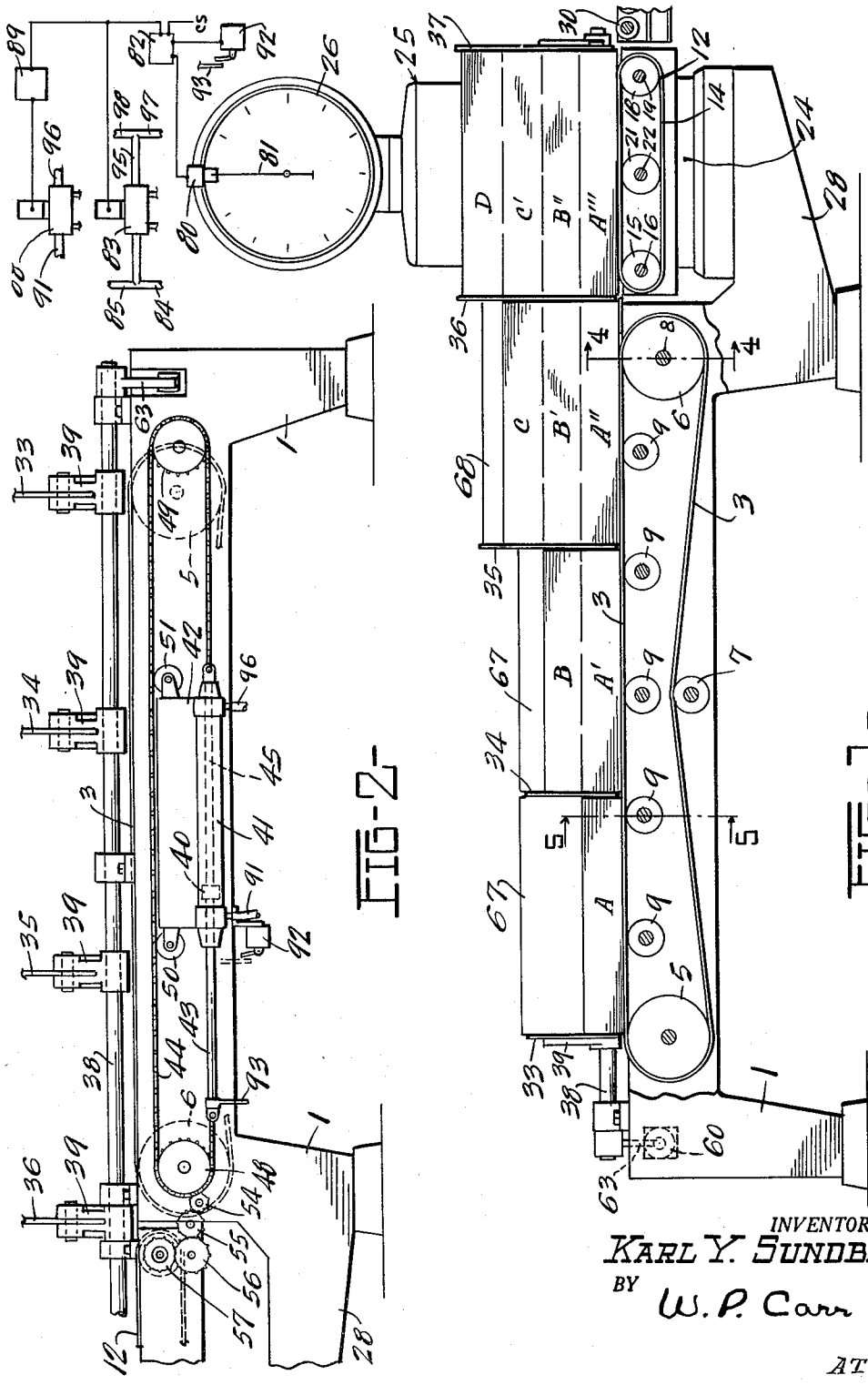
Nov. 7, 1961 K. Y. SUNDBLAD 3,007,591

METHOD AND APPARATUS FOR STACKING AND WEIGHING SHEETS OF WOOD PULP AND THE LIKE

Filed Sept. 20, 1956 2 Sheets-Sheet 1



INVENTOR:
KARL Y. SUNDBLAD
BY W. P. Carr
ATT'Y.

Nov. 7, 1961 K. Y. SUNDBLAD 3,007,591

METHOD AND APPARATUS FOR STACKING AND WEIGHING SHEETS OF WOOD PULP AND THE LIKE

Filed Sept. 20, 1956 2 Sheets-Sheet 2

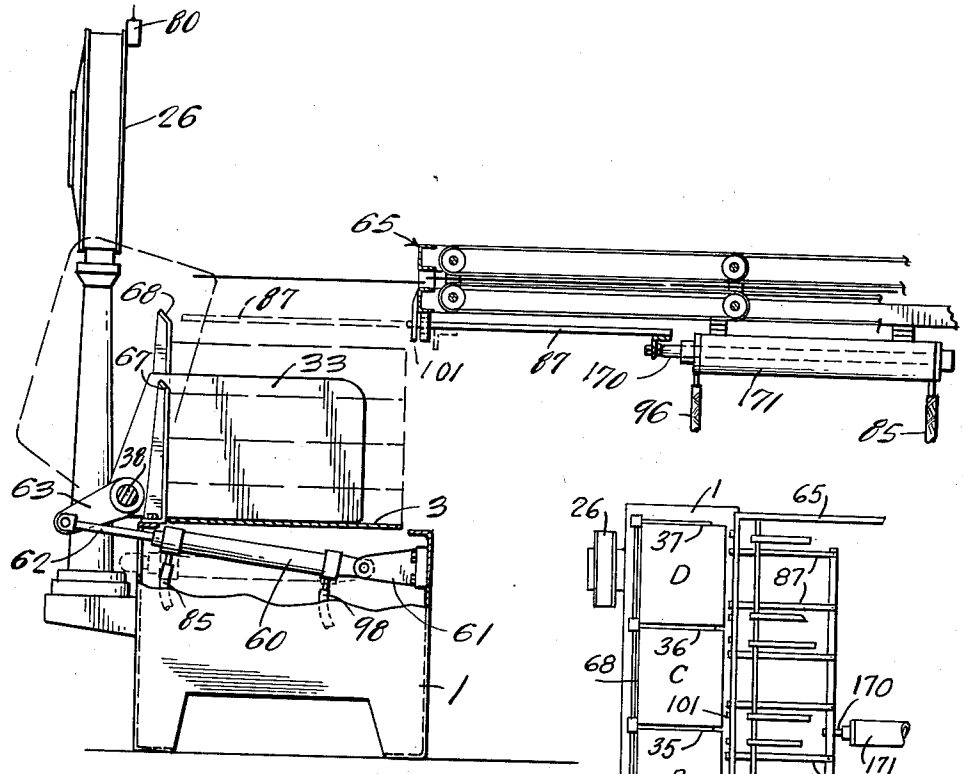


FIG-3-

FIG-6-

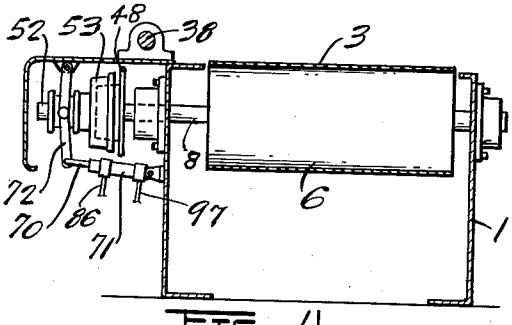


FIG-4-

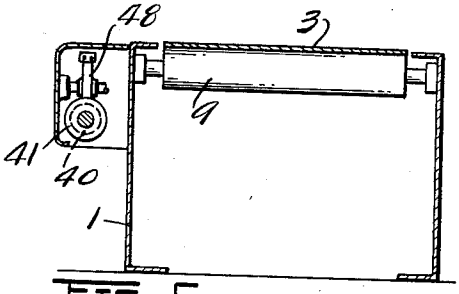


FIG-5-

INVENTOR:
KARL Y. SUNDBLAD.
BY
W. P. Carr
ATT'Y.

United States Patent Office

3,007,591
Patented Nov. 7, 1961

3,007,591

METHOD AND APPARATUS FOR STACKING AND WEIGHING SHEETS OF WOOD PULP AND THE LIKE

Karl Y. Sundblad, Bromma, Sweden, assignor to Nancy O. Sjostrom, Bromma, Sweden

Filed Sept. 20, 1956, Ser. No. 610,919
4 Claims. (Cl. 214—152)

In a mill producing wood pulp, logs are cut and shredded mechanically and chemically into water borne fibrous particles and ultimately formed into a comparatively dry web of pulp. Near the delivery end of the pulp machine, when the pulp is to be shipped in bales, the web is sliced lengthwise into strips of equal width and then the strips are cut crosswise at fixed intervals to form uniformly dimensioned sheets. A quite common size of such sheets is thirty-six by twenty-four inches. The rows of sheets delivered by the machine are dropped upon a receiving platform in separate stacks or piles.

It has been the practice in the past for workmen to transfer the stacks individually to a weighing scale and by manually adding or removing sheets to bring the final stacks to approximately the desired bale weight which usually is a set figure of four or five hundred pounds. The designated weight forms the basis on which payment is made. Subsequently each stack is wired or banded under compression into a bale for shipment.

In carrying out the above method the attendants wait until all the stacks reach a height roughly corresponding to that of a stack having the desired weight and then transfer such stacks by conveyor or truck to the weighing scale. This practice heavily concentrates the labor at spaced intervals leaving idle time between.

Under the pressure of handling a number of pulp stacks in quick succession the weighing is done hurriedly. with the workman transferring a handful of sheets at a time to bring the stack near the desired weight. To avoid creating any underweight bales the workman will almost invariably pile on extra sheets. Consequently, by giving more pulp than it is paid for, the producing mill will suffer at least a slight monetary loss, an average of one percent, on each bale. As the ordinary pulp plant may have an output of 250,000 bales per year, the annual loss can be the equivalent of 2,500 bales. Should this, for instance, involve rayon pulp worth fifteen cents a pound, the value of the pulp given away in excess weight amounts to $75.00 per 500 pound bale or $187,500.00 for the extra 2,500 bales.

Another objectionable feature of the practice of taking such stacks of the height approximating the desired weight of the bale to be shipped arises from the fact that the percentage of water in the pulp is generally greater toward the edges of the pulp web as it arrives from the pulp machine. At the same time the difference in the amount of water affects very slightly, if at all, the thickness of the web. Pulp usually handled in sheet form and shipped in bales has an overall moisture content of ten to fifteen percent. However, it may run as low as five percent at the center of the web and as high as twenty percent along the borders.

Accordingly, the sheets from the outside rows of the sliced web will be heavier due to their greater water content than those in the inner rows, while not being any thicker. Bales formed from the outside sheets do not require as many sheets to reach the desired weight and will be shorter than the bales built from the inner rows of sheets. This has several undesirable effects. One is that the lack of uniformity in size makes packing for shipping or storage more difficult. Another serious consequence is that the water content of a bale built

from the sheets of an outside row is greater than that built from an inside row. As water content is a price factor this makes evaluation more difficult. Also it complicates accurate processing of such pulp in some subsequent chemical operations where the water component must be uniform.

The principal object of this invention is to provide means for forming stacks of sheets of pulp as close as possible to the exact weight desired in the final bale of pulp as shipped.

A further object of the invention is the provision of means for building bales having uniform dimensions.

Another important object is to provide a method and apparatus for producing bales of pulp having the same water content.

A still further object of the invention is the provision of means for automatically stacking and weighing sheets of pulp.

The method and apparatus of the invention by which these objects are attained utilize a conveyor arrangement placed crosswise of the delivery end of the pulp machine to receive the several rows of sheets delivered by the machine. For purposes of illustration, the particular apparatus desclosed herein is adapted to a pulp machine from which four rows of sheets are ejected.

To accommodate such a machine the conveyor has four stacking stations separated by raisable dividers. A weighing scale is associated with the stacking position at one end of the conveyor and power mean are arranged for periodically moving the conveyor the common width of a stack toward the end where the weighing scale is located. The conveyor may be a single unit or be several associated conveying devices.

A preliminary step of the invention is the placing of sheets, preferably manually, upon the conveyor at all stacking stations except the one at the end of the conveyor opposite to that where the weighing scale is situated and away from which the conveyor periodically travels.

The piles of sheets thus built up are stepped up in size with that at the weighing scale station three quarters of the estimated height of a stack weighing the final desired amount, the pile in the station next to that of the scale station one half the estimated height of a full pile, and that in the next adjacent station one quarter of such height, the fourth and last station being left empty. The arrangement of piles as described applies to an apparatus of the invention adapted to a machine from which four rows of sheets are issued.

A similar proportional division of sheets is built up by hand in connection with pulp machines delivering different numbers of rows. For instance, should five rows of sheets be involved, the weighing scale station has sheets piled to a height four fifths of that of a stack estimated to approximate the final desired weight. The adjacent stations respectively receive sheets piled to three, two and one fifth that of the ultimate stack with the opposite end station left empty.

The apparatus is then ready to receive the pulp sheets directly from the pulp machine. As soon as enough additional sheets, approximately the last quarter of a full stack, have been deposited from the pulp machine upon the stack at the weighing scale station to bring its weight to the desired figure, a device immediately responsive to the arrival of the indicating needle on the dial of the scale at the predetermined weight figure causes the delivery of sheets to be momentarily suspended, the stack dividers to be raised, and to move the conveyor one step. This displaces the stack having the correct final weight from the scale to a separate conveyor carrying the stack to the compressing and baling operations.

The step movement of the conveyor brings the stack

originally half the ultimate size but with the addition of sheets building it to three quarters the final height to the weighing scale station from the station adjacent thereto. Likewise the stack manually built to one quarter size is now double that and is shifted to its next station, and the originally empty station with its accumulation of sheets a quarter size in amount is transferred to the station adjacent to that at the end of the conveyor. With delivery of sheets from the pulp machine promptly resumed the cycle is successively repeated. Since each final stack, after the initial operation, comprises sheets taken equally from the four rows of sheets from the pulp machine, all stacks have the same number of the drier and of the more moist sheets and the resulting bales have an overall uniform water content. The correct weight is automatically determined and the bales are of uniform size.

The cited as well as other objects and advantages of the invention will be more apparent upon reading the following description and referring to the drawings in which:

FIGURE 1 is a front elevation of an apparatus embodying my invention;

FIGURE 2 is a rear view of the main portion of the apparatus of FIGURE 1;

FIGURE 3 is an end elevation of the apparatus of FIGURE 1 as viewed from the left of FIGURE 1;

FIGURE 4 is a section of the apparatus of FIGURE 1 taken on the line 4—4;

FIGURE 5 is a similar section taken on line 5—5 of FIGURE 1; and

FIGURE 6 is a plan view on a reduced scale and with parts broken away of the apparatus of FIGURES 1–3.

The apparatus as shown in the front elevation of FIGURE 1 has a main frame **1**. The apparatus faces the delivery end of a pulp machine and is placed adjacent thereto to receive four rows of pulp sheets. A normally stationary belt conveyor **3** supports the stacks formed from three of the rows. The belt conveyor **3** extends around the pulleys **5** and **6** and is held taut by idler pulley **7**. Pulley **6** is mounted on shaft **8**. A series of supporting rollers **9** under the upper stretch of the belt **3** keeps the belt from sagging under the load of the stacks.

Receiving the pulp sheets from the fourth row discharged by the pulp machine is a conveyor **12** associated with and serving as a continuation of conveyor **3**. This conveyor **12** is composed of a series of belts **14** running between three pulleys **15** spaced along shaft **16** and three pulleys **18** mounted in spaced relation on shaft **19**. Load supporting pulleys **21** are on a center shaft **22**.

The conveyor **12** is independently supported upon the platform **24** of the weighing scale **25**, the latter having weight indicating dial **26**. The scale **25** is mounted upon the end extension **28** of the main frame **1**.

A conventional conveyor for receiving stacks from conveyor **12**, and for transporting them to pressing and baling machines is indicated at **30** in FIGURE 1.

Raisable stack dividers **33**, **34**, **35**, **36**, and **37** are secured by brackets **39** to common shaft **38** located on the rear side of the apparatus as shown in the rear view of FIGURE 2. These dividers normally separate the four stacking stations.

Periodic step movement of conveyors **3** and **12** for a fixed distance equal to the common stack width is obtained through action of the piston **40** in cylinder **41**. The latter is stationarily mounted upon a bracket **42** on the back of the apparatus as depicted in FIGURE 2.

The piston rod **43** extending from cylinder **41** is fastened to one end of the chain **44** while the second piston rod **45** extending from the opposite end of the cylinder is secured to the other end of chain **44**. This chain engages a pair of gears **48** and **49** and runs over tightening gears **50** and **51**.

As shown in FIGURE 4, gear **48** is mounted on a floating shaft **52** engageable by clutch **53** with shaft **8**. Pulley **6**, around which belt conveyor **3** extends, is mounted on shaft **8**. Through the gear train illustrated

in FIGURE 2 involving engaging gears **54**, **55**, **56** and **57** the periodic step movement of chain **44** shifting conveyor **3** is also effective to move conveyor **12** across the scale platform **24**.

Preceding the movement of conveyors **3** and **12** the stack dividers **33**, **34**, **35**, **36** and **37** are raised and tilted out of the path of the transverse movement of the stacks by the turning of the common shaft **38** through action of cylinder **60**. The latter is mounted on bracket **61** at the end of the apparatus as may be seen in FIGURE 3. The piston rod **62** from cylinder **60** is linked to the arm **63** fastened to the shaft **38**. Retraction of the piston rod **62** with the movement of the cylinder piston turns shaft **38** to raise the dividers.

As shown diagrammatically in FIGURE 3 the delivery end **65** of the pulp machine drops the pulp sheets upon the stacks supported by the apparatus of this invention. The dividers maintain the sides of the stacks in vertical alignment and back stops indicated at **67** and **68** position the front edges of the sheets in a vertical plane. Both the dividers and back stops may be made to vibrate slightly to arrange the successive sheets in more exact alignment.

In the practice of the method and use of the apparatus of this invention graduated sizes of stacks of pulp sheets are first placed in the second, third and fourth positions, or stations, from the left, as viewed in FIGURE 1, the fourth station being upon conveyor **12** carried by weighing scale **25**. The first stacking station at the opposite end of conveyor **3** is left vacant. The stack in the second station is built to a height approximately one quarter of that of a stack of the desired weight, such as 500 pounds. This built up stack in the second station is represented by the section marked A′. The stack in the third station is built up to approximately one half of the specified height with stack sections A″ and B′; and the stack of the fourth position is piled to three quarters of the desired size comprising parts A‴, B″ and C′. This manual arrangement of the stacks is completed before the delivery of sheets by the pulp machine is initiated.

As a possible alternate method of establishing the stacks of graduated size, the flow of sheets from the pulp machine to the originally empty stations may primarily be interrupted a series of three times by manual manipulation of the control system at quarter stack points to momentarily stop the sheet delivery and move the conveyor system one station distance. The automatic control will then take over through the action of the reporting device **80** with the addition of the final quarter section to the stack at the weighing scale station. While three partial stacks will meanwhile have been removed from the weighing scale position, subsequent stacks will be properly built up to the exact weight required and with components from all rows of sheets as contemplated by the invention.

The stack dividers **33**, **34**, **35**, **36** and **37** are in their lowered operative position at the start of operations. Piston rod **43** is also in its fully extended location as illustrated in FIGURE 2. Clutch **53** is held disengaged through the projection of piston rod **70** from the clutch controlling cylinder **71** with the linkage **72** providing operative association between the piston rod **70** and clutch **53**.

With the disposition of the three graduated stacks upon the three stations completed, the apparatus is ready for receiving sheets as normally discharged from the pulp machine. The sheets are then discharged in four rows and are delivered singly in quick succession one upon the other in the four stacking stations defined by dividers **33**, **34**, **35**, **36** and **37** and the back stops **67** and **68**.

When the stack in the fourth station, over the weighing scale, reaches the predetermined desired weight with the deposit of approximately an additional quarter stack in all four stacking stations, the needle **81** registering the weight on dial **26** of the scale comes within actuating

range of the photo cell or induction element **80**. The latter instantly responds by sending a signal to operate relay **82** to send motivating current from a supply source CS to solenoid air valves **83** and **88**. Solenoid valve **88** is actuated momentarily after valve **83** due to the hold up action of a conventional time delay element **89**.

Functioning of valve **83** resulting from the reaction of the reporting device **80** directs the flow of compressed air or other motivating fluid through piping **84** and **85**. Air through the former by way of the inlet **86** enters cylinder **71** to engage clutch **53**. Air traveling through **85** reaches cylinder **171** associated with the delivery end **65** of the pulp machine and through piston rod **170** drives sheet catching slats **87** forwardly into position to temporarily intercept sheets flowing from the pulp machine. Through another branch of piping **85** air reaches cylinder **60** to retract piston rod **62** and raise dividers **33**, **34**, **35**, **36** and **37**.

Immediately subsequent to the above action of the air from valve **83**, valve **88** is actuated to deliver air through line **91** to cylinder **41** to cause the retraction of piston rod **43**. With clutch **53** engaged, movement of chain **44** with piston rod **43** shifts conveyor **3** and conveyor **12** one stack width to the right as viewed in FIGURE 1. This unloads the full weight stack comprising sections A‴, B″, C′ and D from the fourth piling station upon the scale to the adjacent conveyor **30** (which transports the stack to conventional pressing and baling machines) and moves the three incomplete stacks one station to the right.

At the completion of this movement, limit switch **92** shown fastened to the main frame **1** in FIGURE 2 is tripped by finger **93** depending from the end of piston rod **43**. Through relay **82** operation of switch **92** instantly reverses solenoid valve **83** and shortly thereafter, after the momentary delaying action of delay device **39**, reverses solenoid valve **88**. Reversal of valve **83** exhausts air from lines **84** and **85** and directs air from outlet connection **95** to branches **97** and **98**. Air from branch **97** reaches cylinder **71** to disengage clutch **53**, and air flowing through branch **98** actuates cylinder **60** to lower stack dividers **33**, **34**, **35**, **36** and **37**. Immediately thereafter reversal of valve **88** vents line **91** and directs air through piping **96** to cylinder **171** causing withdrawal of sheet intercepting slats **87** and the dropping of the accumulated sheets therefrom upon the stacking stations. Stationary fingers **101** extending down between the slats push the sheets from the slats as the latter are retracted. Air through a branch of piping **96** enters cylinder **41** to force piston rod **43** back to its extended starting position. The associated return movement of chain **44** is independent of the conveyors **3** and **12** with the preceding disengagement of clutch **53**.

Sheets are again continuously fed to the four stations until the stack on the scale reaches the desired weight and the effect of the indicating needle **81** upon the photo cell or induction unit **80** terminates the next cycle by motivating relay **82** and solenoid valves **83** and **88**. Again the stack built to the exact weight desired is discharged from the weighing scale station for pressing and baling and the other partially built up stacks are shifted over to the adjacent stations.

There are roughly about 500 sheets in each completed bale. By the automatic weighing provided by the apparatus of this invention, variation in weight of the bales does not exceed that of a single sheet. Accordingly maximum overweight is restricted to approximately one pound or one fifth of one percent of the full bale weight, with the average one half of that amount. This is a reduction of some ninety percent of the surplus sheets included in the bales by the previous hand methods and cuts the monetary loss in the same proportion.

It may be observed that the use of the method and apparatus of the invention also accomplishes the previously mentioned objects of producing bales of uniform size and water content.

Important among the features of the invention responsible for the attainment of the objects are the method and means for building up stacks in graduated sizes crosswise of the delivery end of a pulp machine, utilizing a like quantity of sheets from each row for each final stack, automatically terminating the stacking momentarily when the largest stack reaches the desired weight, removing such stack, shifting the remaining partially built-up stacks and resuming the receipt of sheets from the associated pulp machine.

The particular apparatus disclosed herein is for illustration only as it is realized that various other types of conveyors, controls and mechanical elements may be utilized in creating an apparatus embodying the features and spirit of this invention.

Accordingly, the appended claims should be interpreted sufficiently broadly to encompass any such obvious modifications or substitutes except where the language thereof is definitely specific to disclosed elements.

What I claim is:

1. In an apparatus for producing stacks, comparable in dimensions and uniform in weight, of sheets of wood pulp delivered continuously in adjacent rows, the sheets in any one row being dimensionally similar but variable in weight from sheets in another row, delivery means continuously discharging sheets of wood pulp in adjacent rows, a series of receiving stations extending in line crosswise of the delivery means with a separate station receiving in stack formation the sheets of each row discharged by the delivery means, a weighing scale associated with the station at one end of the series, conveyor means for periodically moving the stack of sheets accumulated in each station to the adjacent station in the direction of the end station with which the weighing scale is associated and removing the stack from the end station, an actuator for the conveyor means, a control device for the actuator, responsive to the registration on the weighing scale of a preselected final weight when such weight is reached by the stack in the end station, stack dividers normally separating the stacking stations, and means shifting the dividers out of the way during the movement of the stacks by the conveyor means.

2. An apparatus according to claim 1 in which the control device is associated with an electrical means sensing and reporting the arrival of the weight indicating elements of the weighing scale at a predetermined point.

3. In an apparatus for producing final stacks, comparable in dimensions and of a uniform preselected weight, of sheets of wood pulp delivered continuously in adjacent rows, the sheets being generally similar in dimensions but variable in weight, delivery means continuously discharging sheets of wood pulp in adjacent rows, a series of receiving stations extending in line crosswise of the delivery means with a separate station receiving in stack formation the sheets of each row discharged successively by the delivery means, a weighing scale associated with the apparatus registering the combined weight of partial stacks accumulated in the stations, means capable of intercepting sheets being discharged by the delivery means and temporarily withholding them from the receiving station, a device actuating the intercepting means responsive to the registration by the weighing scale of the preselected weight for a final stack, and means transferring the partial stacks from the stations while the intercepting means are actuated.

4. A method for receiving dimensionally similar sheets of wood pulp delivered in adjacent rows, the sheets in one row being variable in weight from sheets in another row, and stacking the sheets in stacks of a preselected weight and comparable dimensions comprising the provision of a series of receiving stations with a separate station for each row of sheets, preliminarily arranging sheets in stacks of successively greater height in the stations starting with the second station from one end of the series and stopping with the last station at the other end of the series, leaving

the first station vacant and having the stack of the greatest height in the last station of lesser weight than the preselected weight, then receiving a like number of additional sheets in each station, said like number being just sufficient to bring the stack in the last station to preselected weight, removing the stack from the last station and transferring each remaining stack from its original station to the next adjacent station toward the last station, again receiving a second like number of additional sheets in each station, said second like number being just sufficient to bring the stack transferred to the last station to the preselected weight, and repeating the cycle by removal of the stack from the last station, transferring the other stacks,

and receiving additional sheets until the latest stack transferred to the last station reaches the preselected weight.

References Cited in the file of this patent

UNITED STATES PATENTS

1,711,100	Payzant	Apr. 30, 1929
2,104,546	Pennell et al.	Jan. 4, 1938
2,205,767	Lamb	June 25, 1940
2,613,905	Muskat	Oct. 14, 1952
2,645,328	Winters	July 14, 1953
2,704,593	Galoway	Mar. 22, 1955
2,802,658	Hensgen	Aug. 13, 1957
2,822,932	Patrick	Feb. 11, 1958