

March 3, 1970

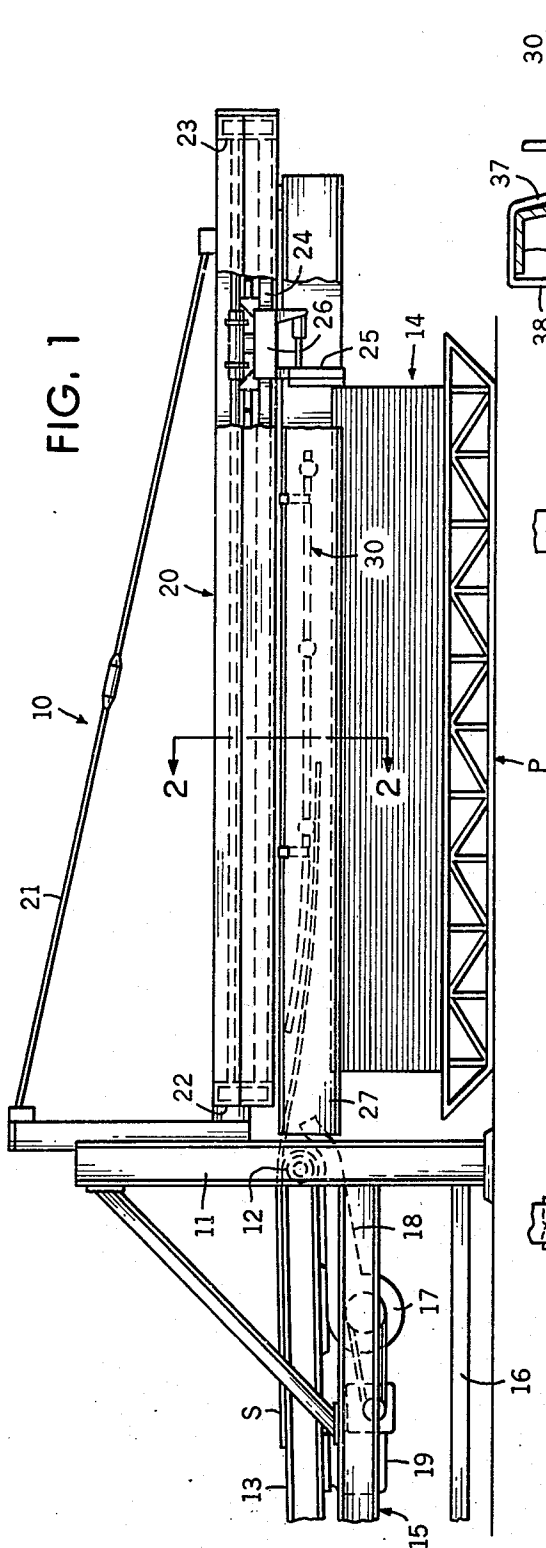
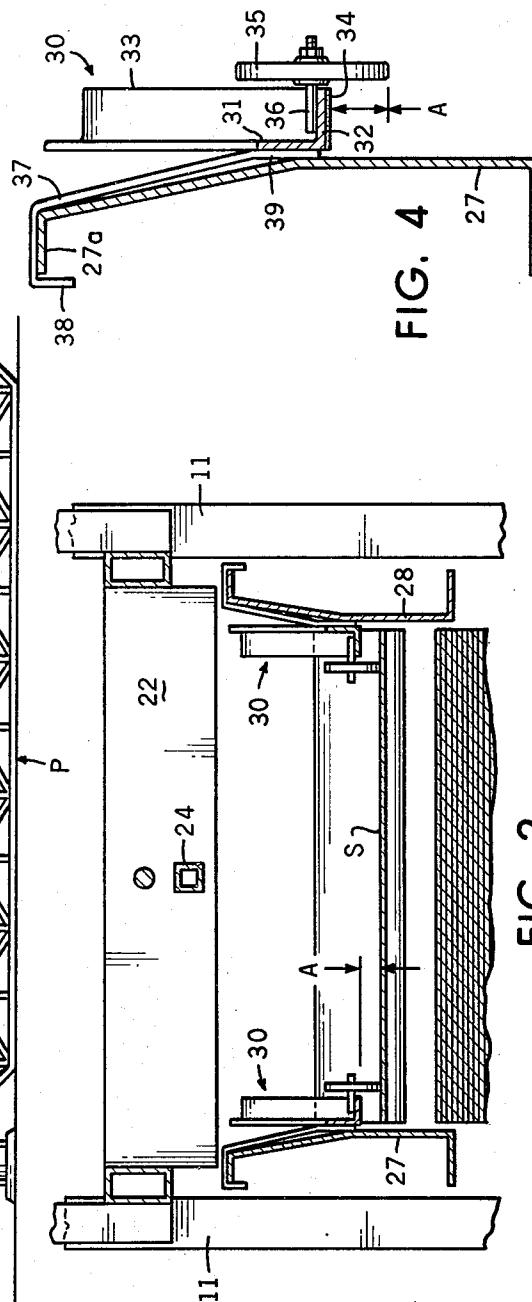
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3,498,599

WAVE DAMPER FOR SHEET STACKING APPARATUS

Filed May 1, 1968

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

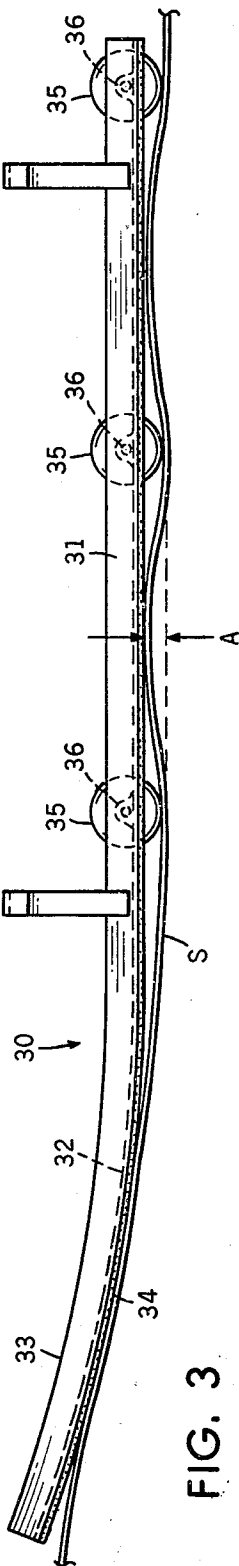


FIG. 3

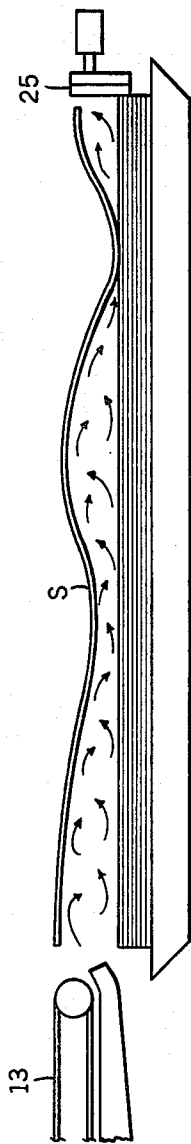


FIG. 6

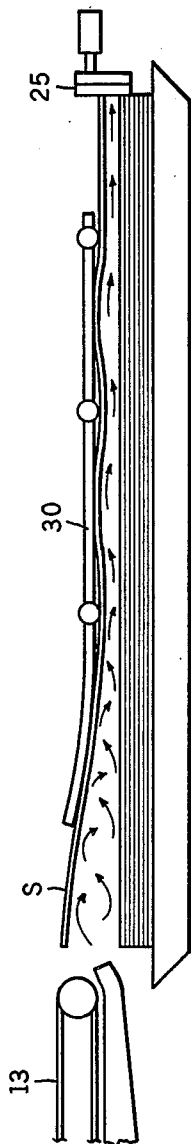


FIG. 5

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**WAVE DAMPER FOR SHEET STACKING
APPARATUS**

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8 Claims

ABSTRACT OF THE DISCLOSURE

Wave damper means for application to stacking apparatus handling long thin sheet material which is projected outwardly on a stream of air into a stacking zone between side guides, the dampers acting to hold the longitudinal margins of the sheet against vertical movement so as to damp violent vertical oscillations and prevent the sheets from slapping against sheets already in the stack. The wave damper means allows some wave motion of the thin sheets in the transverse direction due to the supporting layer of air injected under the sheet as it is projected into the space between the guides, and the resulting arch-form imparts a desired degree of lateral stiffness such that the sheet material is not created or otherwise damaged during its airborne flight between the side guides.

This invention relates to improvements in sheet stacking apparatus and is particularly concerned with damper means to be applied to stacking apparatus when long thin sheet material having no inherent stiffness is to be stacked.

In stacking long thin sheet material which is projected out between side guides into a stacking area on a cushion of air, the air develops turbulence which causes the sheet to form uneven wave patterns and balloon to such an extent that often times the sheet material will flutter vertically and slap on the stack of sheets below or buckle in the transverse direction. This results in unpredictable sheet motion, making it difficult for the sheets to settle down in desired alignment. The action also results in damage to the sheet material.

An important object of the present invention is to provide means for controlling the stacking of long, thin or light gauge sheet material so that damage to the material is avoided.

It is another important object of the present invention to provide means to damp the wave action of thin sheet material projected on a cushion of air into a stacking zone of stacking apparatus.

Still another object of this invention is to provide means for overcoming the problems encountered in sheet stacking apparatus, some problems being enumerated above.

A further object of this invention is to provide attachment means for sheet stacking apparatus so that the apparatus may easily handle a variety of sheet material from material having inherent stiffness characteristics to the very light gauge material having little or no inherent stiffness, such attachment means being especially adaptable to apparatus supplying a layer or cushion of air to support the sheet material during movement into the stacked position.

Yet another object of this invention is to provide air stacker apparatus with attachment means for the side guides to engage the longitudinal edges of thin sheet material and control the flight attitude thereof to prevent violent vertical oscillations in the sheet due to air turbulence and to gain greater speed in stacking such sheets without incurring damage to the surface finish or creasing or bending thereof.

Other objects of this invention will be set forth in greater detail in the following description of a presently preferred embodiment, reference being had to the several views in the accompanying drawings, wherein:

FIG. 1 is a schematic side elevational view of an air stacker apparatus capable of handling a variety of sheet materials, such as those that are short or have a thickness gauge and possess sufficient stiffness, as well as the long light gauge sheets that do not possess the necessary stiffness to permit machine stacking;

FIG. 2 is a transverse sectional view taken at line 2—2 in FIG. 1 to show somewhat schematically the application of the present wave damper means to stacking apparatus;

FIG. 3 is a greatly enlarged longitudinal view of one wave damper means of the present invention;

FIG. 4 is an enlarged transverse sectional view of the wave damper means, the view being similar to the left hand portion of FIG. 2;

FIG. 5 is a schematic view of the wave damper to illustrate the control achieved on thin or light gauge sheet material; and

FIG. 6 is a schematic view of an air stacker showing a typical condition encountered when light gauge sheet material is projected into the stacking zone of air stacker apparatus without the benefit of the damper means of FIG. 3.

The wave damper means, in a preferred embodiment, comprises a pair of units removably attached to the side guides of air stacker apparatus. Each unit includes a longitudinal member presenting a low friction surface to be engaged by the side edge of the sheet material, and a plurality of low inertia rollers carried by the longitudinal members in spaced relation to limit the amplitude of the wave formed in the sheet. The spacing of the rollers is by preference selected to approximately equal the width of the sheet material.

In FIGS. 1 and 2 the air stacker apparatus 10, in brief description, includes a vertical frame 11 adapted to support the rollers 12 at the discharge end of the feed belts 13 which convey the sheet material S into the stacking zone 14. The conveyor belt structure may be supported by horizontal frame means 15 from the frame 11. The frame structure 15 and sub-frame 16 carries a blower unit 17 having its discharge nozzle 18 directed to discharge a cushion of air beyond the rollers 12 such that as the sheet is projected into the space in the stacking zone 14 it is supported by the air cushion. A prime mover unit 19 is operatively connected to the blower in any convenient manner. The stacking zone 14 is defined by a frame assembly 20 attached at the inner end to the vertical frame 11 and supported at its outer end by tension members 21. Frame 20 carries a pair of transverse beams 22 and 23 from which is supported a longitudinal bar 24 on which the backstop means 25 is movably supported by a traveling clamp 26. The clamp is carried by a guide 26a about the bar 24. A pair of side guides 27 and 28 are suitably supported from the beams 22 and 23 and are adjustably spaced apart to suit the width of the sheet material being stacked. While it is not believed necessary to show the details of construction of the stacker, it is noted that with the type of pallet P shown in FIG. 1 the conveyor belt 13 and the frame 20 move vertically in the frame 11 so that proper relationship of the frame 20 to the height of the stack of sheets S can be maintained. The vertical movement is accomplished in known manner in this art.

While the wave damper means of this invention are positionally located in FIGS. 1 and 2, reference will be directed to FIGS. 3 and 4 for more exact details thereof, and similar parts in the several views will be designated by similar reference numerals. In FIG. 3 a typical wave damper means 30 comprises a longitudinally directed

angle member having a vertical leg 31 and a horizontal leg 32. The leading end of the member is provided with an upwardly angled or non-linear portion 33 while the remainder thereof is substantially horizontal. The entire length of the horizontal leg 32 is rendered substantially frictionless by the placement of a strip of Teflon material 34 on the lower surface which is contacted by the side edges of the sheet material. At spaced intervals along the straight portion of the angle member low friction and low inertia rollers 35 are disposed by axle elements 36 secured in any convenient manner (as by welding) to the inner flat surface of the horizontal leg 32. The rollers may be formed from delrin, polyurethane, or other non-marking material.

For purposes of imparting a sense of size of the damper means, for example, when handling sheet material of 16 feet or longer and having a width of about 4 feet, each means 30 may be about 12 feet long and the upwardly directed, non-linear portion may be about 3 feet long and rise above the horizontal by as much as 8 inches. The rollers 35 are spaced apart on about 4 foot centers, depending on the width of the sheets, and there are three such rollers on each.

Each damper means 30 is removably attached (FIG. 4) to a side guide, as the guide 27, by a pair of hanger means 37. Each hanger has an upper hooked end 38 which fits over the upper flange 27a of the guide 27. The opposite end 39 of the hanger 37 is vertically directed to lie flatwise on the face of the side guide, and the end 39 is secured to the vertical leg 31 of the angle member. Damper means 30 possesses sufficient weight to retain proper position on the side guide and restrict the sheet material to a shallow wave form represented by the dimension A in FIGS. 3 and 4.

The function of the damper means 30 when positioned on each of the inner surfaces of the side guides 27 and 28, as is shown in FIG. 2, is to control the reaction of the sheet S during its flight toward the backstop 25 on the air cushion projected underneath the sheet from the nozzle 18. It must be appreciated that sheet material which is substantially only 4 feet wide and upwards of 16 feet long is significantly more flexible in the lengthwise direction than it is in the transverse or side to side direction. That is to say, that there will be less tendency for bending in a 4 foot section than there will be in a 16 foot section. Thus the flexibility of the sheet between its leading and trailing edges is subjected to the aerodynamic effects of the air cushion moving underneath it. The combination of the flexibility of the sheet S and the moving cushion of air supplied below, plus the confining of the air cushion along the side guides 27 and 28 creates a plenum area underneath the sheet so that the air tends to flow past the leading edge of the sheet toward the backstop 25. The aerodynamics of this condition into which the sheet S is projected results initially in flutter which builds up to violent up and down whipping of the leading edge portion of the sheet, and this whipping action develops a series of waves which travel rearwardly through the lengthwise direction of the sheet. This action can be likened to the sheet S being corrugated with the corrugations running from side to side and in which the corrugations are non-uniform like a series of ocean waves breaking on a seashore. Since the wave motion travels lengthwise along the sheet it creates increased stiffness from side to side of the sheet.

In view of the above described condition to which the substantially light gauge and long sheets are subjected, it can be appreciated that the function of the damper means 30 is to engage the leading edge of each sheet as it is projected from the feed belts 13 so as to restrict, right in the initial movement of the sheets into the stacking zone 14, the flutter and up and down whipping of the leading edge. This is very important because by restricting the flutter and whipping action in the initial or leading portions of the light gauge sheets

the subsequent wave formations can be more easily controlled. It is beneficial to permit a restricted height of the wave in the sheet in order to maintain stiffness in the side to side or transverse direction. This is achieved by placing rollers 35 at spaced intervals along each of the damper means 30 so that a very shallow wave formation is established. Thus, each sheet S upon being projected into the stacking zone 14 will proceed on the air cushion under the control of the damper means 30 so that there will be no violent up and down whipping or damaging wave propagation lengthwise through the sheet.

What has been last described above is illustrated in FIG. 5 where it can be seen that the turbulence in the air cushion near the delivery nozzle 18 is rapidly suppressed by the damper means 30 restricting the sheet to a very subdued wave form. As the sheet proceeds farther into the stacking zone 14 the subdued wave form is maintained by the rollers 35 and the turbulence becomes insignificant the farther the sheet advances toward the backstop 25. The action illustrated in FIG. 5 is a significant improvement in the handling of light gauge and relatively long sheets of material as compared to the showing in FIG. 6. In the latter view an attempt has been made to illustrate what occurs in the stacking zone 14 when a light gauge and relatively long sheet is projected into the stacking zone without the side guide being equipped with damper means 30. The violent whipping in the vertical direction in the leading portion of the sheet is sufficient to crease or bend the sheet and the violence of the whipping action generates a following wave form which runs rearwardly through the sheet material. The progression of the violent wave formation lengthwise through the sheet is encouraged and promoted by the turbulence in the air cushion. These conditions have actually been observed and substantial damage has resulted due to the slapping action of the moving sheet on the stack of sheets below. It has also been determined that the violent wave motion generated in each sheet as it is projected into the stacking zone 14 requires a considerable length of time for it to quiet so that the sheet may settle on the pallet. The time delay is costly because it reduces the capacity of the stacking apparatus. These problems are overcome by the provision of the damper means 30 which is described herein.

It should be apparent now in what manner the wave damper means controls the attitude of each sheet S as it is projected outwardly over the air cushion delivered at nozzle 18. The means has the good effect of restricting the height of the waves and yet allows sufficient wave formation to prevent buckling in the transverse direction (that is from side to side between the means 30). It can be appreciated that the cushion of air flows smoothly from the plenum space formed between the side guides 27 and 28 and substantially eliminates tendencies for the sheet to flutter, balloon or slap the sheets in the stack below. As shown in FIG. 1, the sheets are collected in a relatively neat pile on a suitable pallet P which can be removed by a fork lift truck or other suitable means.

The invention has been disclosed in one preferred embodiment, but no unnecessary limitations are intended as equivalent means may be devised to accomplish the desired end result. It is, therefore, the purpose to include all equivalent means within the scope of the appended claims.

What is claimed is:

1. Wave damper means for sheet stacking apparatus having a stacking zone defined between side guides and extending from a sheet delivery end having an air cushion supply source and a remote sheet backstop, said damper means including a longitudinally extending member carried on each of the side guides in position to be engaged only by the longitudinal margins of the sheet to be stacked, roller elements carried by each such member and extending below the member, and skid means

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positioned on each member over the surface thereof engaged by the sheet.

2. The wave damper means set forth in claim 1 wherein said roller elements are formed of light weight low inertia material and are free rotating.

3. The wave damper means set forth in claim 1 wherein said friction reducing means is a strip of low friction material extending throughout substantially the length of each member.

4. The wave damper means set forth in claim 1 wherein said member on each of the side guides is detachably mounted thereon, and is formed with a non-linear end portion to be engaged by the sheet emerging at the delivery end of the stacking zone.

5. The wave damper means set forth in claim 1 wherein hanger means is attached to each said member and said hanger means has one end formed with a hooked portion to engage and suspend said member from the side guides.

6. The combination of a sheet stacker side guide and wave damper means carried by the side guide: said side guide having a longitudinal top marginal flange and an inner face surface presented to sheet material to be stacked; and said wave damper means comprising a member having downwardly facing surface extending lengthwise of said side guide and projecting inwardly from said inner face surface, a plurality of roller means operably mounted on said member and spaced along the length

thereof, and attachment means connected to said member and engaged with said side guide at said top marginal flange, the inward projection of said downwardly facing surface and said roller means being limited to the edge margin of the sheet roller means being limited to the edge margin of the sheet to be stacked.

7. The combination set forth in claim 6 wherein said rollers are spaced apart a distance substantially equal to the width of the sheet to be stacked, and said rollers project below said downwardly facing surface a distance about equal to the amplitude of the wave form in the sheet to be stacked.

8. The combination set forth in claim 6 wherein a portion of the length of said member is non-linear and is directed upwardly relative to the remainder of the length of said member, said non-linear portion being positioned to be engaged first by the sheet to be stacked, and friction reducing means carried on said downwardly facing surface.

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RICHARD E. AEGERTER, Primary Examiner

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,498,599

March 3, 1970

Cullen J. Smith

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, lines 4 and 5, "assignor to L. W. Nash Company, a corporation of Missouri" should read -- assignor, by mesne assignments, to L. W. Nash Company, East Palestine, Ohio, a corporation of Delaware --.

Signed and sealed this 4th day of August 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents