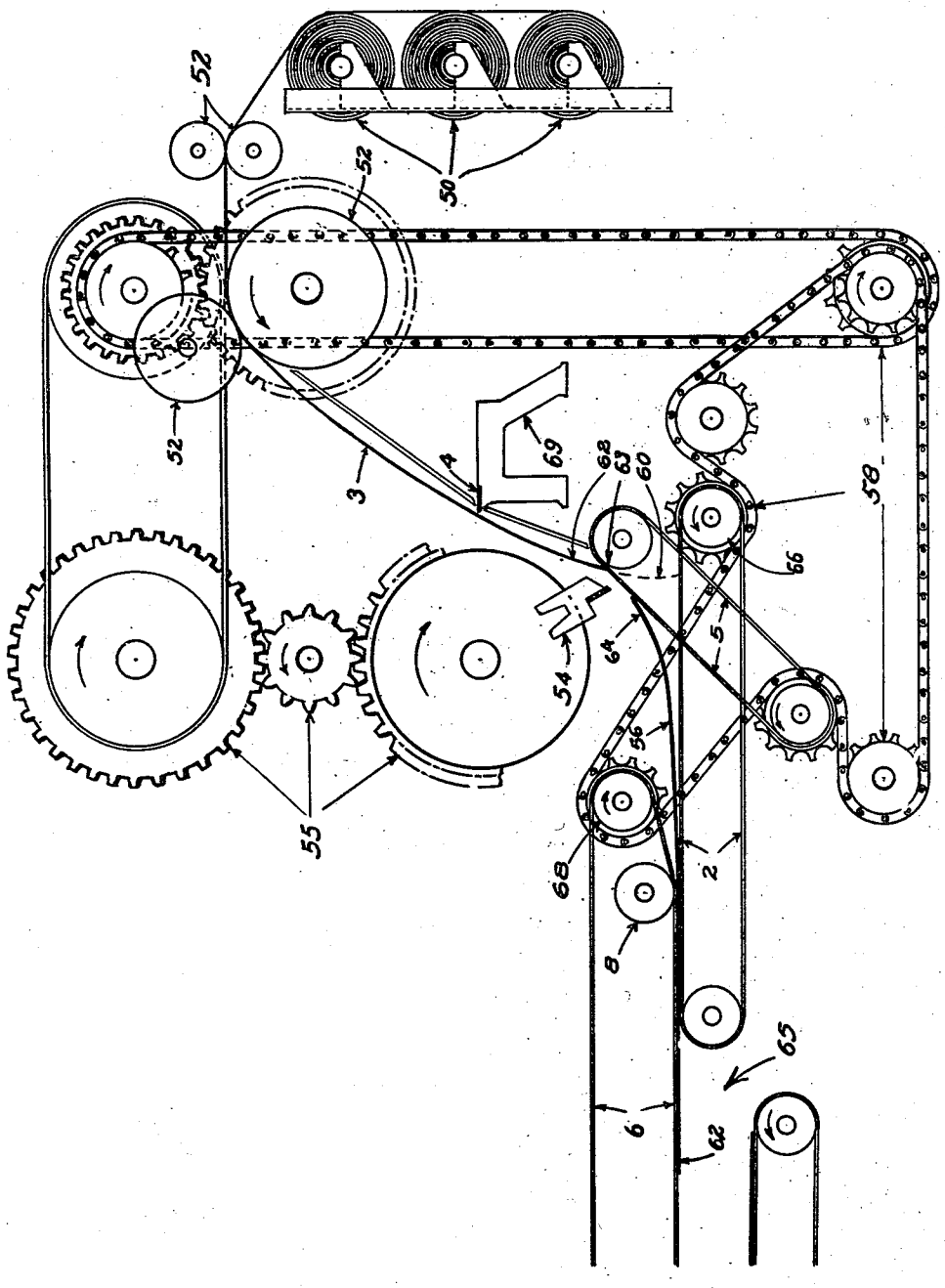
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SHEET-FEEDING METHOD AND MACHINE

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SHEET-FEEDING METHOD AND MACHINE

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The present invention relates to methods of and machines for feeding 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.

An object of the invention is to provide a new and improved method and machine of the above-described character. Other objects will be described hereinafter and will be particularly pointed out in the appended claims.

In machines of the above-described character, it is necessary to control carefully the feed of each on-coming sheet between the time that it leaves the cutter and the time that it reaches the conveyor tapes, else the conveyor tapes will not receive the sheets properly, so as to feed them smoothly into the lay-boy. Once a proper path of travel has been determined for the head of a particular sheet, the heads of the following sheets should also be made to follow that path. This is particularly difficult in the case of overlapping deliveries, in which the sheets are fed by the conveyor tapes to the lay-boy in lapped relation; for the tail of each sheet must be gotten out of the way before the head of the next following sheet arrives at the conveyor tapes.

In one type of machine of this character, the sheets, after they are cut from the paper web, travel, by their own momentum, at an incline, downward from the cutter, on to conveyor tapes that are more or less horizontally disposed below the cutter. Owing to the fact that the web has been unwound from a roll in which it has acquired a curly set, and also for other reasons, such as air currents, the sheets travel downward from the cutter, on to the conveyor tapes, in slightly curved or bowed form. As the bow or curve is usually with the concavity downward, the head of the sheet has a tendency to buckle under at the time that it engages the conveyor belts, but it may also buckle over. If either of these contingencies should happen, the sheets will become jumbled up into a hopeless mass on the conveyor tapes long before reaching the lay-boy.

One of the proposals made to overcome this difficulty has been to position the cutter but very little above the conveyor tapes; as there is not very much vertical space between the cutter and the conveyor, there is not very much opportunity for the head of the sheet becoming buckled between the time that it leaves the cutter and the time of striking the conveyor tapes. This proposal, however, has served merely to introduce many unsolved cutting problems.

Other proposals have involved mechanisms for positively preventing the before-described bowing or curling of the head of the sheet during its travel between the cutter and the conveyor tapes. One of these was to introduce inclinedly disposed or curved stationary or movable members in the path of travel of the sheets between the cutter and the conveyor tapes. These serve to engage the head of each sheet, immediately after leaving the cutter, thus resisting the tendency of the heads of the sheets to bend, and thereby tending to keep the sheets more or less straight. One such proposal for preventing bowing or curling of the head of the sheet has been the use of a short line of inclinedly disposed tapes. This proposal has not heretofore, however, been successful. In order to assure the straightening out of the heads of the sheets, the inclinedly disposed tapes have been run at an excessively high speed, a speed considerably higher than the speed of the conveyor tapes. Because of such high speed, there was no difficulty in straightening out the head of the sheet; but a new difficulty was introduced in that the slower-moving conveyor tapes could not carry the tails of the sheets fast enough away from the faster-moving inclinedly disposed tapes, with the result that the latter caused the tail of each sheet to become curled up. This curved tail stood right in the way of the head of the next-following sheet at the overlapping point, resulting in as bad a jumbled mass of sheets as occurred without the aid of the inclinedly disposed tapes. Up to the present time, therefore, the use of inclinedly disposed tapes, for this and other reasons, has not met with favor.

An object of the invention is to improve upon methods and machines of the above-described character.

Other and further objects will be explained hereinafter and will be particularly pointed out in the appended claims.

With these ends in view, according to a feature of the present invention, the inclinedly disposed tapes are operated at approximately the same speed as the speed of the conveyor tapes. The advantages of straightening out the heads of the sheets are thus retained without introducing any curling of the tails of the sheets.

In the single figure of the drawing, the invention is illustrated as embodied, in preferred form, in a conventional sheet-converting unit,

the cutting unit being illustrated as of the rotary type.

A web 3 is illustrated as led from a roll or rolls 50 of paper or similar material 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 a roll 66. 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, mounted under a roll 8 and around a roll 68, to feed the sheets further, ultimately into a lay-boy (not shown). The tapes 2 and 6 are actuated by mechanism 58, acting upon the rolls 66 and 68, desirably at a speed approximately ten per cent faster than the speed of the web 3, as determined by the feed rolls 52. The mechanism 58 may be in the form of a link chain engaging sprocket wheels upon the shafts that it turns. 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 62 of the oncoming sheets.

For the reasons before given, the sheets 56, as they travel from the cutters 4 and 54 to the tapes 2, become endowed with a tendency to curliness that would cause them to travel in the manner indicated by the dotted curved line 60. The head end 62 of each sheet 56 would thus have a tendency to strike the tapes 2 substantially vertically, about at right angles to the tapes 2, as shown by the dotted curved line 60, or even slightly turned over or under.

The concavity of the curve 60 is not always compensated for by the slightly higher speed of the belts 2 with respect to the feed rolls 52. The head end 62 of the web 3, therefore, instead of traveling smoothly on to the tapes 2, may, sooner or later, become folded down upon the belts 2 by cooperating tapes or belts 6. Further smooth feeding of the sheets into the lay-boy (not shown) becomes then impossible, because of their mussed-up condition. It becomes necessary to stop the machine and lose time in starting afresh, besides involving high loss of paper sheets as waste.

According to a feature of the present invention, the head 62 of the web is caused, instead, to strike against or engage, at 63, a line of sloping or inclinedly disposed tapes 5, positioned between the bed knife 4 and the tapes 2, in the path of feeding movement of the head 62 of the web (or the sheets 56, if previously cut). As shown, the engagement at 63 takes place prior to the cutting action, but the operation would be the same if the head 62 of the sheet were to engage the tapes 5 after the web had been severed to form a sheet. The phrase "a unit of sheet material," or its equivalent, therefore, will be employed to designate either a web or a sheet or a plurality of superposed webs or sheets. The direction of incline of the tapes 5 is such that the head end 62 of a web 3 may strike the tapes 5, at 63, at a much smaller angle than it would strike the tapes 2, as indicated by the dotted line 60, an angle such that the web is gradually straightened out or uncurved thereby, and thus caused to reach the tapes 2 smoothly. The tapes 5 thus constitute a suitable transfer conveyor for feeding the sheets from the knives 4 and 54 to the tape conveyor 2 during the uncurving. In this manner, the approximate right angle between the dotted-line curve 60 and the tapes 2 becomes broken up, becoming converted into an acute angle on the conveyor tapes 5. The tapes 5 then lead the sheets smoothly to the conveyor tapes 2 and 6.

When the tail 64 of a sheet 56 reaches the tapes 5, it does not become curled, or whipped under, or over, the body of the sheet, as has been the case with the before-described high-speed sloping tapes heretofore proposed. The head 62 of the next-following sheet 56, or of the web 3, before the next-following sheet is cut, is thus enabled to travel over the tail 64 of the previous sheet, at the overlapping point 65, at the left of the tapes 2, smoothly, and without causing any jumbling of the sheets. In the case of "tandem" machines, where overlapping does not take place, a corresponding advantage is obtained in that the finished pile of sheets in the lay-boy (not shown) is free from sheets having their tails 64 folded under.

Since the tapes 2, as before stated, travel approximately ten per cent faster than the speed of the web 3, it would serve no useful purpose to drive the inclined tapes 5 at a speed much less than the speed of the tapes 2, as there would not then be a very great improvement over a stationary inclined board. The tapes 5 are therefore shown actuated by the mechanism 58 at approximately the same speed as the speed of the tapes 2. To drive the tapes 5 at a speed greatly higher than the speed of the tapes 2, as before stated, is objectionable. It is permissible, however, to drive the tapes 5 at a speed slightly higher, or even slightly lower, than the tapes 2 but, of course, higher than the speed of the web 3. Such speeds will be included in the specification and the claims within the expression "approximately the same speed as the speed of the tapes 2," or its equivalent.

The action of the tapes 5 is particularly advantageous when used with a cylindrical rotary knife 54, more especially when the knife is provided with shields, as disclosed in Letters Patent 1,882,403, to Charles B. Maxson, issued October 11, 1932, as a very good lead is thereby obtained. Quite satisfactory results, however, have been obtained irrespective of the type of knife employed, under all conditions of speed, stock, etc., heretofore tested. In some cases, it is desirable to raise the whole cutter unit 69 that carries the cutter 4 slightly, with respect to the position formerly occupied in the machine, to provide sufficient space for the tapes 5.

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 a unit of sheet material the head of which is slightly curved, engaging and simultaneously moving the head of the unit to uncurve it, feeding the unit further while uncurving it, and thereafter feeding the unit further at ap-

proximately the same speed as the speed of feed of the unit during the uncurving.

2. A method of the character described comprising feeding at a downward incline from one level toward another level a unit of sheet material the head of which is slightly curved, engaging and simultaneously moving the head of the unit while fed at the downward incline to uncurve it, feeding the unit further while uncurving it, and thereafter feeding the unit further near the lower level at approximately at the same speed as the speed of feed of the unit during the uncurving.

3. A method of the character described comprising feeding to a conveyor a unit of sheet material the head of which is slightly curved, and engaging and simultaneously moving the head of the unit prior to its reaching the conveyor to uncurve it and, while uncurving it, feeding it to the conveyor at approximately the same speed as the speed of the conveyor.

4. A machine of the character described having, in combination, means for feeding units of sheet material, means for engaging the head of each unit fed by the feeding means and thereupon feeding the said unit further, means inclinedly disposed between the two first-named means for engaging the head of each unit prior to its engagement by the second-named means, and means for actuating the inclinedly disposed means in the direction of incline toward the second-named means at approximately the same speed as the speed of operation of the second-named means.

5. A machine of the character described having, in combination, means for feeding units of sheet material, a conveyor disposed below the feeding means for engaging the head of each unit fed by the feeding means and thereupon feeding the said unit further, a conveyor inclinedly disposed between the feeding means and the first-named conveyor for engaging the head of each unit prior to its engagement by the first-named conveyor, and means for actuating the second-named conveyor in the direction of incline toward the first-named conveyor at approximately the same speed as the speed of operation of the first-named conveyor.

6. A machine of the character described having, in combination, means for feeding units of sheet material, a tape conveyor disposed below the feeding means for engaging the head of each unit fed by the feeding means and thereupon feeding the said unit further, a tape conveyor inclinedly disposed between the feeding means and the first-named conveyor for engaging the head of each unit prior to its engagement by the first-named conveyor, and means for actuating the second-named conveyor in the direction of incline toward the first-named conveyor at approximately the same speed as the speed of operation of the first-named conveyor.

7. A machine of the character described having, in combination, a cutter for cutting sheet material into units, means for engaging the head of each unit and thereupon feeding the unit away from the cutter, means inclinedly disposed between the cutter and the feeding means for engaging the head of each unit prior to its engagement by the feeding means, and means for actuating the inclinedly disposed means in the direction of incline toward the feeding means at approximately the same speed as the speed of operation of the feeding means.

8. A machine of the character described having, in combination, a cutter for cutting sheet material into units, means for feeding the sheet material at a downward incline to the cutter, means for engaging the head of each unit and thereupon feeding the unit away from the cutter, means inclinedly disposed in the path of feeding movement of the unit between the cutter and the second-named feeding means for engaging the head of each unit prior to its engagement by the second-named feeding means, and means for actuating the inclinedly disposed means in the direction of incline toward the second-named feeding means at approximately the same speed as the speed of operation of the second-named feeding means.

9. A machine of the character described having, in combination, a cutter for cutting sheet material into units, a conveyor disposed below the cutter for engaging the head of each unit and thereupon feeding the said unit away from the cutter, a conveyor inclinedly disposed between the cutter and the first-named conveyor for engaging the head of each unit prior to its engagement by the first-named conveyor, and means for actuating the second-named conveyor in the direction of incline toward the first-named conveyor at approximately the same speed as the speed of operation of the first-named conveyor.

10. A machine of the character described having, in combination, a cutter for cutting sheet material into units, a tape conveyor disposed below the cutter for engaging the head of each unit and thereupon feeding the said unit away from the cutter, a tape conveyor inclinedly disposed between the cutter and the first-named conveyor for engaging the head of each unit prior to its engagement by the first-named conveyor, and means for actuating the second-named conveyor in the direction of incline toward the first-named conveyor at approximately the same speed as the speed of operation of the first-named conveyor.

11. A method of the character described comprising unwinding material from a roll or rolls, whereby the unwound material becomes slightly curved, cutting the unwound material into units, feeding the units with their heads slightly curved, engaging and simultaneously moving the head of each unit to uncurve it, feeding the unit further while uncurving it, and thereafter feeding the unit further at approximately the same speed as the speed of feed of the unit during the uncurving.

12. A method of the character described comprising unwinding material from a roll or rolls, whereby the unwound material becomes slightly curved, cutting the unwound material into units, feeding the units with their heads slightly curved at a downward incline from one level toward another level, engaging and simultaneously moving the head of each unit while fed at the downward incline to uncurve it, feeding the unit further while uncurving it, and thereafter feeding the unit further near the lower level at approximately the same speed as the speed of feed of the unit during the uncurving.

13. A method of the character described comprising unwinding material from a roll or rolls, whereby the unwound material becomes slightly curved, cutting the unwound material into units, feeding the units with their heads slightly curved to a conveyor, and engaging and simultaneously moving the head of each unit prior to its reaching the conveyor to uncurve it and, while uncurving

it, feeding it to the conveyor at approximately the same speed as the speed of the conveyor.

14. A machine of the character described having, in combination, a cutter for cutting sheet material into units, means for unwinding the material to be cut into units from a roll or rolls and for leading the material so unwound to the cutter, whereby the unwound material becomes led to and past the cutter slightly curved, means for engaging the head of each unit to uncurve it and thereupon feeding the unit further away from the cutter while uncurving it, and means for thereafter feeding the unit further at approximately the same speed as the speed of feed of the unit during the uncurving.

15. In a machine of the character described in which sheet material is unwound from a roll or rolls and led to a cutter to be cut into units that are slightly curved, means for engaging the head of each unit to uncurve it and for feeding the unit further while uncurving it, and means for thereafter feeding the unit further at approximately the same speed as the speed of feed of the unit during the uncurving.

16. A machine of the character described having, in combination, means for feeding at a downward incline from one level toward another level a unit of sheet material the head of which is slightly curved, means for engaging the head of each unit while fed at the downward incline to uncurve it and for feeding the unit further while uncurving it, and means for thereafter feeding the unit further near the lower level at approximately the same speed as the speed of feed of the unit during the uncurving.

17. A machine of the character described having, in combination, means for feeding units of sheet material the heads of which are slightly curved, means for engaging the head of each unit fed by the feeding means to uncurve it and for thereupon feeding the said unit further while uncurving it, and means for thereafter feeding the said unit further at approximately the same speed as the speed of feed of the unit during the uncurving.

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