June 5, 1934. C. D. KNOWLTON 1,961,366

STACKING APPARATUS

Filed Nov. 2, 1931 3 Sheets-Sheet 1

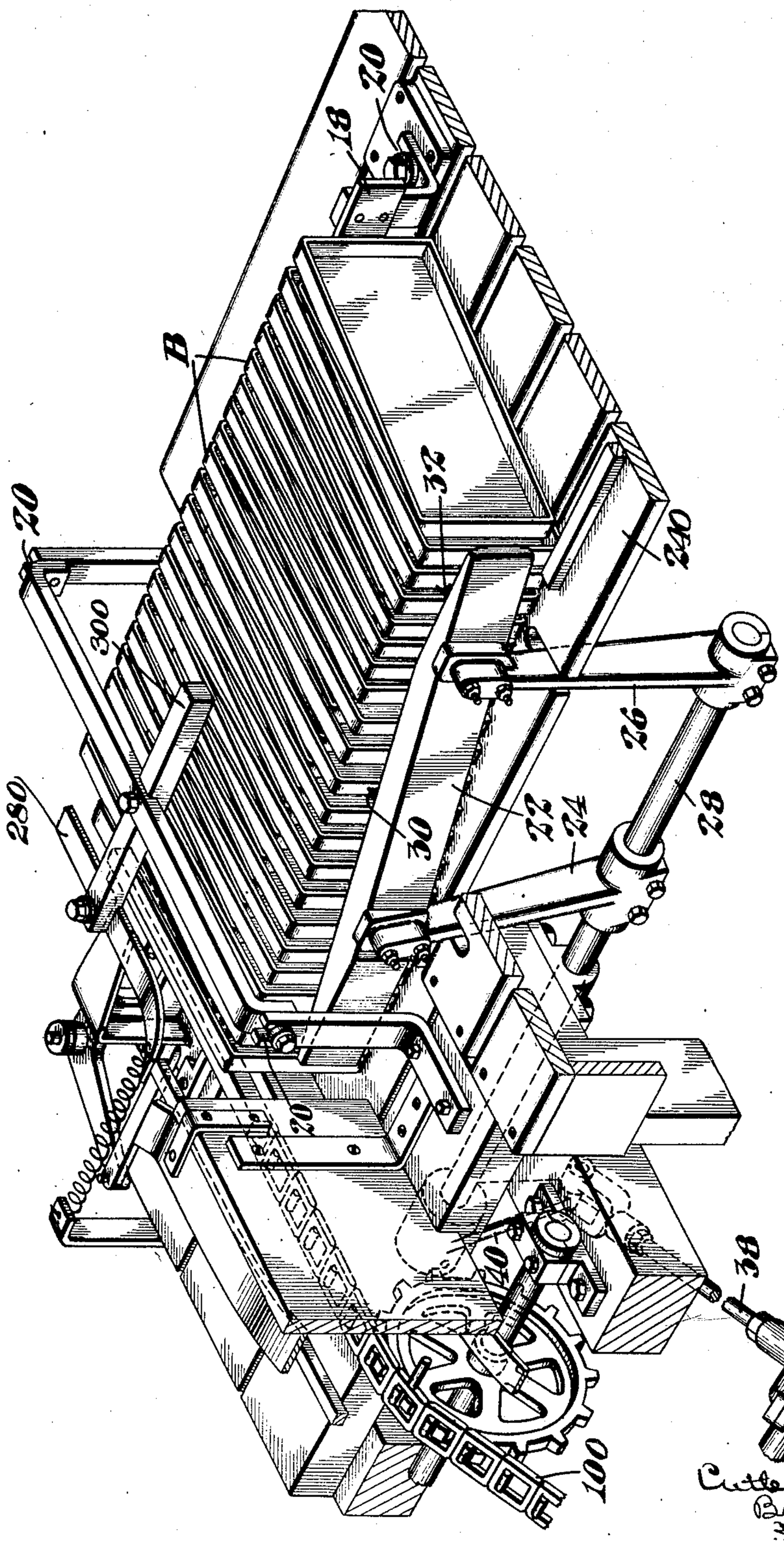

Fig. 1.

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STACKING APPARATUS

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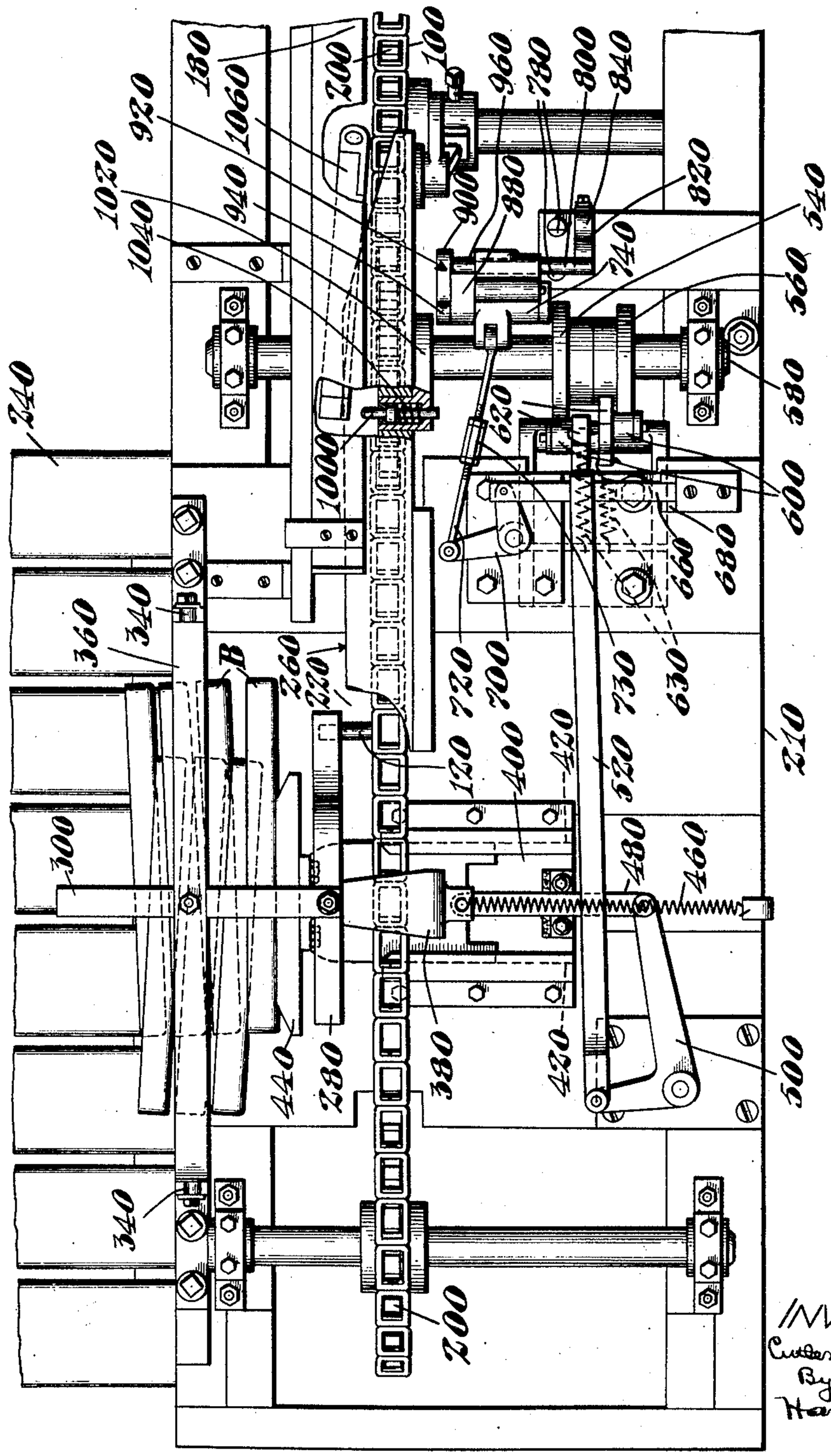

Fig. 2.

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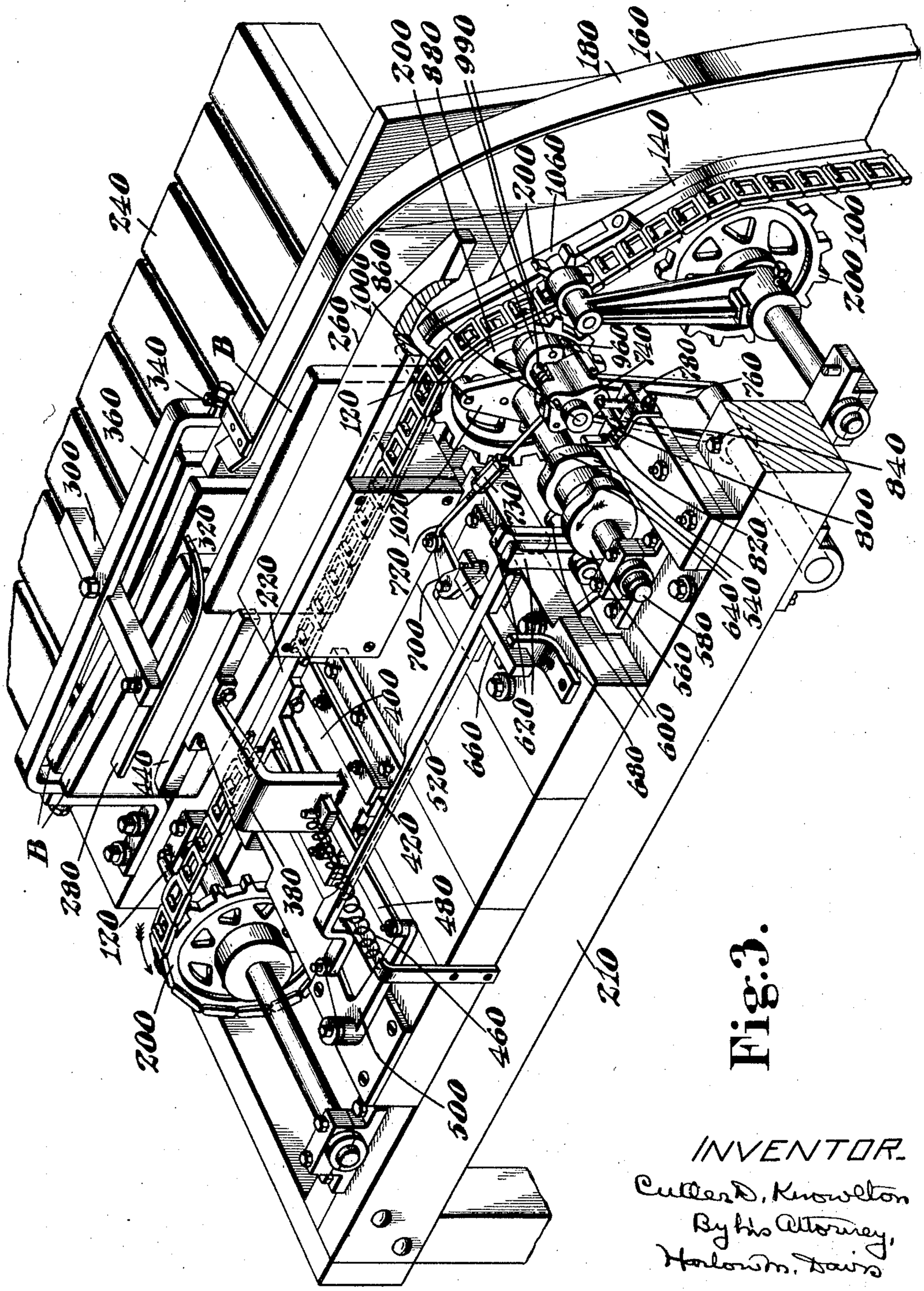

Fig.3.

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UNITED STATES PATENT OFFICE

1,961,366

STACKING APPARATUS

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Application November 2, 1931, Serial No. 572,612

10 Claims. (Cl. 214—7)

This invention relates to apparatus for stacking various articles, it being particularly concerned with the arranging in a nested series of such walled articles as boxes.

In an application for Letters Patent of the United States for improvements in Stacking apparatus, Serial No. 377,001, filed in my name on July 9, 1929 and which issued on February 7, 1933 as Patent No. 1,896,177, is disclosed an organization by which boxes or box-parts, as covers, are brought from some such source as a setting-up machine and are forced successively over a table between guide-walls to form a horizontal stack, with the alternate box-parts oppositely inclined, so said stack is symmetrically arranged and is compact longitudinally. One of the end-walls of each box-part is separated by a substantial extent from the corresponding wall of the part which lies within it, while its opposite end is similarly separated from the wall of the part within which it lies. It is an object of this invention to form a stack which is transversely compact, the end-walls being brought into close proximity to each other, the stack occupying less space and being more stable. For this purpose, I combine, in a novel manner, with means for stacking articles and for causing advance of the stack, movable means contacting with the edges of the advancing articles for changing their position transversely of the stack. When box-parts or other walled articles are stacked with their ends intermeshed, the contact means forces the articles laterally of the stack, with the adjacent walls in close proximity, the intermediate spaces being largely closed. The stack is thus made to occupy a smaller space, is more firmly nested and is therefore more portable. I prefer to advance the stacked articles over a table between opposite walls and to provide means for reciprocating one of the walls toward and from the companion wall. The movable wall is shown as inclined with respect to the opposite wall, the two converging in the direction of advance of the stack, there being a wall-portion substantially parallel to the opposite wall. The separation between the guide-walls is such that the relative movement gradually forces the box-ends toward each other as the stack advances along the converging portions, the final compacting pressure being applied by the parallel portions.

In the accompanying drawings, Fig. 1 illustrates in perspective one of the several forms which my invention may assume, and Figs. 2 and 3 reproduce Figs. 1 and 2, respectively, of the previously mentioned patent with each reference-numeral increased in magnitude.

Generally, the stacking organization may be as disclosed in the patent. A conveyor 100 carries set-up box-parts B across one extremity of a table 240. These box-parts, shown as the cover-portions but which will hereinafter be broadly termed boxes, may be of the form commonly employed for holding pairs of shoes, and rest upon the conveyor on their longitudinal edges, with their open sides toward the direction of advance over the table 240. A plunger 380 is arranged to reciprocate horizontally across the conveyor, it being actuated by mechanism, not shown, in such relation to the advance of the boxes past it that said boxes are forced from the conveyor at different points in their travel. The chosen time-relation causes the boxes to first nest with each preceding box at one extremity and then at the opposite extremity, a stack being produced in which the boxes are alternately oppositely inclined, and with the adjacent end-walls separated, as shown in the drawings. Each operating movement of the plunger 380 advances the accumulated stack a step along the table 240, guided by a top-bar 300 and at one end by a wall 18 rising from the table. This wall 18 and the bar may be adjustable by slot-and-screw connections 20, to allow their correct co-operation with boxes of different sizes.

Opposite the wall 18, and forming with it a channel through which the stacked boxes are advanced by the plunger 380, is arranged a movable wall. This is shown as in the form of a bar 22 carried upon the upper extremity of the arms 24 and 26 fast upon a shaft 28 journaled in the frame. The bar 22 has at its inner side an inclined face 30, furnishing a guide for the advancing stack and extending from a point adjacent to the plunger 380 for a considerable distance along the stack, converging in this direction toward the wall 18. The face 30 is continued by a face 32 upon the bar, the latter face being substantially parallel to the wall 18. The supporting arm 24 is more inclined with respect to the vertical than is the arm 26, to give conveniently the desired angular relation of the face 30 to the stack. The bar 22 is continuously reciprocated toward and from the stack by oscillation imparted to the shaft 28 through connections to a shaft 34 of the stacking apparatus. These connections may include an eccentric 36 upon the shaft 34, an eccentric-rod 38 and a crank arm 40 secured to the shaft 28. The arrangement is preferably such that the bar 22 moves in while the plunger 380 is retracted and

the stack is at rest. When the bar is at the point of maximum withdrawal from the stack, the space between the entering end of the inclined face or wall 30 and the opposite wall 18 is ample to admit without interference the boxes as they are delivered, uncompacted, to the stack. The separation between the wall 32 and the wall 18, when the bar has completed its inward stroke, is sufficient to just admit the stack with the boxes forced together laterally until their end-walls are in close proximity to one another. As a result of these relations, the boxes, starting with their end-walls considerably separated, will, during their step-by-step advance, be gently and gradually forced together laterally until the stack is in the best condition for handling, the initially expanded dimension being reduced to practically a minimum, and the ends of the boxes wedged together so accidental separation is guarded against.

Except for immaterial changes in figure-numbers and reference-characters, the following is copied from the patent hereinbefore referred to, beginning with line 83, page 1 and terminating with line 87, page 3.

An endless conveyor, furnished by a chain 100 having lateral cover-engaging projections 120, brings the covers up an inclined way 140, these covers standing on their lower longitudinal side-walls and being engaged at their rear side-walls. The openings between these walls all lie at the same side of the chain. They travel along a side retaining wall 160 and beneath an overhang 180. Sprocket-wheels 200 support and guide the continuously driven chain, and are rotatable upon the frame 210 of the apparatus. For this advancing arrangement, a gravity-chute or conduit may be substituted. The inclined way terminates in a horizontal delivering table 220, at one side of which is a receiving or assembling table 240 furnishing a stack-support. A wall 260, situated opposite the wall 160 and extending above the table 220, holds the covers against outward displacement as they are advanced by the chain-projections over the delivering table. A bar 280, above and parallel to the table 220, receives the covers beneath it, and with the transverse bar 300 previously mentioned, upon which 280 is mounted, holds the forming stack with some resistance to longitudinal displacement, so that the nesting force is effectively exerted. An upturned end 320 of the bar 280 facilitates the entrance of the covers beneath it, while both bars, by virtue of slot-and-screw connections 340 at the ends of their supporting yoke 360, may be adjusted vertically, and thus the resistance to movement of the stack beneath them changed.

At the side of the conveyor 100 opposite the receiving table 240 is an article-transferring and stacking member, furnished by the plunger 380. The base 400 of this plunger is mounted to reciprocate toward and from the end of the stack of covers B in ways 420 transversely of the chain 100, and has, rising from it, a supporting portion for a horizontal cross-bar 440, so situated as to act upon the covers as they come beneath the bar 280. A spring 460, connecting the plunger and a bracket secured to the frame, holds said plunger normally away from the stack, while operating connections advance the plunger into contact with a cover upon the table 220, to nest it with the preceding covers received by the table 240. These connections are shown as including a link 480 pivoted to the plunger and to a bell-crank lever 500 fulcrumed horizontally upon the top of the frame, this lever being, in turn, joined to a push-bar 520 extending in a direction generally parallel to that of the advance of the covers under the influence of the conveyor. The push-bar may be acted upon by either of two operating mechanisms, the chief elements of which are, in the present instance, supplied by cams 540 and 560 fixed upon a constantly rotated shaft 580, which may also carry and receive power from one of the sprocket-wheels 200 for the chain 100. The peripheries of the cams engage rolls 600, 600 arranged to turn upon opposite sides of levers 620, 620 fulcrumed with their upper extremities lying in the horizontal plane of the bar 520. Springs 630, 630, joining the lower ends of the levers to the frame, hold the rolls against the cams. The active surfaces of the two cams are similarly formed, being gradually curved from a cylindrical portion to a projection producing the maximum throw, from which the surfaces abruptly fall off again to the cylindrical portions. These projections 640 lie at different angles circumferentially of the shaft 580 for the two cams 540 and 560, so that they will cause differently timed operating cycles.

The bar 520 is alternately positioned to receive the action of the respective cams by successive alinement with the levers 620, 620. To effect the shift automatically under the control of the covers, the bar lies in a depression in a slide 660 supported at one extremity in a slot in the upper end of a bracket 680. The opposite extremity of the slide is pivoted to a bell-crank lever 700, to which is articulated a link 720. This link may be made adjustable in length by a turn-buckle 730, to initially produce the correct alinement of the bar 520 with the levers 620. The outer end of the link 720 is pivoted to the head 740 of an actuating arm 760 mounted to swing upon the frame. The oscillation of the lever is limited by opposite pins 780, 780, between which plays a projection 800 from the head. This projection 800 travels across an upwardly bowed portion 820 of a leaf-spring 840, so that the projection is prevented from rebounding after its engagement with the stops. Pivoted at 860 upon the head 740 is a contact device, consisting of a body 880 and a contact member proper 900 fixed across the inner side of the body and extending to opposite sides of the axis 860. Each of the upwardly extending edges of the member 900 has a gradually inclined contact-surface 920 below the axis 860, and abrupt outward inclines 940 at the opposite side. To limit the angular movement of the contact device about the axis and thus determine the initial positions of the surfaces 920, 920, a lateral projection 960 from the member 900 enters a depression in the periphery of the body 880, and is stopped by engagement with the ends of this depression. These extreme angular positions of the contact member 900 are yieldably maintained by a spring-pressed latch 980 movable horizontally in the head 740, and having a rounded end entering either of two depressions 990, 990 in the body 880.

Revolving constantly while the stacking apparatus is in use is an operating member, appearing as a reciprocatory controlling pin 1000 projecting horizontally from the inner side of a crank 1020, conveniently driven by direct connection to the shaft 580 and its sprocket-wheel 200. Normally, in its revolution, the pin is yieldably held clear of the contact member 900, as it passes this, by a spring 1040. In this position, it extends through the sprocket-wheel to receive the contact of a lever 1060 fulcrumed upon the frame, and nor-

mally maintained, as by gravity, out of the path of the pin and in that of the covers as the projections 120 bring them up the incline 140. Generally, the angle at which the lever 1060 lies corresponds to that of the adjacent chain, being such that the path of the operating pin 1000, as it rises in its revolution, is along the side of the lever. Engagement of the ascending cover with the inner side of the lever, or that away from the observer in Fig. 2, swings this out and temporarily holds it. Because of the location of the projections 120 along the chain 100 and the fixed relation thereto of the pin 1000, this establishing a definite time-relation which is held against alteration through the engagement of the sprocket-teeth by the chain, the lever, as it is thus moved, will find the pin opposite its side. Said pin is therefore thrust out against the force of its spring until its outer extremity lies in the same vertical plane as the surfaces 920 of the member 900. When the pin reaches the member, it contacts with one or the other of these surfaces 920, the direction of engagement being such that the projection 960 is held against the end of the depression in the body 880 with which it already contacts. As a result of this contact, the pin 1000, acting through the member 900, body 880 and latch 980, swings the actuating head of the lever 760, and, through the connecting elements, shifts the slide 660 and thereby the bar 520 of the connections to the plunger 380. This moves the bar from alinement with one of the cam-levers 620 opposite the other of said levers. The elements of the apparatus are so related that, when the cover which produced the shift just described has reached the bar 440 of the plunger, the projection 640 of the cam, with the lever of which the rod 520 has been alined, will come into engagement with its lever. This may be assumed to be the cam 540, the angular position of which is in advance of that of the companion cam. The cam 540 will consequently thrust its lever against the rod, and, through the other connections, will move the plunger in to act upon the left end of the cover, this being as viewed in Fig. 2 of the drawings. As a result of this, the thus-transferred cover will be nested with that preceding it, with the right end projecting beyond the latter and being inclined, in its final position, rearwardly across the stack from left to right (Fig. 2). After this transferring action has been accomplished, at which time the pin 1000, in its upward travel, has passed the axis 860, it will engage the more abruptly inclined contact-surface 940 at the opposite side of the axis. The actuating head 740 is now held against movement by the left-hand stop 780, and the force of the pin is exerted to turn the contact member about the axis. This carries the member 900 across the path of the pin and presents the opposite surface 920 for succeeding engagement thereby. This new angular relation of the member 900 is determined by the engagement of its pin 960 with the opposite end of the depression in which it moves, and is held against accidental displacement by the latch 980, entering the other depression 990 from that which it has just left. The stacking apparatus remains inactive until another cover is brought by the conveyor against the lever 1060, this, by its action upon the pin 1000, initiating another cycle. Because, however, of the new position of the contact member 900, the pin acts upon its opposite surface 920, and thus causes the movement of the actuating lever 760, and therefore of the slide 660, to be reversed, presenting the push-bar 520 to the lever of the cam 560 (Fig. 3). The projection 640 of this cam acts later in the cycle, or at a time when the right-hand end of a cover has reached the member 440. The effect is to stagger this last cover with that preceding it, it being oppositely inclined thereto. It will therefore be seen that, for alternate operations of the plunger, the time-interval from the beginning of the cycle is changed, being first shorter and then longer, this continuing throughout its action upon the entire stack, and producing a symmetrical nesting of the opposite extremities of the covers. The table 240 may be of such dimensions as to receive as long a stack as desired, the stability of the horizontally nested boxes not being affected. Any portion of the accumulating stack may be removed from the table at the convenience of the attendant.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a stacking apparatus, a table, means for advancing articles in a stack over the table, opposide walls between which the stack is advanced, said walls converging in the direction of advance, and means for reciprocating one of the walls in contact with the stack toward and from the opposite wall.

2. In a stacking apparatus, a table, means for advancing articles in a stack over the table, opposite walls between which the stack is advanced, and means for reciprocating one of the walls in contact with the stack toward and from the opposite wall, the reciprocatory wall being inclined toward the opposite wall in the direction of advance.

3. In a stacking apparatus, a table, means for advancing articles in a stack over the table, a normally fixed guide-wall for the stack at one side of the table, a shaft journaled at the opposite side of the table, means for oscillating the shaft, arms secured to the shaft at different angles, and a bar secured upon the arms for contact with the articles at the side opposite the fixed wall.

4. In a stacking apparatus, a table, means for advancing articles in a stack over the table, a normally fixed guide-wall for the stack at one side of the table, a shaft journaled at the opposite side of the table, means for oscillating the shaft, arms secured to the shaft at different angles, and a bar secured upon the arms for contact with the articles at the side opposite the fixed wall, the surface of the bar which contacts with the articles having portions forming an angle with each other.

5. In an apparatus for stacking walled articles, means for assembling such articles in a stack with the end of one article between the walls of the next article and with succeeding articles oppositely inclined and for advancing such stack, and means acting upon the ends of articles inclined outside the succeeding articles and while said articles are under the influence of the stacking means for forcing the articles laterally of the stack and the adjacent end-walls into closer proximity.

6. In an apparatus for stacking walled articles, means for assembling such articles in a stack with the end of one article between the walls of the next article and with succeeding articles oppositely inclined, a wall situated adjacent to the intermeshed ends at one side of the stack, and a wall arranged to reciprocate in contact with the ends at the opposite side of the stack, the two

walls furnishing a channel through which said stack is advanced by the stacking means.

7. In an apparatus for stacking walled articles, means for assembling such articles in a stack with the end of one article between the walls of the next article and with succeeding articles oppositely inclined, a wall normally fixed adjacent to the intermeshed ends at one side of the stack, and a wall arranged to reciprocate in contact with the ends at the opposite side of the stack, said reciprocatory wall acting upon the articles advanced by the stacking means and having the forward end of its contact-face substantially parallel to the opposite wall and the rearward portion of said face converging toward the opposite wall.

8. In a box-nesting apparatus, means for delivering boxes, means acting upon the delivered boxes to nest them in a series one within another, and means for closing laterally of the series spaces between the end-wall of each box and the adjacent wall of the box nested within it while all are under the influence of the nesting means.

9. In a box-nesting apparatus, a box-conveyor, a table, a reciprocatory member removing boxes from the conveyor and advancing them nested over the table, guide-walls situated at opposite sides of the table and between which the nested boxes are advanced, and means for moving the walls relatively in contact with the boxes.

10. In a box-nesting apparatus, a box-conveyor, a table, a reciprocatory member removing boxes from the conveyor and advancing them nested over the table, guide-walls situated at opposite sides of the table and between which the nested boxes are advanced by the member, said guide-walls having box-contact-surfaces with portions substantially parallel to each other and portions converging in the direction of advance of the nested boxes, and means for moving the walls relatively in contact with the boxes.

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