as 138, 139, 140 and 141, therearound. Each lug 138 is preferably pivoted on a pin 142 extending between the parallel discs 143 and 144 of each rotatable support 137 and is of hollow triangular configuration with a stop pin such as 145 and a leaf spring 146. Each lug 138 includes an outer wall 147 having angular faces 148 and 149, the face 149 being substantially radial when the lug has yielded inwardly almost enough to disappear entirely between discs 143 and 144.

Each resistance member 135 also includes a cam 152 having a plurality of identical cam paths 153, 154, 155 and 156 equal to the number of lugs on the member, the cam 152 being rotatable with the member 135 on shaft 75. Each path such as 153 includes an arcuate recess such as 157 for a circular cam follower 158 carried on the end of a follower arm 159 pivotable at 161 to the upper frame of stacker means 70. Each path also includes the upwardly inclined rectilinear section 162, the right angular peak 163 and the downwardly inclined section 164. The cam arm 159 is loaded by spring 160 and when follower 158 is in the recess 157 the corresponding resistance lug such as 138 is positioned in advance of the entrance nip 78 with the wall 147 in the path of the leading edges 106 of an approaching box 23. Lug 138 does not, however, function as a fixed barrier but only as a yieldable barrier, movable with the box along the box path when cam 152 unseats follower 158 from its shallow curved recess and raises the follower up the inclined path 162 to peak 163. The pressure of element 94 on the trailing edges 110 of box 23 thus advances the box against yieldable resistance until the angular face 149 is directly under shaft 75 at the nip 78 and is radial to the shaft and normal to the path of the boxes. The leading edges of the lower panels 165 and the upper glued panels 166 of each successive box 23 are thus forced into alignment, by sliding of the still unset glued portions against each other just as the nip 78 firmly

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grips the box 23 between the upper carrier 73 and stacker apron 71. Simultaneously, the follower 158 passes over peak 163 and accelerates the cam 152 and resistance member 135 by sliding down path 164 until the follower drops into the next successive recess to position lug 139 to engage the leading edges of the next box 100. It should be noted that lug 139 will then be riding on the upper face of box 23 as that box is slowly advanced by stacker means 70 and that, thereafter, squaring-up will take place while the boxes such as 23 and 100 are also being stacked, overlapped and shingled.

Preferably the diameter of roll 74 and of discs 143 and 144 is substantially equal so that the carrier belt 73 extends radially beyond the discs. Thus the discs 143 and 144 are not in direct engagement with the flat tubular boxes and can be rapidly rotated by the cam track 164 and follower 158 without affecting the boxes.

I claim:

1. In a machine for making collapsed paper boxes the combination of carrier means advancing said boxes in spaced relation at a predetermined speed along a path; stacker means advancing said boxes at a reduced speed in continuation of said path to shingle and overlap said boxes; and squaring-up mechanism, cooperable with said means, said mechanism including a timed oscillatory trueing element for engaging the trailing edge of a box underlying a succeeding shingled box and a box actuated, rotary, resistance member for resisting the advance of the leading edge of said box while riding on a preceding underlying shingled box whereby said collapsed boxes are individually and successively trued while advancing in shingled, overlapping relation.

2. A combination as specified in claim 1 wherein said stacker means includes a lower apron having a lower pressure roll and an upper carrier belt having an upper pressure roll, said rolls forming an entrance nip and said squaring-up mechanism includes a pair of identical, resistively loaded rotatable supports, each coaxial with, and on opposite sides of, said upper pressure roll, said rotatable supports each having a plurality of inwardly yieldable, resistance lugs spaced therearound, each engaging the front edges of a box in advance of said nip and yieldably resisting the advance of said box beyond said nip while riding on an underlying box already squared up and shingled.

3. A combination as specified in claim 1 wherein said stacker means includes a lower endless apron for receiving boxes from said carrier means; an upper friction, endless carrier belt forming an entrance nip with said apron at a spaced distance beyond said carrier means for gripping said boxes while squared up and a power driven, upper pressure roll, in advance of said entrance nip, for pressing the trailing edges of said boxes down into engagement with said trueing element and controlling the advance of said boxes in cooperation with said squaring-up mechanism.

4. A machine for operating on collapsed, adhesively secured boxes comprising stacker means including a lower, endless apron for receiving said boxes and advancing the same along a path at a predetermined speed; and squaring-up mechanism, said mechanism including an oscillatable trueing element for engaging the trailing edge of each successive box received and advanced by said apron; timed means for oscillating said element at a greater speed than the speed of said apron; a box actuated, rotatable, resistance member having spaced lugs therearound, each engageable by the leading edge of a box advanced by said trueing element and load means operably connected to said rotatable member for first resisting the rotation thereof and then assisting the rotation thereof.

5. A machine as specified in claim 4 wherein said load means comprises a cam rotatable with said resistance member and a spring loaded arm having a cam follower in engagement with said cam.

6. A machine as specified in claim 4 wherein said re-

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sistance member includes laterally spaced, coaxial rotatable supports, each having said lugs pivoted thereto and spring pressed outwardly whereby said lugs are yieldable inwardly to disappear within said supports when directly opposite said apron.

7. A machine as specified in claim 4 wherein said stacker means includes an upper endless carrier having a forward carrier roll coaxial with said rotatable resistance member to form an entrance nip with said apron and said lugs each are engaged by the leading edge of each successive box in advance of said nip whereby each said box is trued before being gripped in said entrance nip.

8. Apparatus for squaring-up collapsed boxes after folding and glueing the same, said apparatus comprising means for advancing said boxes along a path at a predetermined speed, a trueing element oscillatably mounted below said path and adapted to engage the trailing edges of each successive advancing box, timed means for oscillating said element at a greater speed than the speed of said boxes, a box actuated resistance member rotatably mounted above said path and having resistance lugs adapted to be engaged by the leading edges of each successive advancing box and load means, operably connected to said member for causing said lugs to yieldably resist the advance of each blank impelled by said oscillatory trueing element.

9. In combination with stacker means advancing collapsed, glued boxes in shingled, overlapping relation along a path, a squaring-up mechanism comprising a trueing element adapted to successively engage the trailing edges of underlying shingled boxes and to advance said boxes at increased speed along said path and box actuated resistance means, including a rotatable support above said path and load means for resisting the rotation thereof, said support having a plurality of spaced resistance lugs therearound, each with a wall portion adapted to be engaged by the leading edges of a box being advanced by said trueing element and spring pivot means connecting each said lug to said support for maintaining said wall portion substantially normal to the plane of said box as said support rotates in the direction of advance of said box and as said lug rides on the preceding underlying shingled box.

10. In a machine for making paper boxes, the combination of carrier means delivering folded, collapsed paper boxes individually and successively at a predetermined speed to stacker means; stacker means including an endless, lower stacking apron, commencing below the level of the path of said boxes, at the end of said carrier means and advancing at reduced speed through the stacking zone of said machine; a rotatable support, having a plurality of pivotable lugs spaced therearound, mounted above said apron to revolve by engagement of the leading edges of each successive box with one of said lugs; load means operably connected to said rotatable support for permitting, but resisting, the rotation thereof; a trueing element in advance of said apron oscillatably mounted below the path of said boxes and means, synchronized with said carrier means, for oscillating said trueing element into engagement with the trailing edges of each successive box delivered onto said apron.

11. A method of squaring-up collapsed folded boxes which comprises the steps of advancing said boxes individually and successively along a path while shingling said boxes; yieldably resisting the advance of the leading edges of each successive shingled box without halting said box on said path and simultaneously pushing in the direction of advance, on the trailing edge of each said shingled box, until said resistance is overcome thereby squaring up said boxes during shingling and without halting the same on said path.

12. A method as specified in claim 11 plus the step of frictionally gripping and continuing the advance of said shingled overlapping boxes before the termination of said squaring-up steps.

13. Mechanism for aligning folded panels with the body of a flat tubular box having wet adhesive for uniting one panel to another when set, said mechanism comprising pusher means for engaging the trailing edges of said flat tubular box and advancing the box along a path at a predetermined speed; yieldable, unidirectionally rotatable resistance means, in said path for engaging and aligning the leading edges of each said box, and sliding the wet adhered panels thereof into trued condition while said box is advanced along said path by said pusher means, and box gripping, and advancing means, asso-

ciated with said resistance means, and extending therebeyond along said path for holding said panels in trued condition, and continuing the advance of said box while said adhesive sets.

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