Feb. 27, 1940. E. J. BELL 2,191,436

UNLOADING, COUNTING, AND STACKING MECHANISM

Original Filed May 6, 1935 3 Sheets-Sheet 1

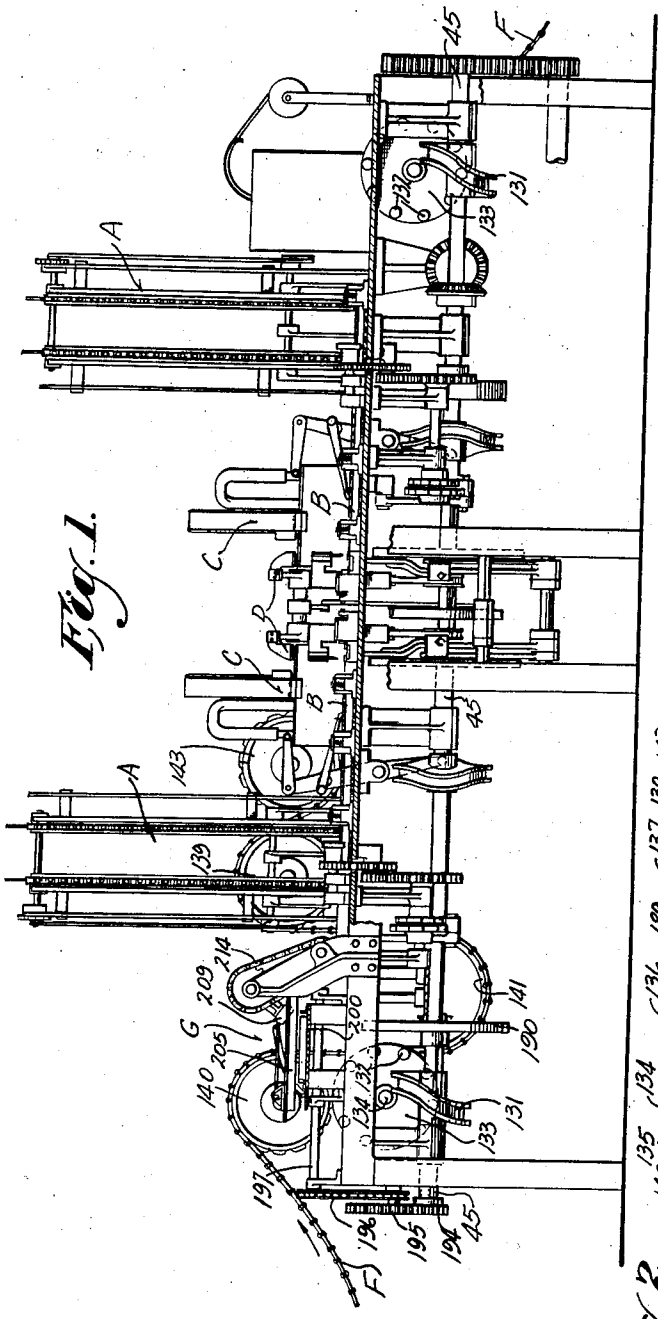


Fig. 1.

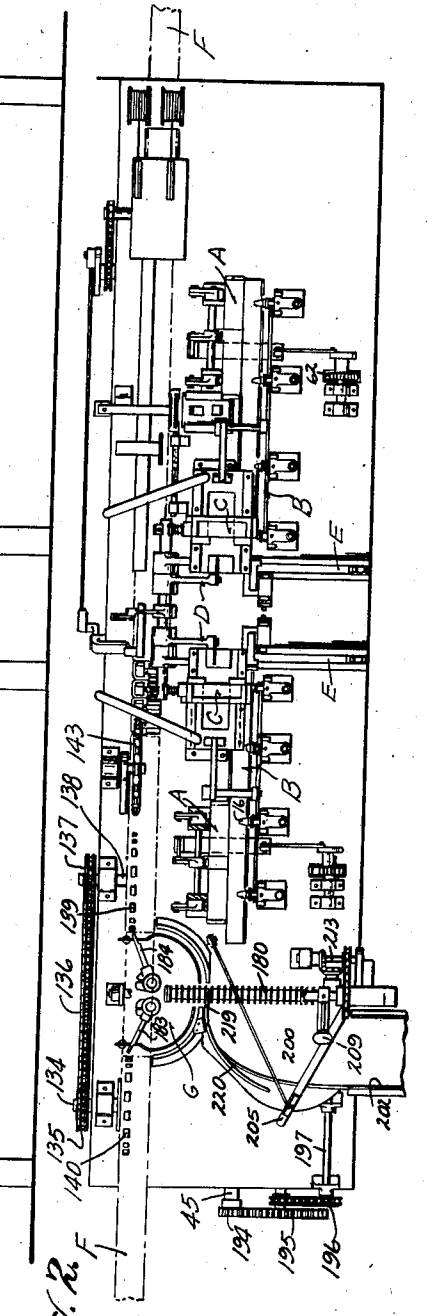


Fig. 2.

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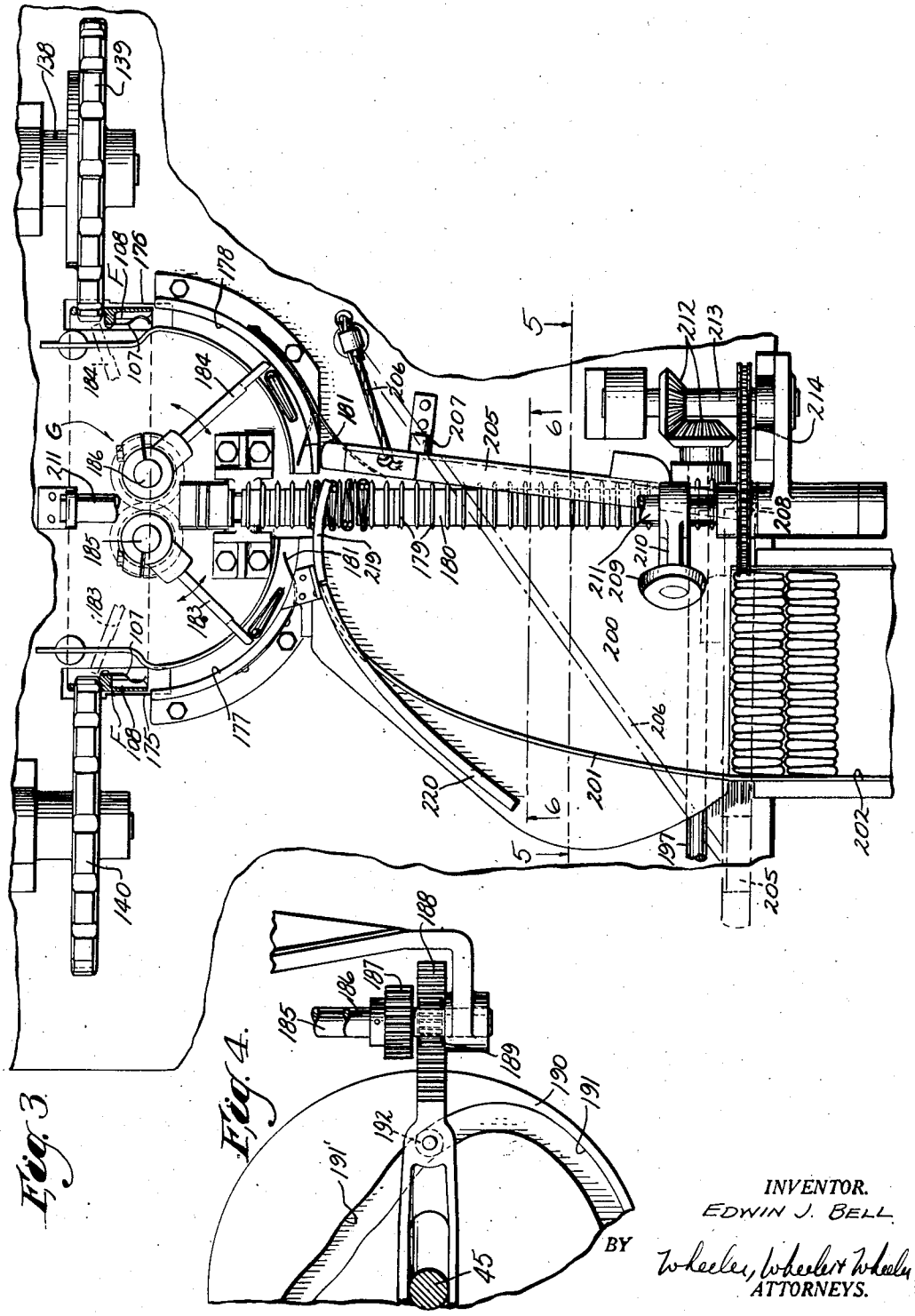


Fig. 3.

Fig. 4.

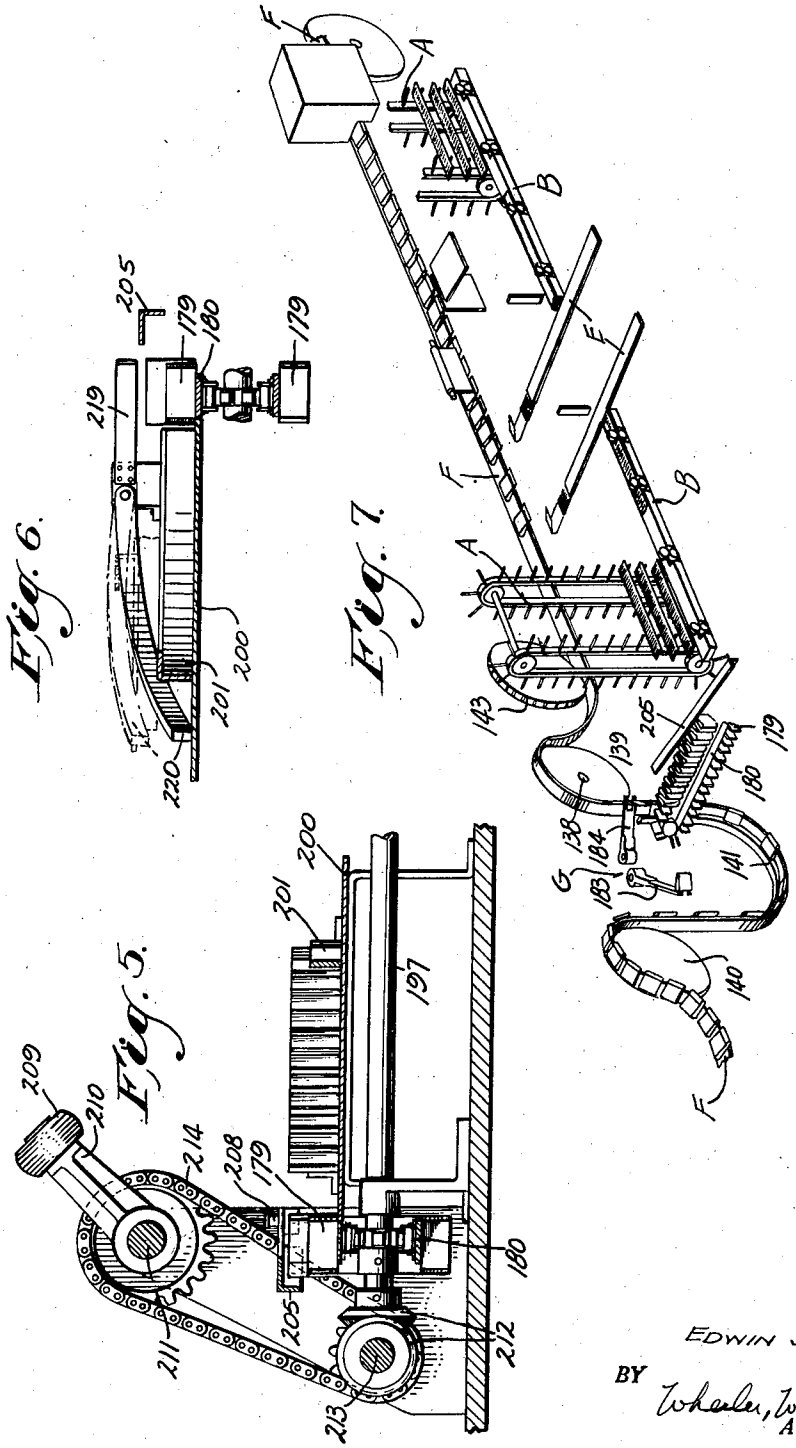
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UNLOADING, COUNTING, AND STACKING MECHANISM

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UNITED STATES PATENT OFFICE

2,191,436

UNLOADING, COUNTING, AND STACKING MECHANISM

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Original application May 6, 1935, Serial No. 20,027. Divided and this application March 14, 1938, Serial No. 195,924

17 Claims. (Cl. 226—4)

This invention relates to improvements in unloading, counting, and stacking mechanism usable in machines for the manufacturing of a variety of products but having particular application to a match book machine. The invention will be described illustratively from the standpoint of a match book machine.

In the preferred embodiment of the invention the devices to be unloaded are assembled on a conveyor chain and it is broadly the purpose of the present invention to provide improved automatic delivery mechanism for taking the completed articles from the chain and delivering them in counted stacks of matched articles. The conventional match book is thick at one end and thin at the other. In order that such books may be stacked in uniform straight rows it is customary to alternate the thick ends of the successive books in the stack, and it is an object of the present invention to accomplish this simply and economically by moving the books alternately in opposite directions to the stacking device and preferably taking the books simultaneously from different flights of the assembly conveyor and delivering them simultaneously to successive positions on a stacking conveyor, the entire operation being preferably continuous.

Other objects will appear in more detail from the following disclosure.

The present application is a division of my application No. 20,027 filed May 6, 1935, Patent No. 2,137,072, Nov. 15, 1938, and entitled "Match book machines."

In the drawings:

Figure 1 is a front elevation of a machine embodying the present invention, omitting those conventional portions thereof which relate to the application of striking paint to the otherwise complete books, and the subsequent drying of the paint.

Figure 2 is a plan view of the mechanism shown in Fig. 1.

Figure 3 is a view showing in plan on an enlarged scale the stacking, counting, and discharge mechanism to which the claims of the present application are primarily directed.

Figure 4 is a fragmentary detail in side elevation of the cam actuated mechanism for operating the unloading fingers.

Figure 5 is a detail view taken in section on line 5—5 of Fig. 3.

Figure 6 is a detail view taken in section on line 6—6 of Fig. 3.

Figure 7 is a diagrammatic view showing the relative positions of some of the major portions of the apparatus.

Like parts are identified by the same reference characters throughout the several views.

I shall first refer briefly to the general organization of the machine as described in my parent application above identified, and follow this with a detailed description of the component parts pertinent specifically to the present invention.

The previously manufactured match combs are inserted, in pairs into the two magazines generically designated by reference character A and illustrated in Figs. 1, 2 and 7.

From each such magazine successive pairs of match combs are discharged into the feeding and cut-off mechanisms generically designated by reference character B, by which match book blanks are successively severed from the leading ends of the successively fed match comb pairs.

In the meantime the cover stock blanks piled in the cover stock magazines generically designated by reference character C are being delivered one at a time to the folding mechanism D, and a match blank feeder E periodically inserts each successive match blank into the folded cover stock and delivers these assembled parts to the conveyor chain F.

It can conveniently be noted in Fig. 7, wherein these parts are diagrammatically illustrated, that the first match blank feeder loads alternate spaces in the conveyor chain F and the second feeder loads the assembled parts into the intervening spaces. The chain is moved step by step, two spaces at a time, and dwells to permit the loading operation above described and the unloading operation with which the present invention is particularly concerned.

After the blanks are assembled in the folded cover stock and delivered to the chain F, the covers are folded over the blanks and stapled or stitched to retain them, the striker paint is applied and allowed to dry on the portion of the chain which is conventional and is not here illustrated.

Finally, the chain returns the finished product to the discharge portion of the machine where the unloader and stacking mechanism generically designated by reference character G nests together the finished books, compacts them in a stack, and delivers counted units for packaging. The unloading point is immediately adjacent the point where the chain is again charged with assembled cover stock and match comb blanks.

Having indicated the general organization of the machine, I shall now describe particularly the

delivery portion thereof with which the present application is primarily concerned.

The conveyor

In the preferred embodiment of the invention conveyor F comprises a chain, each link carrying a receptacle 108. While I drive the chain at several points in actual practice, it is only necessary in the present case to show one drive. The main drive shaft 45 carries a helical cam 131 coacting with the succesive studs or teeth 132 of the crown wheels 133. Crown wheel 133 is mounted on a shaft 134 which projects at the rear of the table and carries a sprocket 135 over which operates the driving chain 136 leading to sprocket 137 and shaft 138. This shaft in turn carries the main driving sprocket 139 over which the conveyor F passes as shown in Figs. 1, 2, 3, and 7. A similar sprocket 140 spaced to the left of sprocket 139 is an idler, and the loaded chain after passing over sprocket 140 has a flight extending downwardly around a guide 141 and thence has another flight extending upwardly over sprocket 139 to provide a bight at the unloading stations hereinafter to be described. The empty chain then passes beneath an idler guide sprocket 143 to the loading points.

The unloader

One of the unloading stations is located where the downwardly descending flight of conveyor F passes through the opening 175 in the machine bed. The other unloading station is located where the flight of the conveyor F emerges from the opening 176 in the machine bed. The arrangement is such that at each dwell of the conveyor chain alternately different receptacles 108 thereof will be at the level of the machine bed at the respective unloading stations.

Leading from each unloading station is an arcuate match book guide or channel just wide enough to receive the finished match book as it is delivered on edge from the chain. The channel 177 leading from the downward flight of the chain is of slightly shorter radius than channel 178, so that the delivery ends of the respective channels are spaced by approximately the thickness of a single match book for delivery of their respective books into different consecutive spaces provided between consecutive spacer bars 179 on the cross conveyor 180. Associated with each of the channels or guideways 177 and 178 is a yieldable retarder 181 in the form of a spring which slows up any unduly rapid motion of the respective books and forces each book to the inner face of its guiding channel for proper delivery into the space next adjacent the dividing bar 179 with which the inner side of the channel is registered at any given operation.

The means for propelling the match books from receptacles 108 of the main conveyor to the proper spaces in the cross conveyor comprise the ejectors or unloading arms 183 and 184, the latter being slightly elongated because of the greater radius of the guide channel 178 with which it coacts. The ends of these arms are bifurcated to be received over the match book retaining clips 107 of the receptacles 108 on conveyor F. Arms 183 and 184 are mounted on rock shafts 185 and 186 respectively for oscillation. They are normally retracted to the dotted line positions indicated in Fig. 3 and remain retracted during each advance of the conveyor over the sprockets 140 and 139. During the dwell of the conveyor F the arms are actuated rapidly to eject books from the receptacles registered with the arms at each of the unloading stations and to propel these books into the cross conveyor in opposite directions, so that the smaller end of one book will lie opposite the larger ends of the adjacent books on the cross conveyor.

The bight in the conveyor has a two-fold object. The books or bundles entering the bight are quarter turned so that the sides previously occupying substantially horizontal positions become vertically disposed. Therefore the ejectors deliver the books or bundles to the cross conveyor on edge with reference to the surfaces which formerly rested upon the feeding conveyor F, and the pairs of bundles simultaneously transferred to the receiving or cross conveyor from opposite sides of the bight will have these surfaces facing in the direction of cross conveyor movement. In other words, the surfaces of both books or bundles which formerly constituted the bearing surfaces will both face in the same direction on the receiving conveyor, although the bundles of the respective pairs are reversed end to end.

This is an important result if the books or bundles have one smooth and one irregular or shouldered surface. Match books and other articles similarly packaged are usually smooth on one side and shouldered on the other, and if the shouldered portions of successive books are opposed they are liable to interlock in a magazine and prevent successful deliveries of one package at a time.

The other result attained by providing a bight in the feeding conveyor is the facility with which two oscillatory sweeps may transfer books or bundles from opposite sides of the bight and deliver them to the receiving conveyor from opposite sides of the latter.

To actuate the arms, the supporting rock shafts 185 and 186 are interconnected by gearing 187 and operated through rack 188 and pinion 189 from a cam 190 mounted on the main drive shaft 45.

The cam groove 191 is concentric with the shaft 45 throughout a major portion of its periphery to hold arms 183 and 184 in their normally retracted positions aforesaid. There is also a slight concentric portion of the cam groove at 191' which causes a very brief period of dwell at the moment of delivery of the respective match books into their appropriate spaces in the cross conveyor 180 in order to make sure that their speed of delivery to the cross conveyor will not cause them to pass beyond it. Rack 188 carries the usual cam follower roller at 192 and may conveniently be guided on the main drive shaft 45 as shown in Fig. 4.

The cross conveyor 180 is in continuous operation, being driven from the main drive shaft 45 through gears 194, 195, chain 196, and shaft 197 as shown in Figs. 1, 2, 3 and 5. The conveyor 180 moves adjacent the counting and stacking table 200 upon which there is a curved guide 201 for forcing the match books into a more compact relation before their delivery to the discharge chute 202 (Fig. 3).

The counting and stacking arm is shown at 205. It is biased by means of a rope 206 and counterweight (or otherwise) to a normally retracted position against the stop 207. It is loosely pivoted at 208 for oscillation from its normally retracted position. Periodically it is oscillated through a wide arc about its fulcrum at 208 as a result of engagement by the roller 209 which

revolves on arm 210 about the axis of the continually rotating shaft 211. Shaft 211 receives motion from the cross conveyor drive shaft 197 through the bevel gearing at 212, jack shaft 213, and chain 214.

During the dwell of the counting and stacking arm 205 the movement of cross conveyor 180 therebeneath will cause the accumulation of a predetermined number of match books within the range of movement of the arm 205. The timing accomplished by the driving connections to shaft 211 is such that when a predetermined number of match books lie within the sweep of arm 205 the roller 209 will strike arm 205 to oscillate it about its fulcrum 208, whereby to sweep the match books from the cross conveyor laterally over the stacking table 200 where the several books will be compacted owing to the constricting action of the guide member 201 on said table. In the final position of arm 205 as shown in dotted lines in Fig. 3, the stack of match books will have been delivered into the mouth of the discharge chute 202 for boxing.

The range of outward movement of the arm 205 is determined by the radius and position of movement of the roller 209. In its revolution about shaft 211 the roller 209 ultimately clears the arm, thus allowing the arm to be retracted by its biasing weight.

During its outward oscillation, the arm 205 passes beneath the fixed arm 219 and, in riding on the upper surface of guide member 201, the bar 205 lifts the switching pawl 220 to the dotted line position shown in Fig. 6 and passes therebeneath. After the passage of the arm 205 the switching pawl drops to its full line position in said figure and hence, after the roller 209 has swung to a position where it clears the arm, and the arm is drawn rearwardly by the biasing weight or rope 206, the arm will ride on to the upper surface of the switching pawl 220 and hence will be carried by the upper surface of the fixed member 219 across the match books already advancing on the continuously moving conveyor 180. The stacking arm 205 thereupon falls by gravity to the position shown in Fig. 3 and Fig. 6, where it is aligned with the match books to sweep them from the cross conveyor when the arm is next engaged by the revolving roller 209.

I claim:

1. In a device of the character described, the combination of a feeding conveyor and a receiving conveyor movable along lines substantially at right angles to each other, the feeding conveyor having portions traveling in opposite directions on opposite sides of the line of movement of the receiving conveyor, means for actuating said conveyors simultaneously step by step, curved guides disposed in the angles formed by said conveyors on opposite sides of the receiving conveyor, oscillatory sweeps cooperative with said guides to remove the bundles from the feeding conveyor and deposit them upon the receiving conveyor, and means for oscillating said sweeps in the intervals between successive conveyor moments.

2. In a device of the character described, the combination with conveyor means providing spaced article supports, of a pair of arms mounted for oscillation in opposite directions about adjacent axes, the free ends of the arms being movable from points near said supports to points at which the free ends of the arms approach each other, a cross conveyor passing said last mentioned point and provided with successive pockets adapted to receive articles propelled by said arms from said supports, guides extending beneath the paths of travel of the respective arms from the respective supports to points spaced along the path of movement of the cross conveyor at a distance equal to the spacing between consecutive pockets of said cross conveyor, whereby the articles propelled by said arms will be delivered to consecutive pockets from opposite directions, and means for periodically removing from the cross conveyor segregated stacks of such articles, said last mentioned means comprising a restricting throat for compacting the articles in the course of their travel therethrough, an arm for sweeping the articles from said cross conveyor to said throat, and means for elevating said arm in its return, whereby to clear articles being advanced by said cross conveyor.

3. In a device of the character described, the combination of a feeding conveyor and a transversely movable receiving conveyor, each provided with bundle holding and spacing projections adapted to permit lateral insertion and delivery of bundles, means for actuating said conveyors simultaneously in step-by-step movements, curved guides leading from one side of the feeding conveyor to opposite sides of the receiving conveyor, oscillatory sweeps operable upon bundles in registry with said guides to transfer them from the feeding conveyor to the receiving conveyor, and means for simultaneously oscillating said sweeps in the intervals between conveyor movements, said guides having their delivery end portions offset with reference to each other along the sides of the receiving conveyor, whereby to deliver bundles in pairs with their ends oppositely disposed.

4. In a device of the character described, the combination of a feeding conveyor and a transversely movable receiving conveyor, each provided with bundle holding and spacing projections adapted to permit lateral insertion and delivery of bundles, means for actuating said conveyors simultaneously in step-by-step movements, curved guides leading from one side of the feeding conveyor to opposite sides of the receiving conveyor, oscillatory sweeps operable upon bundles in registry with said guides to transfer them from the feeding conveyor to the receiving conveyor, and means for simultaneously oscillating said sweeps in the intervals between conveyor movements, said guides having their delivery end portions offset with reference to each other along the sides of the receiving conveyor, whereby to deliver bundles in pairs with their ends oppositely disposed, said feeding conveyor having a bight within which the sweeps operate upon bundles having like side faces opposed, whereby the transferred bundles are delivered to the receiving conveyor with said sides facing in the same direction.

5. In a device of the character described, the combination with a conveyor provided with work receptacles, of an unloading table having spaced unloading stations, guide means providing a bight in the conveyor at said table and arranged for the registration of alternate receptacles with said stations, a pair of unloaders movable over the surface of said table from said stations toward an intermediate nesting point, and means for removing work from said nesting point.

6. In a device of the character described, the combination with a conveyor means having work holding receptacles and providing separate flights, of unloading stations individual to the

respective flights, means for intermittently actuating said conveyor to register receptacles with said stations for the unloading of work therefrom, a stacking conveyor intermediate said flights, ejector arms pivoted intermediate said flights and having delivery portions movable from said stations to said stacking conveyor, guide means on said stacking conveyor defining work receiving spaces thereon, and guide means associated with said ejectors and registering with alternate spaces of said stacking conveyor.

7. In a device of the character described, the combination with a conveyor having work receiving means, of an arm movable across said conveyor in the plane of work carried thereby, stacking means arranged to receive the work displaced from said conveyor in the movement of said arm, means biasing said arm for its return to a normally retracted position, and an arm actuating member revoluble on a path intersecting the path of said arm and the frequency and path of movement of which are determinative of the time and extent of operation of said arm.

8. In a device of the character described, the combination of a bundle feeding conveyor provided with work holding pockets opening laterally to the margin of the conveyor and a transversely disposed receiving conveyor having laterally opening work receiving spaces and intervening partitions, said bundle feeding conveyor having a portion extending perpendicularly to the plane of its other portions along one side of the line of movement of the receiving conveyor, an arcuate bundle guide in the angle between said perpendicularly extending portion and the receiving conveyor, means for actuating said first conveyor step by step, said guide being positioned to register at one end with a pocket of the feeding conveyor and at its other end with a space of the receiving conveyor and an oscillatory sweep cooperative with said guide to transfer bundles from the feeding conveyor to the receiving conveyor in the intervals between the step movements of said conveyors, whereby the sides of the bundles in contact with the feeding conveyor will be disposed perpendicularly with reference to the bundle supporting surface of the receiving conveyor.

9. In a match book machine, the combination with an assembly conveyor having match book receptacles, of guide means for said conveyor providing a series of spaced conveyor flights, a cross conveyor disposed on a line passing between said flights, ejectors operable from said flights to said cross conveyor in opposite directions, means for actuating said ejectors for transfer of match books from the respective flights in opposite directions to cross the conveyor, guideways for controlling the delivery of said match books by said ejectors to assure the positioning of the books in alternation on the nesting conveyor, and another ejector movable across said nesting conveyor and of sufficient length to simultaneously sweep therefrom a predetermined number of match books.

10. In a match book machine, the combination with an assembly conveyor having match book receptacles, of guide means for said conveyor providing a series of spaced conveyor flights, a cross conveyor disposed on a line passing between said flights, ejectors operable from said flights to said cross conveyor in opposite directions, means for actuating said ejectors for transfer of match books from the respective flights in opposite directions to the cross conveyor, guideways for controlling the delivery of said match books by said ejectors to assure the positioning of the books in alternation on the nesting conveyor, and another ejector movable across said nesting conveyor and of sufficient length to simultaneously sweep therefrom a predetermined number of match books, said last mentioned ejector having means for reciprocating it, and means for lifting it from the plane of match books on the nesting conveyor in one direction of reciprocation, whereby to pass over the books accumulated for delivery.

11. In a match book machine, the combination with an assembly conveyor having match book receptacles, of guide means for said conveyor providing a series of spaced conveyor flights, a cross conveyor disposed on a line passing between said flights, ejectors operable from said flights to said cross conveyor in opposite directions, means for actuating said ejectors for transfer of match books from the respective flights in opposite directions to the cross conveyor, guideways for controlling the delivery of said match books by said ejectors to assure the positioning of the books in alternation on the nesting conveyor, and another ejector movable across said nesting conveyor and of sufficient length to simultaneously sweep therefrom a predetermined number of match books, and another guide means for the match books acted on by the last mentioned ejector, said other guide means being formed with a throat portion to compact said match books in a stack in the course of their final ejection.

12. In a device of the character described, the combination with a conveyor provided with work receptacles, of conveyor guide means providing a bight in the conveyor, means disposed adjacent to the bight of the conveyor and constituting a nesting point for the work delivered from said receptacles, a pair of work unloaders movable from receptacles at opposite sides of said bight toward said intermediate nesting point and including work propelling means for delivering work from spaced receptacles of said conveyor in opposite directions to said nesting point, means for the actuation of said unloaders, and means for removing work from said nesting point.

13. In a device of the character described, the combination with a conveyor having spaced flight portions and provided with work receptacles, of a cross conveyor disposed adjacent to said flights and provided with work receiving pockets opening in opposite directions, a pair of unloaders movable to and fro between the respective flights of said first conveyor and alternate pockets of said cross conveyor, said unloaders including means for propelling work from the respective flights of the first conveyor for delivery in opposite directions into the pockets of the cross conveyor to be nested thereon, and means for propelling said first conveyor to register alternate receptacles with said unloaders, and means for synchronously advancing the second conveyor to remove from the path of said unloaders pockets previously filled by nested work and to position unfilled pockets in the path of said unloaders.

14. In a device of the character described, the combination with a conveyor provided with work receptacles and guide means for said conveyor defining two spaced flight portions, of a cross conveyor having work receiving pockets and disposed transversely and extending laterally from one side of the spaced flight portions of the first conveyor, arcuate feedway means extending

from the respective flights of the first conveyor to opposite sides of the cross conveyor in registry with successive pockets thereof, the guide means of the first conveyor being of such dimensions as to register alternate pockets of the first conveyor with differing feedway means in the advance of the first conveyor, means for the intermittent advance of the first conveyor to effect such registration and a pair of oscillatory unloaders having fulcrums in close proximity and substantially in line with the path of the cross conveyor, said unloaders being movable along said feedways and provided with means for the transfer of work from the alternate receptacles of the first conveyor in opposite directions into successive receptacles of the cross conveyor, and means for progressively advancing the cross conveyor for exposing successive empty pockets to said feedways to receive the work propelled by said unloaders.

15. In a device of the character described, the combination with a nesting conveyor having partition means defining work receiving pockets, of an arm pivoted to sweep across said conveyor for the removal of work from a predetermined number of said pockets, a table adjacent said conveyor over which said arm swings for the delivery of such work, and guide means underlying the path of movement of said arm over said table and adapted to confine the work propelled by said arm, said guide means being disposed at a progressively decreasing radius from the axis upon which said arm swings, whereby to force into intimate contact the items of work delivered from spaced pockets by said arm.

16. In a device of the character described, the combination with a nesting conveyor having means providing spaced work pockets, of a delivering arm movable across said conveyor to sweep the work from a predetermined number of said pockets, means for intermittently actuating said arm in a work delivering direction, means for the return of said arm out of the path of the work delivered, and a table adjacent said conveyor over which the delivery of the work is effected, said table having guide means for progressively confining the work in the course of its delivery over the table, whereby to eliminate the spaces originally provided between the work in said pockets.

17. In a device of the character described, the combination of a bundle conveyor having portions guided for movement in opposite directions substantially perpendicularly to other portions of the conveyor, whereby to quarter turn the bundles traversing the bight formed by said perpendicular portions, means for actuating the conveyor step by step, each step corresponding in length to the space occupied by two bundles, and transfer means, operative at opposite sides of the bight in the intervals between step-by-step movements, to remove bundles from the conveyor and deliver them to a receiving device from opposite sides thereof.

EDWIN J. BELL.

CERTIFICATE OF CORRECTION.

Patent No. 2,191,436. February 27, 1940.

EDWIN J. BELL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 58, claim 9, for the words "cross the conveyor" read the cross conveyor; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of April, A. D. 1940.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.