Dec. 28, 1926. 1,612,176

A. T. CAMPBELL

BOX MAKING MACHINE

Filed Sept. 24, 1924 4 Sheets-Sheet 1

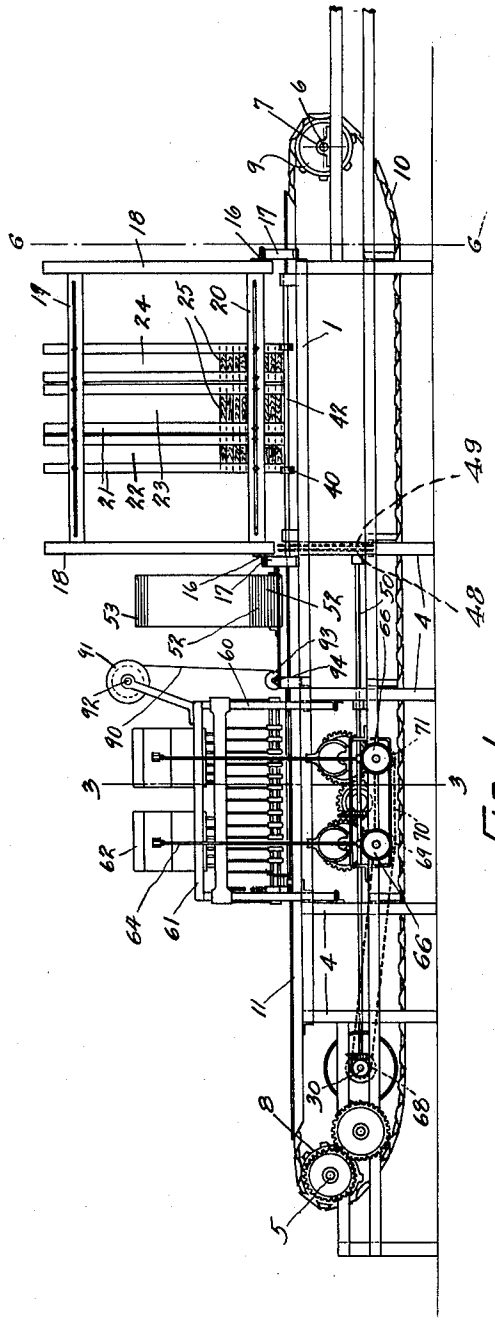


Fig 1

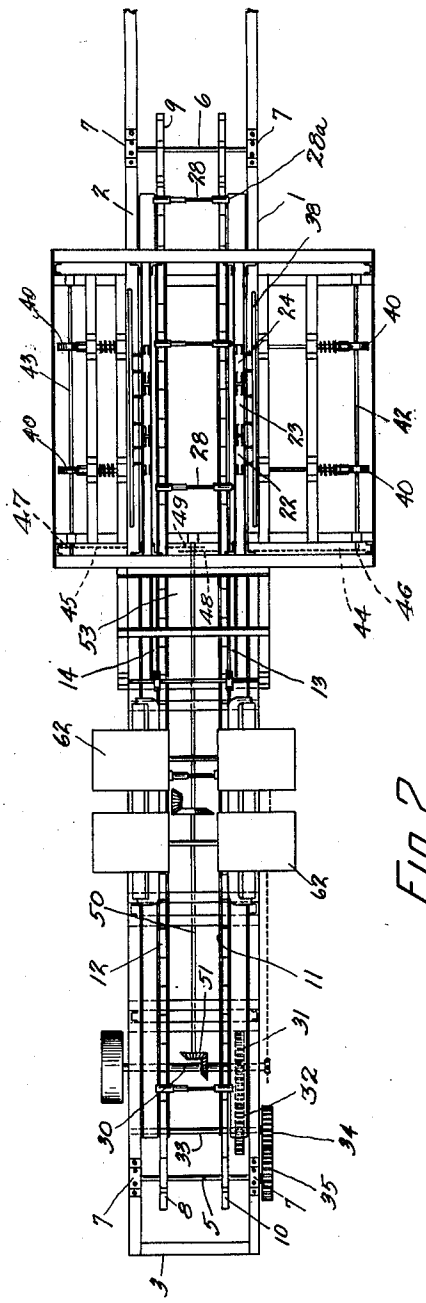


Fig 2

INVENTOR
ARTHUR TALBOT CAMPBELL
BY
Richard J. Cook
ATTORNEY

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A. T. CAMPBELL

BOX MAKING MACHINE

Filed Sept. 24, 1924 4 Sheets-Sheet 2

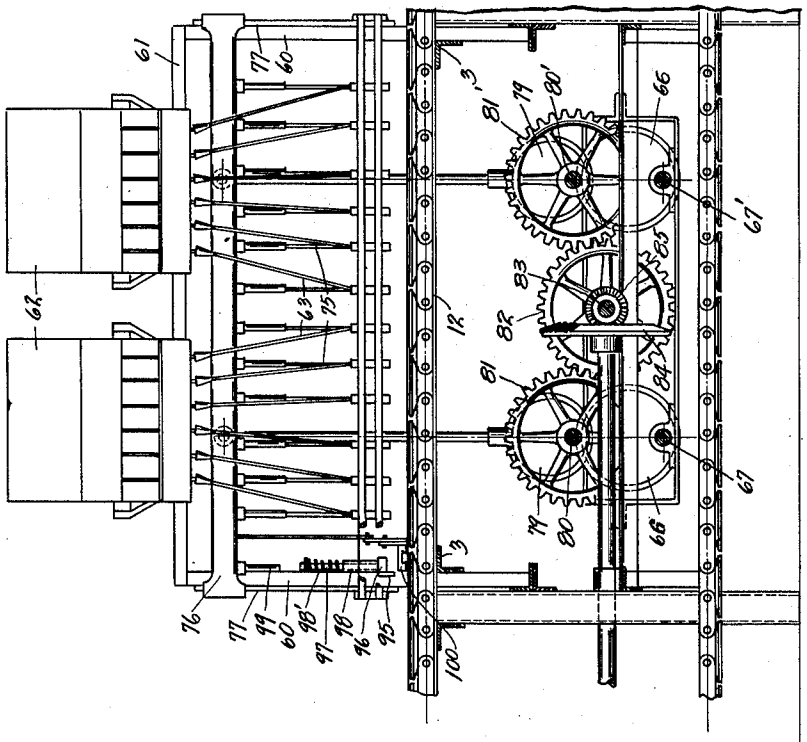


Fig 4

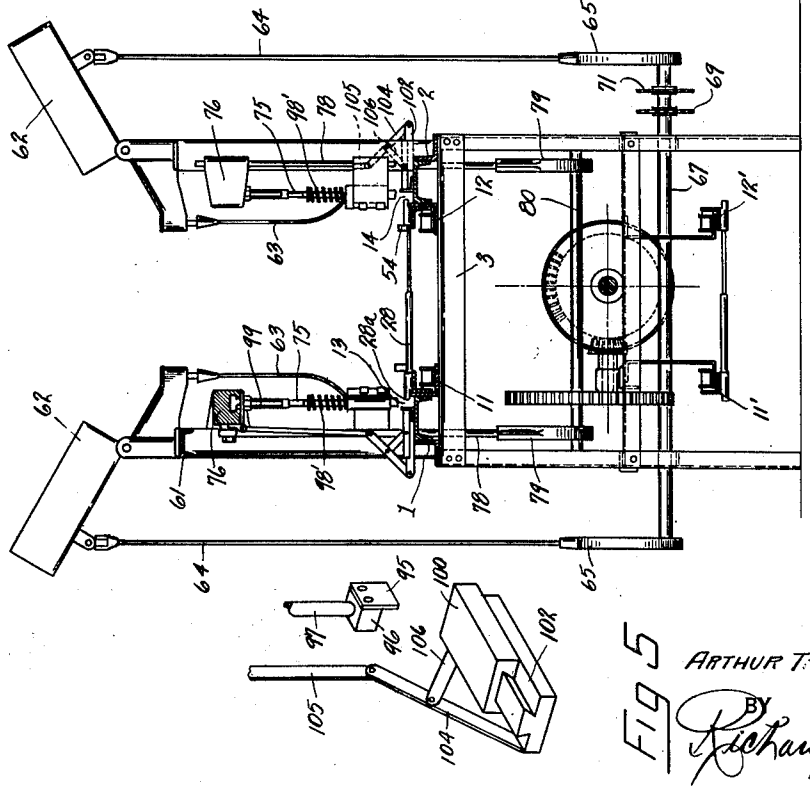


Fig 3

Fig 5

INVENTOR
ARTHUR TALBOT CAMPBELL
BY
Richard J. Cook
ATTORNEY

Dec. 28, 1926. 1,612,176

A. T. CAMPBELL

BOX MAKING MACHINE

Filed Sept. 24, 1924 4 Sheets-Sheet 3

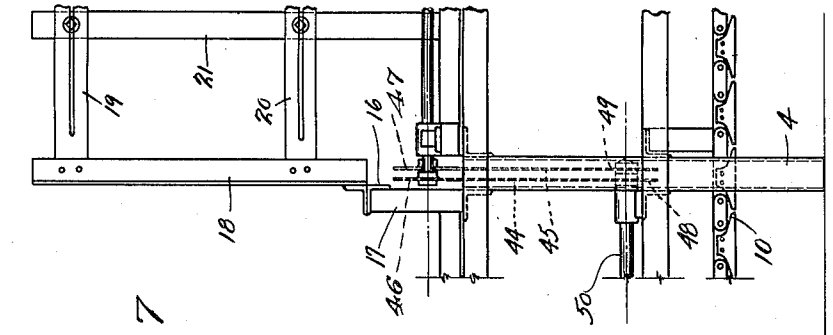


Fig 7

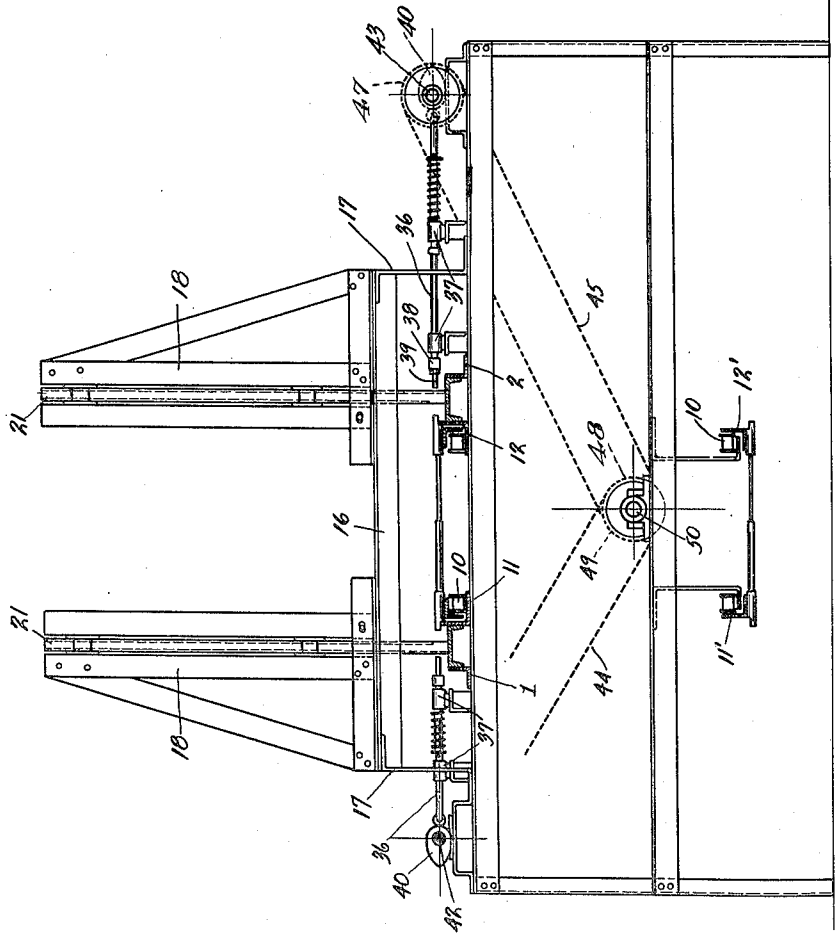


Fig 6

INVENTOR
Arthur Talbot Campbell
BY
Richard J. Cook
ATTORNEY

Dec. 28, 1926. 1,612,176

A. T. CAMPBELL

BOX MAKING MACHINE

Filed Sept. 24. 1924 4 Sheets-Sheet 4

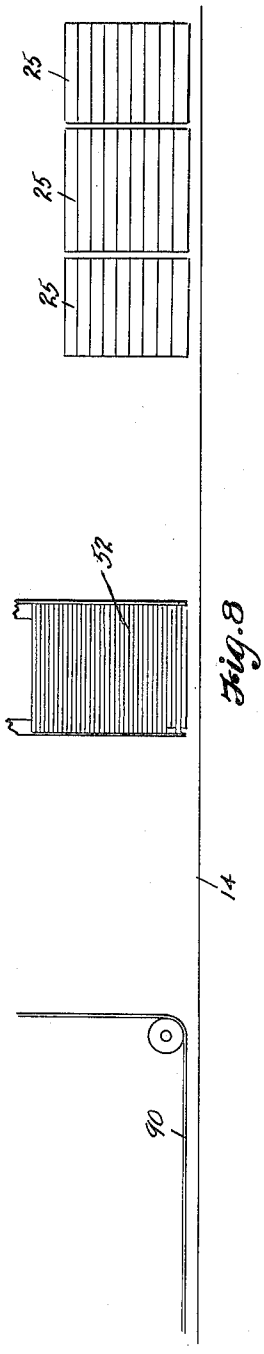


Fig. 8

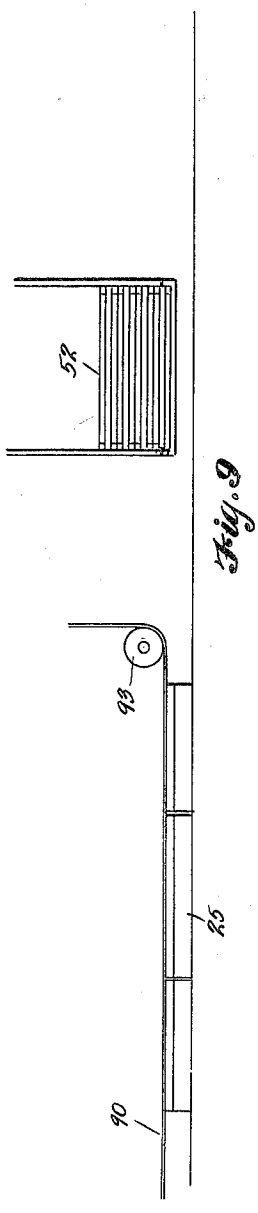


Fig. 9

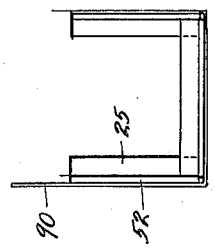


Fig. 11

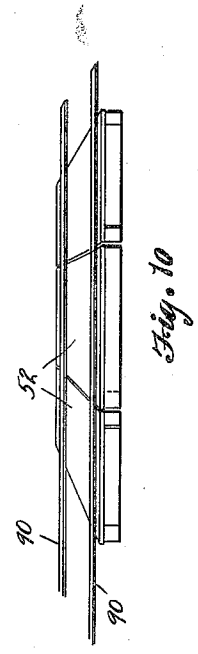


Fig. 10

INVENTOR

ARTHUR TALBOTT CAMPBELL

BY

Richard J. Cook

ATTORNEY

Patented Dec. 28, 1926. 1,612,176

UNITED STATES PATENT OFFICE.

ARTHUR TALBOT CAMPBELL, OF SEATTLE, WASHINGTON.

BOX-MAKING MACHINE.

Application filed September 24, 1924. Serial No. 739,484.

This invention relates to box making machines, and more particularly to a machine that is especially designed for assembling and nailing together the end cleats and bottom and side walls of a collapsible box of that character described and illustrated in United States Patent No. 1,450,273, issued April 3, 1923, it being the principal object of this invention to provide mechanical means for assembling and nailing the parts together and for applying the metal binding strips thereto so that upon the delivery of these parts from the machine they may be easily and quickly made into box form or may be stacked and crated for shipment to be assembled at their points of use.

Other objects of the invention reside in the means provided for feeding the different parts that form the box into the machine for delivery to the nailing devices, and in the details of construction and mode of operation of the parts which apply the binding strips to the ends of the boxes.

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of a box making machine embodied by the present invention.

Figure 2 is a plan view of the same.

Figure 3 is a transverse, sectional view taken through the machine on the line 3—3 in Figure 1.

Figure 4 is an enlarged side elevation of the nailing mechanism at one side of the machine.

Figure 5 is a detail, perspective view of one of the metal band shearing blocks and its operating mechanism.

Figure 6 is a transverse sectional view taken on the line 6—6 in Figure 1.

Figure 7 is an enlarged, side view of a part of the frame structure wherein the box forming panels are stacked.

Figure 8 is a view showing diagrammatically the location of the cleats, sidewalls, and binding strips in the machine.

Figure 9 illustrates a set of cleats and panels advanced beneath the binding strip for nailing.

Figure 10 is a perspective view of the parts as assembled.

Figure 11 is an end view of the parts as arranged to form the walls of a box.

Explanatory to the invention it will be stated here that the present machine is designed especially for the assembling and nailing together the side and bottom panels, end cleats and metal binding strips of boxes which may be of that character illustrated in the United States patent above referred to wherein, as will be best understood by reference to that patent, the cleats are nailed to the inner faces at the ends of the side and bottom panels and are constructed at their ends for dovetailing into each other when the parts are arranged in box form. End walls, not constructed by this machine, are provided with cleats at their upper ends adapted to dovetail into the upper ends of the side cleats to lock the parts together in a rigid structure, and then the metal binding strips are drawn tight about the box and nailed thereto.

Referring more in detail to the several views of the drawings—

The frame structure of the machine would preferably be made up of angle iron, comprising parallel, horizontal beams 1 and 2 that extend lengthwise of the frame, a plurality of transverse connecting beams 3 and a plurality of supporting legs 4, all of which parts are so joined together as to provide a rigid and substantial structure.

At opposite ends of the frame are transverse shafts 5 and 6 supported rotatably in bearings 7, and fixed on these shafts in paired relation are sprocket wheels 8 and 9 about which conveyer chains 10 operate to assemble and advance the box forming parts through the machine past the nailing machines as will hereinafter be described. The upper runs of the conveyor chains are supported for travel within two angle iron guide beams 11 and 12 that are mounted in parallel relation longitudinally of the frame and the lower runs are supported by beams 11′—12′ suspended from the frame.

Erected above the frame, at one end, are feed racks wherein the wooden cleats to which the side and bottom panels of the box are to be nailed, are contained. These racks, or hoppers, are arranged to deliver the cleats from their lower ends into guideways 13 and 14 formed parallel with and just outside the beams 11 and 12 and which extend the length of the machine. The supporting structure for the hoppers consists of beams 16 that are mounted transversely of the frame by means of brackets

17 at their ends, and to which are secured vertical end pieces 18 connected by upper and lower beams 19 and 20 extending in the lengthwise direction of the machine. Secured adjustably to these latter beams are vertically disposed channel members 21 arranged in paired relation so as to provide three separate hoppers at each side of the frame, designated at 22, 23 and 24, wherein the end cleats, which will be designated by numeral 25, are properly stacked.

In this arrangement the cleats to be secured to the sides of the box are contained in the guides 22 and 24 and those for the bottom are held in the central guide 23.

The lower ends of the hoppers terminate just outside the path of travel of the two feed belts, as shown in Figure 6, and the cleats are adapted to be delivered, one at a time, from their lower ends into the guideways 13 and 14 along which they will be advanced by the contacting therewith of the projecting end portions 28^a of cross bars 28 fixed to these belts; the cross bars being so arranged on the belts that the cleats will be taken from their respective hoppers in proper relation for the assembling of the box parts.

It is required for proper operation of the machine, that the conveyer chains be advanced intermittently certain specified distances whereby the cross rods will first be positioned for taking up the cleats when they are delivered from their hoppers, and will then move the cleats into proper relation to the nailing machines whereby the sides and bottom panels of the box will be nailed thereto. This intermittent movement is effected by a driving mechanism, best shown in Figures 2 and 3, wherein 30 designates a power driven shaft mounted transversely of the frame and provided with a gear 31 that meshes with a gear 32 on a transverse shaft 33. On one end of shaft 33 is a gear wheel 34 that drives a gear 35 keyed on the end of shaft 5. The gear 31 is intermittently toothed and in this way there is effected an intermittent driving of the shaft 33 and a resultant intermittent movement of the conveyer belts.

The means which I have provided for delivering the cleats 25 from their respective hoppers into the guideways 13 and 14 consists of the mechanism, best shown in Figure 6, comprising the paired push rods 36 supported horizontally in guide bearings 37 at each side of the frame and joined at their inner ends by bars 38 from which pins 39 extend inwardly in such position that, when the push rods are moved inwardly, they will they will engage with the cleats and move one from each hopper into its guideway. The conveyer chains are not in motion when this takes place and the cross rods are in such position that they will take up and advance the cleats in the same relation as they are delivered. At their outer ends the push rods are adapted to be engaged by cams 40 on shafts 42 and 43 rotatably mounted on the frame at opposite sides and driven in proper synchronism with the movements of the conveyer chains by means of chain belts 44 and 45 operating over sprocket wheels 46 and 47 and over sprocket wheels 48 and 49 on a driven shaft 50 that extends longitudinally of the frame; the latter shaft being driven from the shaft 30 by means of a bevel gear connection as indicated at 51 in Figure 2.

The panels, designated at 52, which form the opposite side and bottom walls of the box are stacked in proper order in a hopper 53 that is erected above the frame and from which the panels may be delivered onto the conveyer belts in proper relation for nailing their ends to the end cleats. The hopper is so spaced above the conveyer that the panels may be withdrawn one at a time from its lower end and the means which I have provided for withdrawing them comprises hooks 54 fixed in spaced relation to the cross rods 28 to extend upwardly only a sufficient distance to engage with the edge of the lower panel in the hopper. As the cleats 25 are advanced by the ends of the cross rods, and the panels 52 are taken up by the hooks on the rods, it will be seen that the panels and cleats will thus be assembled and advanced in proper relation for nailing together.

After the conveyer chains have taken up and advanced the cleats 25, and the panels 52 have been drawn out from the hopper, these parts are advanced beneath the nailing machines which are located in such position that the end of the panels may be nailed to the cleats thereby. Each nailing machine is supported by a frame structure comprising uprights 60 and a cross beam 61 on which inclined nailed hoppers 62 are pivotally supported and adapted to be shaken to deliver the nails into feed tubes 63 from which they are delivered to the hammers. The means for shaking the hoppers comprises the rods 64 that are pivotally fixed at their upper ends to the under sides of the hoppers and, at their lower ends are fixed to collars 65 fitted about eccentric wheels 66 on cross shafts 67—67′ rotatably driven by a chain belt that operates about a sprocket wheel 68 on shaft 30 and sprocket wheel 69 on shaft 67. The shaft 67′ is driven by a chain belt 70 that operates about sprocket wheels 71 on these shafts.

It is of no importance what type or kind of nailing machine is used so long as it operates to perform the work in a satisfactory manner, and for this reason, the nailing device shown will only be briefly described. The nail tubes are so arranged as to deliver the nails at desirable points and they are

driven by vertically reciprocating plungers 75 fixed at their upper ends in cross heads 76 that are slidably carried on guide rods or posts 77. The cross heads are reciprocated by the rods 78 which are pivotally connected therewith and which have operative connections at their lower ends with eccentric 79 on cross shafts 80—80′ mounted beneath the nailers. These latter shafts are driven by gear wheels 81—81′ thereon that operate in mesh with a gear 82 on a transverse shaft 83 that is driven by means of an intermittent gear 84 on the end of the longitudinal shaft 50 meshing with a gear 85 on shaft 83.

The nailing machines also act to secure the metal binding strips 90 to the panels at the ends of the box; the same nails being used for this purpose that secure the panels to the cleats. The metal strips for this purpose are carried or wound on spools 91 supported on a cross shaft 92 above the frame. The ends of these bands are drawn downwardly from the spools and beneath guide rollers 93 supported by brackets 94 at opposite sides of the frame just above the conveyer chains. From these rollers they are drawn forwardly beneath the line of plungers of the nailing machine.

When a nailing operation takes place, the nails are driven first through the metal binding strips, then through the ends of the panels and then through the cleats 25. Thus the bands serve to tie the sides of the box to the bottom thereof. After each set of parts are thus nailed together and advanced from the nailing machine, shearing devices operate to sever the bands between successively formed boxes. A preferred form of shearing device is shown in Figure 5 wherein 95 designates a shearing blade carried on a block 96 fixed to a rod 97 that is mounted slidably in a guide bearing 98 supported from the frame that carries the nailing devices. The plunger is normally held raised above the metal band by a coiled spring 98′ and it is adapted to be engaged at its upper end by a post 99 fixed to nailer cross head when the latter moves downwardly to thereby cause the blade to be brought against the band and into shearing relation with a block 100 beneath the band so that the band will thereby be cut in two. For the reason that after each shearing operation, the block 100 must be withdrawn from the path of travel of the rails of the box, I have mounted it slidably on a guide 102 and have provided a toggle mechanism operable by reciprocable movement of the nailing device for shifting it back and forth. The toggle comprises a link 104 attached at one end to the block and at its other end to a link 105 which is pivotally fixed to the frame and to a link 106 that is attached to the reciprocating cross head.

Thus it will be seen that the blank materials are arranged in position to form a blank comprising a plurality of separate sections, each section comprising sheet material, and a plurality of parallel cleats. The fastening devices, such as nails, or any suitable fastening devices, are then all simultaneously inserted to simultaneously fasten all of the parts of the blank together, whereby only one fastening operation is required, and the immediate result of this operation is a flexible and cleated box blank which can be folded immediately into shape to form a box. The cleats are held in hoppers, as explained, and are fed laterally from the bottom of these hoppers into alignment with the rows of cleats on the blank ahead, which latter blank is being fastened together. The cleats fed laterally into position are moved endwise into position to receive the fastening devices simultaneously with the displacement of the finished blank from beneath the staplers, whereby the materials for each blank are being assembled and moved into position while the blank ahead is being fastened together and then moved forward for delivery from the machine.

I claim—

1. In a machine of the class described in combination, a frame structure, hoppers provided on said frame for containing box end cleats, a hopper for the box side and bottom panels, nailing machines, a conveyer belt operable to assemble and feed the cleats and panels past the nailing machines, and means to feed the cleats laterally to said belt.

2. In a machine of the class described in combination, a frame structure, guide ways extending in parallel relation longitudinally of the structure, nailing mechines disposed above the guideways, hoppers erected above the guideways at opposite sides of the frame for containing box end cleats, a hopper disposed above the frame between the first named hoppers and the nailing machines for containing the box side and bottom panels, a conveyer belt operable along the frame, means for delivering the end cleats laterally into the guideways, and means for delivering the panels onto said cleats for advancement by the belt to the nailing machines.

3. In a machine of the class described, in combination, a frame structure, guideways extending in parallel relation longitudinally of the frame, nailing machines disposed above the guideways, a series of hoppers erected above the guideways at opposite sides of the frame wherein end cleats for the opposite sides and bottom of the box may be stacked, a hopper above the frame between the first named hoppers and nailing machines for containing stacked panels for forming the sides and bottoms of the boxes, a conveyer belt operable beneath the hoppers

and nailing machines, means for simultaneously delivering the end cleats for a box into their guideways by lateral motion of the cleats, for advancement therealong by the conveyer belt, and means on the belt for withdrawing the panels from their hopper onto their respective cleats and for advancing the assembled parts through the nailing machines.

4. In a machine of the class described, in combination, a frame structure, guideways extended in parallel relation longitudinally of the frame, nailing machines erected over the guideways, hoppers erected above the guideways at opposite sides of the frame for containing cleats for the ends and bottoms of boxes, a hopper for the panels used to form the sides and bottom walls of boxes, a conveyor belt, means for intermittently advancing the belt beneath the hoppers and nailing machines, means operable to deliver a set of end cleats for a box into the guideways during periods of rest of the belt, means on the belt for advancing the cleats along the guideways, means on the belt for withdrawing panels from their hopper onto their respective cleats for advancement in proper relation into the nailing machines, means for supporting rolls of binding strips and for holding the ends of said strips in position to be fastened to the panels by the nails which secure the panels to the cleats and means for severing the strips as the nailed parts are delivered from the nailing machines.

5. In a machine of the class described, in combination, a frame structure, parallel guideways extending longitudinally of said frame, belt supporting means at opposite ends of the frame, a conveyer belt operable over said supporting means along the guideways, nailing machines erected above the guideways, a series of hoppers erected above the guideways at opposite sides of the frame for containing the bottom and side cleats of the boxes formed by the machine, a hopper across the frame between the first hoppers and nailing machines for containing panels for forming the box sides and bottom walls, means for intermittently advancing the conveyer belt, means operable to deliver sets of end cleats into the guideways during periods of rest of the belt, means on the belt for engaging the cleats to advance them along the guideways, means on the belt for withdrawing panels from their hopper onto their respective cleats for advancement into the nailing machine, spools supported from the frame on which binding strips may be wound, means for guiding strips from said spools across the ends of the panels, means operable to actuate the nailing machines to secure the strips to the panels and the panels to the cleats, and shearing means operable to cut the bands as the assembled parts are delivered from the nailing machines.

6. A machine of the class described comprising, in combination, means for assembling the box parts, having provision for moving all of the parts laterally of the machine into position for the width of blank to be made, and a nailing machine for nailing the assembled parts together and for securing box binding strips to the assembled parts.

7. In a machine of the class described, the combination with means for assembling box side and bottom panels and end cleats, having means to move all the cleats of a blank simultaneously and laterally, and a nailing machine operable to nail the panels to the cleats, of means for extending box binding strips across the panels in position to be nailed thereto by said nailing machines during the said nailing operation.

8. In a machine of the class described, the combination with means for assembling box side and bottom panels and end cleats, having means to move all the cleats of a blank simultaneously and laterally, and a nailing machine operable to nail the panels to the cleats, of means for supporting binding strips for the box in roll form, means for extending the strips across the box panels in position to be nailed thereto by the nailing machines during the nailing operation, and means for severing the nailed ends of the bands from the rolls.

9. In a machine for making box blanks by combining sheets and cleats with metal binding, the combination of hoppers for the cleats, pushers to feed cleats laterally in a horizontal plane from the bottoms of said hoppers, and feed mechanism to move the cleats longitudinally after being fed laterally into position.

10. In a machine for making box blanks by combining sheets and cleats with metal binding, the combination of hoppers for the cleats, pushers to feed cleats laterally in a horizontal plane from the bottoms of said hoppers, and feed mechanism to move the cleats longitudinally after being fed laterally into position, in combination with devices to automatically supply sheets in position over the cleats, and instrumentalities to supply metal binding in position over the sheets, together with fastener drivers to insert fasteners to secure the binding and sheets to the cleats.

11. In a machine for making box blanks by combining sheets and cleats with metal binding, the combination of hoppers for the cleats, pushers to feed cleats laterally in a horizontal plane from the bottoms of said hoppers, and feed mechanism to move the cleats longitudinally after being fed laterally into position, including stationary and parallel longitudinal guides for the cleats,

in which the cleats are moved endwise after being moved laterally into alignment therewith.

12. In a machine for making box blanks by combining sheets and cleats with metal binding, the combination of hoppers for the cleats, pushers to feed cleats laterally in a horizontal plane from the bottoms of said hoppers, and feed mechanism to move the cleats longitudinally after being fed laterally into position, in combination with instrumentalities to supply flexible binding and sheets to said cleats, in position for the insertion of fasteners through the binding and sheets into the cleats, and means for severing the metal binding at the rear end of each blank while the blank in rear thereof is being fastened together.

13. The method of combining sheets and cleats and metal binding to form flexible box blanks, comprising the arrangement of the metal binding in place, for the fastening operation, thereafter feeding the cleats and sheets under said binding, with the cleats unattached to the sheets, and then fastening the binding and sheets and cleats together.

14. In a machine for making box blanks, the combination of instrumentalities for assembling a plurality of parallel rows of cleats, with sheets and flexible connecting members disposed thereon, with the cleats unattached to the sheets, to provide the different sections of the blank to be made, and mechanism for simultaneously inserting fastening devices in all of said cleats and sheets, to secure the flexible binding members thereto.

15. A structure as specified in claim 14, said mechanism comprising nailers disposed in position to simultaneously drive all of the fastening devices through the flexible binding members, and through the sheets, into the cleats.

16. A structure as specified in claim 14, said instrumentalities comprising cleat feeding devices to feed the cleats laterally into alignment with said rows thereof, for each successive blank, whereby the cleats of each blank are moved laterally into position, and said instrumentalities also including means whereby these laterally shifted cleats are then moved forward simultaneously with the displacement of the finished blank ahead.

17. A structure as specified in claim 14, said instrumentalities comprising hoppers for the cleats, said hoppers being disposed out of alignment with the said rows of cleats on the blank, and said instrumentalities comprising means to feed the cleats laterally from the lower ends of said hoppers, into alignment with said rows, and including means for feeding the cleats endwise into position to have the sheets and binding members fastened thereto.

18. The improved method of making box blanks, to produce blanks each comprising a plurality of flexibly connected sections, each section having sheet material fastened to parallel cleats, comprising the assembling of all of the necessary materials for the blank, with the cleats unattached to the sheets, and the simultaneous fastening of all parts thereof together.

Signed at Seattle, King County, Washington, this 18th day of July, 1924.

ARTHUR TALBOT CAMPBELL.