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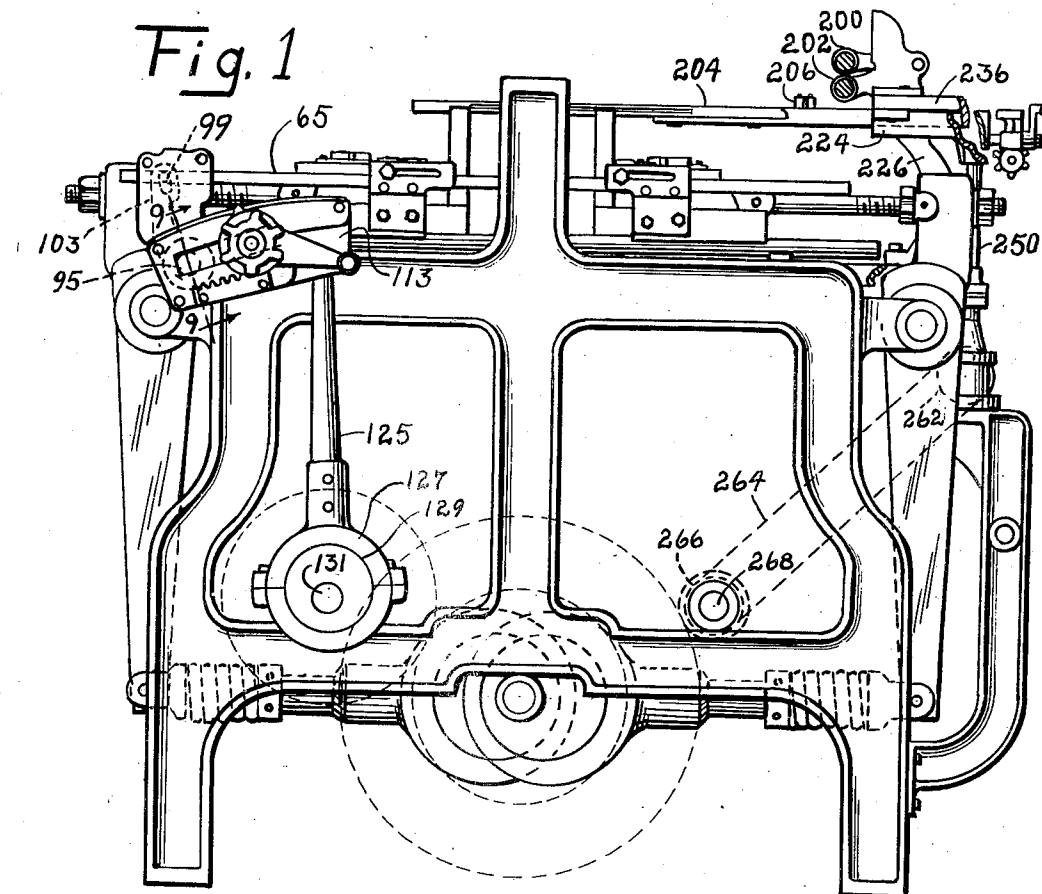
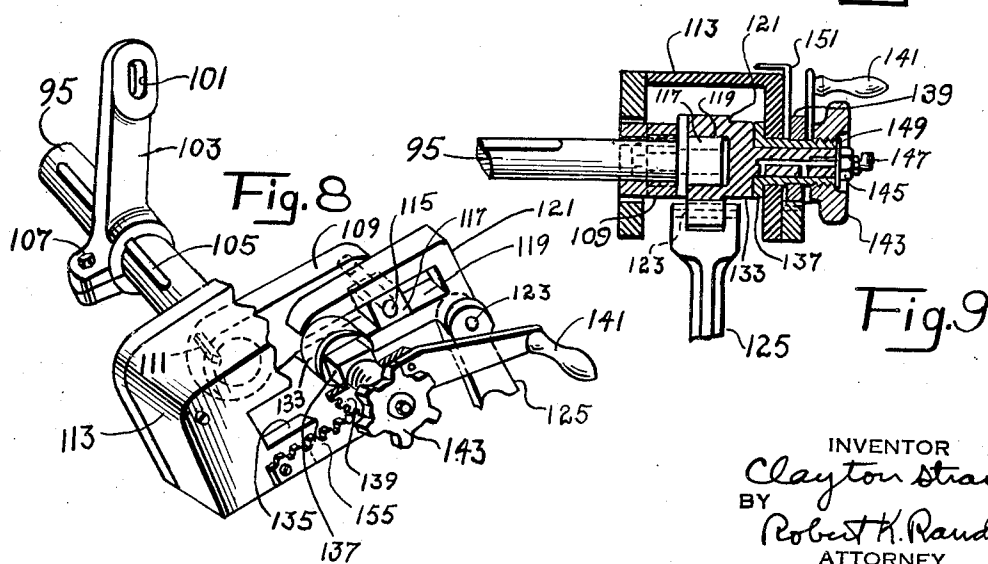
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BOX-MAKING MACHINE

Filed April 13, 1938

2 Sheets-Sheet 1



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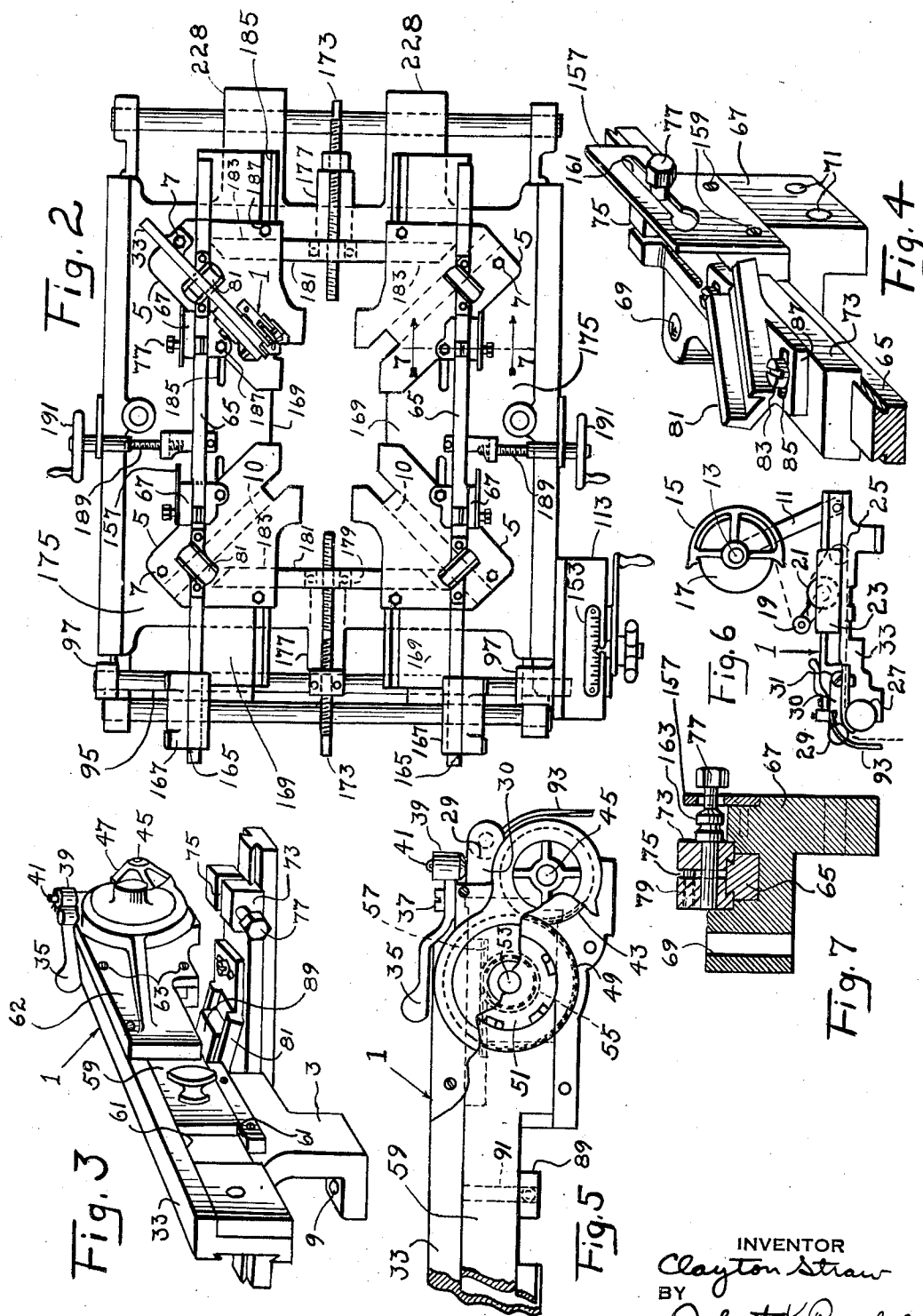
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UNITED STATES PATENT OFFICE

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BOX-MAKING MACHINE

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Application April 13, 1938, Serial No. 201,682

13 Claims. (Cl. 93—41)

This invention relates to box-making machines in general, and in particular comprises several improvements in the well-known Kingsbury & Davis paper box machine of U. S. Letters Patent No. 655,434, dated August 7, 1900; No. 728,086, dated May 12, 1903; and No. 2,082,365, dated June 1, 1937, to which documents reference can be had for an understanding of the operation of all parts not specifically described herein. In general, the present invention aims to improve the said machine in the way of speeding up the adjustment and operation of the box machine and to eliminate the waste of materials hitherto necessarily incident to getting the machine in proper adjustment after a change in the size of the box being made.

To these ends, the invention comprises the novel stay feeding devices and the new box-size adjusting devices shown in the accompanying drawings and set forth in the following description and claims.

In the machines of the aforesaid prior patents, the stay feeding, cutting and pressing devices were driven through the stroke of the presser which pressed the glued end-ports of the folded box against the form. This presser was in turn driven through a spring which yielded to allow for variations in the stroke of the presser incident to changes in the thickness of the stock forming the sides and ends of the box. Since the presser thus automatically varied its length of stroke, and this length of stroke determined the length of stay fed at each operation, the length of stay which would be delivered could only be ascertained and averaged by trial and error during the operation of the machine upon the actual material to be used in forming a particular size or character of box. This meant the spoiling and wastage of considerable box stock and stay material before a satisfactory adjustment could be obtained. Also, each stay feeder had to be adjusted independently, with the manipulation of two adjusting nuts on each presser, or a total of eight separate nuts, in getting the four stays of each box cut to the desired length. Further, when the depth of the box was changed, it was necessary to run the machine without box blanks, make the adjustment of each stay feeder while running, and measure the length of stay thus clipped off until the right length was found, repeating this operation successively with the other three stay feeders. Since the machine runs at from 70 to 120 cycles per minute, a relatively great quantity of stay material would inevitably be cut off

and wasted by the four stay feeders before the adjusting was completed, to say nothing of the waste of time and effort involved in making the adjustment. Lastly, there was always the waste of the first box formed and stayed in the machine, because in order to wet the adhesive of the stay strip, the machine must be run one cycle with no blank in it, to feed the stay past the moistening device. This meant that the stroke given by the presser to the stay feeding slide was too great, as there was neither form nor blank to stop the inward stroke of the presser and hence the length of stay fed during the outward stroke of the presser in preparation for receipt of the first blank was considerably longer than the vertical height of the corners of the box, so that the stays applied to the first box spoiled the looks of the box, making it necessary to discard it.

In accordance with the invention, the stay feed is rendered entirely independent of the stroke of the presser. Accordingly, it is possible to determine exactly in advance, by reference to a scale, the exact length of stay that will be fed at each and every stroke, and thus to make the first exactly like all the rest. Thus, all the customary waste of box blanks and stay material in adjusting the machine is eliminated. Most important, it makes it possible to adjust all four stay feeders simultaneously and identically, with a minimum of effort and loss of time. Further, through making the stay feed independent of the presser, which latter retracts the knife which cuts off the stay, the full half-cycle of the machine during which the knife is retracted can be used for feeding the stay; heretofore only one-half of the back stroke of the presser or one-quarter cycle of the machine could be utilized to feed the stay, as the other half-stroke or quarter-cycle had to be spent in retracting the knife out of the path of the stay before the latter could be shot out. Thus the rate of production of the box-making machine could be doubled without requiring an increase in the rate of stay feed over that previously determined to be the maximum possible speed, which maximum rate of stay-feed is one of the factors definitely limiting the speed of production obtainable in these machines.

To facilitate and speed up the width and length adjustments of the corner-blocks and other parts which shape the box around the form, jack-screws are provided to impart movement to these parts endwise of the box while keeping them in parallel relation, and the problem of keeping these jack-screws out of the path of the vertically reciprocating form has been solved by

using opposed right and left-hand threads on each screw, so that the screws not only retract or push inward the parts to be moved, but also themselves move outward to clear the form.

5 This arrangement replaces the prior primitive method of using a mallet to pound the parts inward or outward, with no provision for keeping the parts in parallel relation. Means is provided to carry the stay-feeder driving devices
10 along with the corner-blocks in thus adjusting the length-staying of the machine, so that such adjustment will not change the length of stay being fed unless otherwise adjusted. Adjustment of the corner-blocks to suit any desired width of box is attained by screw means without affecting the operation of the stay feeding devices.

Other aims of the invention, and their manner of attainment, are as will be made plain hereinafter.

20 An illustrative embodiment of the invention is shown in the accompanying drawings in which,

Fig. 1 is a side elevation showing the main parts of a Kingsbury & Davis quadruple stayer, showing the stay-feed driving mechanism and
25 blank feeding devices of the invention in place thereon, with the stay-feeders themselves removed.

Fig. 2 is a plan view of the machine of Fig. 1, with certain parts omitted, showing the driving mechanism for the stay-feeders and the size-adjusting devices.

Fig. 3 is a perspective view of a portion of one stay-feeding device showing its connection with its actuating slide.

35 Fig. 4 is a perspective view of the actuating slide of Fig. 3, showing the details of construction.

Fig. 5 is a side elevation of the stay feeding device of Fig. 3, showing the stay feeding rolls therein.

40 Fig. 6 is an elevation of the stay feeding device alone of Fig. 3, showing the manner in which the supply of gummed stay material is supported and moistened.

Fig. 7 is a vertical section on line 7—7 of Fig. 2.

Fig. 8 is a perspective view of the adjustable link motion which determines the length of the stays projected at each cycle of the machine.

Fig. 9 is a section on line 9—9 of Fig. 1.

50 The stay feeding devices, indicated generally at 1 in Figs. 3 and 5, are each mounted by means of its foot 3 upon one of the four corner-blocks 5 by means of a bolt 7 put through hole 9 in the horizontal portion of such foot. These
55 corner-blocks 5 are made as usual, except in such particulars as have to do with their adjustable mounting as will be described hereinafter, and perform their usual function of holding the four sides of the box in bent-up relation about the form during the application of the stays to the corners of the box, and of guiding the stay pressers, not shown, which reciprocate diagonally inward in slots 10 as heretofore to
60 press the gummed stays into adherence with the corners of the box. These corner-blocks are in fixed relation upon the machine except during the adjustment of their position, as heretofore.

Each stay feeder 1 has an angularly upstanding arm 11, Fig. 6, at the upper end of which is a stud 13 and guard 15, holding a roll 17 of gummed stay strip which is led around an idler 19, over a moistening roll 21 partially immersed in water in a small tank 23, thereafter reversing
75 its direction of travel around roll 25 to be nipped

between driven feed roll 27 and a presser roll 29 on the end of an arm 30 pivoted at 24 on the stationary frame 33 of the stay feeder. A thumb lever 35 pivoted at 37 on frame 33 has a hub on its extremity containing a spring-pressed plunger 41 the head of which presses down on arm 30 to press roll 29 and the stay strip yieldingly against the surface of the feed roll. To prevent gumming up of roll 29 with adhesive, wetting roll 21 has a groove around its surface centrally disposed in its strip-engaging face, and presser roll 29 is made narrow enough to run on this unwetted central zone of the glued face of the stay strip.

Feed roll 27 is rotated by means of a gear 43 fixed on its shaft 45, a pyramidal fluted knob 47 being fixed on the outward end of shaft 45 to permit of manual operation of the feed roll when desired. Gear 43 engages with a larger gear 49 forming the outer element of a Horton clutch or ratchet 51, of which the inner driving element is fixed on a stub-shaft 53 on which is also fixed a pinion gear 55 meshing with a rack 57 fixed on a slide 59 working in ways 61 provided on the side of frame 33 and held in place by a flat portion of a gear housing 62 fixed to frame 33 by screws 63. As will be obvious, when slide 59 is moved lengthwise of frame 33 in a direction away from feed roll 27, shaft 53 will be rotated by the rack and pinion in a counterclockwise direction to drive gear 49, thereby imparting clockwise rotation to gear 43 of Fig. 5 and a corresponding stay-feeding rotation to feed roll 27; when slide 51 moves reversely, the rollers between parts 49 and 51, of the Horton clutch release their grip, and no rotation of gear 49 takes place. All four stay feeders at the four corners of the box are made as described, except that two of them have their racks 57 located below pinions 55, so as to feed the stay strip during the stroke of slide 59 in the opposite direction to that described.

To actuate the slides 59 of the stay feeders, a driving slide 65 is mounted at each side of the machine for reciprocating movement in suitable slots in two blocks 67 (Figs. 2, 4 and 7) one of which is fixed on each of the four corner-blocks 5 by bolts put through holes 69 and 71 and through the corner-blocks. The top portion of each driving slot 65 is dove-tailed in section, as shown in Figs. 4 and 7, to receive the correspondingly-shaped bottom portion of two cam-blocks 73 which are thus made slidable along the length of the driving slides without danger of escape therefrom, each block being split at one end as indicated at 75 and equipped with a cap screw 77 drawing together the sides of slot 75, to clamp the block securely to slide 65 after it has been given the proper position thereon, the top of the slit being held apart by a stud 79.

On the cam block 73 is mounted a short section of cam-path 81, attached with capacity for angular adjustment by screws 83 put through slots 85 in lugs 87 at the sides of the cam-path. Each actuating slide 59 of the several stay feeders 1 is provided with a rectangular cam-follower 89 which fits within cam-path 81 and which has a shank 91 fixed to it and swiveling in a vertical bearing in slide 59. Thus, when the driving slide 65 is moved in one direction toward the left in Fig. 2, in the present instance, each cam-path 81, normally standing at a 45° angle to the length of the driving slide, causes each actuating slide 59 of the stay feeder to move

along its ways in frame 33 of the stay feeder, thereby effecting the feeding rotation of feed roll 27. Although the respective actuating slides 59 of the two stay feeders which are actuated by a single driving slide 65 are located at a 90° angle with respect to each other, and therefore will be moved in opposite directions simultaneously by the stroke of driving slide 65 in one direction, the location of rack 57 above pinion 55 in one of these stay feeders, and of such rack below its pinion in the other of these stay feeders, imparts the same feeding direction of rotation to the respective feed rolls 27 so that both feed their stay material simultaneously under their respective guards 93 into position to be pressed as heretofore by the corner-presser into adhesion with the sides of the box adjacent the corner being stayed and to be cut off by the usual knife traveling with the presser at the proper point to fit the height of the box sides. Reverse movement of driving slides 65, to the right in Fig. 2, in the construction shown, merely moves the actuating slides 59 and rotates the driving element of the Horton clutch reversely and idly in preparation for the next feeding stroke.

The adjustable mounting of cam-paths 81 on cam-block 73 is utilized only in first setting up the machine, or in correcting for wear in the course of long use or for errors in machining, as its only function is to obtain the same length of stay feed in the case of all four stay feeders for a given movement of driving slides 65; i. e., to equalize the feed of all stay feeders.

Once this equalization has been attained, the adjustment of the length of stay delivered and cut off from each of the four stay feeders simultaneously, to suit the depth of box being made, is attained by varying the throw of the driving slide 65. These slides are driven in unison from a common rockshaft 95 at the left-hand side of the machine, mounted in bearings 97 on the machine frame. Each slide 65 is provided with a laterally-extending pin 99 working in a slot 101, in the end of an arm 103, Figs. 1 and 8, the hub of which is splined at 105 to the rockshaft with capacity for adjustment along such rockshaft without loss of its angular relation thereto (to provide for width adjustment of the machine) and held in operatively fixed position along such rockshaft by a cap screw 107 clamping the split hub tightly in place on rockshaft 95. Pin 99 fits closely in slot 101, to avoid lost motion.

The length of each stay fed and cut is accurately controlled by varying the throw of rockshaft 95 in the following manner: rockshaft 95 is provided at its end with an arm 109, Figs. 8 and 9, secured thereon against rotation by key 111, and oscillating within a casing 113 bolted rigidly to the side of the machine. In the end of arm 109 is fixed a pin 115, on which swivels a square block 117, closely fitting within a slot 119 in a link 121 pivotally connected at its right-hand end at 123 to a connecting rod 125 terminating at its lower end in a strap 127 encircling an eccentric 129 fixed on cam-shaft 131 which as heretofore propels the form (not shown) up and down. The left-hand end of slotted link 119 is provided with a shouldered shank 133 which forms the pivot about which the slotted link oscillates. The reduced end of this shank 133 extends out through a slot 135 in the front plate of casing 113, such slot being curved concentric with cam-shaft 131. This reduced portion of shank 133 is provided with a bushing 137

having a flange within the slotted front plate of casing 113, a square portion fitting slidably and non-rotatably within slot 135, and outside of this a cylindrical portion on which is freely rotatable a pinion 139 having fixed thereto a hand-crank 141, the bushing finally terminating in an exteriorly threaded end to which is applied a hand-nut 143. The reduced end of shank 133 integral with slotted link 119 is bored axially and radially to provide an oil passage lubricating the bearing surface of this shank against the interior of bushing 137 as the shank oscillates constantly within the stationary bushing during the operation of the machine. The outward end of this oil passage is threaded, and a cap screw 145 having an oil-cup 147 and communicating central oil passage are applied thereto, the cap screw holding in place a washer 149 which prevents hand-nut 143 from being backed off far enough to let the oscillating link 121 move inward into engagement with arm 109.

Thus, shank 133 of slotted link 121 forms the fulcrum about which such slotted link oscillates when its right-hand end is lifted and lowered by connecting rod 125 and eccentric 129. The amplitude of movement of rockshaft 95, and hence the stroke of driving slides 65 and the consequent extent of simultaneous feed of the four stay strips, is determined by the position of the axis of pin 115 along slot 119. When the axis of pin 115 is put in line with the axis of shank 133 about which slotted link 121 oscillates, obviously the movement of link 121 by connecting rod 125 will cause no arcuate movement of arm 109 and correspondingly no rocking of rockshaft 95 and no feed of the stay strips; but as the axis of oscillation of link 121 is moved out of line with pin 115 and along the slot 135 in the casing toward the left, the portion of the up-and-down movement of the right-hand end of link 121 that is transmitted to pin 115 and thus to arm 109 to rock the rockshaft and feed the stays is constantly increased. The length of stay fed being thus in exact and fixed ratio to the spaced relation between the axis of pin 115 and the axis of shank 133, a pointer 151 held on the square portion of bushing 137 outside the casing can be made to read on a scale 153, Fig. 2, on top of such casing in terms of the length of stay delivered and cut off simultaneously through each of the four stay feeders at each cycle of the machine.

To adjust this stated spaced relation, the axis of shank 133 is moved along slot 135 in the casing through manual rotation of pinion 139 by crank 141, this pinion engaging with a rack 155 fixed on the casing just below slot 135. When the proper adjustment has been attained, the setting is maintained by tightening hand-nut 143. This locks the rack gear 139 against rotation by clamping it against the shoulder terminating the squared portion of the bushing which fits the slot 135 and keeps it from rotating therein, while the rack engaging with the pinion prevents relative motion, of the shank and bushing along the slot.

By this means, the length of stay fed and cut off at each machine cycle can be adjusted and predetermined with the utmost accuracy without the need of putting the machine through even a single cycle of its operation. Further, the stay-length can be varied or adjusted at any time during the full speed operation of the machine, without the necessity of stopping the operation to make the adjustment.

Special provision is made to facilitate the adjustment of the width and length settings of the machine in changing it over to make a different size of box, without losing control of the stay feeding devices. Thus, each of the blocks 67 which are fixed on the corner-blocks 5 and in which the driving slides 65 are guided, is provided with an adjustment plate 157 fixed thereon by screws 159 and having a horizontal key-hole slot 161 formed therein within which the reduced shank of shouldered clamping screws 77 oscillates as the driving slides 65 are operated. Clamping screw 77 is provided with a shoulder 163 in such spaced relation to plate 157 that this clamping screw cannot be backed out sufficiently to free cam-blocks 73 for adjusting movement along driving slides 65 except when shoulder 163 is in axial alignment with the circular hole at the big end of key-hole slot 161. Thus, cam-blocks 73 are either clamped to slides 65 or held immovable with respect to corner-blocks 5, at all times.

In first setting up the machine, the screws 77 are thus backed out into such circular holes, and the machine is turned over to bring driving slides 65 at the extreme left-hand end of their stroke as viewed in Fig. 2, small marks 165 being provided to be visible out from under casings 167 guarding the movement of arms 103, so as to indicate such extreme position. Link 121 of the stroke-varying device is racked back by handle 141 to its extreme left-hand position, pointer 151 standing at the end of the scale which indicates full stroke. With the extreme or starting position for the movement of each cam-block 73 and its cam-path 81 thus established with respect to block 67 and thereby with respect to its stay feeder 1 and in particular with respect to the actuating slide 59 thereof having the cam-follower 89, it will be seen that each actuating slide 59 of the four stay feeders is kept at the starting position of its stroke during the entire time that the screws 77 are loosened to permit spreading or narrowing of the machine. When these screws are again tightened, the actuation of driving slide 65 will thus impart an equal feeding stroke to each stay feeder, and assure that cam-follower 89 will work within its proper scope in cam-path 81.

In widening the machine, it is necessary to shift the position of arms 103 lengthwise of rock-shaft 95. To effect this easily and accurately, casings 167 are bolted onto the end of each side-table 169 of the machine, on which are mounted corner-blocks 5, and which are movable widthwise of the machine. Each casing 167 has protruding lips between which the hub of one arm 103 fits rather closely. Thus, when clamping screws 107 are released, and side tables 169 moved in or out to provide for a change in the size of the box being made, arms 103 will be carried along shaft 95 and along their splines 105 without loss of alignment with their connected driving slides 65. After such adjustment, clamping screws 107 are again set up to prevent the slightest lost motion at this point arising to vary the length of the stay fed.

Knob 47 for manual feed of the stay material provides for wetting the glue on this material before the machine is started, the pyramidal shape making it possible to set the four stay feeders close together for making very small boxes.

The novel provisions for lengthening and shortening the machine to enable it to make boxes of different lengths comprise adjusting

screws 173, Fig. 2, each having both a right-hand and a left-hand thread. One of these threads engages within a vertical extension on a bracket 177 extending outwardly from the center frame 175 at each end of the machine. The other thread on each screw 173 is threaded into a block 179 fixed at midlength to the under side of each of the two cross-bars 181 which are received in freely sliding but closely-fitting relation in slots 183 in the four corner-blocks 5, which are mounted for endwise sliding adjustment on side-tables 169 by means of slots 185 and bolts 187. When these screws 173 are rotated by a wrench applied to the squared outer ends thereof, after loosening corner-blocks 5 on side-tables 169, the screws will pull outwardly on the pair of corner-blocks at each end of the machine, to lengthen the form-receiving central aperture within the machine, and at the same time the screws themselves will back out of the machine by reason of their reverse threads so as not to enter the path of the form; yet these screws will not protrude far enough beyond the ends of the machine to be in the way of the operator in his working around the machine. Thus the reverse threads on the screws make possible the use of screw-adjustment means permitting the necessary extremes of length-adjustment of the machine without interfering either with the passage of the form or creating an inconvenience or hazard to the operator. The width-adjusting devices remain as heretofore, comprising single-thread screws 189 operated by hand-wheels 191 sliding the side-tables 169 in or out on transverse tracks on center-frame 175.

While I have illustrated and described certain forms in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departure from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular forms shown, or to the details of construction thereof, but

What I do claim is:

1. In a box-making machine, in combination, box-forming devices, presser devices, a stay-feeding device, a drive-shaft, means causing the drive-shaft to drive the forming and pressure devices, and intermediate driving connections between the stay-feeding device and the drive-shaft including manually adjustable means for varying the scope of the driving impulse transmitted to the stay-feeding device from the drive-shaft, independent of the time and scope of operation of the presser devices.

2. In a box-making machine, in combination, box-forming devices, presser devices, a stay-feeding device disposed obliquely of the box being formed and at one corner thereof, a slide reciprocating parallel to one side of the box, a cam and cam-follower intermediate the slide and the stay-feeder actuating the latter upon reciprocation of the slide, a drive-shaft, means driving the presser devices from such drive-shaft, and means independent of the presser devices and the said driving means therefor transmitting actuation from the drive-shaft to the slide.

3. In a box-making machine, in combination, a stay-feeder comprising feed-rolls, a slide, and rack and pinion connections between the slide and the feed-rolls to rotate the latter when the slide is moved, a second slide, cam-and-follower connections between the two slides whereby the first is actuated to rotate the rolls when the

second is moved, a drive-shaft, and direct connections between the drive-shaft and the second slide for actuating the latter.

4. In a box-making machine, in combination, 5
four stay-feeders each serving one corner of the box being made, a single oscillating element driving all four stay-feeders in unison, a drive-shaft, and driving means intermediate the latter and the oscillating element having capacity for varying the scope of movement of the oscillating element independently of the position of the box sides. 10

5. In a box-making machine, in combination, 15
four stay-feeders each serving one corner of the box being made, a single oscillating element driving all four stay-feeders in unison, a drive-shaft, a single connecting rod driven by such shaft, a single lever given a constant throw by such connecting rod, and means connecting the oscillating element with such lever with capacity for varying the point of such connection along the length of such lever. 20

6. Driving means for the four stay-feeding devices of a box-making machine including, in combination, a drive-shaft, a single connecting rod driven by such shaft, a single lever vibrated by the connecting rod, arms in driving connection with the stay-feeding devices, and driving connections between these arms and the lever shiftable to vary the throw of the arms and thus to vary equally and in unison the amplitude of actuation of all four stay-feeders and the length of stay fed at each actuation thereof. 25

7. In a box-making machine, in combination, a stay-feeder, cam means actuating the same, a movable element actuating the cam means, and connections between the cam means and the movable element providing for shift of the cam means incident to change of the latter's position on the machine for boxes of different sizes, a reciprocating form, box-forming devices shiftable on the machine to provide for the making of boxes of different sizes, and means in connection with the box-forming devices causing shift of the cam means with respect to its actuating element with retention of the time relationship between the cam's actuation of the stay-feeder and the reciprocation of the form. 30

8. In a box-making machine, in combination, a stay-feeder, a slide, cam means on the slide actuating the stay-feeder, devices forming a corner of the box, movable on the machine to provide for making different sizes of boxes, and carrying the stay-feeder, and means alternatively fixing the cam means to the slide or to the corner-forming devices, to keep the cam means in definite relation to the stay-feeder regardless of the position of the latter on the machine. 35

9. In a box-making machine, in combination, devices forming a corner of the box adjustably positioned on the machine, a stay-feeder carried by such devices, cam means actuating the stay-feeder, a driven slide, and a clamping screw alternatively fixing the cam means to the slide when tightened and holding the cam means against movement relative to the corner-forming devices when loosened. 5

10. A stay-feeder for box-making machines having in combination a feed roll, means pressing the stay into feeding engagement therewith, a ratchet-clutch driving the feed roll, a pinion driving one element of the ratchet-clutch, a rack driving the pinion, a member moving obliquely to the rack, a cam carried by such member engaging a part on the rack, and means for reciprocating the said obliquely-related member to reciprocate the rack. 10

11. In a box-making machine, in combination, a plurality of devices forming the corners of the box adjustably positioned for movement widthwise and lengthwise of the machine to provide for the making of boxes of different sizes, means engaging at least two of such corner-forming devices to prevent change of their angular relation to each other, and a screw having right-hand and left-hand threads respectively engaged with such means and with a fixed part on the machine to move such means and thereby the associated corner-forming devices simultaneously inwardly and outwardly of the machine. 15

12. In a box-making machine, in combination, a plurality of devices forming the corners of the box adjustably positioned for movement widthwise and lengthwise of the machine to provide for the making of boxes of different sizes, means engaging a pair of such devices to move them simultaneously and equally inwardly or outwardly of the machine, and a screw having right-hand and left-hand threads respectively engaging the said means and a fixed part on the machine frame and thereby itself moving inwardly and outwardly of the machine while imparting movement in the same directions to the said means and the corner-forming devices. 20

13. In a box-making machine, in combination, box-forming devices, presser devices, a stay-feeding device, a drive-shaft, means causing the drive-shaft to drive the forming and presser devices, and intermediate driving connections between the stay-feeding device and the drive-shaft including means for varying the scope of the driving impulse transmitted to the stay-feeding device from the drive-shaft, independent of the time and scope of operation of the presser devices. 25

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