Feb. 7, 1933. C. D. KNOWLTON 1,896,177

STACKING APPARATUS

Filed July 9, 1929 3 Sheets-Sheet 1

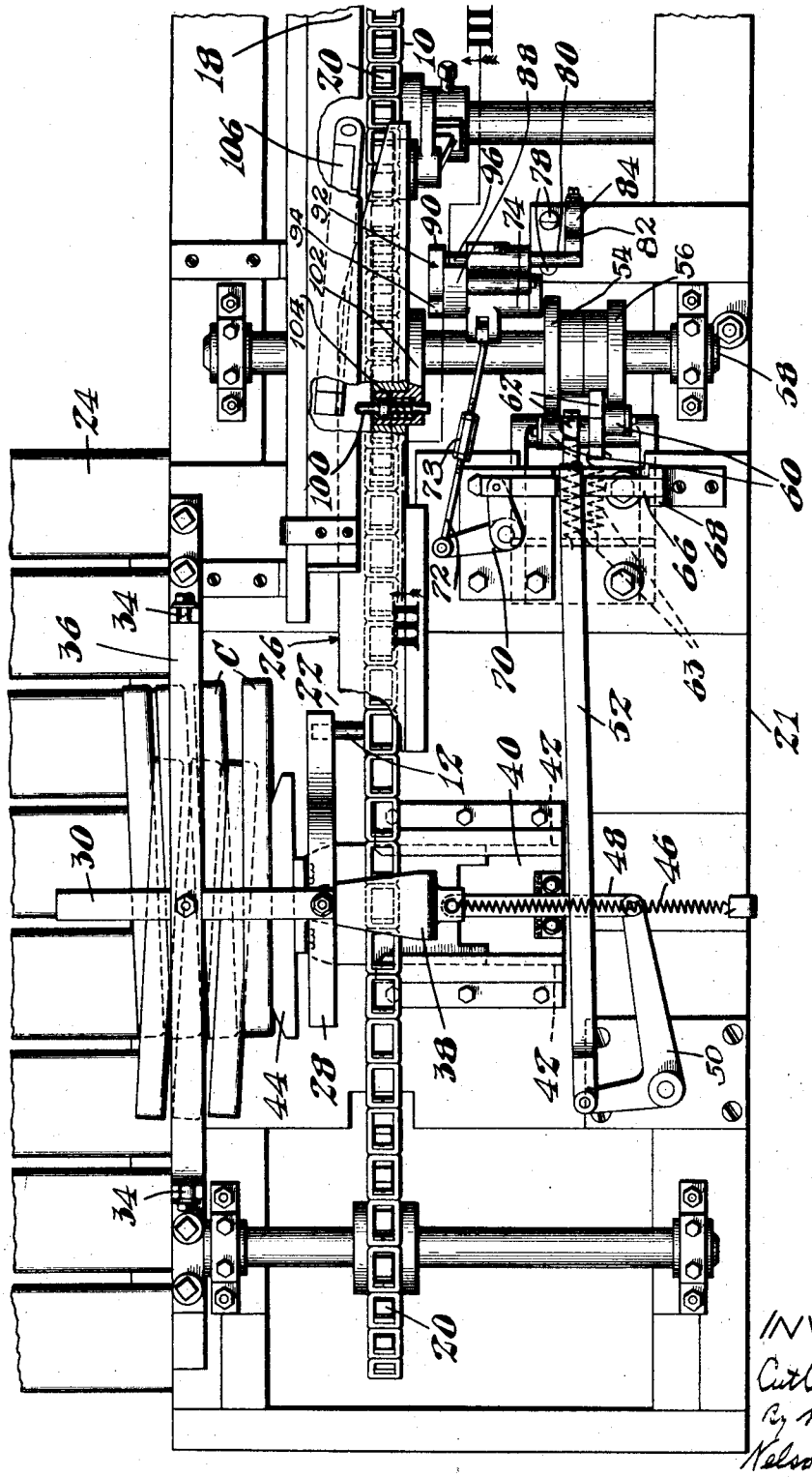


Fig.1.

INVENTOR.
Cutler D. Knowlton
By his Attorney,
Nelson W. Howard

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STACKING APPARATUS

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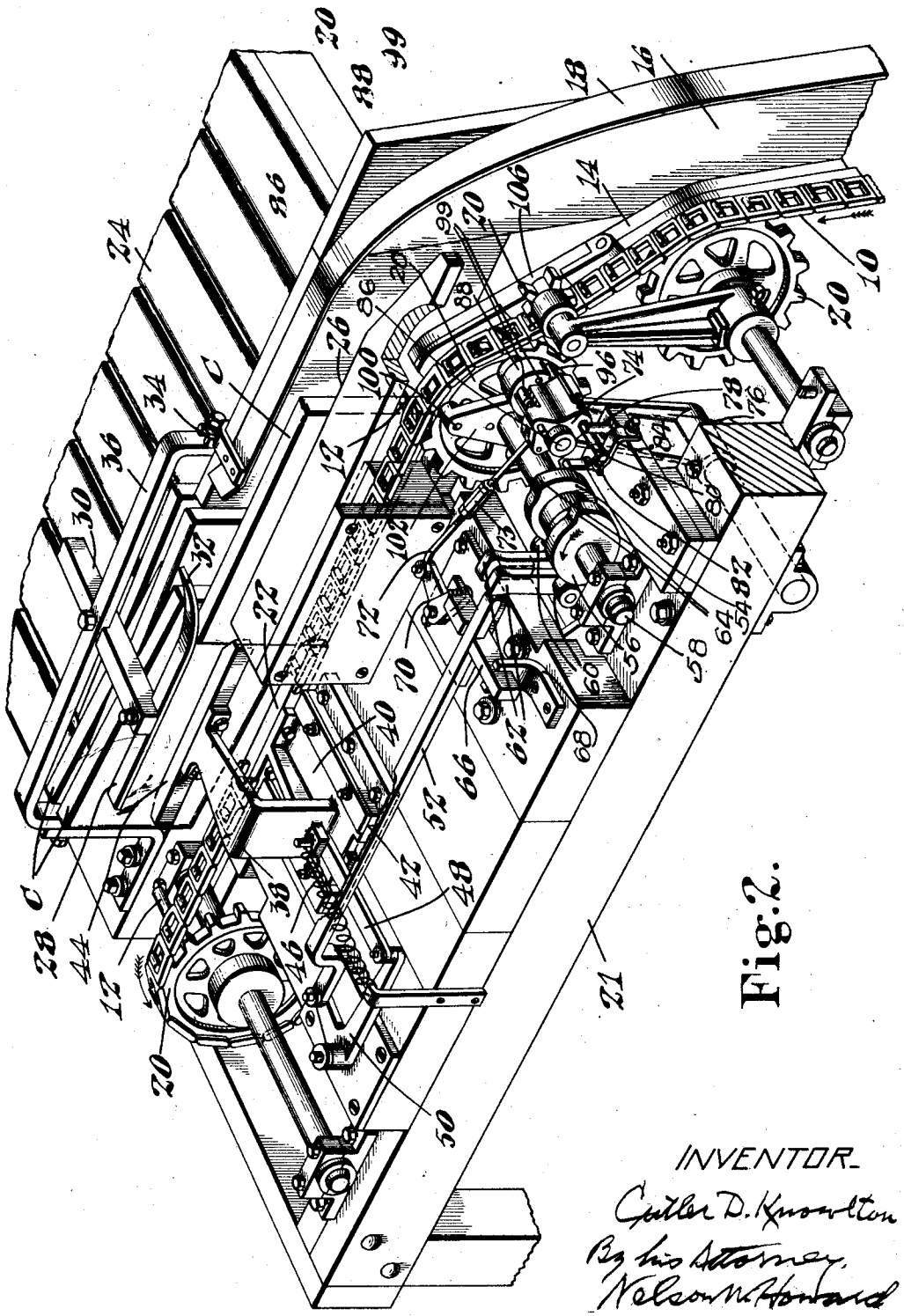


Fig. 2.

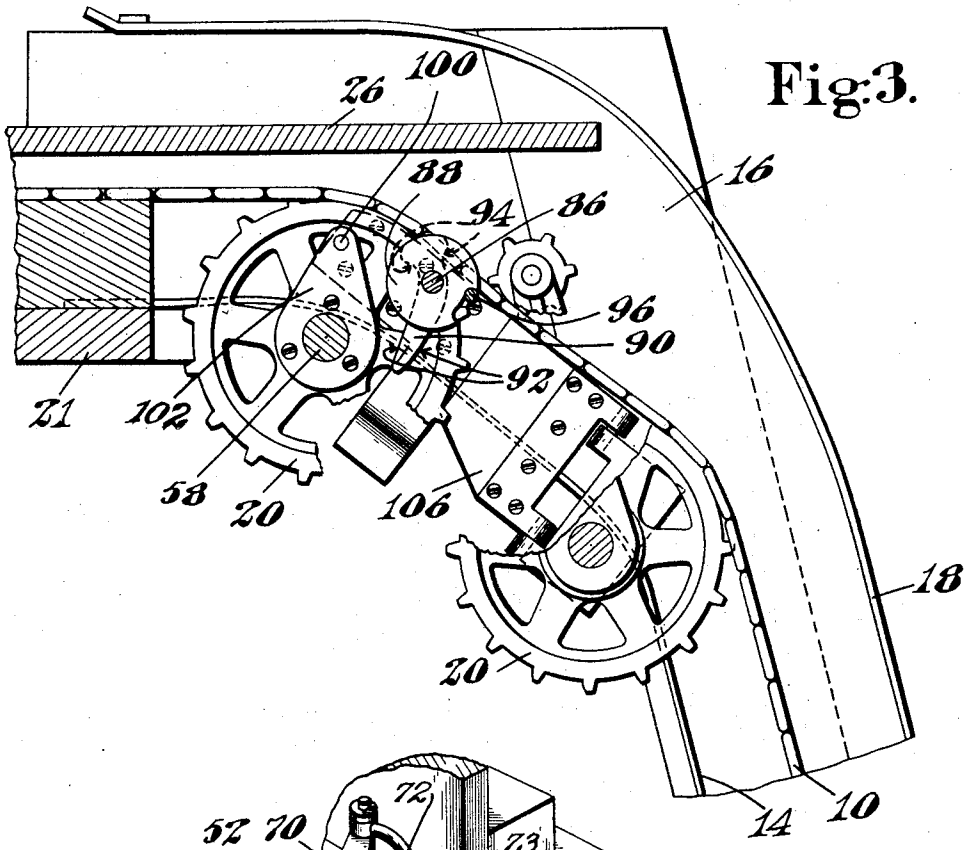
INVENTOR.
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By his Attorney
Nelson N. Howard

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Filed July 9, 1929 3 Sheets-Sheet 3

Fig.3.



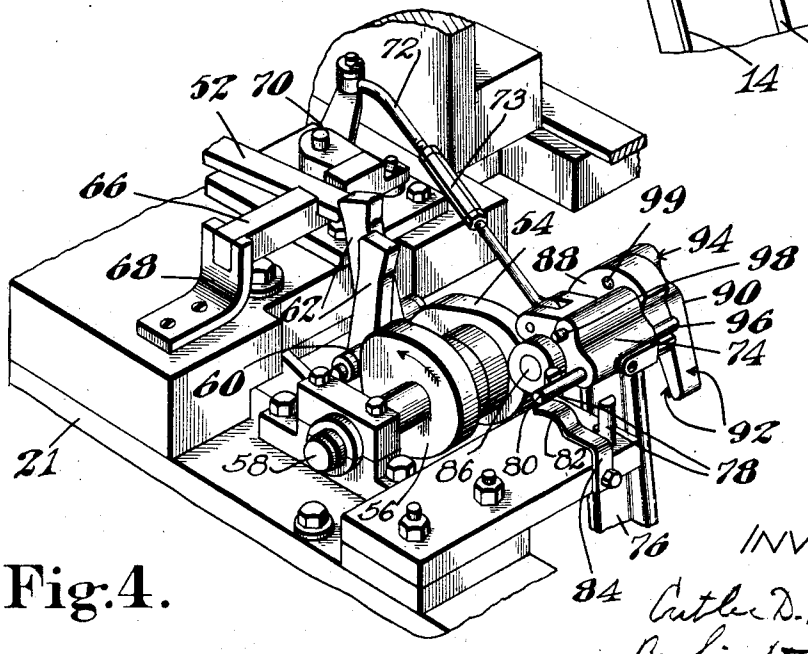


Fig.4.

INVENTOR.

Cutler D. Knowlton

By his Attorney,

Nelson W. Howard

Patented Feb. 7, 1933 1,896,177

UNITED STATES PATENT OFFICE

CUTLER D. KNOWLTON, OF BEVERLY, MASSACHUSETTS, ASSIGNOR TO HOAGUE-SPRAGUE CORPORATION, OF LYNN, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

STACKING APPARATUS

Application filed July 9, 1929. Serial No. 377,001.

The present invention is concerned with apparatus for stacking, or arranging in an unbroken series, various articles. Especially is this invention applicable to the nesting together of such walled articles as boxes, this last term, it is to be understood, comprehending either the body-portions or covers of boxes.

In the manufacture of set-up boxes, after they have been formed and their walls secured, it is a common practice to nest them in stacks, so they may be transferred conveniently to some other point, as that at which they are to be packed in cases. Since box-walls are ordinarily parallel, they can be nested at one extremity only, each box lying within the preceding box of the stack at one end and projecting outside it at the opposite end. This projecting portion, in turn, receives the succeeding box. It is a purpose of the present invention to facilitate the stacking operation by providing means for accomplising it automatically, instead of manually. This result I attain by combining in a novel manner with means for advancing articles as they come, for example, from a box-setting-up machine, other means, which acts during their advance to remove them from the advancing means and assemble them with an end of one article between the walls of the next, and with the succeeding articles oppositely inclined. The assembling or transferring means, which preferably also removes articles from the advancing means, may consist of a movable member, which is caused to engage each article, whether or not it be walled, when the extent of its advance is different from that of the previously engaged article. That is, the engagement is at a different time in the operating cycle, so the transverse relation of succeeding articles to the stack is different, and they are thereby staggered. This gives the desired alternate nesting of opposite ends. Preferably, the transferring or stacking member is controlled in its movement by the articles themselves. Thus, an article upon the advancing means or conveyor may initiate its separation from said conveyor. This insures the production of an assembling action only when there is another article ready to be advanced for transfer. In the illustrated embodiment of the invention, the change in the time-interval between succeeding stacking operations is attained by the employment of two operating mechanisms, which may include cams, made effective by connections to the stacking member carried into alternate co-operation with said mechanisms. To control this alternation, I have shown herein an actuating device arranged for movement in opposite directions, under the influence of a power-driven member, and arranged to both shift the connections and reverse the direction of their movement, application of power being preferably controlled, as already indicated, by the articles, which may move said driven member into active position.

One of the many forms this invention may assume is illustrated in the accompanying drawings, in which

Fig. 1 is a top plan view of my improved stacking apparatus;

Fig. 2 is a perspective view thereof, taken from the right in Fig. 1;

Fig. 3 is a vertical sectional detail on the line III—III of Fig. 1; and

Fig. 4 is a detail in perspective of a portion of the operating mechanism for the cover-transferring member.

The particular apparatus disclosed is adapted for nesting box-covers, such as are indicated at C in Figs. 1 and 2. An endless conveyor, furnished by a chain 10 having lateral cover-engaging projections 12, brings the covers up an inclined way 14, the 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 16 and beneath an overhang 18. Sprocket-wheels 20 support and guide the continuously driven chain, and are rotatable upon the frame 21 of the apparatus. For this advancing arrangement, a gravity-chute or conduit may be substituted. The inclined way terminates in a horizontal delivering table 22, at one side of which is a receiving or assembling table 24 furnishing a stack-support. A wall 26, situ-

ated opposite the wall 16 and extending above the table 22, holds the covers against outward displacement as they are advanced by the chain-projections over the delivering table. A bar 28, above and parallel to the table 22, receives the covers beneath it, and with a transverse bar 30, upon which 28 is mounted, holds the forming stack with some resistance to longitudinal displacement, so that the nesting force is effectively exerted. An upturned end 32 of the bar 28 facilitates the entrance of the covers beneath it, while both bars, by virtue of slot-and-screw connections 34 at the ends of their supporting yoke 36, may be adjusted vertically, and thus the resistance to movement of the stack beneath them changed.

At the side of the conveyor 10 opposite the receiving table 24 is an article-transferring and stacking member, in the form of a plunger 38. The base 40 of this plunger is mounted to reciprocate toward and from the end of the stack of covers C in ways 42 transversely of the chain 10, and has, rising from it, a supporting portion for a horizontal cross-bar 44, so situated as to act upon the covers as they come beneath the bar 28. A spring 46, 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 22, to nest it with the preceding covers received by the table 24. These connections are shown as including a link 48 pivoted to the plunger and to a bell-crank lever 50 fulcrumed horizontally upon the top of the frame, this lever being, in turn, joined to a push-bar 52 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 54 and 56 fixed upon a constantly rotated shaft 58, which may also carry and receive power from one of the sprocket-wheels 20 for the chain 10. The peripheries of the cams engage rolls 60, 60 arranged to turn upon opposite sides of levers 62, 62 fulcrumed with their upper extremities lying in the horizontal plane of the bar 52. Springs 63, 63, 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 64 lie at different angles circumferentially of the shaft 58 for the two cams 54 and 56, so that they will cause differently timed operating cycles.

The bar 52 is alternately positioned to receive the action of the respective cams by successive alinement with the levers 62, 62. To effect the shift automatically under the control of the covers, the bar lies in a depression in a slide 66 supported at one extremity in a slot in the upper end of a bracket 68. The opposite extremity of the slide is pivoted to a bell-crank lever 70, to which is articulated a link 72. This link may be made adjustable in length by a turn-buckle 73, to initially produce the correct alinement of the bar 52 with the levers 62. The outer end of the link 72 is pivoted to the head 74 of an actuating arm 76 mounted to swing upon the frame. The oscillation of the lever is limited by opposite pins 78, 78, between which plays a projection 80 from the head. This projection 80 travels across an upwardly bowed portion 82 of a leaf-spring 84, so that the projection is prevented from rebounding after its engagement with the stops. Pivoted at 86 upon the head 74 is a contact device, consisting of a body 88 and a contact member proper 90 fixed across the inner side of the body and extending to opposite sides of the axis 86. Each of the upwardly extending edges of the member 90 has a gradually inclined contact-surface 92 below the axis 86, and abrupt outward inclines 94 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 92, 92, a lateral projection 96 from the member 90 enters a depression in the periphery of the body 88, and is stopped by engagement with the ends of this depression. These extreme angular positions of the contact member 90 are yieldably maintained by a spring-pressed latch 98 movable horizontally in the head 74, and having a rounded end entering either of two depressions 99, 99 in the body 88.

Revolving constantly while the stacking apparatus is in use is an operating member, appearing as a reciprocatory controlling pin 100 projecting horizontally from the inner side of a crank 102, conveniently driven by direct connection to the shaft 58 and its sprocket-wheel 20. Normally, in its revolution, the pin is yieldably held clear of the contact member 90, as it passes this, by a spring 104. In this position, it extends through the sprocket-wheel to receive the contact of a lever 106 fulcrumed upon the frame, and normally maintained, as by gravity, out of the path of the pin and in that of the covers as the projections 12 bring them up the incline 14. Generally, the angle at which the lever 106 lies corresponds to that of the adjacent chain, being such that the path of the operating pin 100, 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. 1, swings this out and temporarily holds it. Because of the location of the projections 12 along the chain 10 and the

fixed relation thereto of the pin 100, 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 92 of the member 90. When the pin reaches the member, it contacts with one or the other of these surfaces 92, the direction of engagement being such that the projection 96 is held against the end of the depression in the body 88 with which it already contacts. As a result of this contact, the pin 100, acting through the member 90, body 88 and latch 98, swings the actuating head of the lever 76, and, through the connecting elements, shifts the slide 66 and thereby the bar 52 of the connections to the plunger 38. This moves the bar from alinement with one of the cam-levers 62 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 44 of the plunger, the projection 64 of the cam, with the lever of which the rod 52 has been alined, will come into engagement with its lever. This, as illustrated in Fig. 4, may be assumed to be the cam 54, the angular position of which is in advance of that of the companion cam. The cam 54 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. 1 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. 1). After this transferring action has been accomplished, at which time the pin 100, in its upward travel, has passed the axis 86, it will engage the more abruptly inclined contact-surface 94 at the opposite side of the axis. The actuating head 74 is now held against movement by the left-hand stop 78, and the force of the pin is exerted to turn the contact member about the axis. This carries the member 90 across the path of the pin and presents the opposite surface 92 for succeeding engagement thereby. This new angular relation of the member 90 is determined by the engagement of its pin 96 with the opposite end of the depression in which it moves, and is held against accidental displacement by the latch 98, entering the other depression 99 from that which it has just left. The stacking apparatus remains inactive until another cover is brought by the conveyor against the lever 106, this, by its action upon the pin 100, initiating another cycle. Because, however, of the new position of the contact member 90, the pin acts upon its opposite surface 92, and thus causes the movement of the actuating lever 76, and therefore of the slide 66, to be reversed, presenting the push-bar 52 to the lever of the cam 56 (Fig. 2). The projection 64 of this cam acts later in the cycle, or at a time when the right-hand end of a cover has reached the member 44. 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 24 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 an apparatus for stacking articles, each of said articles having side-walls between which is an opening, means for advancing the articles to be stacked, such articles under the influence of the advancing means being supported upon one of their side-walls with the openings lying at the same side of the advancing means, a stacking member normally situated at one side of the path of the articles and being movable across such path, means for producing a stacking movement of the member for each article advanced, and a stationary member across which the articles are thrust from the advancing means by the stacking member and upon which they are continuously supported.

2. In an apparatus for stacking articles, each of said articles having side-walls between which is an opening, means for advancing the articles to be stacked, such articles under the influence of the advancing means being supported upon one of their side-walls with the openings lying at the same side of the advancing means, a stacking member normally situated at one side of the path of the articles and being movable across such path, and means for producing stacking movements of the member differing with relation to the extent of advance of alternate articles.

3. In an apparatus for stacking articles, each of said articles having side-walls between which is an opening, means for advancing the articles to be stacked, such articles under the influence of the advancing means being supported upon one of their side-walls with the openings lying at the same side of the advancing means, a stacking member normally situated at one side of the path of the articles and being movable across such path,

and means controlled by the articles for producing a stacking movement of the member for each article advanced.

4. In an apparatus for stacking articles, means having spaced projections for engaging and successively advancing articles to be stacked, and means controlled by the articles and having elements movable in a definite time-relation to the travel of the projections for removing said articles from the advancing means and assembling them in a stack.

5. In an apparatus for stacking articles, an endless conveyor for advancing articles to a stacking position, a receiving support for the stack, a stacking member movable transversely of the conveyor toward and from the support, means for producing a stacking movement of the member for each article advanced by the conveyor, and means for changing the time-relation between the delivery of the articles by the conveyor to the stacking position and the movement of the stacking member.

6. In an apparatus for stacking articles, an endless conveyor for advancing articles to a stacking position, a receiving support for the stack, a stacking member movable transversely of the conveyor toward and from the support, means for producing a stacking movement of the member for each article advanced by the conveyor, and means acting for each article delivered by the conveyor for changing the interval between the beginning of a stacking cycle and the initiation of movement of the stacking member.

7. In an apparatus for stacking articles, means for advancing articles to be stacked, a movable stacking member co-operating with the advancing means, and means for determining the time of movement of the stacking member, the time-determining means being acted upon by the articles upon the advancing means before said articles reach the stacking member.

8. In a stacking apparatus, an article-conveyor, means for separating articles from the conveyor and stacking them, and means acting upon each operation of the stacking means for changing the time of such operations.

9. In a stacking apparatus, an article-conveyor, means for separating articles from the conveyor and stacking them, and means arranged to render the time-interval between the initiation of the operation and the separation of an article alternately longer and shorter for succeeding cycles.

10. In an article-stacking apparatus, a conveyor, a movable stacking member co-operating with the conveyor, operating means for the stacking member, and controlling means arranged to change the time of each operating cycle.

11. In an article-stacking apparatus, a conveyor, a movable stacking member co-operating with the conveyor, operating means for the stacking member, and controlling means arranged to change the time of each operating cycle and including a member arranged for actuation by a conveyed article.

12. In an article-stacking apparatus, a reciprocatory stacking member, a plurality of operating mechanisms for the member, and connections between the member and mechanisms including a member movable into cooperation with any one of said mechanisms.

13. In an article-stacking apparatus, a reciprocatory stacking member, a plurality of operating mechanisms for the member, connections between the member and mechanisms including a member movable into cooperation with any one of said mechanisms, and means controlled by an article to be stacked for moving the member.

14. In an article-stacking apparatus, a reciprocatory stacking member, two cam mechanisms for operating the member, the operating surfaces of the cams of said mechanisms being arranged at different angles, and connections arranged to join the stacking member to either cam.

15. In an article-stacking apparatus, a movable stacking member, means for operating the member, controlling means for the operating means having a member movable into controlling position by an article to be stacked, and power mechanism contacting with the controlling member to actuate it.

16. In an article-stacking apparatus, a movable stacking member, means for operating the member, controlling means for the operating means having a power-driven member movable into controlling position by an article to be stacked, and a member actuated by the driven member to produce the controlling effect.

17. In an article-stacking apparatus, a movable stacking member, means for operating the member, controlling means for the operating means having a power-driven member movable into controlling position by an article to be stacked, and a member actuated by the driven member to produce and reverse the controlling effect.

18. The combination with a movable transferring member, of means for moving the member at one time in a transferring cycle, means for moving the member at a different time in a transferring cycle, and means for rendering either of the moving means effective.

19. The combination with a movable transferring member, of means for moving the member at one time in a transferring cycle, means for moving the member at a different time in a transferring cycle, and means for rendering the moving means alternately effective.

20. The combination with a movable transferring member, of means for moving the

member at one time in a transferring cycle, means for moving the member at a different time in a transferring cycle, connections to the transferring member arranged to be shifted into co-operation with either moving means, and a device arranged to shift the connections and to reverse the direction of such movement.

21. The combination with a movable transferring member, of means for moving the member at one time in a transferring cycle, means for moving the member at a different time in a transferring cycle, connections to the transferring member arranged to be shifted into co-operation with either moving means, and a device controlled by contact of an article to be transferred and arranged to shift the connections and to reverse the direction of such movement.

22. The combination with a movable transferring member, of means for moving the member at one time in a transferring cycle, means for moving the member at a different time in a transferring cycle, connections to the transferring member arranged to be shifted into co-operation with either moving means, a constantly driven controlling member, and an actuating device engaged by the controlling member and joined to the connections.

23. The combination with a movable transferring member, of means for moving the member at one time in a transferring cycle, means for moving the member at a different time in a transferring cycle, connections to the transferring member arranged to be shifted into co-operation with either moving means, a constantly driven controlling member, and an actuating device engaged by the operating member and joined to the connections, said actuating device being organized to reverse the effect of the controlling member upon the connections to the transferring member.

24. The combination with a movable transferring member, of a plurality of means for moving the member, connections to the transferring member arranged to be shifted into co-operation with either moving means, a constantly driven controlling member, and an actuating device engaged by the controlling member and joined to the connections, said actuating device including two relatively movable elements, one acted upon by the controlling member and the other joined to the connections.

25. The combination with a movable transferring member, of a plurality of mechanisms for moving the member, connections to the transferring member arranged to be shifted into co-operation with either moving means, a constantly driven controlling member, and an actuating device engaged by the controlling member and having an element joined to the connections and an element movable on the associated element by the controlling member for opposite engagement thereby.

26. In a box-nesting apparatus, an endless conveyor, a plunger arranged to reciprocate transversely of the conveyor, and means arranged for operation by a conveyed box before it reaches the path of the plunger for effecting the reciprocation of said plunger when a box is alined therewith.

27. In a box-nesting apparatus, a conveyor, a plunger arranged to reciprocate transversely of the conveyor, two operating mechanisms, connections to the plunger having a member arranged for movement into co-operation with either operating mechanism, a continuously rotatable member, a reciprocatory pin carried by the member, a lever arranged to contact with the conveyed boxes and be moved thereby to project the pin, and an actuating device movable by the projected pin and joined to the connecting member.

28. In a box-nesting apparatus, a conveyor, a plunger arranged to reciprocate transversely of the conveyor, two operating mechanisms, connections to the plunger having a member arranged for movement into co-operation with either operating mechanism, a continuously rotatable member, a reciprocatory pin carried by the member, a lever arranged to contact with the conveyed boxes and to be moved thereby to project the pin, and an actuating device movable in opposite directions by the projected pin and joined to the connecting member.

29. In a box-nesting apparatus, a conveyor, a plunger arranged to reciprocate transversely of the conveyor, two operating mechanisms, connections to the plunger having a member arranged for movement into co-operation with either operating mechanism, a continuously rotatable member, a reciprocatory pin carried by the member, a lever arranged to contact with the conveyed boxes and be moved thereby to project the pin, and an actuating device joined to the connecting member and having a member arranged for movement by the pin to be engaged thereby at its opposite sides.

30. In a box-nesting apparatus, a conveyor, a plunger arranged to reciprocate transversely of the conveyor, two cams arranged with their operating surfaces at different peripheral angles, a connecting member movable for co-operation with either cam and joined to the plunger, a rocking arm, a contact member arranged to rock upon the arm and joined to the connecting member, and a member movable by the conveyed boxes and arranged to rock the arm and contact member.

31. In a box-nesting apparatus, a conveyor, a plunger arranged to reciprocate transversely of the conveyor, two cams ar-

ranged with their operating surfaces at different peripheral angles, a connecting member movable for co-operation with either cam and joined to the plunger, a rocking arm, a contact member arranged to rock upon the arm and joined to the connecting member, and a power-driven member variable in position by the conveyed boxes and arranged to engage the contact member.

In testimony whereof I have signed my name to this specification.

CUTLER D. KNOWLTON.