United States Patent [19]

Thompson et al.

[11] **3,724,089**

[45] **Apr. 3, 1973**

[54] **SHEET WINDING, TURNING AND ALIGNING METHOD AND APPARATUS**

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[22] Filed: **Dec. 2, 1971**

[21] Appl. No.: **204,252**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 147,944, May 28, 1971, Pat. No. 3,680,220.

[52] **U.S. Cl.** **34/23**, 34/38, 34/149, 34/150, 34/163, 214/65, 271/61

[51] **Int. Cl.**.....**F26b 3/04**

[58] **Field of Search**....34/23, 38, 149, 150, 163, 189; 214/65; 271/61

[56] **References Cited**

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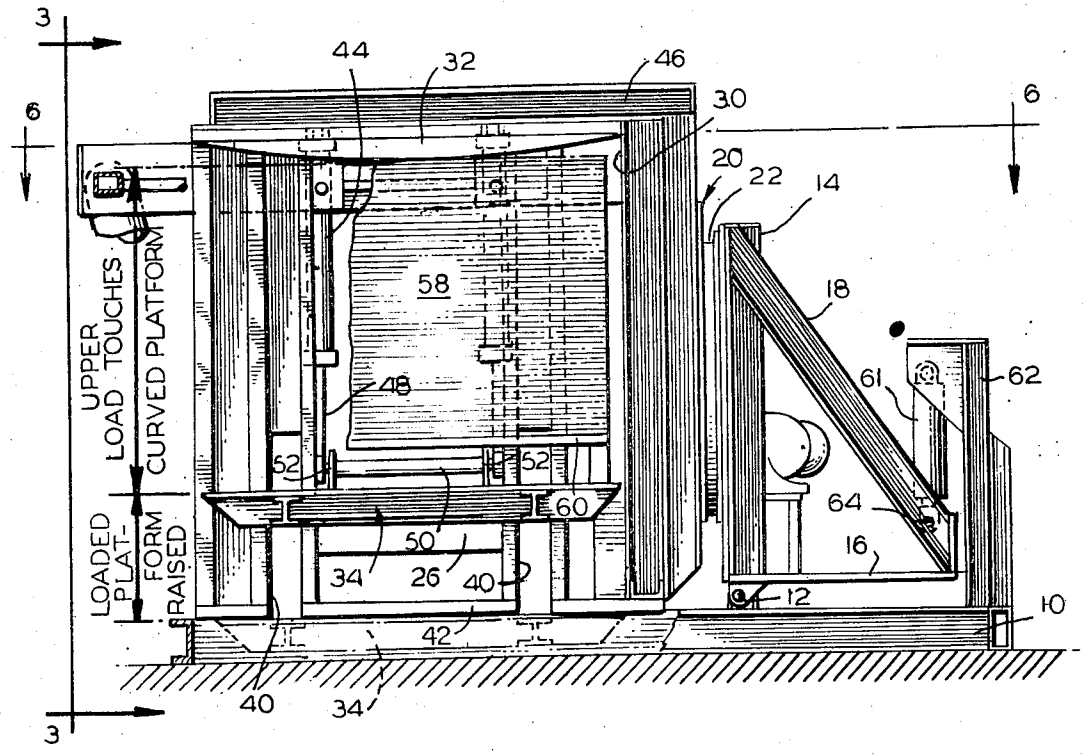
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[57] **ABSTRACT**

A sheet winding, turning and aligning method and apparatus for printed paperboard sheets and the like wherein a stack of horizontal sheets comprising the stack are rotated in the vertical plane while being confinedly supported, beyond 90°, with the boards being projected against a curved plate to implement breaking any ink pack which may be in a load due to movement of the sheets against one another and to provide enhanced column strength to prevent a tendency of the board slipping to the bottom of the pile as retaining jaws of the turner are opened, with resultant bottom edge pressure preventing proper winding or aeration, the boards or sheets comprising the load subsequently being tilted by the device to dispose the bottom and side edges at an angle from the horizontal and the vertical planes and vibrating and aerating the bottom and side edges of said sheets when so tilted to align sheet edges.

18 Claims, 9 Drawing Figures



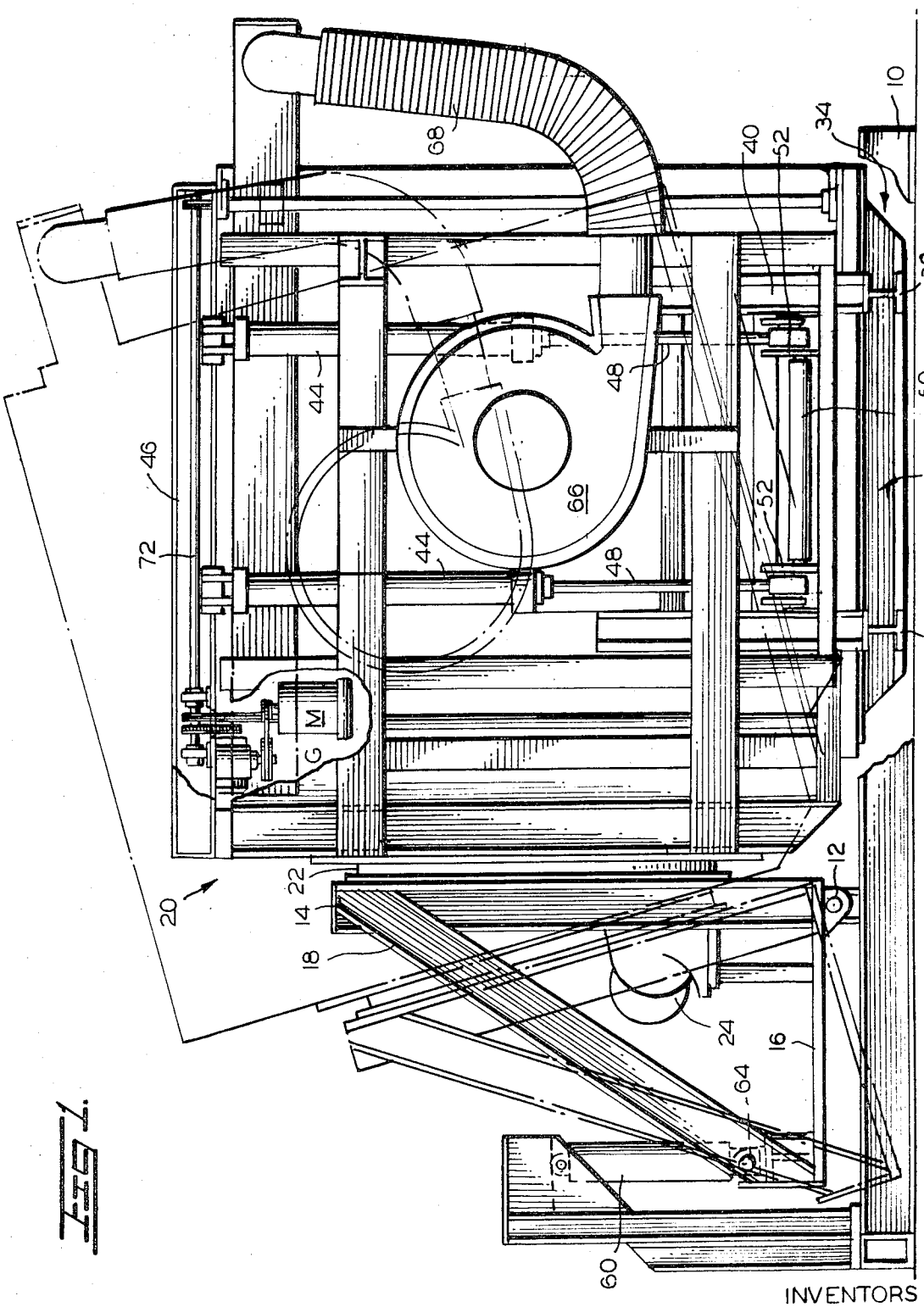


Fig 1.

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Fig 2.

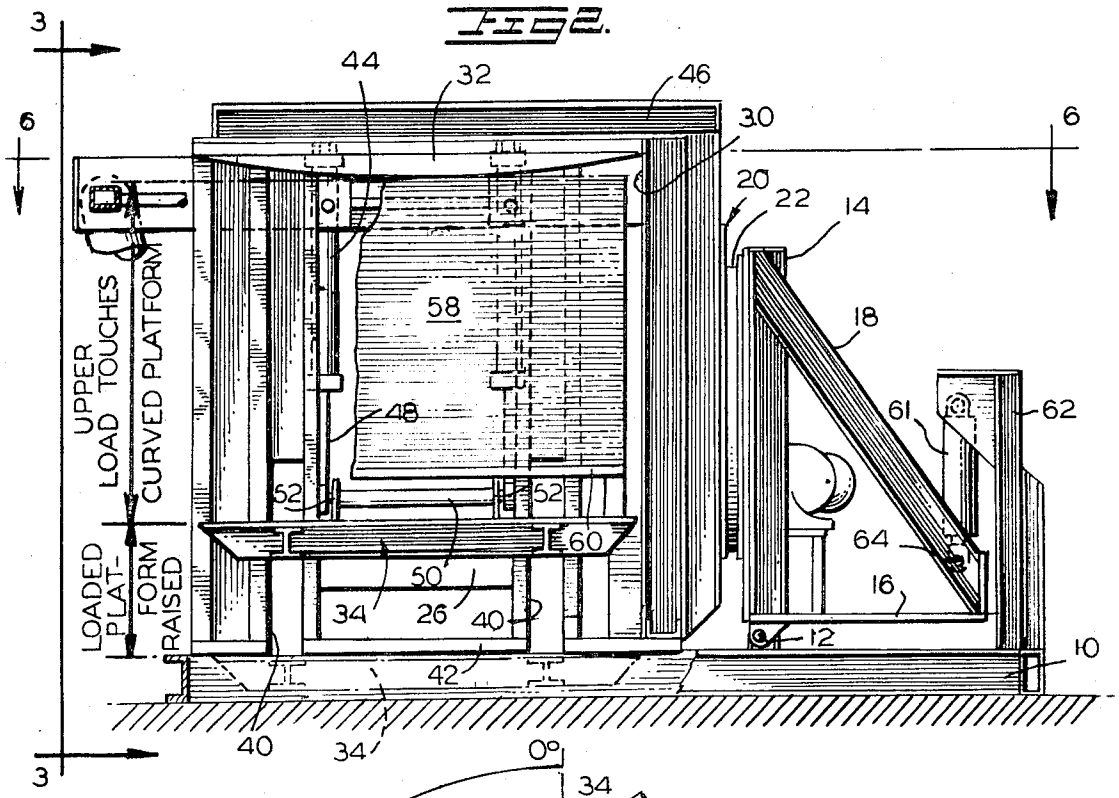
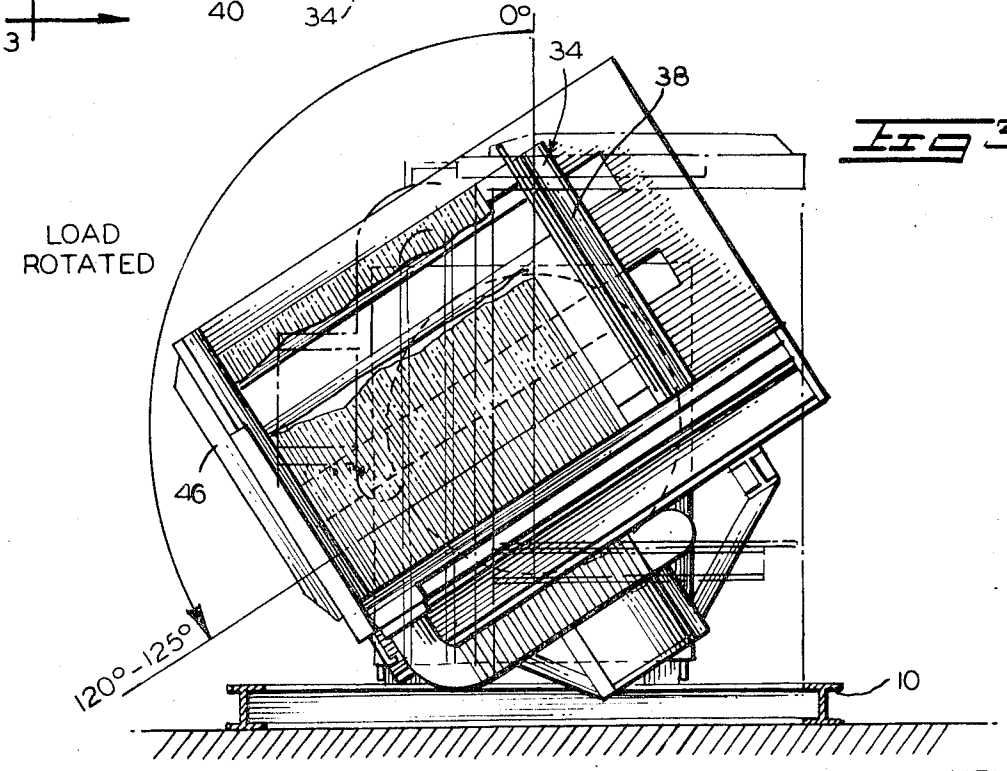


Fig 3.



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FIG 4

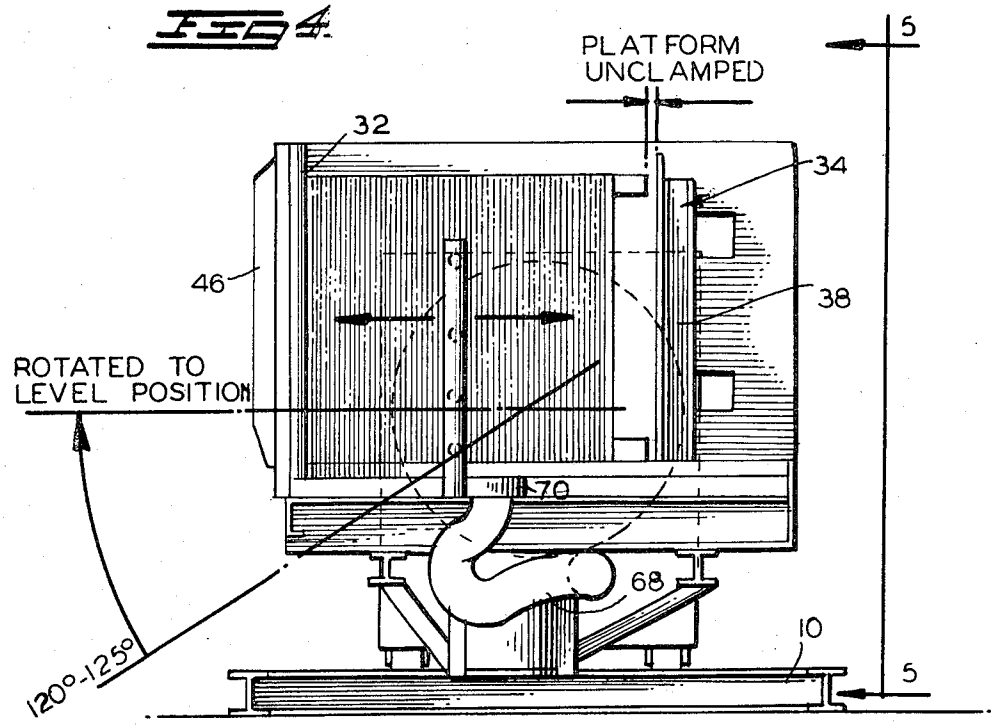
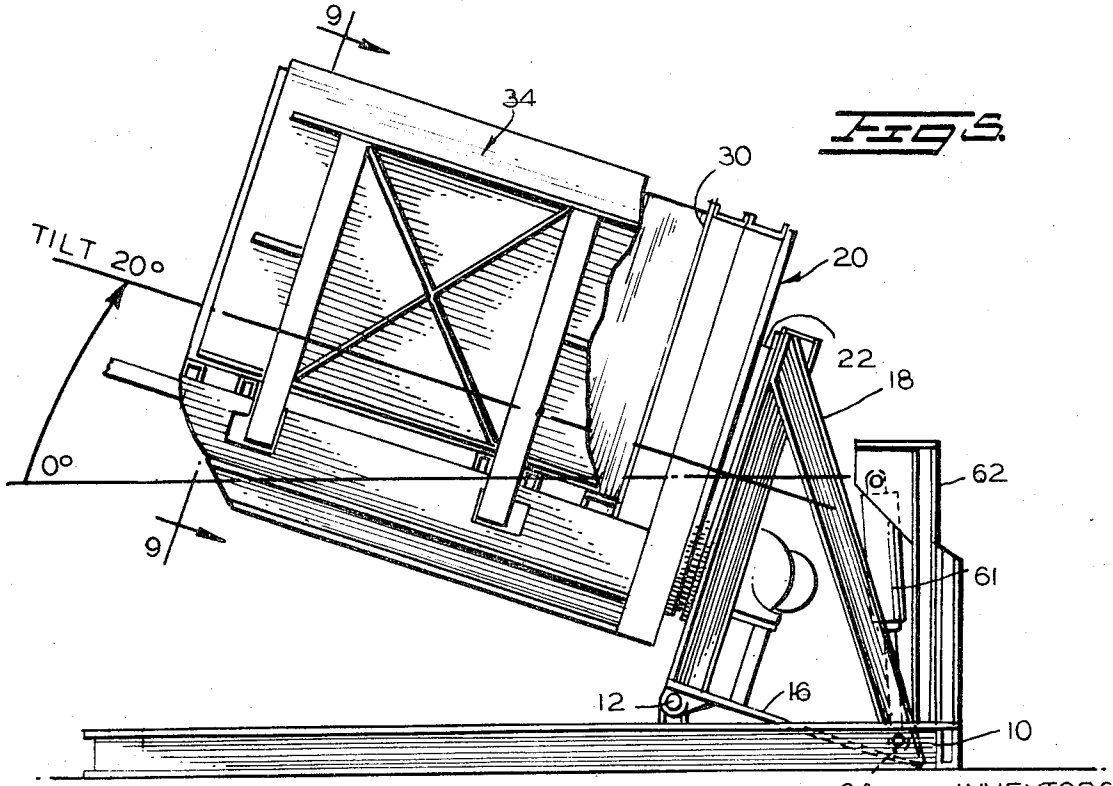


FIG 5



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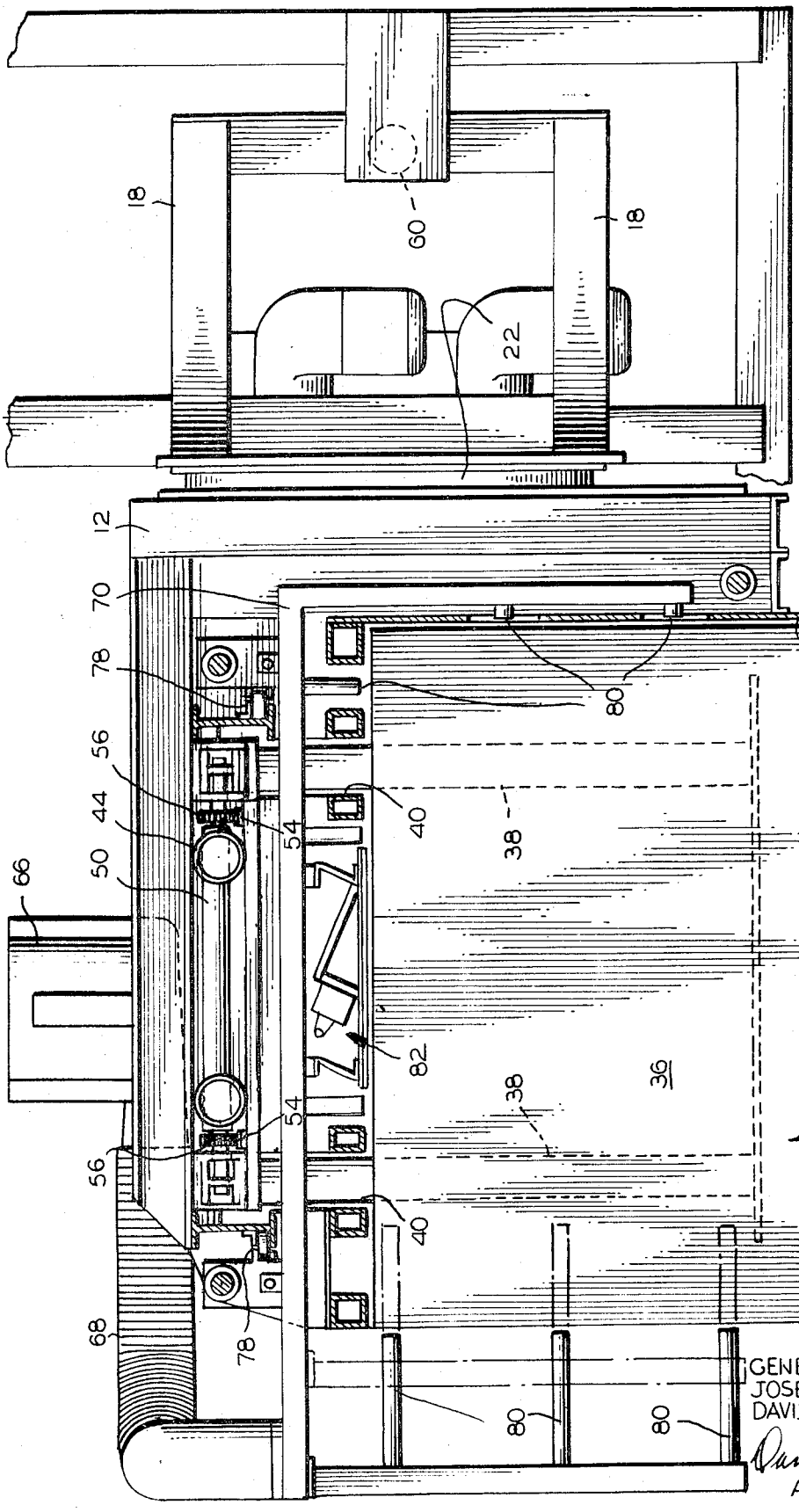


FIG. 6

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Fig 7.

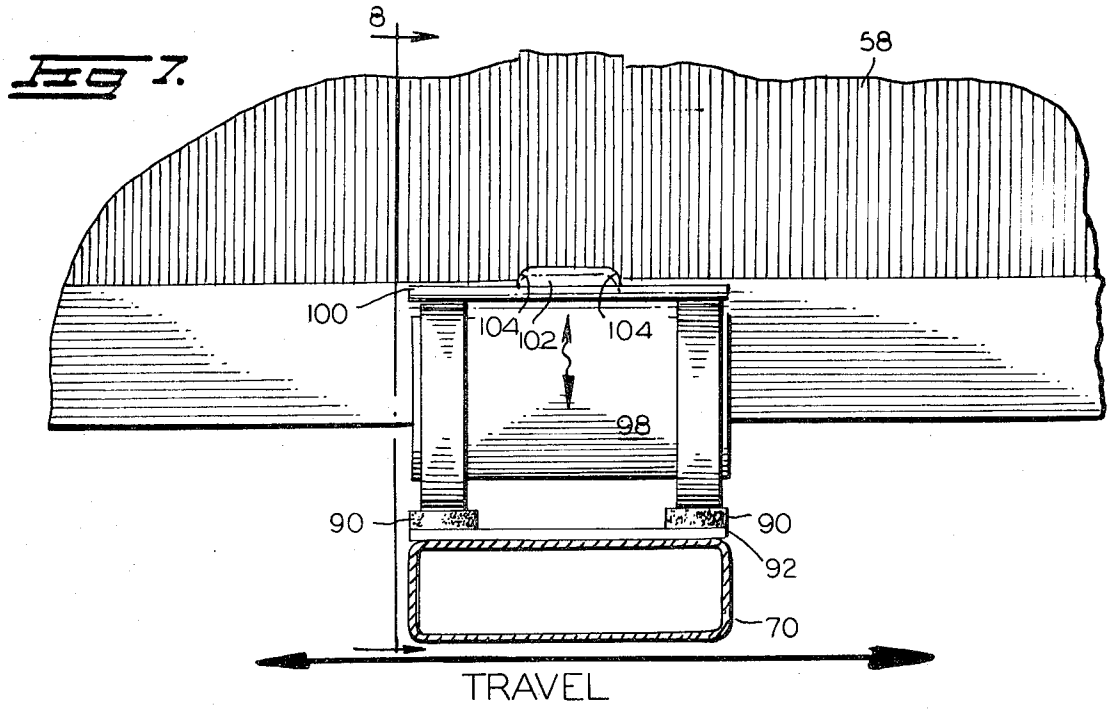
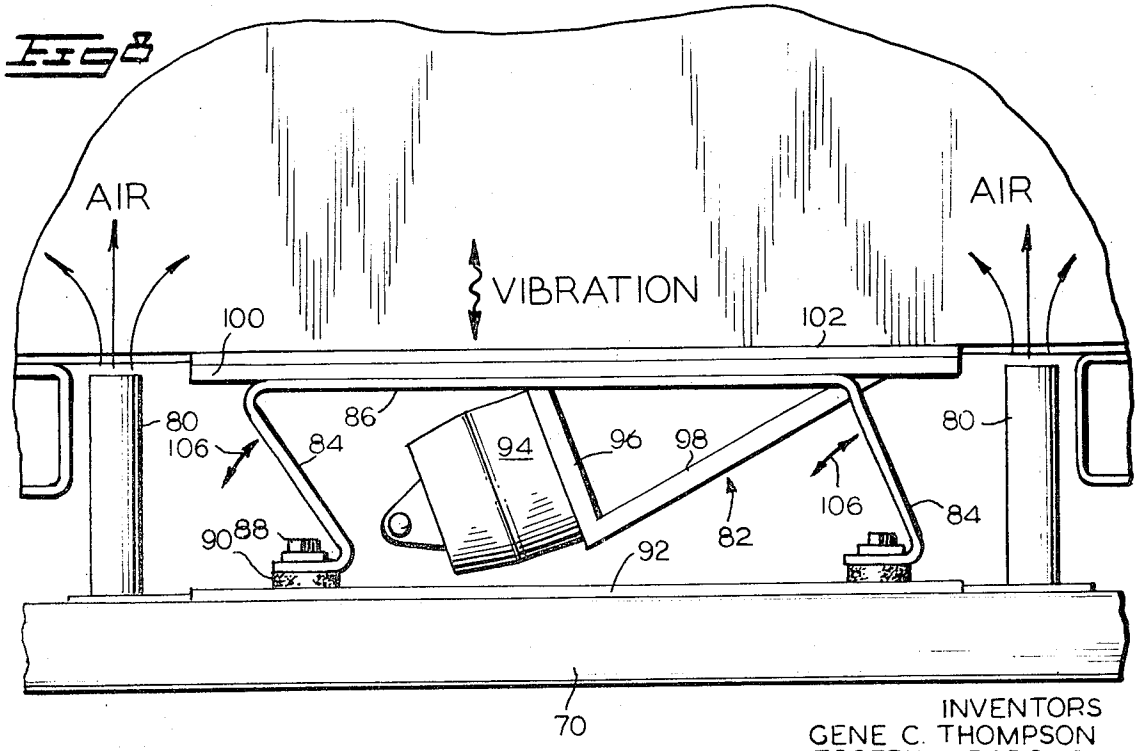


Fig 8



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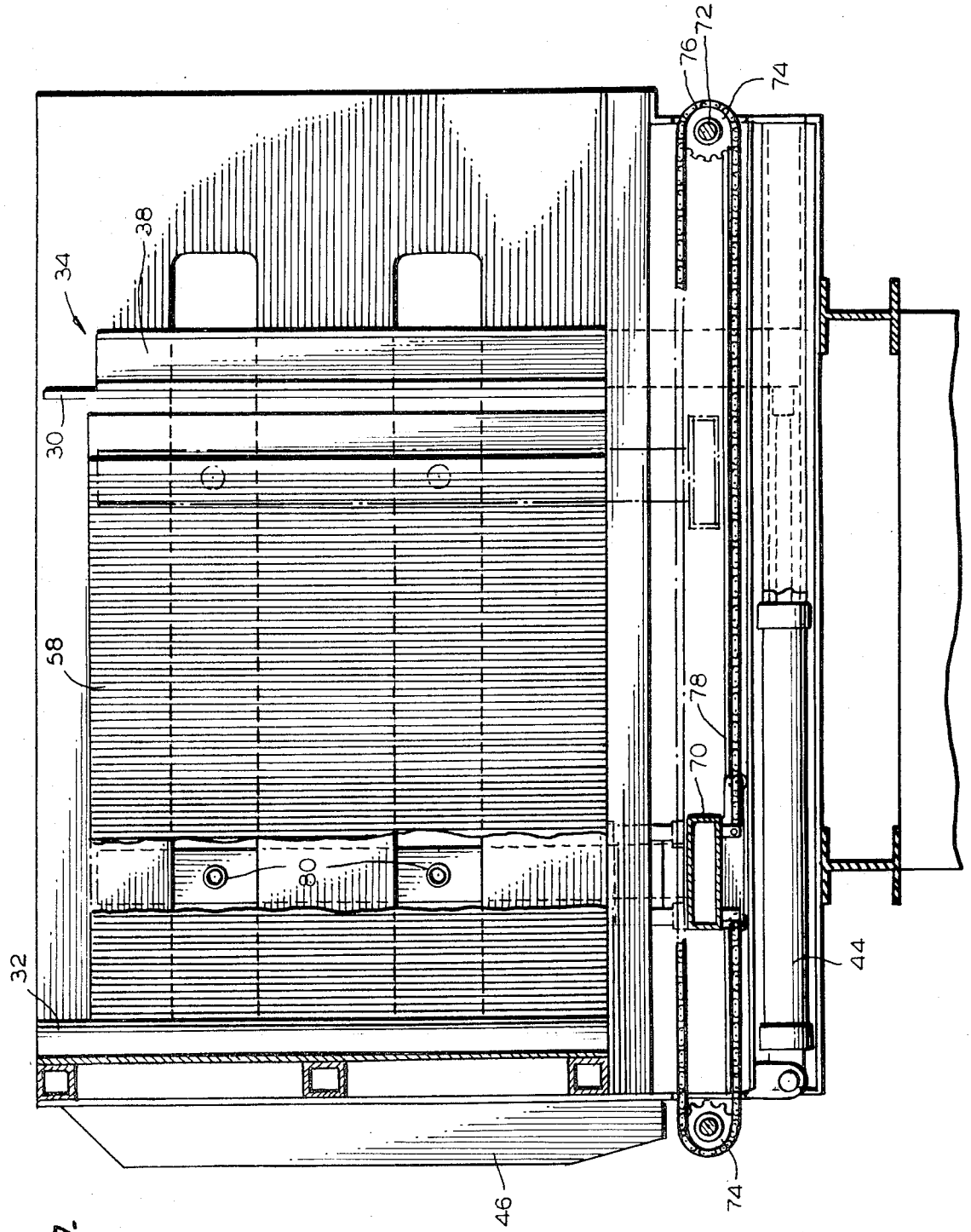


Fig. 9.

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SHEET WINDING, TURNING AND ALIGNING METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

The present application constitutes a continuation-in-part of our prior co-pending application Ser. No. 147,944, entitled SHEET WINDING AND TURNING METHOD AND SYSTEM, filed May 28, 1971 and now U.S. Pat. No. 3,680,220, the present invention constituting an improvement over the disclosure therein.

DESCRIPTION OF THE PRIOR ART

G. Ruud U.S. Pat. No. 3,418,725 — Dec. 31, 1968.

This patent teaches aeration of a stack of printed sheets to prevent them from sticking together wherein sheets substantially vertically supported at their lower edges are successively acted on in a direction transverse thereto to successively raise the sheets, and vibrating individual raised sheets of the stack.

Ruud does not teach impingement of the sheets against a curved surface to implement breaking ink pack nor a subsequent tilting together with vibrating and aerating for improved edge alignment of sheets in the stack as in the present invention.

Prior known methods and apparatus have not been entirely satisfactory in operation to eliminate sticking or blurring of freshly printed sheets in a stack. Our previous application provided improvements in winding and jogging devices. However, it has been found under some circumstances that some printed sheets will remain stuck together regardless of mechanical treatment imparted to them and such sheets as do separate will do so when subjected to extreme sheer stress induced by partial placement of the pile on the curved surface of our prior invention, and while an air blast or aeration increases separation or unsticking of the sheets, the pile or stack under some circumstances does not have desired squareness or edge sheet alignment.

The present invention gives improved results over our prior invention and meets a need as outlined above in the prior art.

SUMMARY OF THE INVENTION

The present invention provides a sheet winding, turning and aligning method and apparatus wherein ink pack in a stack or pile of sheets is broken, necessary column strength is provided to the sheets, and the sheet edges are brought into desired squareness. The results of the invention are attained, subsequent to impingement upon a curved surface to break the ink pack, by tilting the sheets in the stack to an inclined angle and at that time vibrating and aerating the sheets with air blasts in a manner to corellate and align the sheet edges in the stack.

Additional objects and advantages of the present invention will be more readily apparent from the following detailed description of an embodiment thereof when taken together with the accompanying drawings in which:

FIG. 1 is a side elevational view of the invention showing tilting of the apparatus in broken lines;

FIG. 2 is a side elevational view from the opposite partially fragmentary side of FIG. 1 with a sheet stack elevator platform in a sequenced position, the lowermost sheets being broken away to show platform assembly components

FIG. 3 is an end elevational view along line 3—3 of FIG. 2 with the apparatus in a subsequent operational sequence to implement ink pack breaking;

FIG. 4 is a view similar to FIG. 3 of a subsequent step sequence;

FIG. 5 is a view similar to FIG. 4 of a further sequenced position to implement sheet edge alignment;

FIG. 6 is an enlarged detailed horizontal sectional view taken along the line 6—6 of FIG. 2;

FIG. 7 is an enlarged detailed fragmentary sectional view of a vibrator and air chamber unit, with the travel cycle schematically depicted;

FIG. 8 is a vertical fragmentary sectional view taken on line 8—8 of FIG. 7 showing the vibrator and air chamber; and

FIG. 9 is an enlarged detailed fragmentary vertical sectional view taken along line 9—9 of FIG. 5 disclosing a traversing air chamber and associated mechanism.

Referring now in more detail to the drawings, the apparatus includes a base or support 10 which pivotally mounts at 12 a vertical frame 14 with associated base plate 16 and brace 18. The members 14, 16 and 18, and associated mechanism, constitute a turntable assembly generally designated 20. The turntable assembly is mounted in a cantilever fashion by an appropriate bearing assembly at 22 which is interconnected through gearing to gear motors 24. The turntable assembly is adapted for rotation by a gear motor 24 from the position shown in FIG. 2 to the position of FIG. 3 to angularly rotate a stack of sheets mounted or supported within the turntable through a desired angular rotation or displacement greater than 90° and, for example, preferably between 100° – 125° to effect an initial impact breaking of ink adherence between the sheets, as will be pointed out in greater detail hereinafter.

The turntable assembly 20 includes, generally designated, a back wall 26, side wall 30 and with a curved surface top plate 32, all comprising a rigid structure in the nature of a cage with an open end for insertion and removal of sheets in stacks, and the entire unit being rotatable by bearing 22. A moveable platform assembly 34 includes a platform 36 carried by I beams 38, or the like, moving in slots 40 which serve as guideways and extend through bottom plate member 42 of the turntable assembly. A pair of clamp cylinders 44, affixed to fixed top member 46 of the turntable assembly at their upper ends have rods 48 attached to shaft 50, and rotatably mounted with respect thereto, by means of brackets 52 attached to the upper side of moveable platform 36 and serve to raise or lower the platform. Toothed racks or the like 54 are secured to back wall 26 and are engaged by and with toothed sprocket wheels 56.

In operation a sheet stack as generally designated 58 loaded on pallet 60 is positioned within the turntable assembly through the open front end thereof by means of a lift truck or the like and placed on the top of moveable platform 36. The platform 36 through the mechanism above described can be raised together with the sheet stack so that the uppermost one of the sheets is engaged with the underside of curved plate 32. This is an adjustable engagement as will be described

hereinafter. The rack and sprocket arrangement in conjunction with the clamping cylinders ensures rectilinear movement of platform **36**, and prevents tilting thereof.

After loading of a sheet stack, and an initial raising of the platform **36** for a clamping engagement with the curved plate **32**, the turntable assembly is rotated about bearing **22** as indicated in FIG. **3** of the drawings, so that the sheets are turned from a horizontal position through a vertical plane and to a tilted position of approximately 100° – 125°. This rotation throws the sheets against the curved surface of plate **32** and gives an initial ink pack breaking action.

Subsequent to this the turntable assembly, FIG. **4**, is reversely rotated to a level position wherein the sheets **58** are vertical, on an edge, and the platform **36** moved an increment away from curved plate **32** as indicated by the platform unclamped notation. This is to provide a certain degree of looseness in and between the sheets in the stack which are now standing on an edge.

Subsequent to this initial ink pack breaking the turntable assembly is tilted to tilt the load or sheet stack upwardly through an angle of approximately 20° as shown in FIG. **5**. This is accomplished by means of a tilt cylinder **61** secured between upright frame member **62** and a pivot **64** on brace **18** which interconnects vertical frame **14** and base member **16**. Upon actuation of tilt cylinder **61** the turntable assembly will assume the position shown in FIG. **5**. This operation is to initially move the pile or sheets therein uniformly against the back surface of the turntable assembly for the purpose of aligning the edges of the sheets in the stack. The sheet edge alignment is facilitated by means of an aerating and vibrating assembly. The aerating or winding assembly includes a blower **66** connected by flexible duct **68** to a header **70** which extends across the width of the machine, and is moveably mounted with respect thereto by a mounting including spaced rotatable shafts **72** mounting gears **74** having entrained therearound a sprocket chain **76** attached at its free ends to the header **70**. Motor M and gearing G operate this structure. Appropriate guides generally indicated at **78** are provided for alignment in movement of the header. The header **70** extends across the back wall **26** and side wall **30** and has aerating nozzles **80** operatively connected thereinto and extending into proximity to the sheets in the stack **58**. Operatively associated with and mounted on the header portion **70** extending along back wall **26** is a vibrator unit **82** which includes a frame of resilient metal or the like including depending legs **84** interconnected by a top member **86** with the legs connected by means of bolts **88**, resilient cushions or washers **90**, and bar **92** to the header.

A vibrator **94**, which can consist of for example a VM–100 Vibco vibrator, is attached to the frame by bars **96**, **98** or the like. A horizontal plate **100** is attached to top member **86** and a flat bar **102** having beveled edges **104** is mounted on plate **100**. The flat bar **102** is adapted to move with the header or air chamber and upon operation of vibrator **94**, and the resilient mounting provided, will vibrate a narrow band of sheets in the pile as shown in FIG. **7** of the drawings. As the header moves along the vibrator will affect or act on an isolated narrow band of the pile edges, for example about 2½ inches, by raising this band about one quarter inch above the other edges. At the same time air is being blown through the aerating or winding nozzles. The combination further aids alignment and additionally the air blast helps to solve the sticking problem. Since only a narrow band is being vibrated the remainder of the pile is not disturbed and, therefore, no vibrtion forces are transmitted to the structural members of the machine. Isolating this small amount of paper also reduces the vibrator size required to do the job. It will also be apparent that the tilting backward of the sheets in conjunction with the action of the vibrator, as indicated by arrows **106**, will tend to force or float the sheets into the downward corner between the base and side of the turntable assembly and greatly enhance the edge aligning feature.

In operation the following sequence of operation elucidates the over-all function of the machine:

SEQUENCE OF OPERATON

The Winder-Jogger is designed to wind, jog-align and break tack on loads of printed stock. Also available is ability to remove damaged stock. Machine can also invert load 180° if desired.

A period of trial and operator learning will be required to achieve best load aligning at minimum cycle time. The manual cycling will allow various operations to be tried to achieve best results.

The basic cycle will include the following steps:

1. Load Skid of paper onto moveable platform.
2. Press "Clamp" button to lift load until it is close or touches curved platform — max squeeze is not required.
3. "Rotate CCW" Button used to turn load through 100° –125°, laying load onto curve to break tack and orientate load for aeration.
4. Jog "unclamp" button until load is free and slides down to underneath support beams. Continue jogging "unclamp" until moveable platform is about three-fourths inch to 1 inch loose of skid.
5. "Rotate CW" until load is level.
6. "Tilt-up" load until limit switch stops unit at about 20° angle.
7. Start blower and vibrator by pressing "on" button.
8. Press "Right Trav." Button to traverse air and vibration to right through load. Hold until Limit Switch stops at right hand end of load.
9. Press "Left Trav." Button to traverse air and vibration to left through load. Hold until Limit Switch stops at L.H. end of load. Stop blower and vibrator with "off" buttons.

NOTES:

A. If pile is not uniformly back against back surface, make another pass through load.

B. Any particularly stubborn sheet or group may be stopped on and allowed to vibrate back.

C. Stop air on any sheets to be removed and pull outward and upward on these to remove from stack. Jog air right and left to find free point for easiest pull.

D. If pile does not seem to move ell, try opening pile some more by jogging "unclamp" button. Practice will help determine correct amount to do this. If unclamp is opened too much and pile starts to sag, "Rotate CCW" 20° - 30° and "clamp" slightly to straighten up load, return to level.

E. Always leave air chamber at left end of travel when finished.

10. Press "Tilt Down" Button and lower load until stops are reached.

11. Rotate load "CW" until L.S. Stops pile vertical on skid. Note: if rotate pushbutton will not work, press "-Clamp" button to close to 72 inches or less.

12. Press "unclamp" button to lower load to floor level stopping platform movement just as stops are touched.

13. Remove load with truck.

14. Jog "unclamp" button to level platform in frame opening as required. Machine is ready to receive next load.

While a preferred embodiment has been shown and described hereinbefore, manifestly minor changes and modifications can be made and incorporated in the apparatus without departing from the spirit and scope of the invention as defined in and limited solely by the appended claims.

We claim:

1. A method of winding sheets comprising:

A. vertically stacking a plurality of horizontally oriented super-imposed sheets;

B. rotating the stack about a longitudinal axis through an angle greater than 90°;

C. impinging the sheets in the so rotated stack against a curved surface to break cohesion between the sheets and to contour and position the sheets for enhanced column strength;

D. reversely rotating the stack to an angle of 90° to the horizontal to position the sheets vertically edgewise supported;

E. tilting the stack to dispose the bottom and one side edge of the sheets at downwardly and rearwardly inclined supported angles respectively from the horizontal and vertical; and

F. vibrating and aerating the bottom edges of the sheets when so tilted to align sheet edges.

2. A method of winding, turning and aligning sheets comprising:

A. vertically stacking a plurality of horizontally oriented superposed sheets on a base support;

B. rotating the stack about a longitudinal axis through an angle greater than 90°;

C. impinging the top of the so rotated stack of sheets against a curved surface to break cohesion between the sheets and contour and position the sheets for enhanced column strength;

D. reversely rotating the stack to an angle of 90° to the horizontal to position the sheets vertically edgewise supported along first side edges thereof;

E. angularly tilting the stack at an angle to the horizontal to position the first sheet edges at a corresponding angle with second side edges of said sheet at right angles to said first supported edges and being edgewise engaged and supported;

F. winding the so angularly disposed stack of sheets along at least one side edge thereof, and simultaneously vibrating a narrow band of said sheets along the said first supported side edges to urge said second side edges into oriented alignment with the support thereof.

3. A method of winding, turning and aligning sheets as claimed in claim 2 wherein said sheets simultaneously with said vibrating are winded along said first supported side edges.

4. A method as claimed in claim 3 wherein winding includes introduction of aerating medium and along the bottom and side edges of said supported sheets.

5. A method as claimed in claim 4 wherein aerating medium is introduced from a plurality of air nozzles mounted for movement along said edges.

6. A method as claimed in claim 5 and including reversely angularly tilting the stack to a horizontal edge positionment, and subsequently further reversely rotating the stack to its original position for removal and subsequent treatment.

7. A method as claimed in claim 1 including aerating side edges of the sheets when so tilted, said vibrating and aerating serving to float said sheets into the downwardly formed angle between the supported edges of the sheets.

8. Apparatus for winding, turning and aligning sheets comprising:

A. a rotatably mounted turntable including:

i. a movable base platform to initially support a vertical stack of horizontal sheets;

ii. a curved upper plate, extending across the top of said turntable;

iii. a back; and

iv. a side;

B. means to rotate said turntable, and a stack of sheets on said base platform, in a vertical plane initially through an angle greater than 90° to impinge uppermost sheets in said stack against said curved upper plate, and to subsequently reverse rotate the same to dispose said sheets vertically on a side edge thereof;

C. means to aerate the vertically disposed sheets along an edge thereof; and

D. means to angularly tilt said turntable and vertically disposed sheets at an angle to the horizontal, and means to vibrate and simultaneously aerate bottom side edges of the sheets.

9. Apparatus as claimed in claim 8, said means to aerate said side edges being disposed along at least two sides of said sheets.

10. Apparatus as claimed in claim 9, wherein the vibrating means comprises an elongated plate extending across the said side of said turntable supporting the bottom edges of said sheet, said plate being mounted for movement along said side under said bottom edges of said sheets, said plate having a narrow width for coaction with a narrow band of sheet edges, and having a height sufficient to raise contacted sheet edges a small amount from the supporting surface therefor.

11. Apparatus as claimed in claim 10, said aerating means including headers movably mounted for rectilinear movement along sides of said turntable, air nozzles operatively connected to said headers and opening in the direction of sheet edges adjacent thereto, said vibrator plate being associated with one said header for translation therewith.

12. Apparatus as claimed in claim 10, said vibrating means includes a frame including a top and depending legs of resilient material, the bottoms of said legs being resiliently mounted on said turntable, and a vibrator unit operatively connected to said frame and said plate, resiliency of said frame and the mount therefor permitting vibration of said plate vertically and horizontally.

13. Apparatus as claimed in claim 12 wherein said frame, in conjunction with the support mount therefor, is in the shape of an inclined quadrilateral with the legs inclined toward the angle formed between sheet edges disposed at an angle to the horizontal, vibration of said frame and plate mounted thereon, in conjunction with air during aeration, serving to float said sheets into the downwardly formed angle between the supported edges of the sheets to facilitate edge alignment of the sheets along the supporting sides therefor.

14. Apparatus as claimed in claim 8 including means for moving said base platform comprising spaced fluid actuated cylinders and pistons connected to said base platform and operable to move said base platform and sheets supported thereon vertically to engage the uppermost sheet with said curved upper plate, and retract the base platform incrementally to slightly space the uppermost sheet and curved plate to facilitate aeration thereof.

15. Apparatus as claimed in claim 14 and further including rack means on said turntable, said base platform operatively rotatably mounting pinion gears thereon in operative association with said racks, said racks and pinions being longitudinally spaced with respect to said base platform length and in alignment with the fluid moving means for the platform to insure equalization of movement of the ends of said base platform during raising and lowering.

16. Apparatus as claimed in claim 8, said means rotatably mounting said turntable including a pivotally mounted frame, bearing means mounting said turntable on said frame, a drive motor, and gearing interconnecting said drive motor and said turntable, operable for rotating said turntable on said bearing.

17. Apparatus as claimed in claim 16 and means for tilting said frame and turntable mounted thereon to angularly tilt said turntable and vertically disposed sheets at an angle to the horizontal to facilitate sheet edge alignment.

18. Apparatus as claimed in claim 17 and including means to vibrate and simultaneously aerate bottom side edges of the sheets when angularly tilted.

* * * * *