Feb. 22, 1938. G. SEIFERT 2,109,359

BOX MAKING MACHINE

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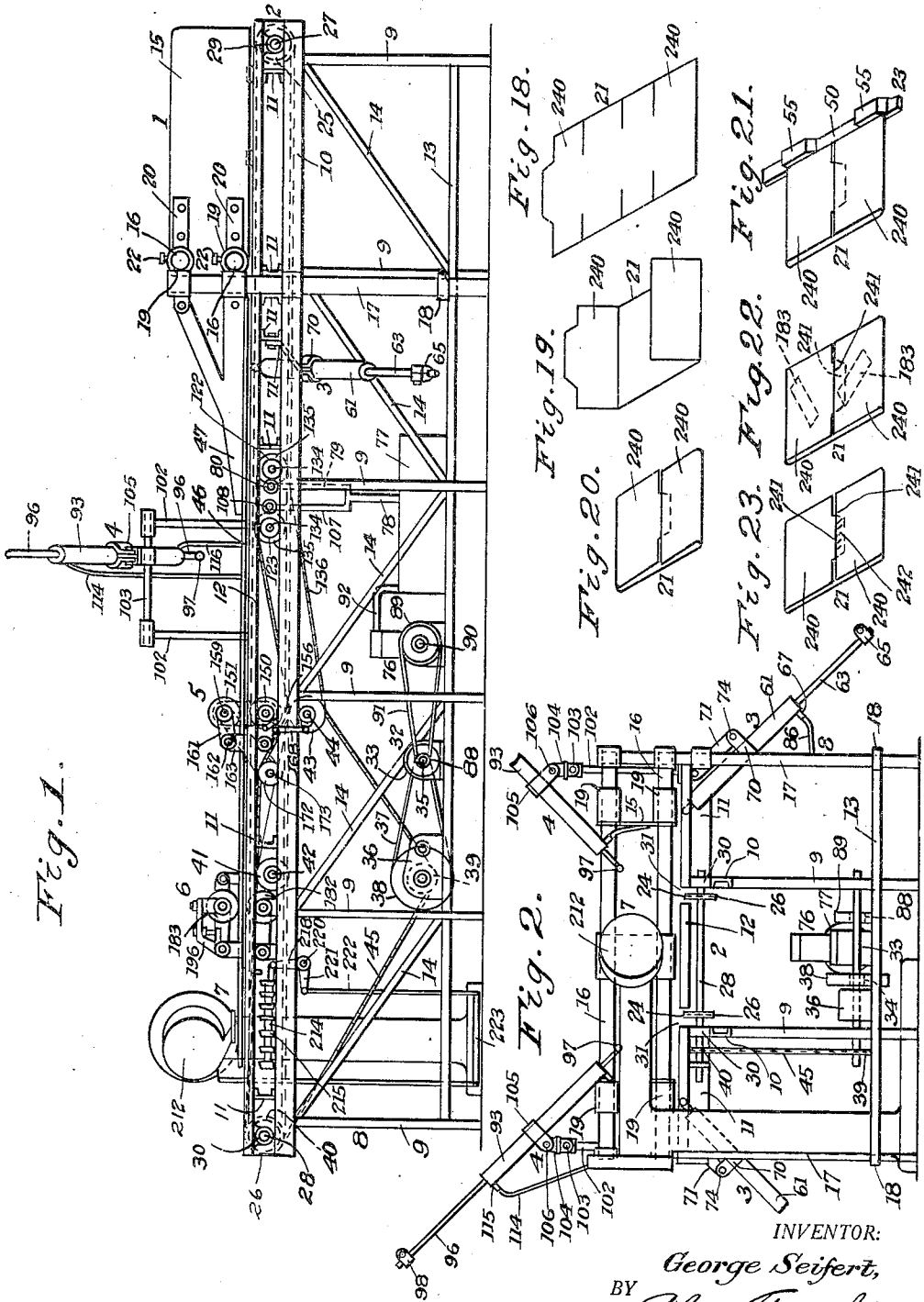


Fig. 1.

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 22.

Fig. 23.

Fig. 2.

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BOX MAKING MACHINE

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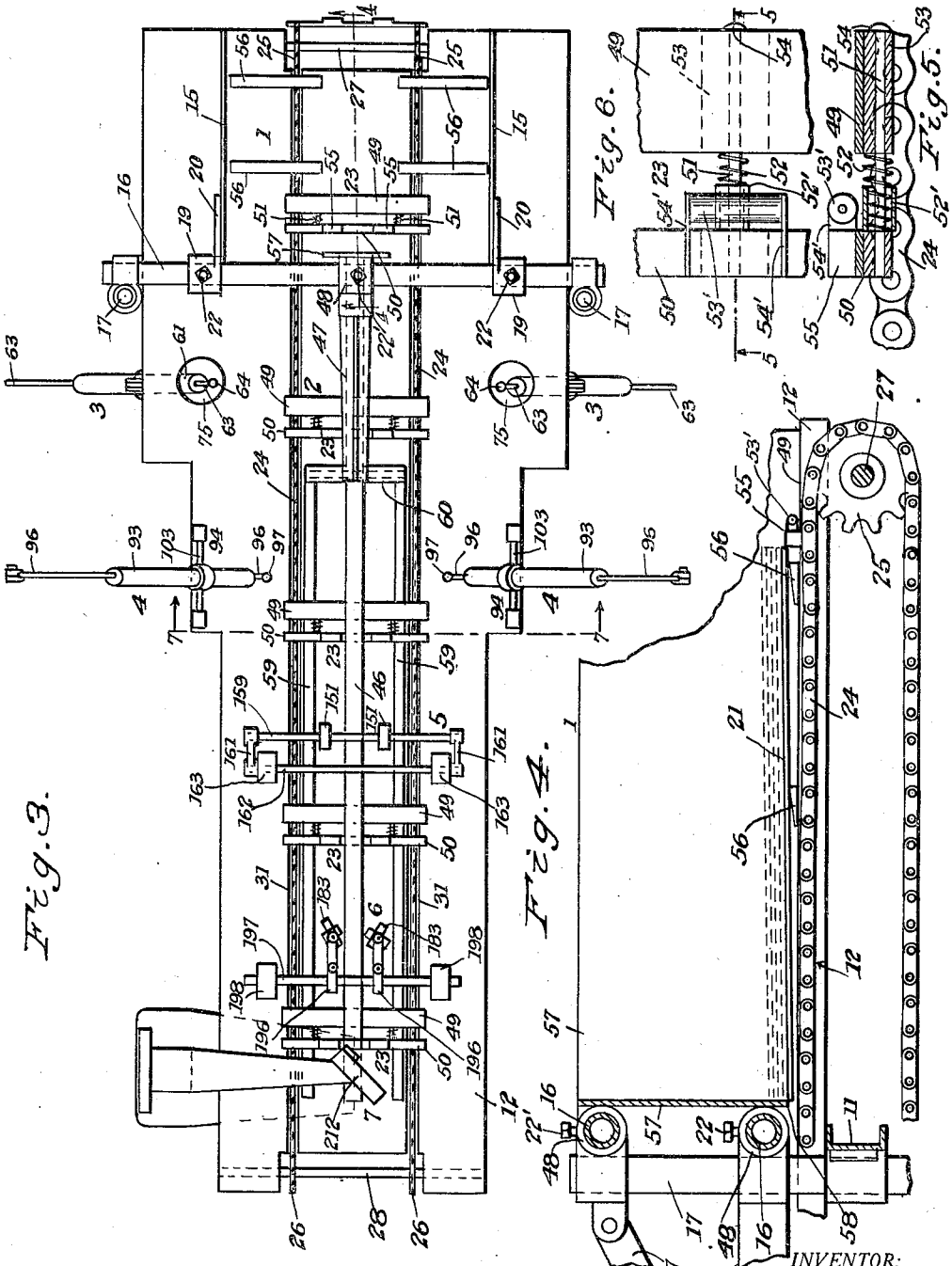


Fig. 3.

Fig. 6.

Fig. 5.

Fig. 4.

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BOX MAKING MACHINE

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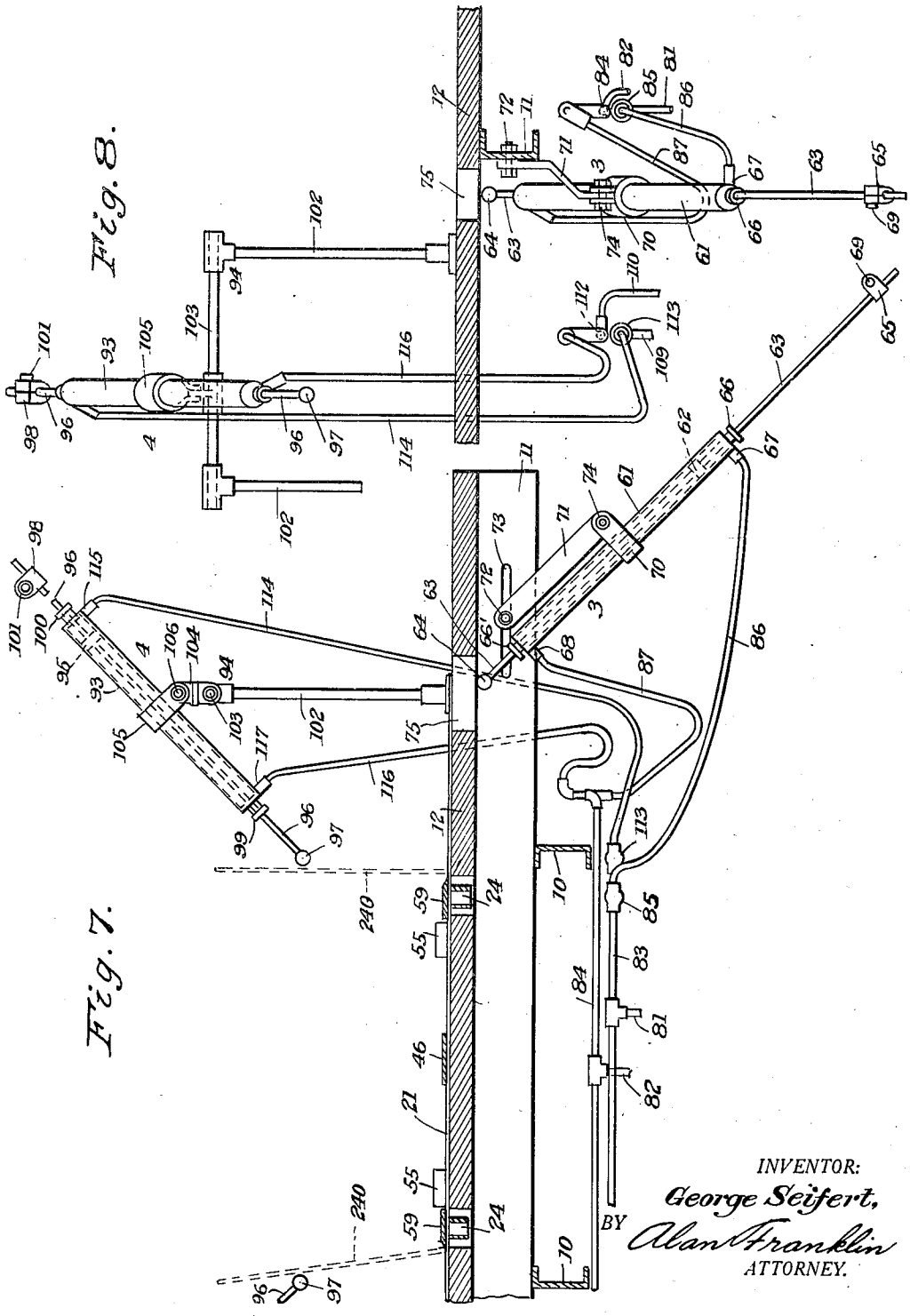


Fig. 8.

Fig. 7.

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BOX MAKING MACHINE

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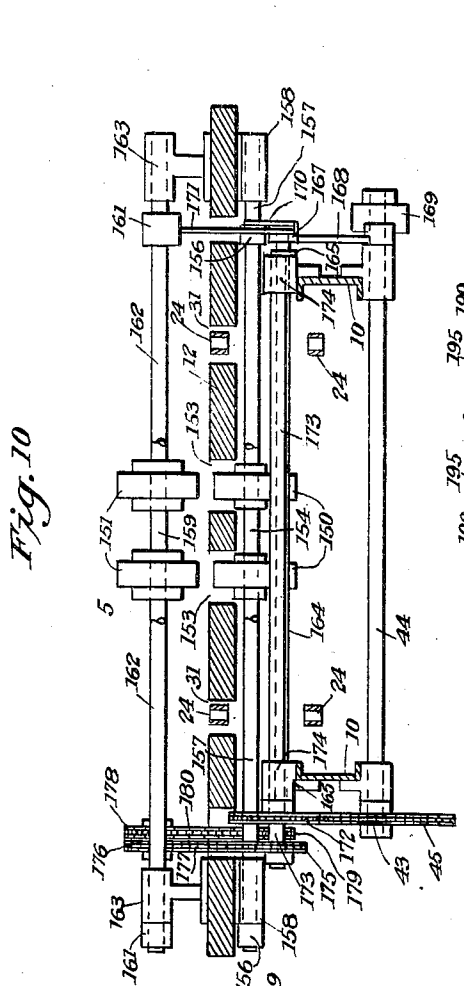


Fig. 10

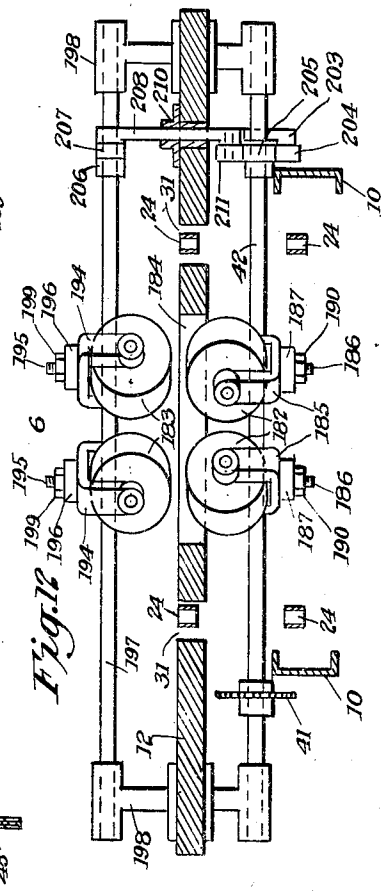


Fig. 12

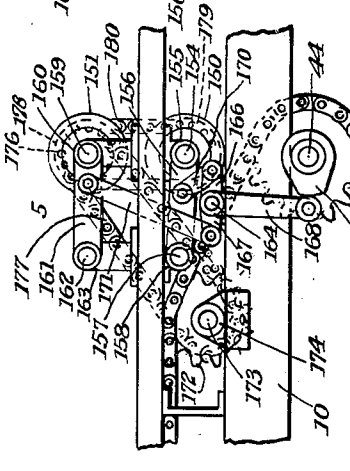


Fig. 9

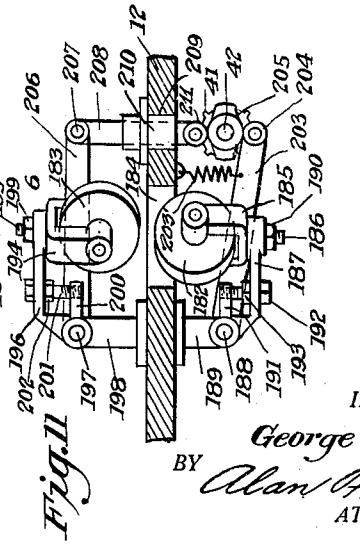


Fig. 11

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BOX MAKING MACHINE

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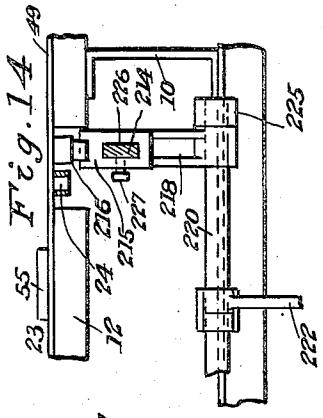


Fig. 14.

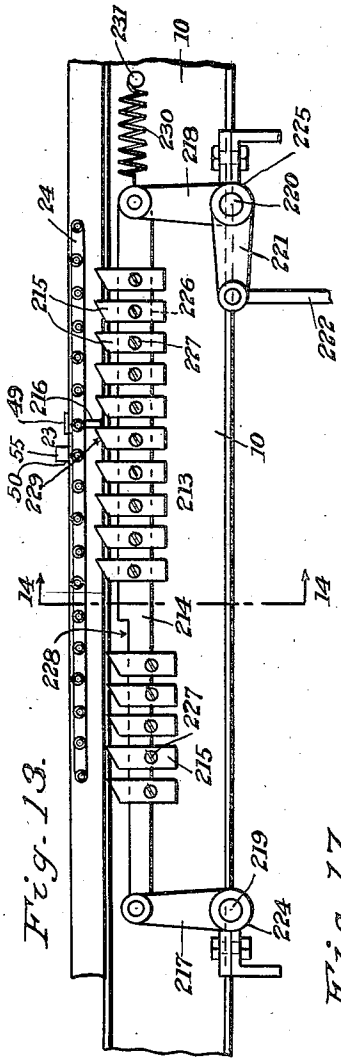


Fig. 13.

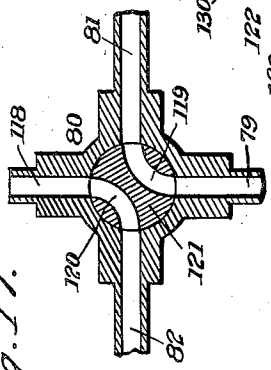


Fig. 17.

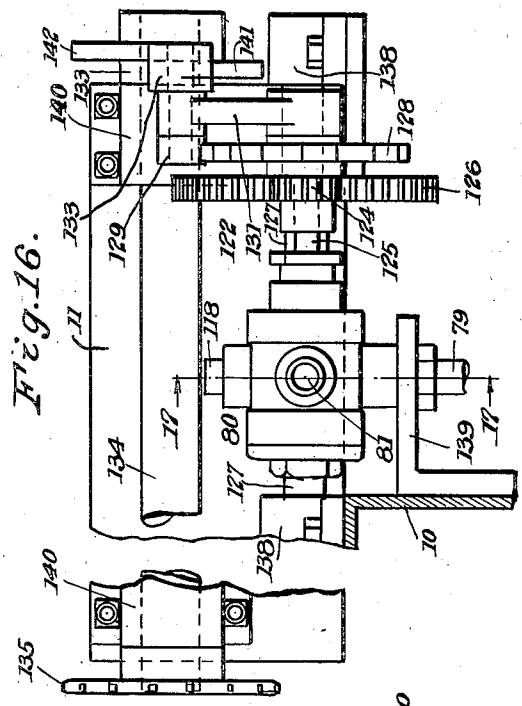


Fig. 16.

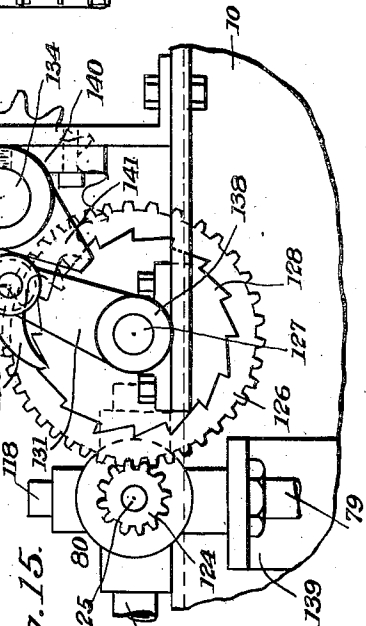


Fig. 15.

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BOX MAKING MACHINE

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Fig. 25.

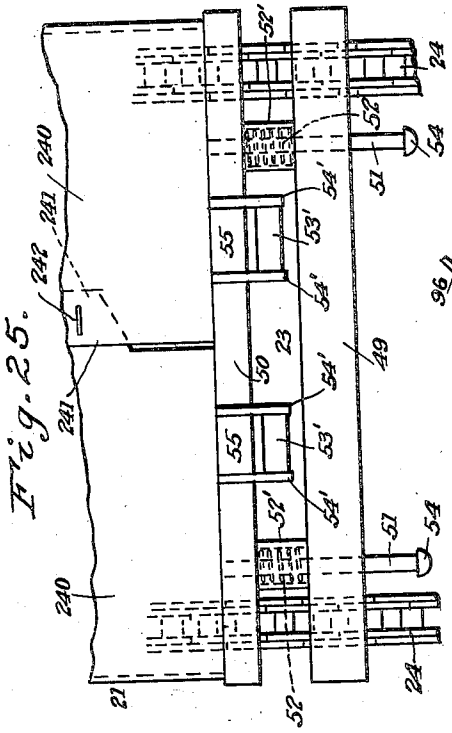


Fig. 24.

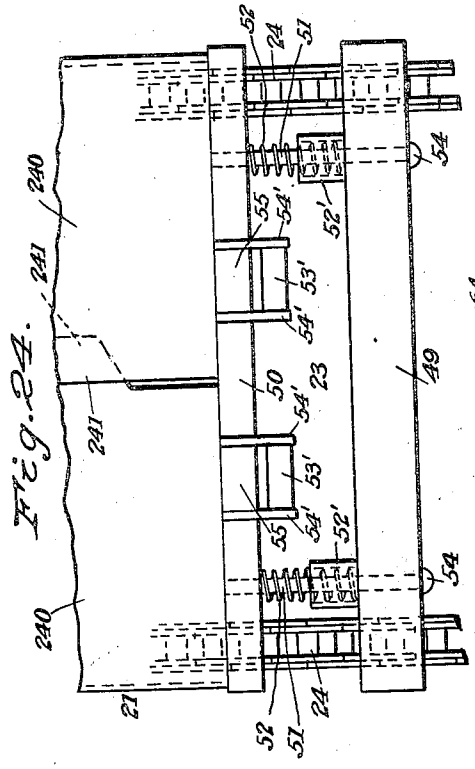


Fig. 26.

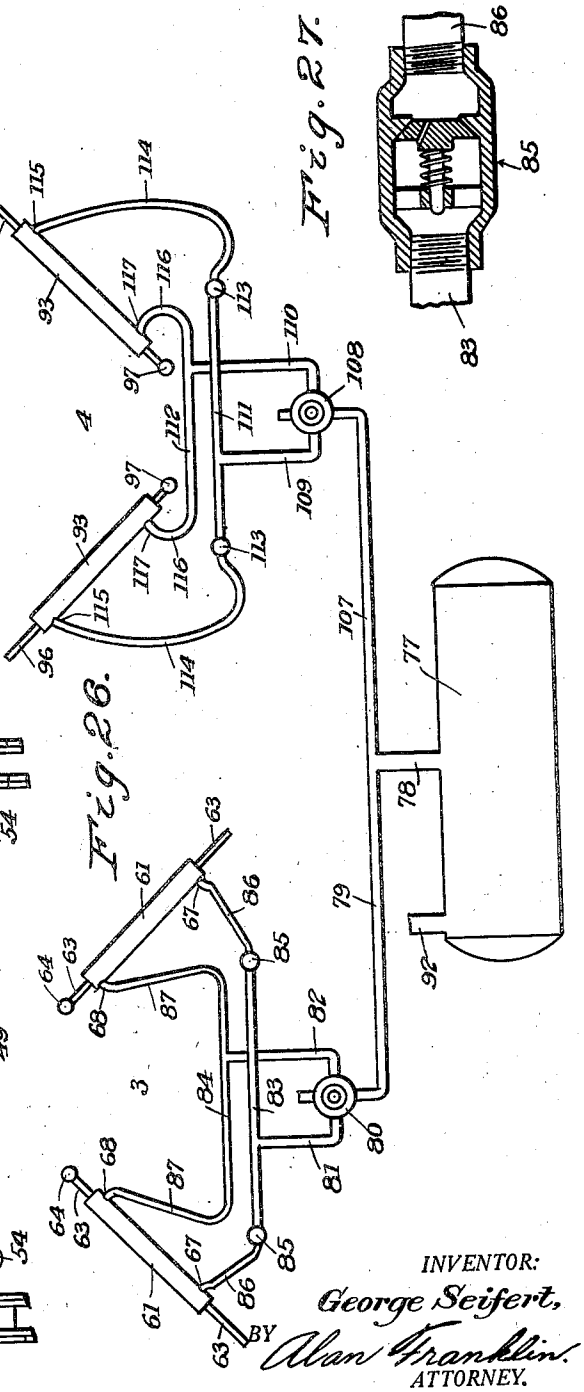


Fig. 27.

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Feb. 22, 1938. G. SEIFERT 2,109,359

BOX MAKING MACHINE

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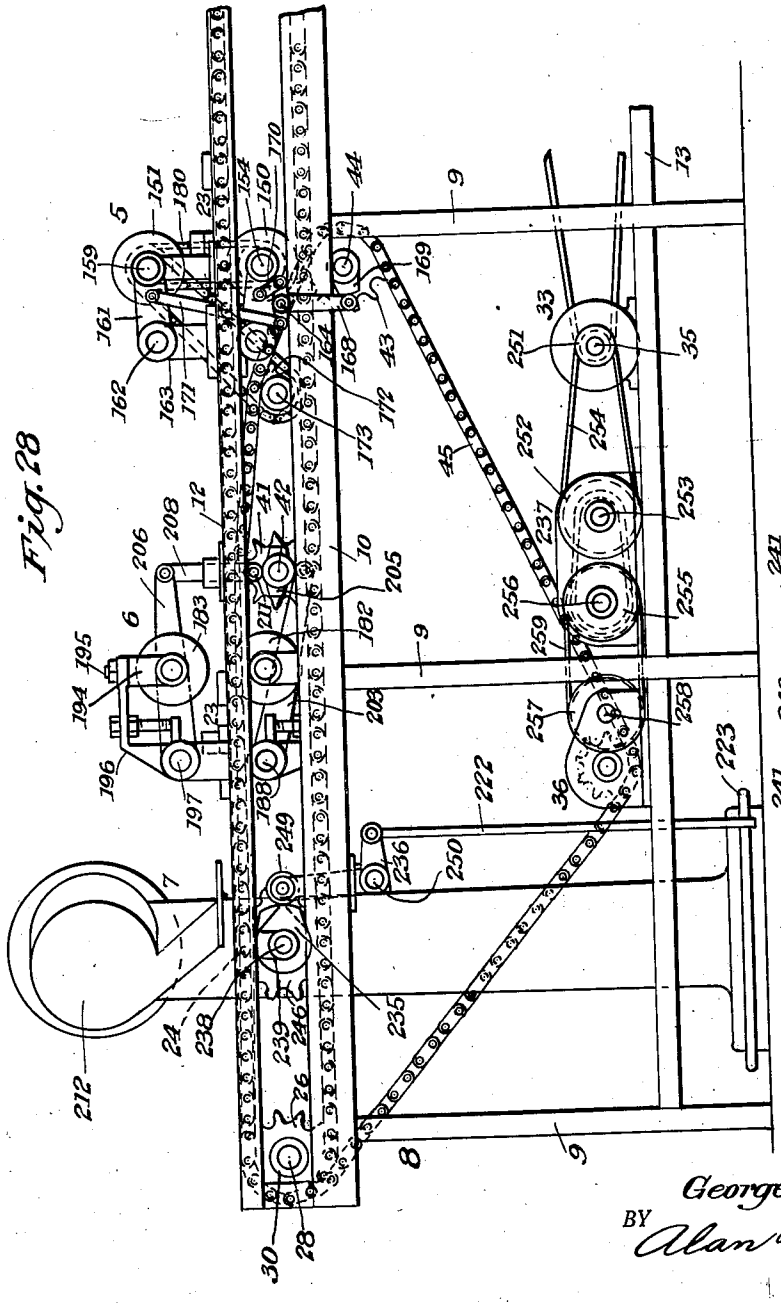


Fig. 28

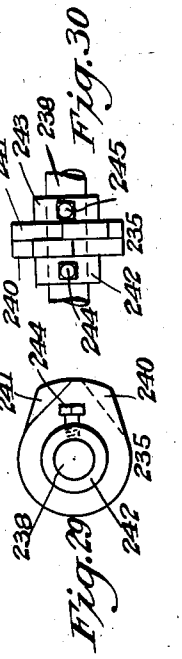


Fig. 30

Fig. 29

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Patented Feb. 22, 1938 2,109,359

UNITED STATES PATENT OFFICE

2,109,359

BOX-MAKING MACHINE

George Seifert, Beverly Hills Township, Los Angeles County, Calif.

Application February 15, 1937, Serial No. 125,733

9 Claims. (Cl. 93—42)

This invention relates to box-making machines, and the general object of the invention is to provide a machine for automatically folding and stitching fiber board or corrugated paper boxes.

Another object is to provide a machine of the character stated which will be rapid, accurate and economical in operation.

Other objects and advantages will appear hereinafter.

The invention is illustrated in the annexed drawings which form a part of this specification and in which,

Fig. 1 is a side elevation of my invention.

Fig. 2 is an end elevation of the delivery end of my invention.

Fig. 3 is a plan view of my invention.

Fig. 4 is an enlarged fragmentary longitudinal vertical section, taken on line 4—4 of Fig. 3, illustrating the hopper and feed for the unfolded box blanks.

Fig. 5 is an enlarged fragmentary longitudinal vertical section, taken on line 5—5 of Fig. 6, illustrating the box feeding mechanism.

Fig. 6 is a plan view of Fig. 5.

Fig. 7 is a fragmentary front elevation of the air gun box folding mechanism taken on line 7—7 of Fig. 3.

Fig. 8 is a side view of Fig. 7.

Fig. 9 is an enlarged side view of the mechanism for positioning the box after it is folded.

Fig. 10 is a front view of Fig. 9.

Fig. 11 is a side view of the box straightening mechanism.

Fig. 12 is a front view of Fig. 11.

Fig. 13 is an enlarged side elevation of the trip mechanism for operating the stitching mechanism.

Fig. 14 is an end view of Fig. 13.

Fig. 15 is an enlarged end view of the control valve mechanism for the box-folding air guns.

Fig. 16 is a side view of Fig. 15.

Fig. 17 is a section of the air gun control valve taken on line 17—17 of Fig. 16.

Figs. 18 to 23 inclusive are perspectives of one of the box blanks, illustrating respectively the successive folding and other operations thereof by the machine.

Fig. 24 is an enlarged plan view of one of the box feed units shown engaging a box blank in its normal feeding operation.

Fig. 25 is a view like Fig. 24, except that the box blank is shown held stationary, while the staples are being driven through its overlapping edges, and the feeding mechanism is shown moved forward until the stop sleeves are engaged between the supporting bar and the engaging bar, for centering the overlapping edges of the box during the stapling operation.

Fig. 26 is a schematic view of the box folding means.

Fig. 27 is a longitudinal section on an enlarged scale of one of the valves of the box-feeding means.

Fig. 28 is a side elevation of a modification of the trip mechanism for controlling the stapling machine.

Fig. 29 is a side view of the trip cam of the trip mechanism shown in Fig. 28.

Fig. 30 is an edge view of the cam shown in Fig. 29.

Referring more particularly to the drawings in which corresponding parts are designated by the same reference characters in all of the figures, my invention comprises generally a hopper 1 for the box blanks to be folded and stitched, feeding means 2 for the box blanks, first folding means 3, second folding means 4, jogging means 5, straightening means 6, and stitching means 7.

The various mechanisms of my machine are mounted on a frame 8 including uprights 9, longitudinal beams 10 mounted on the upper ends of said uprights, cross beams 11 mounted on said longitudinal beams 10, a table 12 mounted on said cross beams, a base member 13 connected to the uprights 9 near their lower ends, and angle braces 14 connecting adjacent uprights 9.

The hopper 1 is mounted at the front end of the machine, and comprises a pair of spaced vertically disposed walls 15, adjustably mounted above the table 12 on a pair of superimposed horizontal rods 16 extending transversely over the table 12, which rods are secured at their ends to the upper end portions of a pair of uprights 17 respectively which are positioned adjacent the side edges respectively of the table 12 and are connected near their lower ends to the base member 13 by connections 18. Sleeves 19 are slidably fitted on the cross rods 16 and are formed with shanks 20 secured to the outer sides of the hopper walls 15, whereby said walls are slidably mounted on said cross rods, so that they may be moved toward or away from each other to receive between them unfolded boxes 21 of different sizes. Set screws 22 are seated in the sleeves 19 for engaging the rods 16 for securing the hopper walls 15 in the different positions on said rods to which they are adjusted to receive the box blanks of different sizes.

The box feeding mechanism 2 includes a plu-

rality of feed units 23 mounted on a pair of chains 24 extending longitudinally of the machine over sprockets 25 and 26 secured on shafts 27 and 28, respectively, which shafts are journaled in bearings 29 and 30, respectively, mounted on the under side of the table 12 at the front and rear ends thereof respectively. The upper reaches of said chains extend through longitudinal slots 31 in the table 12, so that the feed units 23 on said upper reaches of said chains are drawn over the table 12 from the front to the rear end of said table, as said chains are caused to travel over said sprockets 25 and 26, by means of driving mechanism 32, which includes a motor 33, pulley 34 on the motor shaft 35, reduction gear 36, belt 37 extending over the motor pulley 34 and drive pulley 38 of the reduction gear 36, driven sprocket 39 of said reduction gear, a drive sprocket 40 on the feed chain drive shaft 28, drive sprocket 41 on the drive shaft 42 of the straightening mechanism 6, drive sprocket 43 on the drive shaft 44 of the jogging mechanism 5, and a chain 45 extending over said sprockets 39, 40, 41, and 43. The motor 33 and the reduction gear 36 are mounted on the base member 13 near the rear end of the machine. A feed guide bar 46 extends longitudinally and centrally over the table 12 from the hopper 1 to the stitching mechanism 7 between the chains 24 and is secured at its front end to the under side of an arm 47 which is mounted at its forward end, by sleeves 48 formed thereon and fitted on the cross rods 16 of the hopper 1. Each of the feeding units 23 comprises a supporting bar 49 and a box-engaging bar 50 yieldingly mounted on said supporting bar by means of rods 51 and springs 52. The bars 49 and 50 extend transversely of the machine and the ends of the supporting bar 49 are secured to the chains 24 respectively. The rods 51 are secured in the engaging bar 50 and slidably extend through bearings 53 on the under side of the supporting bar 49, and the rods 51 are formed at one end with heads 54 for engaging the outer ends of the bearings 53 for limiting the movement of the engaging bar 50 away from the supporting bar 49 under the influence of the springs 52, which surround the rods 51, between the bars 49 and 50, with their ends engaging said bars respectively. The engaging bar 50 is formed intermediate its ends with a pair of spaced upstanding box-engaging lugs 55. Sleeves 52' surround the springs 52 respectively, and the ends of said sleeves are adapted to engage the adjacent edges of the supporting bar 49 and the engaging bar 50 to limit the forward movement of the bar 49, against the tension of said springs, when the bar 50 is momentarily held stationary by the engagement of the rear edges of the box with the lugs 55 on said bar 50, while the staples are driven through the over-lapping edges of the box by the stitching machine 7, in the manner hereinafter more particularly described. Rollers 53' are journaled at the rear of engaging bar 50, in brackets 54' mounted on said bar, for engaging the under side of the next lowest box blank and lifting said blank and the blanks above it slightly, so that the lowest blank, engaged by the lugs 55 of the engaging bar 50, may be more easily fed from under the blanks above it by the feed unit 23. A pair of spaced box-supporting bars 56 are secured to the table outwardly from each chain 24, within the hopper 1, and the inner ends of each pair of said bars extend over said chains respectively, at a sufficient distance above said chains to allow the feed-unit bars 50 and 49 to pass under them, while the inner ends of both pairs of said box-supporting bars 56 extend only a short distance over said chains, so that the box-engaging lugs 55 on the feed unit bars 50 may pass between said inner ends of said box-supporting bars 56. A transverse vertical stop plate 57 is mounted at the rear of the hopper 1 on the sleeves 48 with its lower edge 58 positioned only sufficiently above the table 12 to permit the lowermost box 21 to be fed rearwardly out of the hopper by a feed unit 23. At opposite sides respectively of the guide bar 46 are positioned a pair of guide and folding bars 59 extending longitudinally of the table 12, which bars are mounted at their forward ends, by means of cross members 60, on the rear end of the arm 47, and rest slightly above the surface of the table 12, so that two adjoining walls of a box 21 may be fed under said bars 59 respectively, while the other two walls of the box may be folded respectively over said bars by the folding means 3 and 4, and the box may be guided by the engagement of the outer edges of said bars with the inside of two corners respectively of the folded box, as the box is fed rearwardly by a feed unit 23.

The first folding means 3 includes a pair of cylinders 61, mounted at opposite sides respectively of the machine, pistons 62 reciprocatively mounted in said cylinders respectively, and piston rods 63 secured in said pistons respectively and extending through both ends of said cylinders respectively, the folding ends of said piston rods being formed with heads 64 for engaging the sides of the box to be folded, and there being adjustable stops 65 secured on the lower end portions of said piston rods for engaging the lower ends of the cylinders 61 for limiting the folding movement of the pistons 62 and piston rods 63. Packing boxes 66 and 66' surrounding the piston rods 63 are provided in the lower and upper ends of the cylinders 61 respectively. The cylinders 61 are provided with ports 67 and 68 in their lower ends and upper ends respectively. The stops 65 are in the form of clamps including screws 69 for securing the stops in different positions, to which they are adjusted on the piston rods 63. Each of the cylinders 61 is adjustably mounted on the frame 8 of the machine by means of a clamp 70, link 71, and a clamp bolt 72 which extends through the upper end of said link and through a horizontal slot 73 in one of the cross beams 11 of the frame 8, the clamp 70 embracing the cylinder 61 and the lower end of the link 71 being secured to said clamp by the clamp bolt 74. Upon loosening the clamp bolt 72 said bolt may be moved along the slot 73 for adjusting the position of the cylinder 61 to its proper folding position in which position the cylinder is secured by tightening the clamp bolt 72. The table 12 is provided with openings 75 through which the piston rods 63 are projected for folding two sides of the box upwardly. The pistons 62 and piston rods 63 are operated by compressed air supplied to the cylinders 61 by an air compressor 76, and air storage tank 77, through pipe 78 leading from said tank, branch pipe 79 leading from said pipe 78, valve 80, connected to said branch pipe, pipes 81 and 82 leading from said valve, pipes 83 and 84 connected to said pipes 81 and 82 respectively, control valves 85 connected to the ends respectively of pipe 83, hose 86 leading from said check valves respectively to the lower end ports 67 respectively of cylinders 61, and hose 87 leading from the ends respectively of pipe 84

to the upper end ports 68 respectively of said cylinders 61. The compressor 76 is driven by the motor 32 through a pulley 88 on motor shaft 35, pulley 89 on compressor shaft 90, and a belt 91 extending over said pulleys. From the outlet of the compressor a pipe 92 leads into the storage tank 77.

The second folding means 4 includes a pair of cylinders 93 mounted on frames 94 supported on opposite sides of the table 12 respectively, pistons 95 reciprocatively mounted in said cylinders respectively, and piston rods 96 secured in said pistons respectively and extending through both ends of said cylinders, respectively, the lower folding ends of said piston rods being formed with heads 97 for engaging the upwardly folded sides respectively of the box for folding said sides downwardly, there being adjustable stops 98 secured on the upper end portions of said piston rods respectively for engaging the upper ends of said cylinders 93 respectively for limiting the downward folding movement of the pistons 95 and piston rods 96. Packing boxes 99 and 100 in the lower and upper ends respectively of cylinders 93 surround the piston rods 96 respectively. The stops 98 are in the form of clamps including screws 101 for securing the stops in different positions on the piston rods 96 to which they are adjusted. Each of the supporting frames 94 for the cylinders 93 comprises a pair of standards 102, secured at their lower ends upon the table 12, and a horizontal cross bar 103 secured at its ends to the upper ends respectively of said standards. Each cylinder 93 is adjustably mounted on the cross bar 103 of a frame 94 by means of an upstanding arm 104, secured on said cross bar, and a clamp 105 embracing the cylinder 93, said clamp being pivotally secured to the upper end of said arm by the clamp bolt 106, whereby the cylinder is longitudinally adjustably mounted in said clamps and pivotally mounted on said clamp bolt. The pistons 95 and rods 96 are operated by the compressed air from the tank 76 which air is supplied from said tank through pipe 78, branch pipe 107 leading from said pipe 78, valve 108 connected to said branch pipe, pipes 109 and 110 leading from said valve, pipes 111 and 112 connected to said pipes 109 and 110 respectively, check valves 113 connected to the ends respectively of said pipe 111, hose 114 leading from said check valves respectively to ports 115 in the upper ends of cylinders 93 respectively, and hose 116 leading from the ends respectively of pipe 112 to ports 117 in the lower ends respectively of said cylinders.

Each valve 80 and 108 is provided with an exhaust port 118 and with two ports 119 and 120 in its rotary plug 121. The valves 80 and 108 are automatically operated respectively by valve-operating mechanisms 122 and 123, which are identical in construction and a description of valve-operating mechanism 122 will apply to valve-operating mechanism 123. The valve-operating mechanism 122 includes a pinion 124, secured on the valve plug shaft 125, in mesh with a gear 126, secured on a shaft 127, on which shaft is also secured a ratchet 128 engaged by a pawl 129 pivoted by pin 130 on the outer end of an arm 131 turnably mounted on shaft 127, which pin 130 also carries a roller 132 engaged by a cam 133 secured on a shaft 134, on which shaft is also secured a sprocket 135 over which travels a chain 136, which chain also travels over the corresponding sprocket 135 of the valve-controlling mechanism 123 of valve 108, and over a sprocket 137 secured on the shaft 44 of the jogging mechanism 5. The shaft 127 is journaled in a bearing 138 mounted on one of the horizontal beams 10 of the frame 8. The valve 80 is mounted on a bracket 139 secured to said beam 10. The shaft 134 is journaled in bearings 140 mounted on one of the cross beams 11 of the frame 8. The cam 133 is formed with a pair of cam members 141 and 142 which alternately engage the pawl-arm roller 132.

The jogging mechanism 5 includes a pair of power driven lower pressure rollers 150 and a pair of power driven upper pressure rollers 151 for engaging the lower and upper sides respectively of the folded box to advance the box a little faster than it is fed by the feeding mechanism 2 and move the rear edge of the box forwardly of the box-engaging bar 50 of its feed unit 23, so that the rear edges of the folded sides of the box, which might be folded over the engaging lugs 55 on said bar, may drop down in front of said lugs and be subsequently engaged by said lugs, whereby the folded sides of the box may be fed straight in position to be stitched together by the stitching machine 7, in the manner hereinafter more fully described. The rollers of each of said pairs 150 and 151 are spaced a short distance apart at opposite sides of the longitudinal center of the table 12 and the table is provided with slots 153 through which the rollers 150 move up or down for engaging or disengaging the under side of the box. The rollers 150 are secured on a shaft 154 extending transversely of and under the table 12 and is journaled at its ends in bearings 155 on the forward ends of a pair of arms 156, which arms are secured at their rear ends on a shaft 157 extending transversely of and under the table 12 and journaled at its ends in bearings 158 mounted on the under side of said table. The rollers 151 are secured on a shaft 159 extending transversely of and above the table 12 and journaled at its ends in bearings 160 on the forward ends of a pair of arms 161 which are secured at their rear ends on a shaft 162 extending transversely of and above the table 12 and journaled at its ends in bearings 163 upstanding from said table. A shaft 164 extends transversely of and under the table 12 and is journaled at its ends in bearings 165 mounted upon the longitudinal beams 10, on one end of which shaft are secured a pair of arms 166 and 167, and a depending cam arm 168 which engages a cam 169 secured on the drive shaft 44. A link 170 connects the arm 166 and the lower arm 156 and a link 171 connects the arm 167 and the upper roller arm 161 through which links the rollers 150 and 151 are swung toward or away from each other by the engagement of the cam arm 168 with the cam 169. A sprocket 172 over which the chain 45 travels is secured on a shaft 173 extending transversely of the machine, between the longitudinal beams 10 and the table 12 and is journaled at its ends in bearings 174 mounted on said beams respectively. On said shaft 173 is secured a sprocket 175 and on the shaft 159 is secured a sprocket 176 over which sprockets extends a chain 177. A sprocket 178 is also secured on the shaft 159 and a sprocket 179 is secured on the lower roller shaft 154, over which sprockets loosely extends a chain 180.

The straightening means 6 includes a pair of lower rollers 182 and a pair of upper rollers 183 for engaging the lower side and the upper folded sides respectively of the folded box for straighten-

ing the overlapping edges of the folded sides with relation to each other, so that said edges will be positioned properly for stitching the same together by the stitching machine 7. The rollers of each of said pairs 182 and 183 are spaced a short distance apart at opposite sides of the longitudinal center of the table 12, and said table is provided with slots 184 through which the rollers 182 move up or down for engaging or disengaging the under side of the box. The rollers of each pair 182 and 183 are also disposed at an angle to the longitudinal center of the table so that they converge in the rearward direction of the machine, which causes them to apply pressure to the folded sides of the box to straighten the overlapping edges of said sides in position for stitching as above described. The rollers 182 are journaled to rotate freely in yokes 185 which are formed with depending stud pivots 186 extended through the outer ends of arms 187 respectively, which arms are secured at their rear ends on a rock shaft 188 journaled in brackets 189 secured to the under side of the table 12.

The lower ends of the yoke studs 186 are threaded to receive nuts 190 which engage the lower sides of the arms 187 for adjustably securing the yokes 185 and their rollers 182 in their adjusted angular positions. The brackets 189 are formed with threaded lugs 191 to receive the upper ends of bolts 192 which are extended upwardly through the arms 187 with the heads of said bolts engaging the under sides of said arms for supporting the same, together with the yokes 185 and rollers 182 in operative position. Stop nuts 193 are fitted on the bolts 192 for engaging the upper sides of the arms 187 and locking the bolts 192 against turning with said arms adjusted and properly positioning the rollers 182. The rollers 183 are journaled to rotate freely in yokes 194 which are formed with upstanding stud pivots 195 extended through the outer ends of arms 196 respectively, which arms are secured at their rear ends on a rock shaft 197 journaled in brackets 198 secured to the upper side of the table 12. The upper ends of the yoke studs 195 are threaded to receive nuts 199 which engage the upper sides of the arms 196 for adjustably securing the yokes 194 and their rollers 183 in their adjusted angular positions. The brackets 198 are formed with threaded lugs 200 to receive the lower ends of bolts 201 which are extended downwardly through the arms 196 with their heads engaging the upper sides of said arms for supporting said arms, together with the yokes 194 and their rollers 183 in operative position. Stop nuts 202 are fitted on the bolts 201 for engaging the under sides of the arms 196 and locking the bolts 201 against turning with said arms adjusted and properly positioning the rollers 183. A cam arm 203 is secured at its rear end on the rock shaft 188 and carries on its forward end a roller 204 which engages a cam 205 secured on the drive shaft 42, of the straightening mechanism 6. A spring 203' is connected to said cam arm 203 and to the table 12 for raising the rollers 182, into straightening contact with the lower side of the folded box, when the low parts of the cam 205 are brought opposite the cam roller 204. The engagement of the high parts of the cam 205 with the cam roller 204 lowers the rollers 182 out of contact with the lower side of said box after the upper folded sides of the box have been straightened for stitching the overlapping edges of said folded sides together. To the rock shaft 197 is secured the rear end of a cam arm 206 which is pivotally connected at its forward end at 207 to the upper end of a vertical link 208, which extends downwardly through an opening 209 in the table 12 and through a bearing 210 mounted on said table, and carries at its lower end a roller 211 for engaging the cam 205 for lowering the upper straightening rollers 183 into straightening contact with the folded sides of the box, for straightening said sides for stitching the overlapping edges of said sides together, and for raising said straightening rollers out of straightening contact with said folded sides of the box when said sides have been straightened by said rollers and the box has been fed to the stitching machine 7.

The stitching means 7 comprises a conventional stapling machine 212 driven by its own motion and a control mechanism 213. The stapling machine 212 is mounted on the floor on which my invention is mounted, so that the stapling elements of said stapling machine are positioned to drive staples through the overlapping edges of the folded sides of the box and clinch the ends of the driven staples against the under side of the overlapping edge of the lower folded side of the box. The stitching control mechanism 213 includes a horizontal dog bar 214, a plurality of dogs 215 adjustably mounted on said bar, triggers 216 secured on the bars 49 of the feed units 23 respectively, a pair of rock arms 217 and 218 connected at their upper ends to the ends respectively of the dog bar 214, a pair of rock shafts 219 and 220 on which said rock arms are respectively secured, a crank arm 221 secured on the rock shaft 220, and a link 222 connected at its upper end to said crank arm 221 and at its lower end to the clutch operating treadle 223 of the stapling machine 211. The rock shaft 219 extends across the machine and is journaled in bearings 224 mounted on the lower side of the longitudinal beams 10 of the frame of the machine, and the rock shaft 220 also extends across the machine and is journaled in bearings 225 mounted on the lower side of said longitudinal beams. Each of the dogs 215 is provided with a slot 226 through which the bar 214 extends and a set screw 227 is seated in the dog for engaging the bar 214, whereby the dogs are adjusted to their proper operative positions and detachably secured in such positions on said bar. The bar 214 is formed with its upper edge offset downwardly at 228, on which edge one or more dogs 215 may be positioned so that their upper leveled edges 229 will rest below and out of reach and operative relation to the triggers 216 when said dogs are not needed, the number of dogs needed depending upon the number of staples to be driven by the stapling machine 211 through the overlapping edges of the folded sides of the box. A spring 230 is connected to one end of the dog bar 215 and to one of the longitudinal beams 10 of the frame of the machine, as at 231, for returning said bar and the dogs 215 thereon to their initial positions, each time a dog has been engaged by a trigger 216 and the trigger has escaped the dog, for operating the clutch treadle 223 of the stapling machine 211, so that a staple will be driven by said machine through the overlapping edges of the folded sides of a box.

The operation of my invention is as follows:

The unfolded boxes 21, as shown in Figs. 4 and 18 of the drawings, being stacked horizontally in the hopper 1 with the lowermost box resting upon the supporting bars 56, and the various operating mechanisms of the machine being driven by

the driving mechanism 33, a feed unit 23 is moved by the chains 24 into the forward end of the hopper 1, so that the lugs 55 on the bar 50 of said feed unit engage the rear edge of the lowermost box in the hopper and feed said box forwardly out of said hopper under the lower edge 58 of the stop plate 57 at the forward end of the hopper 1, onto the table 12, the next lower box in the hopper dropping upon the supporting bars 56 in the hopper 1, whereupon the sides 240 of the box which is fed onto the table are engaged by the heads 64 on the upper ends of the piston rods 63 of the first folding mechanism 3, and said sides are folded upwardly into vertical position by said first folding mechanism as shown in dotted lines in Fig. 7 and as illustrated in Fig. 19. The feeding mechanism 2 continuing to feed the box forwardly on the table 12, the heads 97 on the lower ends of the piston rods 96 of the second folding mechanism 4 engage the vertically folded sides of the box and said sides are folded, by said second folding mechanism, downwardly flat upon the unfolded sides of the box, as illustrated in Figs. 7 and 20 of the drawings. The folded box is then fed forwardly by the feeding mechanism 2 between the lower rollers 150 and the upper rollers 151 of the jogging mechanism 5, whereupon said lower rollers are moved up against the under side of the box, by the cam 169 through the medium of cam arm 168, arm 166, link 190 and roller arm 156, while the upper rollers 151 are moved down against the folded sides 240 of the box by the cam 169, cam arm 168, arm 167, link 171 and roller arm 161, and the box, gripped between said rollers is moved forwardly by said rollers faster than the feeding mechanism 2 and away from the feed bar 50 of the feed unit 23, so that the rear edges of the folded sides of the box, which might be resting upon the lugs 55 of said feed bar, on account of said sides of the box not being folded square, will drop down upon the unfolded sides of the box, whereupon said rear edges will be positioned to be engaged by the forward sides of said feed bar lugs, when the box passes beyond said jogging rollers, and said lugs on the feed unit 23 catch up with the box, as illustrated in Fig. 21. When said feed unit catches up with the box and the lugs 55 engage the rear edges of both the unfolded and folded sides of the box, the box is fed by said feed unit 23 between the rollers 182 and 183 of the straightening mechanism, whereupon the rollers 182 are moved up into contact with the under side of the unfolded sides of the box, by the cam 205, through the medium of cam arm 203 and roller arm 187, while the rollers 183 are moved down into contact with the upper sides of the folded sides 240 of the box, by the cam 205, through the medium of the cam arm 206 and roller arm 196, and the box being gripped between said rollers, the angularity of said rollers straightens the folded sides of the box so that the overlapping edges 241 of said sides are brought into proper position with relation to each other to be secured together by the stapling machine 211 as shown in Fig. 22. The box is then fed by the feeding mechanism 2 forwardly from between the straightening rollers 182 and 183 under the stapling machine 211, whereupon the trigger 216, associated with the feed unit by which the box is being fed, engages and escapes the dogs 215 successively, and throws the clutch of the stapling machine 211 into and out of engagement successively through the medium of the dog bar 214, spring 230, arm 218, crank shaft 220, crank arm 221, link 222 and treadle lever 223 and its connections, which causes said stapling machine to drive a series of staples 242 successively, in suitably spaced relation, through the over-lapping edges 241 of the folded sides of the box, as shown in Fig. 23 of the drawings. During each stapling operation of the stapling machine in driving a staple through the overlapping edges 241 of the folded sides of the box, the box is held stationary by the stapling machine, and the engaging bar 50 with its lugs 55, engaged by the rear edges of the box, is also held stationary, while the supporting bar 49 is moved forward, by the moving chains 24, toward said engaging bar 50, against the tension of the springs 52, until the adjacent edges of the supporting bar 49 and engaging bar 50 engage the ends of the stop sleeves 54', which positions the engaging bar 50, and the folded box engaged by the lugs 55 of said bar, in perfect alignment while the staple is being driven through the overlapping edges of the sides of the box, whereby the overlapping edges of the sides of the box are positioned properly to receive the staples. The folded and stitched box is then fed on forwardly from the stapling machine and delivered from the rear end of the table 12. As each box is fed from the hopper and folded, stitched and delivered, succeeding boxes are likewise fed, folded, stitched and delivered as above described.

In the modification of the trip mechanism, for operating the stitching mechanism 7, a cam 235 and cam bell-crank lever 236 are substituted for the trigger 216, dogs 215 and dog bar 214 and connections, and a conventional variable speed drive 237 is interposed between the motor and the reduction gear 36. The cam 235 is secured on a shaft 238 journaled in bearings 239 mounted on the upper longitudinal frame beams 10. The cam 235 is made in two sections 240 and 241 formed with hubs 242 and 243 fitted on the shaft 239 and adjustably secured on said shaft by set screws 244 and 245 respectively, whereby the cam sections 240 and 241 may be relatively adjusted about the shaft 239 to lengthen or shorten the cam 235. A sprocket 246 is secured on the shaft 238 and a sprocket 247 is secured on the shaft 28 of the box-feeding mechanism 2, over which sprockets extends a chain 248. One arm of the bell-crank lever 236 carries a roller 249 for engaging the cam 235, while the other end of said lever is connected to the upper end of the link 222 which is connected at its lower end to the treadle lever 223 of the stapling machine 211. The bell-crank lever 236 is pivotally mounted at 250 on the under side of the upper frame beam 10. The variable speed drive 237 is driven by the motor 33 through a pulley 251 secured on the motor shaft 35, a pulley 252 secured on the shaft 253 of the variable speed drive 237 and a belt 254 extending over said pulleys. The reduction gear 36 is driven from the variable speed drive 237 by a pulley 255 secured on the shaft 256 of said variable speed drive, a pulley 257 secured on the shaft 258 of said reduction gear, and a belt 259 extending over said pulleys.

In the operation this form of trip mechanism the clutch of the stapling machine 211, by means of the cam 235, bell-crank lever 236, link 222 and treadle 223 and its connections, is held in engagement continuously to maintain the stapling machine in continuous operation by its own motion while all of the staples are driven through the overlapping edges 241 of the box, and, by means of the variable speed drive 237, the speed

of the box feeding mechanism 2 may be varied to vary the speed of the movement of the folded box through the stapling machine, whereby the spacing of the staples driven by said machine through the overlapping edges of the box may be varied.

I do not limit my invention to the exact construction herein shown and particularly described since variations and modifications may be made therein without departing from the spirit of the invention.

I claim as my invention:

1. In a box-making machine, a table, a pair of folding bars mounted over said table, means for feeding an unfolded box over said table and under said guide bars, a first folding means comprising a pair of rods and means for pushing the ends of said rods against two sides of said box for folding said sides respectively upwardly against the edges of said folding bars, a second folding means comprising a pair of rods and means for pushing the ends of said rods against said upwardly folded sides of the box for folding said sides downwardly over said folding bars in position with their edges in overlapping relation, and means for securing said overlapping edges together.

2. In a box-making machine, a feed unit including a feed bar formed with upstanding lugs, means for advancing said feed unit to engage the rear edge of an unfolded box to feed said box forward, means for folding two sides of said box into position with the edges of said sides overlapping, jogging means for gripping said folded box and advancing said box beyond said feed unit, whereby the rear edges of said folded sides are allowed to drop down in front of the lugs of said feed bar, when said sides are not folded straight and their rear edges have folded upon said lugs, so that when said folded box passes beyond said jogging means, said rear edges of said sides of said box will be engaged by said feed-bar lugs and said folded box fed forward by said feed unit, means for straightening said folded sides of the box for properly positioning the overlapping edges of said sides to be secured together, and means for securing said overlapping edges of said sides together.

3. In a box-making machine, a box-feed unit including a supporting bar, a box-engaging bar mounted on a pair of rods slidably mounting in said supporting bar springs surrounding said rods between said bars for normally forcing said box-engaging bar away from said supporting bar, and sleeves surrounding said springs between said bars for limiting the movement of said supporting bar toward said box-engaging bar for centering the folded edges of the box while staples are driven through said overlapping edges.

4. In a box-making machine, means for folding two sides of a box into position with their edges overlapping, a pair of lower rollers, a pair of upper rollers, means for feeding said folded box between said lower rollers and said upper rollers, means for moving said lower rollers and said upper rollers toward each other for gripping the folded box therebetween, with said upper rollers gripping said folded sides respectively and straightening the same into position for securing said overlapping edges together, and means for securing said overlapping edges together when said folded sides are straightened by said rollers.

5. In a box-making machine with straightening rollers, as claimed in claim 4, said rollers being disposed at an angle to the direction of feeding movement of the folded box.

6. In a box-folding machine with straightening rollers, as claimed in claim 4, said lower rollers converging in the direction of feeding movement of the folded box, and said upper rollers converging in the direction of feeding movement of the folded box.

7. In a box-making machine, a feed unit including a feed bar formed with upstanding lugs, feeding means for advancing said feed unit to cause said lugs to engage the rear edge of an unfolded box to feed said box forward, means for folding two sides of said box into position with the edges of said sides overlapping, jogging means comprising a pair of lower rollers and a pair of upper rollers, means for moving said lower rollers and said upper rollers toward each other for gripping said folded box therebetween, and means for rotating said rollers to advance said gripped folded box beyond said lugs of said feed bar, whereby the rear edges of said folded sides are allowed to drop down in front of said lugs of said feed bar, when said sides are not folded straight and their rear edges have folded upon said lugs, so that when said folded box passes beyond said jogging means, said rear edges of said folded sides of said box will be engaged by said feed-bar lugs and said folded box fed forward by said feeding means and said feed unit, means for straightening said folded sides of the box for properly positioning the overlapping edges of said folded sides to be secured together, and means for securing said overlapping edges of said sides together.

8. In a box-making machine, means for feeding a box through the machine, means for folding two sides of the box in overlapping relation as the box is fed through the machine, means for stapling together said overlapping edges of said folded sides of the box, as the box is fed through the machine, means for varying the speed of said feeding means, without varying the speed of said stapling means, for varying the spacing of the staples driven through said overlapping edges of said folded sides.

9. In a box-making machine as claimed in claim 8, means for timing the operation of said stapling means according to the speed of said feeding means, so that said stapling means will be operated only while the folded box passes therethrough.

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