Nov. 23, 1943. H. OSBORN 2,335,078

SHEET FEEDING APPARATUS

Filed Nov. 26, 1941 3 Sheets-Sheet 1

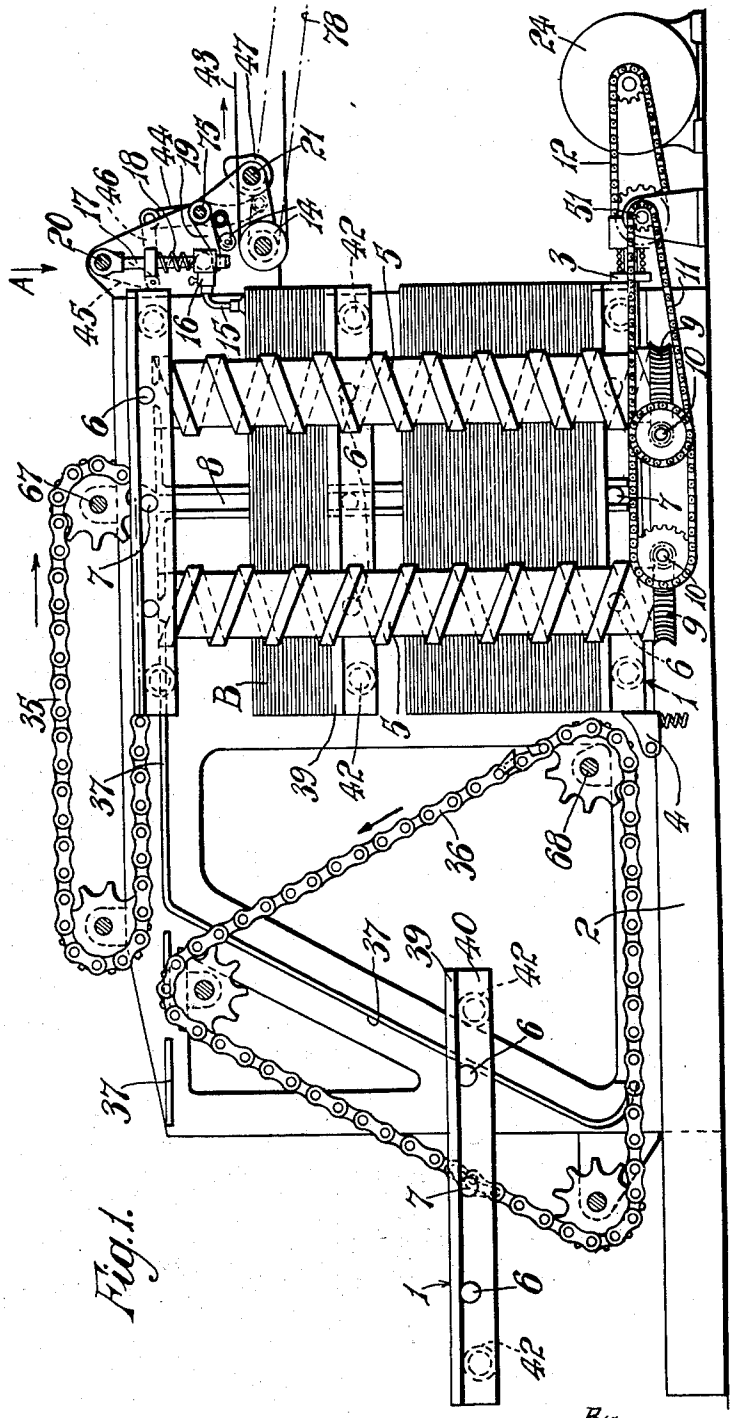


Fig. 1.

Inventor
Howard Osborn
By
Watson, Cole, Grindle & Watson
Attorneys.

Nov. 23, 1943. H. OSBORN 2,335,078

SHEET FEEDING APPARATUS

Filed Nov. 26, 1941 3 Sheets-Sheet 2

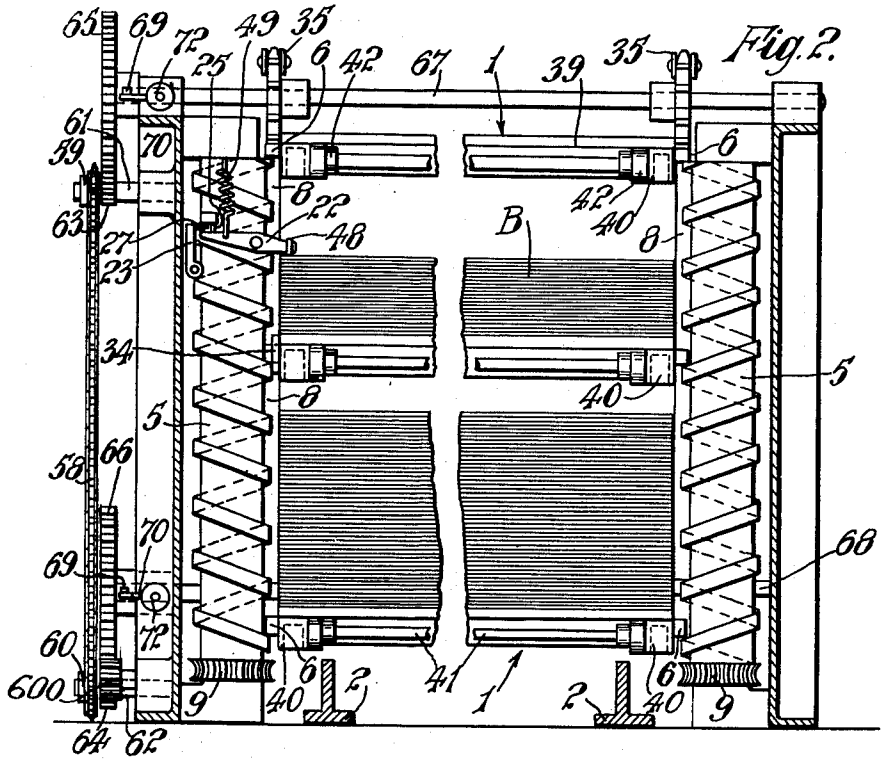


Fig. 2.

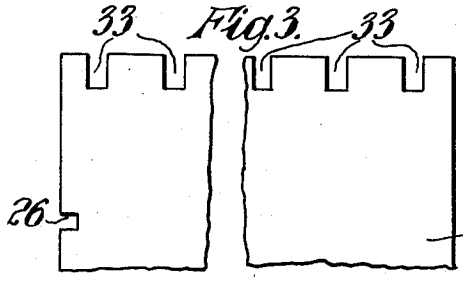


Fig. 3.

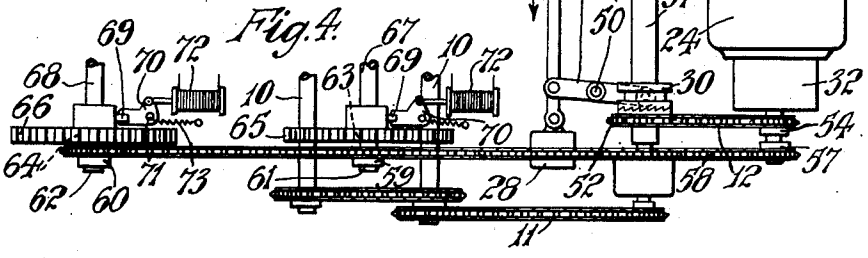


Fig. 4.

Inventor
Howard Osborn
By Watson, Cole, Grindle & Watson
Attorneys

Nov. 23, 1943. H. OSBORN 2,335,078

SHEET FEEDING APPARATUS

Filed Nov. 26, 1941 3 Sheets-Sheet 3

Fig. 5.

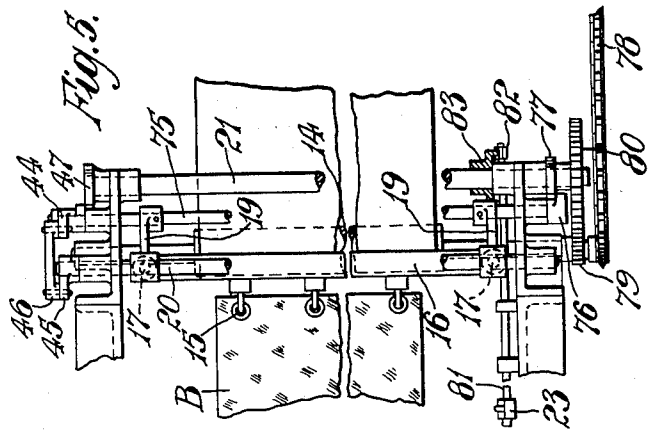
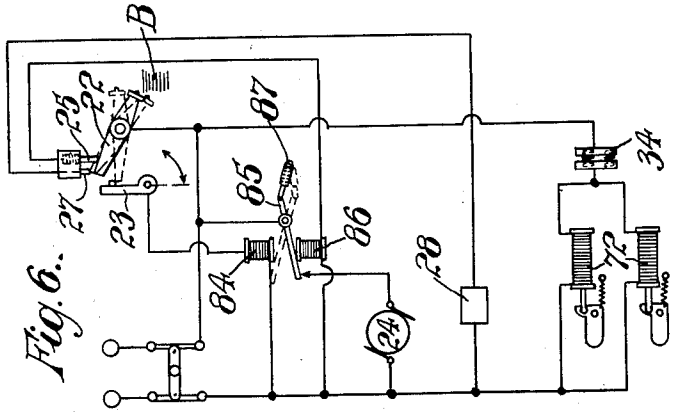


Fig. 6.



Inventor
Howard Osborn
By Watson, Cole, Grindle & Watson
Attorneys.

Patented Nov. 23, 1943

2,335,078

UNITED STATES PATENT OFFICE

2,335,078

SHEET FEEDING APPARATUS

Howard Osborn, Stapleton, Bristol, England, assignor to The Thrissell Engineering Company Limited, Bristol, England, a British company

Application November 26, 1941, Serial No. 420,579
In Great Britain December 18, 1940

11 Claims. (Cl. 214—8.5)

This invention concerns improvements in or relating to sheet-feeding apparatus of the kind in which sheet removal means is adapted to remove sheets from the top of a pile carried by a support which is moved upwardly by an elevator to raise the pile towards a sheet feeding position where the sheets can be removed by sheet-removal means. Such sheet-feeding apparatus will be referred to below as "apparatus of the kind described."

Apparatus of the kind described is usually employed when the pile contains a large number of sheets or when the individual sheets are of such a size as to make the pile, from which the sheets are to be fed, a relatively heavy pile to support. The present invention is particularly applicable to an apparatus for feeding sheets of solid fibre board or mill board to container-making or other machinery. In some cases the pile of such boards may be 24" high and the size of the boards such that the pile weighs approximately 1½ tons. The weight of a grid to support such a pile would be in the region of 1½ hundredweights.

Whereas in apparatus of the kind described it has heretofore been customary manually to remove the support when the pile thereon has been exhausted, it will be appreciated that when dealing with a support the weight of which is of the nature of 1½ hundredweights, this is not a practical proposition. Consequently, in container making or other machines which operate upon such boards, the boards have been fed individually and manually to the machine. Manual feeding of the sheets naturally reduces the rate of output of the machine and it is an object of the present invention to provide a sheet feeding apparatus capable of automatically feeding sheets of solid fibre board, mill board or other similar material from a pile.

It is, moreover, not practicable to employ a sheet-feeding apparatus of the kind in which sheets are fed from the bottom of a pile contained in a magazine hopper because the weight of the pile is such as to render likely the scarring of the liners of the boards during the pulling out of a board from the bottom of the pile. For this reason, therefore, it is necessary to feed such boards from the top of a pile.

According to the invention there is provided apparatus of the kind described wherein an elevator is provided for raising loaded supports in succession to a sheet feeding position and for lifting said supports, when empty above the sheet feeding position to permit the elevator to raise a following loaded support to the sheet feeding position.

Further according to the invention there is provided apparatus of the kind described wherein mechanism is provided for moving a support from a loading position to a position at which the support is engaged by an elevator arranged to move the support upwardly towards the position at which the sheet removal means is operative and past said latter position to a further position at which the support is engaged by delivery mechanism arranged to guide the support away from the elevator in a direction transverse to that in which the support is moved by the elevator. The elevator may be driven at different speeds whereby, when the last sheet of a pile has been removed from a support, the latter may be quickly moved past the position at which the sheet removal means is operative while simultaneously a further support is raised to a position such that the sheet removal means may become operative on the pile on said further support. Wheels may be provided on the supports for moving the latter from the loading position to the elevating position.

The mechanism for moving the loaded support into position to be engaged by the elevator may include a conveyor-chain, said chain being caused to move when a support being raised by the elevator reaches a predetermined position whereby the newly loaded support is permitted to move into position to be engaged by the elevator.

Further according to the invention there is provided apparatus of the kind described wherein a detector device is operatively connected with the driving means to stop the upward movement of the support when the top of the pile on said support reaches a given level and wherein means is operative when the pile is exhausted to move the support upwardly out of range of the sheet removal means and simultaneously to raise a further support having a pile of sheets to a position at which the sheet removal means can remove sheets from the said further support.

Further according to the invention there is provided apparatus of the kind described wherein a detector device is operatively connected with the driving means to stop the upward movement of the support when the top of the pile on said support reaches a given level and wherein means is operative when the pile is exhausted, to increase the rate of upward movement of the support so as to move the support upwardly out of range of the sheet removal means and simul-

taneously to raise, at said increased speed, a further support having a pile of sheets to a position at which the sheet removal means can remove the sheets from said further support.

Further according to the invention there is provided apparatus of the kind described wherein the driving means includes both a striking mechanism to stop and to start the driving means and a change-speed mechanism, each of which mechanisms is independently operable by a detector device, the latter being arranged to operate the striking mechanism to stop the upward movement of the support when the top of the pile on said support reaches a given level and to operate the change-speed mechanism when the pile is exhausted to increase the speed of the elevator which thus carries the empty support above a sheet feeding position and simultaneously raises a following loaded support having a pile of sheets to a sheet feeding position.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which—

Figure 1 is a side elevation of an apparatus constructed according to the invention, the front frame being omitted.

Figure 2 is an end elevation of Figure 1 partly in section.

Figure 3 is a fragmentary view of a support.

Figure 4 is a plan of part of Figure 1 showing the driving arrangements.

Figure 5 is a fragmentary view of Figure 1 in the direction of the arrow A.

Figure 6 is a circuit diagram.

Referring to the drawings, a pile of sheets B (i. e. solid fibre boards) is placed upon a support which consists of a wheeled trolley 1. The trolley comprises plate 39 carried on spaced channel irons 40 in which are mounted two axles 41 which are spaced apart and arranged to support flanged wheels 42.

The trolley 1 while in the loading position rests on rails 2 which engage the flanged wheels and by means to be described later is at the required instant moved or projected to a position to be engaged by an elevator. Its motion is retarded by a spring buffer 3 and recoil is prevented by a spring catch 4. The elevator comprises four rotatable vertical columns 5 on which are machined spiral endless cams or screws which engage rollers 6 on the trolley, thus causing the latter to ascend as the columns rotate. The spirals of the rear columns are of opposite hand to those in front in order that the horizontal forces or thrusts shall be equalised and other rollers 7 ride in vertical tracks 8 to further ensure stability. At the base of each column is fixed a wormwheel 9 driven by a wormshaft 10 which is driven by chains 11 and 12 (or 13) from an electrical motor 24 in the manner hereinafter described.

As the columns are rotated, the trolley is lifted off the rails 2 and is raised to a sheet feeding position as shown in Figure 1 at which sheet removal means is adapted to remove the top sheet of the pile and deliver it between a pair of draw rollers 14 which feed the sheet to the container maker or other machine, for example along a conveyor belt 43. The sheet removal means may comprise a plurality of suckers 15 mounted on a sucker bar 16 which is slidably mounted on arms 17 on which it is urged downwards by springs 18 but held upwards by rocking arms 19. The arms 17 swing about a pivot shaft 20, the motion being effected by levers 44 and 45 and link 46 from a cam 47 on a camshaft 21. The lever 44 is loosely mounted on a shaft 75. The arms 19 are keyed to the shaft 75 and there is also fixed to this shaft a cam lever 76 having a roller at its end which engages a cam 77 fixed on the camshaft 21, see Figure 5. The resultant motion due to the action of the rocking arms 19, the arms 17 and the springs 18, is such that the suckers are first lifted to raise the top sheet from the pile and thereafter moved substantially horizontally to convey the leading edge of the sheet into the grip of the draw rollers 14. These rollers consist of a rotatable lower roller which co-operates with an oscillating upper roller in the customary manner, the latter being operated by the lever 44. The roller 14 is driven from the container maker or other machine by a chain or the like indicated at 78, Figure 1 and the camshaft 21 is driven from the spindle of the roller 14 by gear wheels 79 and 80, see Figure 5.

The elevator is moved intermittently as described below and between each movement of the support (i. e., the trolley 1) when the elevator is stationary, the suckers operate to remove several sheets in succession from the top of the pile. The rate at which the elevator, when moving, raises the trolley during the period in which the sheets are all removed therefrom by the suckers (i. e., the time taken to empty a trolley) is slightly greater than the rate at which the pile of sheets diminishes when the thickest sheets for which the machine is adapted are being fed at the greatest rate. To control the intermittent movement of the elevator, predetermined upper and lower levels of the top of the pile are chosen between which it is desired that the suckers shall be operative to remove sheets from the pile. These levels may for example be decided by a limit of plus or minus ¼". A detector comprising a pivoted arm 22 carrying a roller 48 is arranged to determine when the pile is within the predetermined limits. Should the pile rise above the upper limit the outer free end of the detector arm is engaged by a swinging switch 23 which is moved towards the detector arm at every downward stroke of the suckers 15, thus closing an electrical circuit and causing the driving motor 24 to be stopped. The switch 23 is fixed to a shaft 81 journalled in the frame of the machine and a cam lever 82 is fixed at one end of the shaft. A roller on the end of this lever engages a crown cam 83 mounted on the camshaft 21 and shown in section in Figure 5. As the suckers remove sheets from the top of the pile, the roller 48 of the detector moves downwardly under the action of spring 49 until the top of the pile falls below the predetermined lower limit, at which time the detector arm engages an electrical contact 25 and makes a circuit which restarts the motor.

When the pile of sheets on a support is exhausted, the detector roller 48 drops through a slot 26 (Figure 3) in the plate 39 thus causing the end of the detector arm to engage the aforesaid contact 25 and also a further contact 27 which makes a further electrical circuit in which is included a solenoid or electro-hydraulic device 28, Figure 4. The plunger of the solenoid is arranged, when the circuit is made, to actuate the ends of levers 29 which are pivoted at 50 between their ends and to rotate the levers about the said pivots. The other ends of the levers engage in collars 30 and 31 which are axially slidable on an intermediate shaft 51 which is arranged parallel with the shaft of the electrical motor. Each col-

lar comprises one part of a toothed clutch, the other part of which is fixed to a sprocket 52 or 53 connected by the chains 12 and 13 respectively to further sprockets 54 and 55 on the driving motor. When the solenoid plunger operates the levers 29 the two parts of the toothed clutch comprising the collar 31 are engaged while simultaneously the other clutch comprising the collar 30 is disengaged. A spring 56 moves the parts in the reverse direction when the pull of the solenoid ceases. The sprocket 55 is directly mounted on the armature shaft of the motor while the sprocket 54 is fixed to a shaft driven from the armature through reduction gearing contained in the casing 32 Figure 4. During the period when the sheets are all being removed from a support, the intermittent movements of the elevator are at the lower speed because the driving of the elevators takes place through the reduction gearing but when the solenoid operates, the drive is direct from the armature shaft and thus the driving mechanism of the elevator is speeded up so that the elevator moves temporarily at an increased speed so as quickly to raise the trolley to a position above that at which the suckers are operative.

Slots 33 are provided in the plate 39 of the trolley to permit the latter, when empty, to pass above the suckers.

At some suitable predetermined position before the pile is exhausted, one of the rollers 6 on the trolley is arranged to engage a contact 34 Figure 2 and so complete an electrical circuit which causes a conveyor chain 35 to move one cycle and another conveyor chain 36 half of a cycle. This motion can be obtained by driving the chains from the motor through an automatically disengaging clutch or other means known to the art. An arrangement of this kind is illustrated in Figures 2 and 4 where a further sprocket 57 is fixed on to the same shaft as the sprocket 54. A chain 58 on the sprocket 57 passes around further sprockets 59 and 60 mounted on counter-shafts 61 and 62 respectively. These counter-shafts are mounted in bearings in the machine frame and also have small gear wheels 63 and 64 respectively fixed to them. These gear wheels drive larger gear wheels 65 and 66 respectively (the latter being driven through an idler 600) which are mounted on the shafts 67 and 68 of the chain conveyors 35 and 36. Each of these large gear wheels forms part of an automatically disengaging clutch which may be clutched to the shaft, bearing the large gear wheel, by a key which is operatively connected to a lever 69. A bell crank lever 70 is pivoted at 71 and a solenoid 72 operates the bell crank lever to pull it out of the way of the lever 69 at the necessary times to permit the key to engage both gear wheel and shaft. A spring 73 returns the lever 69 to the position shown in Figure 4 when the contact 34 breaks, that is when the gear has been driven a sufficient number of revolutions to impart the necessary movement to the corresponding chain conveyor.

When the first trolley is moved upwardly at an increased rate, after the pile carried thereby has been exhausted, the elevator simultaneously moves upwardly the next trolley which has previously been moved into position on the spiral columns. The increased rate of upward movement is maintained until the first trolley has been moved out of range of the suckers and until the top of the pile on the succeeding trolley has been moved to a position to be operated by the suckers. A valve is provided in the air line so that should the top sheet of the pile on the further trolley be "curly" there will be no tendency for any one sucker to operate prematurely. This valve is shown diagrammatically at 74 Figure 4 and may be operated from one of the levers 28 as indicated in the figure.

The trolley which has been raised above the suckers is fed (simultaneously with the moving in of the next loaded trolley to the base of the elevator) away from the elevator along a track 37 by the chain conveyor 35 and then descends back again to the loading position being held and controlled by the chain conveyor 36 and the rear roller 6 of the trolley which rests upon the downwardly directed portion of the track 37.

In some cases the trolley may not be propelled by conveyor chains since it may be desired manually to wheel the loaded trolleys into position to be engaged by the elevator. In such a case the electrical contact 34 would operate an audible or visual signal which warns the operator that a loaded trolley should be pushed into the requisite position.

Figure 6 is a diagram showing the essentials of the circuit and the parts previously described with reference to the other figures bear the same reference numerals. As drawn, the motor 24 is running and driving the machine through the reduction gear.

When the arm 22 engages the swinging switch 23, a solenoid 84 pulls up the arm of the switch 85 and stops the motor. But as soon as enough sheets have been fed so that the arm 22 comes into contact with the contact 25, the other solenoid 86 pulls down the arm of the switch 85 and the motor restarts. The switch is kept in the "on" and "off" positions after the current in a solenoid ceases by a spring barrel 87 which holds the arm in either position over the dead centre.

When a pile of sheets is exhausted and the arm 22 engages both contacts 25 and 27 the motor restarts and at the same time the drive is altered to the direct or higher speed as the solenoid 28 becomes energised.

The switch 34 is shown diagrammatically and consists of two halves sprung apart. As a trolley roller passes, it closes the switch and the automatic clutches are caused to operate.

What I claim as my invention and desire to claim by Letters Patent is:

1. An article handling device of the class described comprising, in combination, a plurality of supports for piled articles adapted to pass successively through the device, means for successively raising said supports to a predetermined feeding level, means for successively feeding the articles from the top of the pile carried by the support currently at said level, means for raising said support when empty above said feeding position at an increased speed to permit said raising means to lift a subsequent support to said feeding position and driving means for said raising and feeding means synchronized for operation of said means at proper sequences and speeds.

2. In a feeding device of the class described, means for successively raising a plurality of supports upon which articles are piled to a predetermined level at which said articles are successively removed from the pile, and past said level at an increased speed to a further position, delivery mechanism for successively engaging said supports at said further position and moving them away in a direction transverse to that in which they are moved by said raising means, means for moving said supports from a loading position

wherein the articles are placed thereon to a position at which the supports are engaged and lifted by said raising means and driving means for said raising and feeding means synchronized for operation of said means at proper sequences and speeds.

3. A device as claimed in claim 1 in which means are provided for actuating said raising means slowly while adjacent said feeding level for presenting the top sheets of the pile to the feeding means, and means for actuating said raising means more rapidly to deliver an empty support past the feeding level and presenting a new loaded support to said level.

4. A device as claimed in claim 1 in which mechanism including a conveyor is provided for successively moving the loaded supports into position to be engaged by said raising means, said mechanisms also including means for operating said conveyor and means for actuating said conveyor operating means when a preceding support reaches a predetermined position while being raised.

5. An article handling device of the class described comprising, in combination, a plurality of supports for piled articles, means for successively raising said supports to a predetermined feeding level, means for successively feeding the articles from the top of the pile carried by the support currently at said level, means for raising that support when empty at an increased speed above said feeding position to permit said raising means to lift the next successive loaded support to said feeding position, driving means for said raising means, and detector mechanism operatively connected with said driving means to stop the raising means when the top of the pile on the support reaches a given level and when said pile is exhausted to raise the support upwardly out of the range of the feeding means and simultaneously raise the subsequent loaded support to article feeding position.

6. An article handling device of the class described comprising, in combination, a plurality of supports for piled articles, means for successively raising said supports to a predetermined feeding level, means for successively feeding the articles from the top of the pile carried by the support currently at said level, means for raising said support when empty above said feeding position to permit said raising means to lift a subsequent support to said feeding position, driving means for said raising means, means for starting and stopping said driving means and means for increasing the speed of said raising means, and detector mechanism operatively connected with said driving means to start and stop the raising means for maintaining the top of the pile at feeding level as the pile is depleted and when said pile is exhausted to raise the support upwardly at an increased speed out of the range of the feeding means and simultaneously to rapidly raise a subsequent loaded support to article feeding position.

7. A device as claimed in claim 6 in which the detector mechanism includes a single detector element which is disposed in the path of the article in the pile and actuates both the starting and stopping means and the speed change means.

8. A device as claimed in claim 2 in which there are provided buffer means for cushioning the delivery of the loaded support to raising position, and latch means for retaining the support against rebound from said raising position.

9. A device as claimed in claim 1 in which the raising means comprises a rotatable screw threaded pillar, a projection on each of said supports, for engagement with the threads of the pillar, and means to prevent displacement of the support transversely while being raised.

10. An article handling device of the class described comprising in combination, a plurality of supports for piled articles, means for successively raising said supports to a predetermined feeding level, means for successively feeding the articles from the top of the pile carried by the supports currently at said level, means for raising said supports when empty above said feeding position to permit said raising means to lift a subsequent support to said feeding position, driving means for said raising means, means for increasing the speed of said raising means, and means for starting and stopping said driving means to start and stop the raising means for maintaining the top of the pile at feeding level as the pile is depleted and when said pile is exhausted to raise the support upwardly at an increased speed out of the range of the feeding means and simultaneously to rapidly raise a subsequent loaded support to article feeding position.

11. A device as claimed in claim 10 in which a single detector element is disposed in the path of the article in the pile and actuates both the starting and stopping means and the speed change means.

HOWARD OSBORN.