March 21, 1933. H. L. JOACHIM 1,902,436

METHOD OF AND APPARATUS FOR STACKING SHEETS

Filed Aug. 3, 1931 2 Sheets-Sheet 1

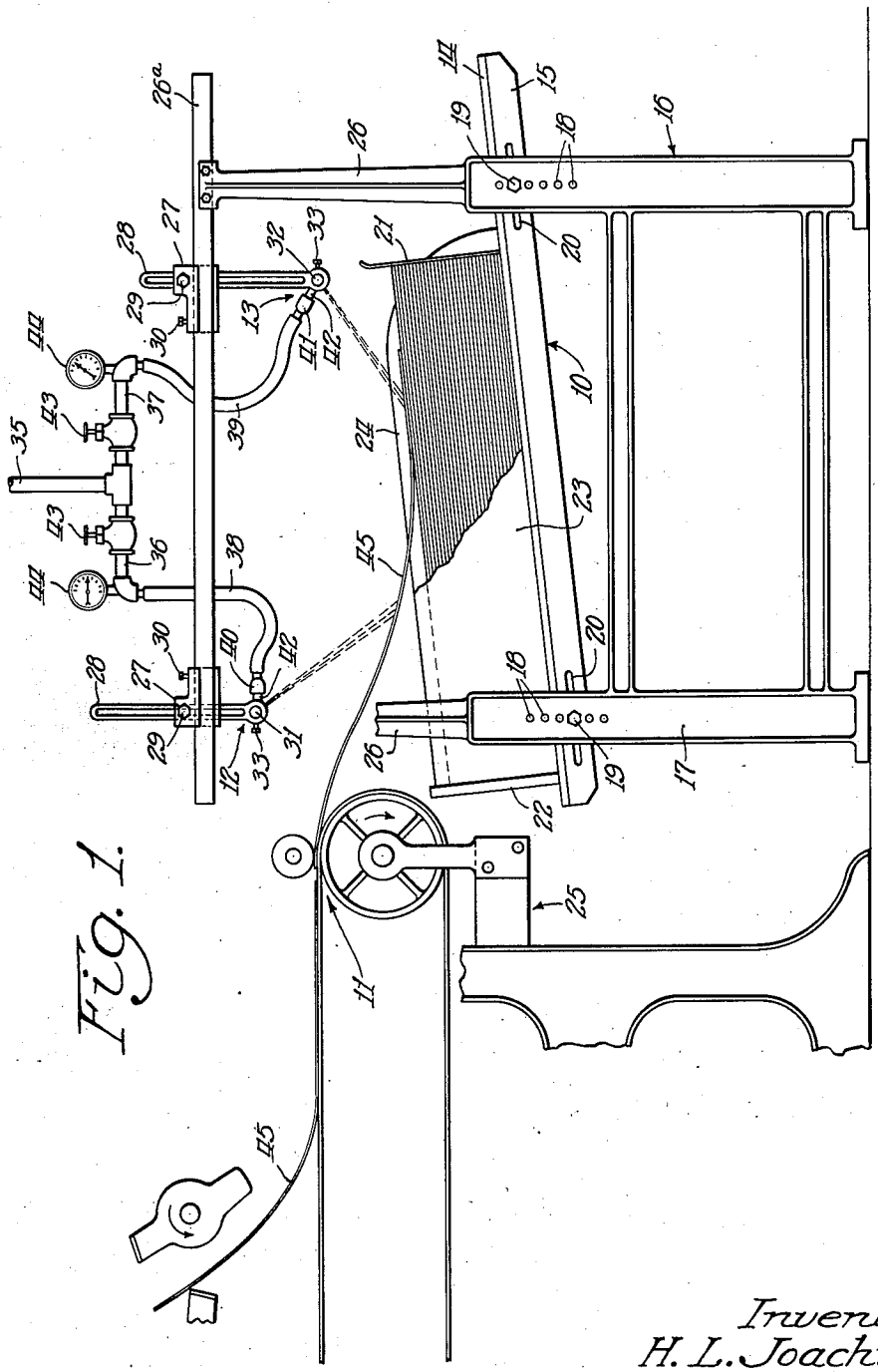


Fig. 1.

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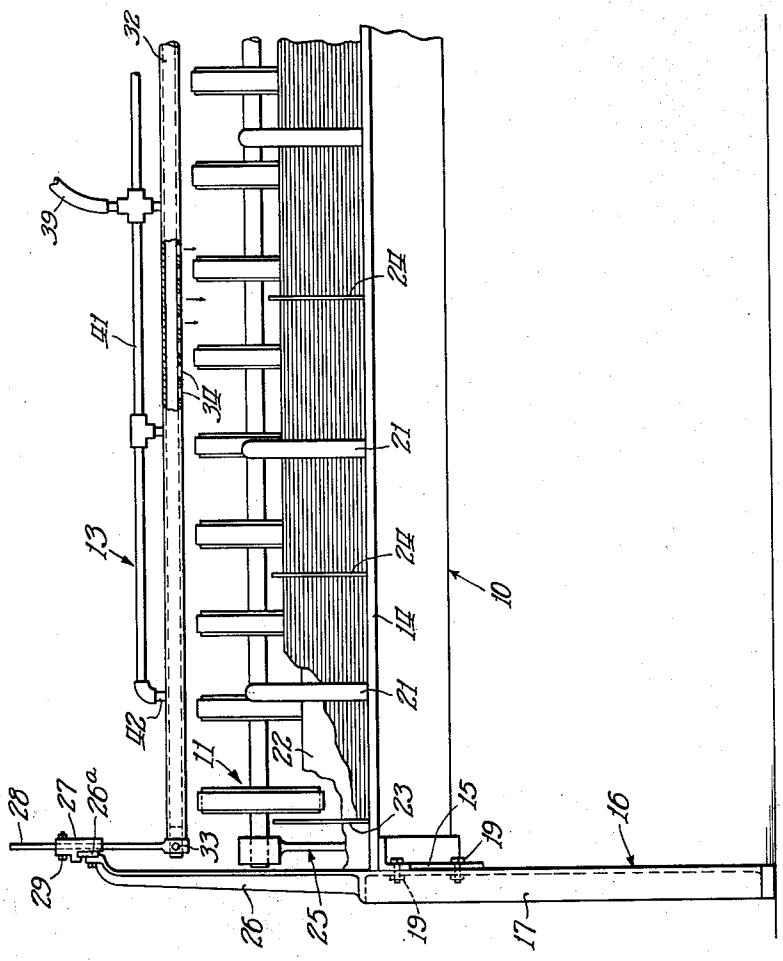


Fig. 2

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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR STACKING SHEETS

Application filed August 3, 1931. Serial No. 554,649.

The present invention relates to sheet stacking methods and devices and more particularly to a device for and method of stacking sheets of paper, paper board or like sheet material at the finishing end of a paper or like machine where the sheets are delivered from the end of a conveyor on which the sheets are carried at relatively high speed.

One object of the invention is to provide a device of the character described which is economical to construct and operate and efficient for the purpose intended.

Another object is to provide a sheet stacking means utilizing continuous air jets for insuring the accurate placement of the sheets upon a support to which they are delivered by a conveying means.

A further object is to provide an air jet means acting first to speed up the sheet as it leaves the conveyor and then slow down the sheet and deposit it accurately upon a support.

An additional object of the invention is to provide a sheet stacking device capable of operating upon sheets of a great variety of dimensions and provided with jet delivering means capable of adjustment and control to vary the angle and intensity of the jets and also to vary the distance between the individual jet delivering means.

Still another object of the invention is to provide a simple sheet stacking mechanism particularly adapted for use at the finishing end of a paper board machine, which will stack the sheets of paper board as rapidly as produced, which requires a minimum of manual aid and which minimizes wastage.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Figure 1 is a side elevation of a preferred embodiment of the invention with certain portions broken away for the sake of clearness; and

Figure 2 is a partial rear elevation of the device as illustrated in Figure 1 with certain portions not necessary for clearness being omitted.

Similar reference numerals throughout the several views indicate the same parts.

The present invention provides a sheet handling and stacking device which is simple in form and made of parts not likely to get out of order and which may be readily adjusted by unskilled workmen to produce the desired results. The invention, as disclosed, comprises a sheet support, a conveyor for delivering sheet thereto and one or more jets located above the support for acting on the sheets.

Referring more particulary to the drawings, there is shown at 10 a support table to which the sheets are delivered from a conveyor 11, the sheets being brought to rest upon the support 10 by a pair of jet delivery means indicated generally at 12 and 13.

The support 10 comprises a plate 14 secured to side frame members, one of which is indicated at 15. The support is suitably mounted for adjustment on a base 16, the upright standards 17, 17 of which are provided with a series of holes 18 for receiving bolts 19 engaging within slots 20 in the frame members 15. By this mechanism the sheet support may be tiltably adjusted to assume various angles with respect to the conveyor 11. The plate 14 of the support is provided with spring stops 21, back stop 22 and sides 23 within the confines of which the sheets of material are received and maintained in a uniform stack. Where desired, dividers 24 may be provided for separating the stacks of sheets when a number of sheets are to be stacked simultaneously.

The conveyor 11 may be of any suitable type but is preferably a conventional strap conveyor actuated by any suitable source of power and having its ends suitably mounted on a frame 25.

The jet delivery means is preferably located beyond the end of the conveyor and over the sheet support. For the purpose of conveniently locating the jet delivery means over the sheet support there is preferably provided an extension 26 on each of the stand-

ards 17 to the upper end of which extensions is secured to a slide bar 26*a* from which the jet delivery means is suspended and along which it is adjustable. While there are preferably two similar parallel slide bars extending longitudinally of the direction of travel of the sheets and disposed on each side of the sheet support 10, merely one of these bars has been illustrated as a matter of convenience.

Each jet device is individually mounted upon the slide bars by means of saddle members 27 slidable thereon and supporting a slotted link 28 through which a bolt 29, projecting through the saddle member 27, is adapted to pass so that by means of this bolt the link may be secured in any adjusted position. The saddle is provided with a set screw 30 by which it may be secured to any desired point on the slide bar.

The jet delivery mechanism comprises a main conduit, indicated at 31 and 32, respectively, having their ends suitably closed and pivotally engaged in the ends of the links 28, set screws 33 being provided for maintaining the conduits in any given rotated position. Each conduit is provided with a slot or series of slots 34 through which air may escape to form a flattened jet extending the width of the sheets to be stacked. While the ports 34 are shown in Fig. 2 in the form of a plurality of slits or openings such as have been found very satisfactory in practice, they may obviously comprise orifices of any suitable character such as a single slit, a series of perforations or nozzles or the like.

Air under pressure is conducted to the conduits from any suitable source through a pipe 35 from which suitable branch pipes, indicated at 36 and 37, lead it to flexible tubing 38 and 39 which conduit the air to distributor heads 40 and 41 having a plurality of connections 42 connected to the conduits 31 and 32, respectively, whereby the air is distributed uniformly therethrough. Each branch 36 and 37 is equipped with a valve 43 and gauge 44 for regulating the amount of air pressure passing to the conduits.

In operation, as the sheets of material 45 are delivered by the conveyor 11 the momentum of their travel tends to thrust them out over the sheet support 10 in practically the same plane as that in which they travel on the conveyor. It will thus be seen that, when the sheets are coming from the machine at relatively high speeds, unless effective means is provided for urging the sheets forwardly and downwardly upon the support, there will be a tendency for the rear edge of one sheet to fail to clear the forward edge of the succeeding sheet. In such case the oncoming sheet will be blocked in its passage to the stack and will be thrown to one side or the other, or curled up, or otherwise inaccurately delivered to the stack, thereby disrupting the stacking operation and causing the spoilage of a number of sheets.

According to the present invention, the jet issuing from the jet delivery means 12 is directed continuously in a relatively narrow stream across the width of the sheets and strikes each sheet shortly after the advancing edge thereof comes over the sheet support whereby it is forced downwardly thereon. This jet is also biased at an angle to the plane of the surface of the sheet so as to not only force the sheet downward but also to impart an accelerated onward movement in the direction of travel thereof, the accelerated onward movement serving to deflect the sheets quickly away from the conveyor and overcoming any tendency to jamming at the point of delivery. In stacking such material as medium weight paper board very satisfactory results have been obtained by adjusting the jet so that it is inclined forwardly at an angle varying from approximately 40° to 55° with respect to the plane of the sheet projected from the conveyor just before the edge of the sheet is influenced by the jet.

When the sheet has been advanced a substantial distance out over the support it comes under the influence of the jet issuing from the jet directing means 13. This jet impinges in a relatively narrow stream across the width of the sheet, downwardly upon its surface and against its direction of travel, preferably at an angle varying from about 20° to 30° with relation to the surface of the sheet as it moves along the support. It will be noticed that the forward portion of the sheet, at this point of its travel, lies substantially parallel to the surface of the support.

The pressure of the first jet on the sheets is preferably substantially greater than that of the second jet so that the counteractive force of the latter jet will not overcome the accelerated forward movement of the sheets, as imparted by the first jet, until the sheets are clear of the conveyor. For most practical purposes it has been found that very satisfactory results are obtained where the pressure is in a ratio of about 2 to 1; for example, where the pressure at the gauge on the branch pipe 36 is five pounds per square inch, the pressure at the gauge on pipe 37 should be approximately two and a half pounds per square inch. However, the weight of the material operated upon largely governs the pressure with which the jets should impinge to obtain best results.

Further adjustments of the jets are made possible by the adjustable link members 28 and the saddles 27. By adjusting the links the level of the conduits 31 and 32 may be raised or lowered with respect to the surface of the sheets of material as necessitated by changes in the sheet dimensions, particularly as to changes in length or weight. Obvi-

ously, when the weight of the material is substantial it will be desirable to take as much advantage of the force of the jets as practicable and this is only possible by utilizing the jets as soon as possible after emission from the conduits, for, as is well known, the greater the distance between the outlet and the surface the more dissipated will the air stream become because of its tendency to spread out. It will also be apparent that as the length of the sheets is changed the spacing of the conduits should be changed accordingly, and with the present device this is easily accomplished by loosening the set screws 30 and sliding the saddles to any desired position on the slide bars 26*a*. If for any reason the plane of the sheets as delivered is changed or the slope of the sheet table is altered, the conduits may be rotated so as to maintain the preferred angle of impingement of the jets upon the sheets. These adjustments, of course, are only necessary where substantial changes are made in the class of, or dimensions of, the material operated upon.

When cutting and stacking a plurality of small sheets from a wide sheet of paper coming from a paper board machine it has heretofore been necessary to station one man at each stack and frequently necessitating as many as six persons to handle the output. Obviously, by this method even though the operators become highly proficient in guiding the sheets, a large number of pieces will frequently be wasted because of the difficulty of keeping up with the machine, particularly where light weight material is manufactured. While this inefficiency may not be as noticeable where relatively heavy material is being stacked, it is considerably aggravated when light weight sheets are produced since the forming machine may be speeded up to 240 feet or more per minute. It is also very apparent that this manual operation is very uneconomical from the standpoint of labor cost.

From the foregoing it is apparent that the present invention provides a mechanism for accurately forcing the sheets onto the sheet receiving support, and is adaptable to handle sheets of any dimensions, weight or caliper. In certain operations where it has been found necessary to employ six persons to handle the stacking of sheets from a paper board machine the present invention gives highly satisfactory results with no more than two attendants to look after the stacking operation and remove the stacks of sheets. Thus, with this improvement there is a minimum of wastage and the sheets may be stacked at any speed within the range of the production machine in connection with which it is operated. Furthermore, the invention provides a sheet stacking device adapted to stack any sheet material of comparatively light and relatively stiff character such as paper, wood, or the like; and the apparatus is of such a character as to require very little skill in making adjustments and is very efficient in stacking sheets.

The machine of the present invention is admirably suited for operations such as the manufacture of paper, where the speed of the output is varied within considerable limits, due to the fact that all of the adjustments may be easily and quickly made without stopping or in any way altering the operation of the paper forming machine.

Where referred to in the specification or appended claims the laying or stacking of sheets on the support is intended as well to mean the laying of the sheets upon other sheets already disposed on the support.

While the present description sets forth a preferred embodiment of the invention, numerous changes may be made in the construction without departing from the spirit of the invention, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. A device of the class described comprising a support for a pile of sheets, conveying means terminating adjacent the support and disposed so as to project the sheets over such support in a plane substantially aligned with the plane of the conveying means, a conduit adapted to be connected to a source of air pressure disposed above the plane of the conveying means and transversely to its direction of travel, a port in the conduit for directing an air jet across the width of the sheets and biased in the direction of travel of the sheets whereby to facilitate the delivery and laying of the sheets on the support.

2. A device for conveying and stacking sheets of material comprising in combination a conveyor, means for supporting a stack of sheets delivered thereby, a pair of spaced conduits adapted to be connected to a source of air pressure disposed above the level of travel and transversely to the direction of travel of the conveyor, and ports in said conduits for directing air jets across the width of the sheets, the jet adjacent the end of the conveyor being biased to impinge on said sheets in the direction of travel of the conveyor and the other jet being disposed beyond the first mentioned jet relative to the conveyor and being biased to impinge on the sheets in the opposite direction to the travel of the conveyor.

3. A device for stacking sheets of material comprising in combination conveying means, means for supporting a stack of sheets, a conduit adapted to be connected to a source of air pressure disposed above the level of

travel, and transversely to the direction of travel of the sheets, and a port in said conduit for directing an air jet across the width of the sheets and biased in a direction contrary to the direction of travel of the sheets whereby to retard the movement of and facilitate laying of the sheets upon said supporting means.

4. A device for stacking sheets of material comprising in combination a conveyor, means for supporting a stack of sheets as delivered, a pair of spaced conduits adapted to be connected to a source of air pressure disposed above, and transversely to the direction of travel of the conveyor, ports in said conduits for directing air jets across the width of the sheets, the jet adjacent the end of the conveyor being biased to impinge on said sheets in the direction of travel of the conveyor, the other jet being disposed beyond the first mentioned jet relative to the conveyor and being biased to impinge on the sheets in the opposite direction to the travel of the conveyor, and one of the jets impinging upon the sheets with substantially greater force than the other jet.

5. A sheet stacking mechanism comprising, in combination, means for delivering sheets of material, a support for receiving said sheets, an air pressure directing means for forcing the sheets into position on said support, said means being adapted to direct two air jets against the upper surface of the sheets, one jet being directed from a point near the end of the conveyor at an angle with the sheets of from 40° to 55° and biased in the direction of movement of the sheets and tending to increase the speed of the sheets as they leave the conveyor, the remaining jet being directed from a position located beyond the last mentioned jet relative to the conveyor at a distance approximately equal to the longitudinal dimension of the sheets being stacked.

6. A sheet stacking device comprising means for delivering sheets of material, a support for receiving said sheets, and means for retarding and forcing the sheets into position on said receiving means comprising an air jet directed from a position above the sheets so as to impinge in a definite stream upon the surface of the sheets at an angle of from 20° to 30° and in opposition to the movement of the sheets, whereby the friction of the air will substantially retard further movement of the sheets and force them down onto the receiving support.

7. A sheet stacking device adjustable to handle various sheet sizes, comprising a sheet support, a conveyor for delivering sheets thereto, sheet deflecting means comprising adjustable air jet directing means for delivering a jet of air at various angles downwardly and in the direction of travel of the sheets for urging said sheets away from the conveyor and onto the support, and other adjustable air jet directing means for delivering another air jet at various angles downwardly and opposite to the direction of travel of the sheets.

8. In combination with a conveyor for delivering sheets and a sheet receiving support, air jet directing means for stacking sheets of material delivered at high speeds comprising conduits adapted to be connected to a source of air pressure, and ports in said conduits for directing jets of air downwardly upon said sheets, one of said jets being directed to strike the sheets at an angle downwardly and away from said conveyor and another jet directed to strike said sheets at an angle downwardly and against the movement of said sheets, and means for selectively adjusting the striking angle of the jets when the size of sheet operated upon is changed.

9. A device of the class described comprising, in combination, a support for a stack of sheets, conveying means for delivering sheets thereto, means for directing jets of air upon the sheets as delivered for deflecting and forcing the same onto a stack on said support, said means comprising suitably apertured conduits connected to a source of air pressure and disposed above the sheet support, and spaced from each other in the direction of travel of the sheets, means for regulating the air pressure transmitted to each conduit, means for adjusting the position of the conduits with respect to one another and to the surface of the sheets as delivered, and means for regulating the angle of impingement of the jets.

10. The method of delivering and piling sheets which comprises providing a sheet support, projecting sheets at relatively high speed over the support, continuously directing an air jet downwardly against the sheets and in the direction of their movement so as to depress the forward edge of each sheet and simultaneously urge the sheet in the direction of its movement, and continuously directing another jet at a point farther on in the travel of the sheet to impinge on the sheet subsequent to the contact of said first mentioned jet with the sheet and in a direction against the movement thereof whereby its movement will be retarded and the sheet will be brought to rest upon the support.

11. The method of delivering and stacking sheets which comprises providing a sheet support, projecting sheets at relatively high speed over the support, and continuously directing an air jet to impinge on a bias upon the upper surface of each sheet in a direction against the movement of the sheet whereby its movement is retarded and the sheet is brought to rest upon the support.

12. A sheet stacking device comprising in combination a conveyor for delivering sheets,

sheet supporting means, and sheet deflecting means comprising two compressed air conduits provided with ports for directing air jets across the width of the sheets and impinging upon the upper surface of the sheets, said jets biased at different angles with relation to the surface of the sheets so that one jet will strike the sheets at an angle downwardly and in the direction of travel of the sheets and the other jet will strike the sheets at an angle downwardly and against the movement thereof, whereby the sheets are both urged away from the conveyor and forced down upon the sheet supporting means, and adjusting means for selectively increasing or decreasing the distance between said conduits so that the air jets will accommodate substantially longer or shorter sheet sizes.

13. A sheet stacking device comprising in combination a conveyor for delivering sheets, sheet supporting means, and sheet deflecting means comprising two compressed air conduits provided with ports for directing air jets across the width of the sheets and impinging upon the upper surface of the sheets, said jets biased at different angles with relation to the surface of the sheets so that one jet will strike the sheets at an angle downwardly and in the direction of travel of the sheets and the other jet will strike the sheets at an angle downwardly and against the movement thereof, whereby the sheets are both urged away from the conveyor and forced down upon the sheet supporting means, and means for independently raising or lowering said conduits with relation to the level of travel of the sheets.

14. A device of the class described comprising a sheet support, a conveyor, a pair of conduits adapted to be connected to a source of air pressure disposed above the sheet support and transversely to the direction of travel of the conveyor, ports in said conduits for directing air jets upon the sheets delivered by the conveyor, one jet impinging on the sheets with substantially greater force than the other, means for rotating the conduits to adjust the angle of impingement of the jets, and valve means for selectively regulating the pressure of the air transmitted to each conduit.

15. A sheet stacking device comprising a sheet support, means for delivering sheets, a conduit arranged with ports for directing jets against the sheets, links for supporting said conduit, laterally extending bars in fixed relation with said sheet support, saddle members slidably supported in the general direction of the movement of the sheets, said links being slidably engaged with the saddle members, and means on the said saddle members for securing the links at any desired position intermediate their ends for maintaining the conduit at any selected level.

16. A sheet stacking device comprising a sheet support, means for delivering sheets, a conduit arranged with ports for directing jets against the sheets, links for supporting said conduit, laterally extending bars in fixed relation with said sheet support, saddle members slidably supported in the general direction of the movement of the sheets, said links being slidably engaged with the saddle members, and the ends of the conduit being pivotally engaged with the links.

Signed at Philadelphia, Pa. this 17th day of July, 1931.

HERMAN L. JOACHIM.