APPARATUS FOR FORMING STACKS OF BOARDS

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Application June 28, 1946, Serial No. 689,624

11 Claims. (Cl. 214—6)

1 The present invention relates to apparatus for stacking board-like articles.

More particularly the invention relates to that type of handling apparatus which will receive a plurality of boards, will transfer them to a differential speed-up device, selectively advance them thereon, and eventually stack the boards in a preferred form of arrangement, and then transfer the stack to a point of delivery.

The invention is of particular applicability to the stacking of gypsum boards, commonly known as gypsum wallboards and gypsum lath, which are usually offered to the public in the form of a stack containing a definite number of boards which may, additionally, be suitably fastened together either by being wrapped in paper or held together by means of paper strips or various clamping devices such as suitably shaped clips and the like. Particularly when using the latter system, and where wrapping is not provided, it is advisable to form the stacks with the unpreferred sides of the boards outwardly directed and hence exposed, while the preferred sides, i.e., the ones which are to be presented to the inside of the room in which the boards or laths are to be used, are kept unexposed in the stack, and hence protected from injury and from becoming soiled or marred. This is not intended to imply that one side of the boards is necessarily better than the other, as the main object is merely to preserve at least one side of the boards against injury during transportation, so that there will be available for use one side which is in its original clean condition.

In the continuous production of such boards, it has become more or less standard practice to pass them through a multiple-deck dryer; this being true of gypsum-core boards as well as of boards made entirely from wood-pulp, ground food, and the like. The invention, however, is not limited to the handling of these types of boards, but is considered as being generically directed to the handling of any sufficiently rigid board-like objects or articles which will lend themselves to translatory movement upon rollers, belts or similar conveyors, and which may be turned completely over from their obverse to their reverse sides without buckling or deformation.

Accordingly it is one of the objects of the present invention to provide a handling system comprising various operatively associated and combined instrumentalities, which by their conjoint operations effect the transfer of boards to a stacking device in which the boards are stacked so that none of the preferred sides will be exposed either at the top or bottom of the resulting stack.

Still further objects of the invention are to provide an apparatus for selectively accelerating the speed of travel of one or more of a number of boards being transported on substantially the same level, so as to arrange said boards in an echelon, that is with the boards in progressively advanced relation one to the other.

Another object of the invention is to provide an apparatus for completely turning over one of a plurality of boards, to deposit this upon a receiving element, and then to deposit thereupon further boards in their unreversed position, to eventuate a suitable stack having the desired orientation of boards therein.

A further object of the invention is to provide a suitable combination of various transporting, accelerating and reversing means to practice a method in which boards received from a conveyor have their respective speeds of travel modified so as to accelerate that of selected boards, then are either turned over or not, as desired, stacked into a stack of desired orientation, and the stack conveyed to a desired point of delivery.

Still further objects of the invention will become apparent from the further description and claims hereinafter when considered in connection with the hereto appended drawings.

Generally considered, the apparatus comprises three separate sections, the first of which includes a horizontal roller conveyor upon which the boards arrive, usually three abreast, having previously been treated and acted upon by other instrumentalities which form no part of the present invention. The second section is a selective accelerating section in which the boards are placed in an echelon arrangement, one board being accelerated relative to two others, and a second board accelerated relative to a third. The third section comprises means for turning over the most accelerated board, depositing it upon the two other boards upon it; then turning over the next arriving most accelerated board, depositing it upon the three boards already deposited, placing two more boards upon it, thereby to eventuate a stack of six boards, which are then jointly conveyed as a finished stack to a point of delivery.

Means for selectively actuating these different sections and instrumentalities are also provided.
The apparatus is illustrated in the accompanying drawings, in which:

Fig. 1 is a top plan view of the entire apparatus;

Fig. 2 is a side elevational view of the apparatus shown in Fig. 5;

Fig. 3 is a fragmentary sectional view, on a somewhat enlarged scale, of that portion of the apparatus that turns over and stacks the boards, taken on line 3-3 of Fig. 4;

Fig. 4 is a sectional view of the apparatus shown in Fig. 3, showing the boards as they are being turned over and stacked, taken on line 4-4 of Fig. 1; and

Fig. 5 is a view similar to Fig. 4, but with a stack of boards already accumulated and in process of being further moved.

The boards arrive on that section of the apparatus designated broadly as section A. which comprises a suitable framework 16 upon which are mounted a series of driven rollers 11 which are actuated by means of an underlying contacting belt 12 which derives its motion from pulley 13, which is affixed to rotating shaft 14, which is actuated through a series of chain-belts 15, 16 and 17 from a prime mover 18, which is shown in the form of an electric motor; the belt 12 being pressed against the rollers 11 by belt-supporting roller 19 (see Fig. 2). The boards (which are omitted from Figs. 1, 2 and 3, for the sake of simplifying the showing) move at the same speed to the left (see arrow) until they encounter the next section, B, which is the accelerating section, in which the boards are selectively accelerated. The section B consists of a plurality of smaller individual rollers 21, 22 and 23 which are driven from a suitable motor 18. By proper proportioning of the driving means, that is, the chains 15, 16 and 17, the board which lies on that part of the conveyor which has the rollers 21 thereon, will be speeded up relatively to the board arriving on the rollers 22, while the board on the rollers 23 will move still more slowly. A set of positively driven pinch rolls 24, 27, and 28, beneath which smaller rollers 25, with a spacing between just about equal to the thickness of the boards, serve positively to push the boards out on to angle-Iron supports 28, 29 and 30, which it will be noticed (see Fig. 4) are so arranged that they will support the boards at a point which is one side of the center of gravity of the boards, support 28 being to the left of the center of gravity of the boards b, supported thereby, and supports 29 and 30 being to the right of the center of gravity of boards b and b, respectively.

Considering that the boards are substantially the length of the supports, the boards cannot drop off the supports 28, 29 and 30 until they have completely cleared the pinch rollers 24, 27 and 28, respectively. Immediately they have done so, however, their free unsupported longitudinal edges will be guided by fingers 25' to engagement with belts 32 which will carry said edge to the left thereby causing the board to be completely turned over and then conveyed to and dropped into a receiving mechanism which comprises a receiving pan 31. The left hand edges of the boards falling from the supports 28 and 30 will also encounter the belts 32, which will pull the boards completely off the supports so that the previously supported edges will now also drop and the boards will fall upon belts 32, which transport them to the left (see Fig. 4) until they fall on top of the first board, which has been completely turned over, and deposited in pan 31. By means of a suitable thruster 33 (see Figs. 1 and 2) the belts 32 are brought into contact with the stack which hence moves to the left (upwardly in Fig. 1) and places the entire stack upon a conveyor section D which is provided with a plurality of free rollers 34. At this point the stack may be pushed to the right until it arrives on section E which is also provided with rollers 35. At this point the boards may be given any desired treatment or removed for shipping.

The boards handled by the apparatus of the present invention, are usually paper covered and have a desired or preferred surface and an undesired or unpreferred surface. In making up bundles of such boards, particularly where metal-clamping means or paper strips are employed, such clamping or securing means engage only with the edge portions of the stack of boards, leaving the outside surfaces of the top and bottom boards exposed. Such surfaces may therefore be easily marred in shipment and handling of the bundle and therefore the edges of the sides of the boards which are exposed when the boards are put to use. In order that the preferred sides of the boards shall not be injured during manufacture, the board-manufacturing apparatus is so designed that the boards issue therefrom with the preferred sides exposed and the unpreferred sides up. This is advantageous as it will avoid marring the preferred side as by grease, dirt or other things dropping on to the boards as they progress through the apparatus. However, by completely turning over the first boards, the side which had been the bottom or preferred side now lies uppermost, therefore having the unpreferred side facing down. Other boards may then be piled on top thereof to form a stack of, say, three boards, although in actual practice it has been found advantageous to build up a stack of six boards.

With the apparatus constructed as herein shown, the fourth board of the stack will also be turned over, while the fifth and sixth boards will not be turned over. It is customary to build up a stack of six boards, as this makes a bundle which is not too heavy for convenient handling. However, a stack of any desired number of boards can be built up by a machine constructed in accordance with the present teachings.

The accelerating section B can be made more clearly seen in Figs. 1 and 2. It comprises a framework 20, supporting the rollers 21, 22 and 23, which are respectively arranged to travel at different speeds, rollers 21 traveling the fastest, rollers 22 at an intermediate speed, and rollers 23 at the slowest speed. This therefore will bring boards which are advancing on the rollers 23 to a first pinch-roller 24 by means of which the board in cooperation with the underlying smaller roller 25 is pushed out on to a support 26 while the second board traveling on rollers 22 will encounter pinch-roller 27 and the corresponding roller 28, and will be pushed out on to the support 26, while the third board traveling on rollers 23 will be pushed out by means of pinch roller 29 and underlying cooperating roller on to the support 30. The pinch rollers are driven by belts or chains 56 from motor 18.

The turning over of the boards, as accom-
plished in section C comprises, in further detail, the following instrumentalities and operations. After the boards leave the respective pinch rollers 24, 27 and 28, they will be passed to the angle-iron supports 25, 28 and 30. It will be noticed that these supports are the full length of the boards, but that they are not aligned with the center of the respective rollers 24, 27 and 29, but are displaced to one side, the support 24 being displaced to the greatest extent.

The boards will be placed in these supports and at the same time are kept from falling from the supports by the engagement of the boards with the rollers 24, 27 and 28. However, the moment that the board is released by, for instance, the pinch roller 24, it will fall with its right hand edge downwardly (see Fig. 4), the edge being engaged by the belts 32 which effect complete overturning of the board so that when it is delivered to pan 31 it will be in a position with its face up. Similarly, the board riding on support 28 will drop therefrom after the end of the board has left the pinch roller 27, and the board riding on support 30 will drop when it has passed through and has been released by pinch roller 29, but this board will not turn over.

The operation which then follows can best be understood from the dotted line position as they are falling from the supports; board b1 being delivered by belts 32 to the pan 31 in reversed position, that is with its unpreferred side facing downwardly in the pan. The second board, b2, falling from the support 28, will encounter with its left hand edge the moving belts 2. These belts pass respectively over pulleys 38, then around pulleys 43, and travel along a plane underneath the pan 31 on a number of supporting rollers 46, thence passing over driven rollers 39 at the extreme left end of their travel, then returning in a downwardly direction and to the right, eventually passing over pulleys 40 and 41 and then over pulleys 42. These belts will therefore tend to pull the left hand edge (as seen in Fig. 4) of board b2 toward the left so that the board will fall flat on to the belts 32 with the unpreferred side uppermost and therefore with its face (so marked on Fig. 4) down. By reason of the travel of the belts 32 the board will be pushed out until it will fall into the pan 31. A stop 44 hinged at 45, is provided at the left hand side of the pan for the purpose of limiting the travel of the board propelled into the pan by the belts 32. The result will therefore be the deposition of board b2 with its face against the face of the board b1 which by that time will be lying in the pan 31. Shortly thereafter board b1 will likewise fall on to the belts 32 in a manner entirely similar to that of b2 and hence will be deposited face down on top of board b2 in the pan 31. The next board which then arrives will also be a board b3 which will then be deposited face up on the three boards already in the pan to be followed by a second set of boards b1 and b2 which will be deposited, of course, face downwardly. There will thus be an accumulation of six boards in the pan 31, the bottom one being with its reverse side against the bottom of the pan and the top one with its reverse side upwardly. This, therefore, eventually

ates a bundle which can be handled without damage to the preferred faces of the boards. A suitable stop 60 keeps the boards from sliding rearwardly out of the pan as best can be seen in Fig. 1, the pan 31 is made up of four laterally spaced sections, the two outer ones being somewhat wider than the others. This sectional construction is necessary in order to allow the belts 32 to be brought upwardly into engagement with the bottom of the stack when it is desired to transport the same out of the pan 31. Only the two outside pan sections are provided with the hinged stops 44.

Those portions of belts 32 which underlie the pan 31 and extend some distance to the left thereof, are supported by a plurality of freely rotating rollers 48 which are carried by suitable shafts that are mounted in beams 47. The latter are pivotally supported at 48.

Each of the belts 32 (as seen in Fig. 4) is kept taut by reason of the relationship of the pulleys 40 and 41 over which it passes, the latter pulley being carried by an arm 52 pivotally mounted at one end on the shaft 53, the free end of the arm being provided with a weight 55. The stops 44 on the pan 31 are capable of being pulled downwardly by means of the links 49 which are pivotally connected to the shaft 51 which also carries arms 57 which are connected, by means of the links 58, to the right hand or free ends of the beams 47 so that the said beams, together with the rollers 46 thereon and the thereby supported belts 32, may be pushed upwardly into the spaces between the sections of pan 31 for the purpose of engaging the bottom of the stack of boards accumulated in the pan. This changed position is best seen in Fig. 5, in which the beams 41 with their rollers 46 thereon are shown in their uppermost position, whereby the belts 32 have now engaged the bottom of the stack of boards and the arms 57 have been moved to their uppermost positions. The shaft 51 has made a partial rotation to the left and has therefore rocked the arms 50 downwardly which in turn have pulled down links 49, thereby swinging stops 44 downwardly so that the latter now completely clear the adjacent edge of the stack of boards. Accordingly the stack of boards can now travel on the belts 32 in the direction of the arrow, and eventually become deposited upon the set of transverse rollers 34. At the same time the arms 52 with their attached weights 55 will have moved into their uppermost positions to accommodate the belts 32 and keep them taut.

Once the stack of boards has been delivered upon the rollers 24, the shaft 51 is rotated to the right so that the various parts will resume the positions shown in Fig. 4.

The means for actuating the shaft 51 comprises a thruster 33 which can best be seen at the extreme left of Figs. 1 and 2. This thruster may be either pneumatically or electrically operated, and may, for example, be an air cylinder or a solenoid, the entire object of the thruster being to effect the movement of the shaft 51 to the extent indicated, this being accomplished by having the thruster attached to a rocker arm 61 which is keyed to the shaft 51, and the free end of said arm being attached to the reciprocating rod 62 of the thruster. The operation of the thruster is under the control of an operator stationed near the end of the machine, and in full sight of its operation.

The belts 32 are operated by positively driving
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The apparatus may be constructed of any suitable material, but preferably is made from iron or steel, and the rollers are preferably made of metallic material, although if desired they may be made of wood or plastics. Those rolls or rollers which exert initial motivating force upon the boards may, if desired, be covered with a material having a greater coefficient of friction such as example as soft rubber or felt, this being particularly desirable in case of the pinch rolls 24, 27 and 29.

The apparatus disclosed is of course subject to variation, and it will be understood that the invention is not limited by the particular detailed disclosure, providing that the apparatus and method carried out thereby is within the scope and purview of the appended claims, in which the inventors claim as their invention:

1. A machine for stacking board-like objects comprising a conveyor for moving a plurality of such objects in horizontal side-by-side arrangement; means for advancing said conveyor for selectively accelerating the travel of some of said objects relatively to each other; driving means adjacent to said conveyor and fed thereby for turning over one of said objects onto its other side; carrying means for transporting the thus overturned object to a receiving-means, said carrying means also serving subsequently to transport the other objects in their normal position and depositing them upon the overturned object in the receiving-means, thereby eventuating a stack of said objects in said receiving-means; and a conveyor for conveying said stack to a point of delivery.

2. A machine for stacking board-like objects comprising a conveyor for moving a plurality of such objects in horizontal side-by-side arrangement; means on said conveyor for selectively accelerating the travel of said objects relatively to each other comprising rollers driven at varying speeds; driving means for turning over one of said objects onto its other side; transporting means for conveying the overturned object to a receiving-means; receiving means comprising a pan on which said turned over object is received; said transporting means also serving for subsequently piling the other of said objects upon the turned over one to eventuate a stack thereof in said pan; and a conveyor for conveying said stack from said pan to a point of delivery.

3. A machine for stacking board-like objects comprising conveying-means for a plurality of such objects in horizontal side-by-side arrangement; means for accelerating travel of said objects relatively to each other comprising individual sets of driven-roller conveyors driven at decreasing speeds relative to the speed of the adjacent set; means for positively propelling said objects to a reversing means and holding them in a horizontal plane until entirely within said reversing means; reversing means comprising a support positioned to one side of the center of gravity of one of said objects thereby permitting it to overturn completely; means for depositing the other object or objects on the reversed object to eventuate a flat stack thereof; and means for conveying said stack to a point of delivery.

4. Means for producing substantially flat arrangements of boards of building material comprising a conveyor for horizontally advancing a plurality of said boards in echelon arrangement; dropping-mechans for completely overturning the most advanced board and means for depositing it in a receiving-pan in overturned flat position and for depositing the other boards upon the overturned board to eventuate a stack thereof.

5. A machine for stacking boards comprising a conveyor for advancing a plurality of boards with a preferred side down in echelon arrangement; over-turning means for dropping the most advanced board with the preferred side up onto a transporting means, for transporting it to a substantially flat receiving-pan; said dropping means also serving for piling other boards onto said transporting-means to have them deposited thereby with their preferred sides down upon the preferred side of the first-deposited board to form a stack thereof; and a conveyor for moving said stack.

6. A machine for stacking boards in a stack in which only the unpreferred sides of said boards are exposed which comprises a conveyor for feeding said boards in horizontal side-by-side relationship to an accelerated portion of said conveyor by which said boards are arranged in echelon; reversing means for turning the most advanced board completely over and means for depositing it with the unpreferred side down in a receiving-pan; said latter means also serving for piling other boards upon said deposited board to eventuate a stack containing a plurality of said boards but with at least the last board with its unpreferred side upward; and a conveyor for moving said stack to a point of delivery.

7. Apparatus for producing a stack of boards with the bottom board and at least the topmost board having their unpreferred sides exposed which comprises a roller conveyor adapted to advance a set consisting of a plurality of boards in side-by-side relationship, a section of said conveyor being provided with driven rollers adapted by their differential speeds to accelerate the speed of selected boards relative to other boards, and said conveyor, and said section and feed by said conveyor for over-turning at least the first of a set of boards leaving said conveyor and for thereafter depositing other boards thereon.

8. Apparatus for stacking a plurality of boards comprising a frame, transverse supporting members thereon, a receiving-pan for said boards, means for propelling said boards onto said supports in unbalanced equilibrium, said means holding said boards in horizontal position until they have entirely cleared said means, whereby the boards will tilttingly drop from the supports; and conveying-means for receiving the ends of the dropped boards and depositing them in said receiving pan.

9. Apparatus for stacking a plurality of boards comprising a frame, transverse supporting members thereon, a receiving-pan for said boards, roll-means for propelling said boards onto said supports in unbalanced equilibrium, said roll-means maintaining said boards in horizontal position until clear of the rolls, whereby the boards will tilttingly drop from the supports; one of said supports being so far from the center of gravity
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of the board and so spaced from said pan that it will turn completely over and become deposited in said pan in reversed position; conveying means for receiving the ends of the other boards and eventually the entire boards and horizontally conveying them to and depositing them in said pan superposed upon the first board therein deposited; conveying means beneath said pan arranged to extend into longitudinal openings in said pan; and means for elevating said conveying means so as to contact the bottom of the stack and convey the stack from the pan to a point of delivery.

10. The apparatus of claim 9 in which the pan is provided with a movable stop at the side toward which the stack is conveyed, and means for moving said stop to non-stopping position.

11. Apparatus for stacking a plurality of boards and turning some of them completely over so as to eventuate a stack whose bottom board and at least the top board have their unpreferred sides exposed, which comprises a frame, transverse board-supporting members therein positioned so as to support said boards in unbalanced relationship; means for propelling a plurality of boards in echelon arrangement onto said supports while holding them in horizontal position until entirely clear of said means, whereby the boards will tiltly drop from the supports, means for causing the first of said boards entering the apparatus and dropping from said supports to turn completely over; means positioned below said supports at a distance less than the width of a board to receive the succeeding dropping boards without their turning over and to convey them to and deposit them in a receiving means in which all of said boards accumulate until a stack of the desired number has formed, said receiving means being provided with a plurality of slots in the bottom thereof; conveying means comprising prising belts operating below said receiving means but liftable through said slots therein so as to engage the bottom of said stack; and means for lifting said belts to cause the stack to be carried out of said receiving means and transported to a point of delivery.

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