Nov. 11, 1941. L. L. MATTHEWS 2,261,972

SHEET FEEDING AND STACKING METHOD AND MACHINE

Filed April 27, 1940 4 Sheets-Sheet 1

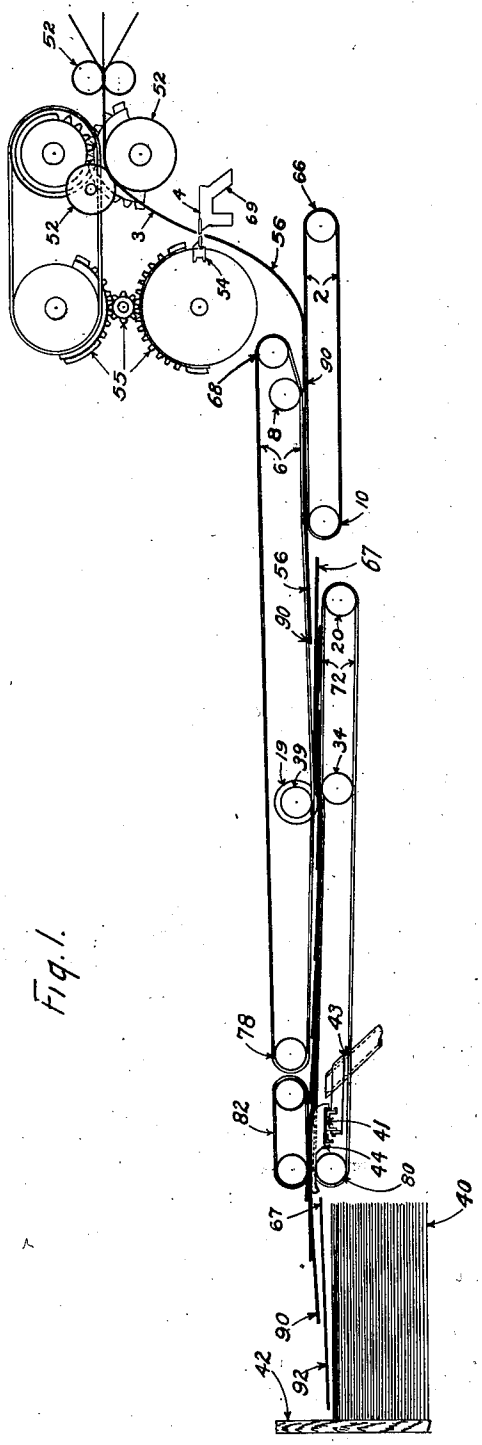

Fig. 1.

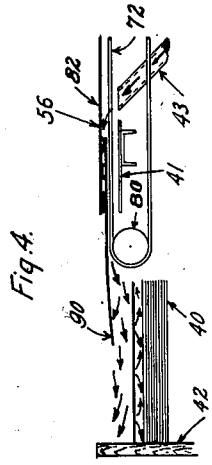

Fig. 4.

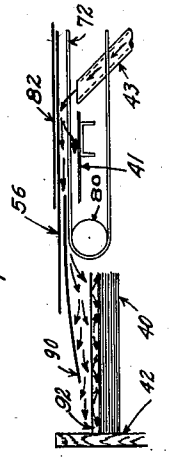

Fig. 3.

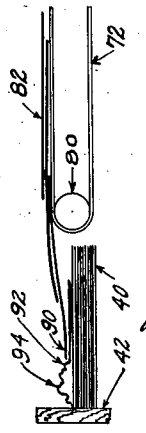

Fig. 2.

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Nov. 11, 1941. L. L. MATTHEWS 2,261,972

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Filed April 27, 1940 4 Sheets-Sheet 2

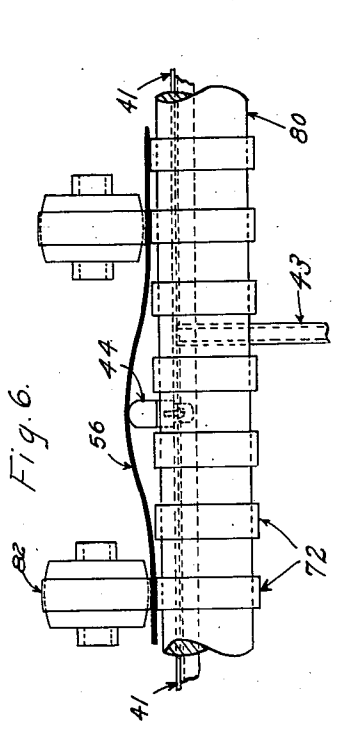

Fig. 6.

Fig. 5

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Nov. 11, 1941. L. L. MATTHEWS 2,261,972

SHEET FEEDING AND STACKING METHOD AND MACHINE

Filed April 27, 1940 4 Sheets-Sheet 3

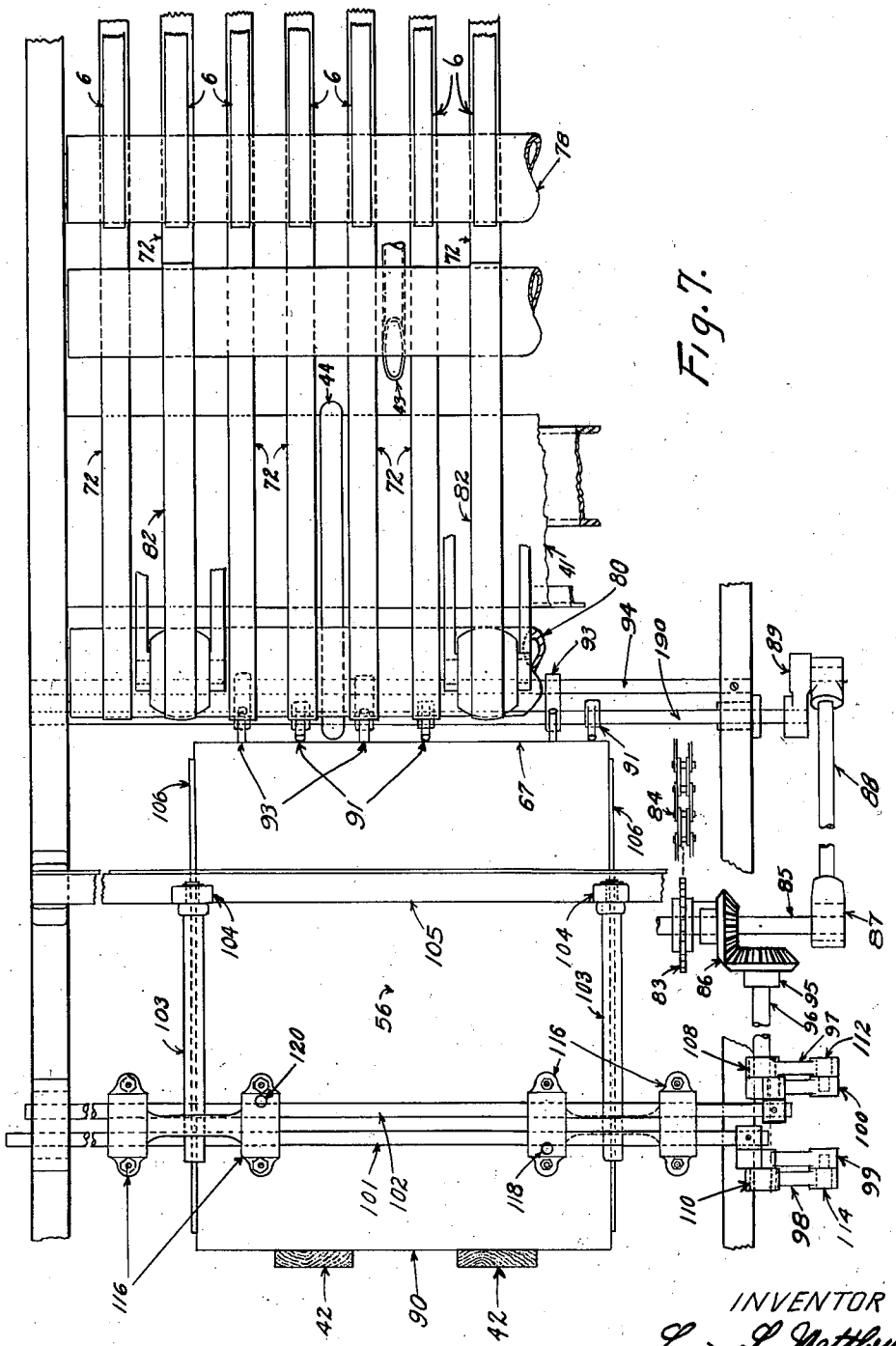

Fig. 7.

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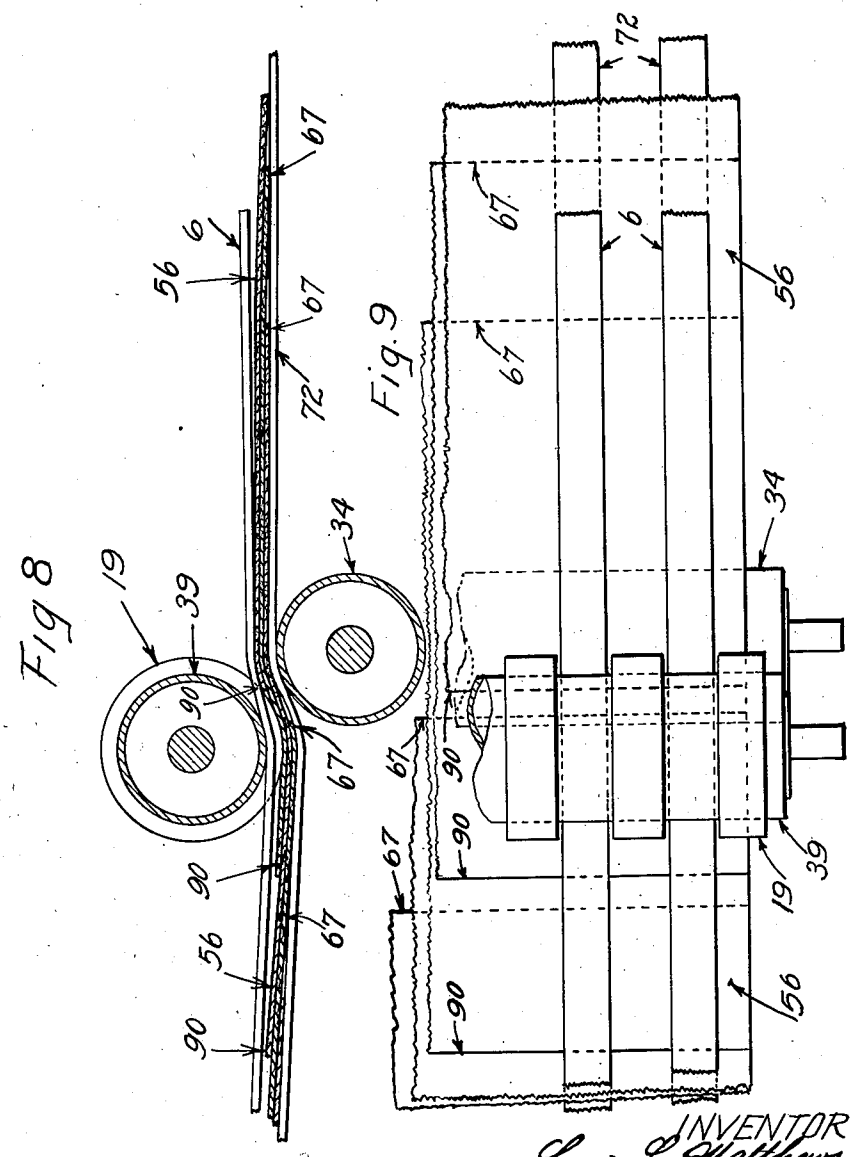
SHEET FEEDING AND STACKING METHOD AND MACHINE

Filed April 27, 1940 4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,261,972

SHEET FEEDING AND STACKING METHOD AND MACHINE

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Application April 27, 1940, Serial No. 331,977

24 Claims. (Cl. 271—76)

The present invention relates to methods of and machines for feeding and stacking sheet material, such as paper and the like. The invention is particularly related to methods and machines involving high speeds, like those used at paper mills for cutting webs from a roll or rolls into sheets, and feeding the sheets, by means of more or less horizontal conveyor tapes, into a lay-boy or other magazine. The sheets are fed by high-speed tapes to low-speed tapes by which they become overlapped, and it is in this overlapped condition that they arrive in the lay-boy.

An object of the invention is to improve upon methods and apparatus dealing more particularly with the delivery of the overlapped stream of sheets on to the pile or stack in the lay-boy. Other and further objects will be explained hereafter and will be particularly pointed out in the appended claims.

The invention will now be described more fully in connection with the accompanying drawings, in which Fig. 1 is a diagrammatic view, in side elevation, illustrating the invention in preferred form; Fig. 2 is an explanatory diagram illustrative of the prior art; Figs. 3 and 4 are similar explanatory diagrams illustrating the invention; Fig. 5 is a fragmentary enlarged view of the lay-boy end of the machine; Figs. 6 and 7 are corresponding end view and plan, respectively; and Figs. 8 and 9 are fragmentary sectional and plan views of a detail, upon a larger scale.

A web 3, which may be led from a roll or rolls (not shown) of paper or similar material is fed between feed rolls 52 and over a stationary bed knife or cutter 4, mounted upon a cutter unit 69. The term "web," "paper," "sheet," or its equivalent, will be employed to denote either a single layer or a plurality of superposed layers of the paper or other material. A rotary cutter 54, operated by mechanism 55, cooperates with the cutter 4 to cut the traveling web into sheets 56. The invention is equally applicable to use with previously cut sheets. Owing to the feeding action of the rolls 52, aided by gravity, the sheets 56 travel at a downward incline toward high-speed conveyor tapes or belts 2, that are mounted over rolls 10 and 66. During such travel, the heads 90 of the sheets may engage a stationary inclined guide board (not shown), disposed between the cutter 4 and the tapes 2, or a line of sloping or inclinedly disposed tapes (not shown) described in a copending application, Serial No. 326,975, filed March 30, 1940. The belts or tapes 2 are disposed approximately horizontal, substantially parallel to the bed knife 4, at a level below the level at which the web is fed between the rolls 52. The belts 2 cooperate with conveyor tapes or belts 6 that are mounted under a roll 8 and around rolls 68 and 78, to feed the sheets, at relatively high speed, to relatively low-speed tapes 72, shown mounted over rolls 20, 34 and 80. The head 90 of each sheet is received by the low-speed tapes 72 from the high-speed tapes 2 and 6 in a region of bend formed between the roll 34 below and an upper roll 39 above. The relatively low-speed tapes 72 are overlapped by, and separated from, the high-speed tapes 6, as shown. The sheets 56 are thus fed at relatively high speed, confined by the tapes 2 and 6, over the roll 10, to the relatively low-speed lower tapes 72, but become unconfined by the tapes 2 and 6 after leaving the roll 10.

The upper and lower rolls 39 and 34 extend transversely of the machine, the upper roll 39 to the left of the lower roll 34. As described in a copending application, Serial No. 330,665, filed April 20, 1940, the upper roll 39 may be constituted of steel tubing upon which may be fixedly mounted, with a tight push-on fit, a plurality of rings 19 that may be constituted of a phenol-condensation or other suitable product, like Bakelite. The Bakelite rings 19 are disposed all the way across the machine, close enough to one another so that there is just sufficient room between each two successively disposed rings 19 for the passage of an upper relatively high-speed tape 6 between them. The surface of the roll 39 thus becomes provided with a plurality of rings of smaller diameter than the rings 19 and alternating with the rings 19, but integral with the roll 39. The lower reaches of the high-speed tapes 6 each engages under one of these exposed rings of the roll 39. The ring surfaces 19 exposed on the roll 39 each extends down through between adjacently disposed high-speed tapes 6 into engagement with the relatively low-speed lower tapes 72, forming the before-mentioned region of bend between the rolls 34 and 39. The Bakelite rings 19, in cooperation with the low-speed tapes 72, constitute a soft means for stopping the high-speed travel of the sheet. The head of the sheet becomes thereupon gripped or pressed on opposite sides between the tapes 72 below and the rings 19 of the upper roll 39 above. The lower tapes 72 and the upper roll 39 thus cooperate to receive the head 90 of each sheet 56, and to slow down the speed of advance of the sheet. Because of this reduction in speed, the head 90 of each sheet, as it is delivered from between the high-speed tapes 2 and 6, will lap over the

tail 67 of the prior-fed sheet, as illustrated. In overlapped relation upon the low-speed tapes 72, the sheets are then fed by the low-speed tapes 72 and cooperating short low-speed upper tapes 82 at relatively low speed into a lay-boy 40, and against a front wall or stop or walls or stops 42 thereof. The end of the lay-boy 40 opposite to the walls 42 is disposed adjacent to the roll 80.

As explained in the said application, Serial No. 330,665, the rolls 34 and 39 may be mounted upon a carriage (not shown) that is adjustable back and forth in the line of feed to correspond to sheets 56 of different length.

The tapes 2 and 6 may be actuated desirably at a speed approximately ten per cent faster than the speed of the web 3, as determined by the feed rolls 52. The roll 8 is shown positioned to the left of the rolls 66 and 68 and the roll 68 is shown raised slightly above the tapes 2 to provide a space in which the tapes 2 and 6 may bite the heads of the oncoming sheets.

Where necessary, the sheets, as they travel past the roll 10, may be stiffened in any suitable way, as by means disclosed in application, Serial No. 328,367, filed April 6, 1940. This facilitates the sheets being fed from between the high-speed tapes 2 and 6 to the low-speed tapes 72 smoothly, and without muss-ups.

There is a tendency, particularly when dealing with long, light or sticky sheets, for the head 90 of a sheet, as it enters the lay-boy, owing to its weight, to engage an intermediate portion 92 of the next previously fed sheet, at the top of the pile in the lay-boy 40. As the sheet is fed forward into the lay-boy, its head 90 pushes forward on the portion 92 of the previously fed sheet, producing a wrinkle therein, as illustrated at 94 in Fig. 2.

According to the illustrated embodiment of the present invention, this is avoided by positioning a horizontally disposed steel plate or table 41 just back of the roll 80, as shown in Figs. 1, 3, 4, 5 and 7. The table 41 extends crosswise of the machine, at a level a little below the upper reach of the tapes 72. An air current from an air-jet nozzle or nozzles 43 is driven against the underside of the passing sheets and over the top of the table 41. The nozzles 43 may, if desired, be adjustable; but once adjusted, they may be retained in adjusted position, in a space between successive tapes 72. The air table 41 holds or confines the injected air up against the paper, so that the air travels horizontally out and forward above the table and below the sheet, into the lay-boy. In the absence of a bottom support like that provided by the table 41, the air, striking the underside of the paper, would bound back, or spill all down from the sheet. This air table 41 extends far enough back from the stop 42 so that the air current, moving at fast speed, has time to break through the stream of sheets piling in the lay-boy, under the head end 90 of the slow-moving overlapped sheet before that head end of the sheet can strike the front stop 42, as illustrated by the arrows in Fig. 3. The air table 41 for preventing spillage, and its position far enough back of the back edge of the pile of sheets in the lay-boy to afford sufficient time for the air to break through the moving stream of paper in the lay-boy before the head 90 of any particular paper strikes the front stop 42, are considered to be important features of the invention.

The air current enters from the nozzles 43 between the table 41 and the underside of the sheet 56 in a forwardly sloping direction. If the air current were directed vertically, there would be a considerable part of spillage over backwards when it struck the paper. Directed at an angle, as illustrated, the spillage is, of course, practically completely forward and, being confined by the paper on top and the steel blade 41 below, it has no where to go except forward through the stream of paper. As this air current, furthermore, moves forward faster than the paper, the same effect is produced as if the paper were being pulled backwards.

The air draft may be produced in any desired way, as by means of a blower, conventionally shown at 73, driven by a motor or in any other desired way, and provided with an adjustable shutter or damper 74 over the central intake hole for regulating the quantity of air in the draft. If available, the draft may be supplied from the compressed air line of the mill, or from any other source of air supply.

It is sometimes desirable to employ also a waver for longitudinally waving the sheets prior to their delivery into the lay-boy 40, thus to put a lengthwise wave in the stock, in order to stiffen it. The waver may be constituted of a plain metal finger, as illustrated at 44, or it may be of the type illustrated and described in a copending application, Serial No. 327,860, filed April 4, 1940. At this low-speed delivery point, it is desirable, particularly when dealing with long, heavy sheets, to mount the waver 44 in the tape space next to the nozzle 43, as illustrated more particularly in Figs. 6 and 7. The lengthwise waving hump will then be produced by the waver 44 in a region of the stack adjacent to the nozzle. There are two advantages, among others, in so positioning the hump. First, it provides a path for the air current from the nozzle 43 to enter, which helps the air to break through more easily. Secondly, the air current coming from the nozzle 43 becomes thus enabled to lengthen out the wave, thus improving the stiffening of the head end 90 of the sheet. The different paths that the air currents take under and above the top several sheets in the pile are illustrated by the arrows of Figs. 3 and 4.

A sprocket 83, driven by a chain 84 from any available power source (not shown), operates a shaft 85 on which are mounted a bevel gear 86 and an eccentric connecting head 87. The eccentric connecting head 87 is connected by a rod 88 to a connecting head 89, fastened to a rock shaft 190. The rock shaft 190 is provided with jogger fingers 91 the upper ends of which oscillate or rock back and forth in the line of feed to engage the rear edges 67 of the sheets deposited upon the top of the stack or pile in the lay-boy 40. One or more, usually several, of these endwise back-and-forth jogging movements of the fingers 91 may take place against the rear edge 67 of each sheet. By means of this jogging, the papers 56 are carefully pushed into the proper position in the lay-boy 40, with their heads 90 in engagement with the front stops 42.

As time is required to enable the injected air current to travel out over the pile of sheets in the lay-boy 40, the several sheets at the top of the pile are rendered more or less buoyant, or floating. The presence of even a slight amount of air between the sheets enables the sheets to slide very easily, and facilitates the endwise jogging. Light, delicate papers may thus be

jogged with a very gentle jogging motion, without injury to the paper.

Stationary fingers 93, alternately spaced with respect to the movable fingers 91, as illustrated more particularly in Fig. 7, and mounted rigidly upon a fixed supporting rod 94, determine the position of the rear edge of the pile of papers in the lay-boy 40. The stationary fingers 93 are provided with bearings in which the rock shaft 190 is mounted loosely, to enable it to turn freely therein. As viewed in Fig. 5, the lower portions of the movable fingers 91 are somewhat concealed, in all positions of the latter, by the stationary fingers 93.

The bevel gear 86 meshes with another bevel gear 95 that is pinned to a shaft 96 that runs lengthwise of the machine or parallel to the flow of paper into the lay-boy. The rotation of this shaft 96 reciprocates connecting heads 97 and 98 that are cam-mounted on the shaft 96, their cams 108 and 110 turning freely in the connecting heads 97 and 98 to convert their rotary motion into a reciprocal motion, in bearings 116, of rods 101 and 102 to which the heads 98 and 97 are connected by pivoting studs 112 and 114 to bell cranks 99 and 100. As the cams 108 and 110 in the connecting heads 97 and 98 are fastened to the shaft 96, with their high section 180 degrees apart relative to each other, the rod 101 will travel to the left when the rod 102 travels to the right, and vice versa. Riding on each of these two rods 101 and 102 is a T-shaped bracket 103. The brackets are secured to the respective rods 101 and 102 in any desired way, as by means of thumb screws 118 and 120, at 90 degrees to the respective rods. The stem of the T runs back and forth, by means of rollers 104 rolling on an angle iron 105. Suspended from and attached to each bracket 103 is a sheet steel side jogger blade 106. As the jogger casting 103 is caused to move with the rods 101 and 102, the blades are caused to travel in and out, or toward and from each other. When moving toward each other, they engage the sides of the paper sheets at the top of the pile in the lay-boy 40 to jog the sheets sidewise, as the fingers 91 jog them endwise. This sidewise jogging, too, is aided by the fact that the sheets of paper at the top of the pile are somewhat afloat on air layers, as before described.

The end joggers 91 thus act upon the rear edges 67 of the upper sheets 56 in the lay-boy, and the side joggers 106 close in upon the opposite sides of the said upper sheets, to prevent their spreading sidewise. Jogging in both directions is facilitated by the air currents before described.

The pile or stack of papers in the lay-boy 40 is automatically lowered by degrees to maintain the top of the pile at substantially constant height, so as to enable the stream of overlapped sheets to enter the lay-boy freely, without hindrance by the accumulated sheets already in the pile. This may be effected in any desired way, as by the means disclosed in Letters Patent 1,545,912, issued July 14, 1925, to Charles B. Maxson.

Modifications will occur to persons skilled in the art, and all such are considered to fall within the spirit and scope of the invention, as defined in the appended claims.

What is claimed is:

1. A method of the character described comprising feeding sheets in lapped relation on to a pile of sheets, blowing air in under the sheets during their overlapping travel, and causing the upper sheets of the pile to float on the air.

2. A method of the character described comprising feeding sheets in lapped relation on to a pile of sheets, blowing air in under the sheets during their overlapping travel, causing the upper sheets of the pile to float on the air, and jogging the floating sheets.

3. A method of the character described comprising feeding sheets in lapped relation, stopping the further travel of the sheets to cause the sheets to accumulate in a pile, blowing air in under the sheets during their overlapping travel and prior to the time that they are stopped, and causing the upper sheets of the pile to float on the air.

4. A method of the character described comprising feeding sheets in lapped relation, blowing air in under the sheets during their travel, and waving the sheets to stiffen them.

5. A method of the character described comprising feeding sheets in the form of a stream of sheets in lapped relation, stopping the further travel of the sheets at a predetermined point to cause the sheets to accumulate in a pile, and blowing air at high speed under the sheets during their travel far enough back of the predetermined point to enable the air to break through the stream of sheets prior to the time that the sheets are stopped.

6. A method of the character described comprising feeding sheets in the form of a stream of sheets in lapped relation, stopping the further travel of the sheets at a predetermined point to cause the sheets to accumulate in a pile, blowing air at high speed under the sheets during their travel far enough back of the predetermined point to enable the air to break through the stream of sheets prior to the time that the sheets are stopped, and jogging the sheets.

7. A method of the character described comprising feeding sheets in lapped relation, waving the sheets, and blowing air in under the sheets during their travel into the space produced by the wave.

8. A method of the character described comprising feeding sheets in lapped relation, forming waves in the sheets to stiffen the sheets, and blowing into the waves to improve the stiffening.

9. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation into the lay-boy, a table below the traveling sheets on the conveyor, and means for delivering an air jet above the table and under the sheets traveling into the lay-boy.

10. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation into the lay-boy, a table below the traveling sheets on the conveyor, means for delivering an air jet above the table and under the sheets traveling into the lay-boy, and means for jogging the sheets.

11. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation with the lay-boy, a table below the traveling sheets on the conveyor, and means for delivering an air jet at an angle over the table and under the sheets traveling into the lay-boy.

12. A machine of the character described having, in combination, a lay-boy having a stop, a tape conveyor for carrying sheets in lapped relation into the lay-boy and against the stop, a roll disposed adjacent to the lay-boy over which the conveyor is mounted, a table under the conveyor to one side of the roll, and means for de-

livering an air jet at an angle over the table and under the sheets traveling into the lay-boy, the table extending far enough back of the lay-boy to permit the air from the air jet to break through under the head end of a lapped sheet before the head end strikes the stop.

13. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation into the lay-boy, a table below the traveling sheets on the conveyor, means for delivering an air jet over the table and under the sheets traveling into the lay-boy, and means for waving the sheets.

14. A machine of the character described having, in combination, a lay-boy, a conveyor comprising a plurality of tapes for conveying sheets in lapped relation into the lay-boy, a table below the traveling sheets on the conveyor, a nozzle between adjacent tapes of the conveyor for delivering an air jet over the table and under the sheets traveling into the lay-boy, and a waver disposed between one of the said tapes and another tape adjacent to the said one tape.

15. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation into the lay-boy, a table below the traveling sheets on the conveyor, means for delivering an air jet over the table and under the sheets traveling into the lay-boy, means for waving the sheets, and joggers acting upon the rear ends and the sides of the sheets as they arrive in the lay-boy.

16. A method of the character described comprising feeding sheets on to a pile of sheets, injecting air in under the sheets during their travel, and confining the injected air against the under sides of the sheets.

17. A method of the character described comprising feeding sheets in the form of a stream of sheets in lapped relation on to a pile of sheets, injecting air in under the sheets during their overlapping travel, and confining the injected air against the under sides of the upper sheets of the pile to enable the air to break through the stream of sheets, whereby the upper sheets of the pile will be caused to float on the air.

18. A machine of the character described having, in combination, means for feeding sheets in lapped relation, a table below the traveling sheets, and means for delivering an air jet above the table and under the traveling sheets.

19. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation into the lay-boy, and means for blowing in under the lapped sheets traveling into the lay-boy.

20. A machine of the character described having, in combination, a lay-boy, a conveyor for carrying sheets in lapped relation into the lay-boy, means for waving the sheets, and means for blowing in under the lapped sheets traveling into the lay-boy.

21. A method of the character described comprising feeding sheets in the form of a stream of sheets in lapped relation on to a pile of sheets, and blowing air at high speed under the sheets during their overlapping travel to enable the air to break through the stream of sheets to cause the upper sheets of the pile to float on the air.

22. A method of the character described comprising feeding sheets in lapped relation on to a pile of sheets, injecting air in under the lapped sheets during their lapping travel, and confining the injected air against the under sides of the lapped sheets.

23. A method of the character described comprising feeding sheets in lapped relation on to a pile of sheets, blowing air in under the sheets during their overlapping travel, and jogging the sheets.

24. A machine of the character described having, in combination, means for feeding sheets in lapped relation, a table below the traveling sheets, means for delivering an air jet above the table and under the traveling sheets, and means for jogging the sheets.

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