Oct. 11, 1932. C. B. MAXSON 1,882,403

METHOD OF AND MACHINE FOR CUTTING, FEEDING, AND STACKING SHEET MATERIAL

Filed May 27, 1930

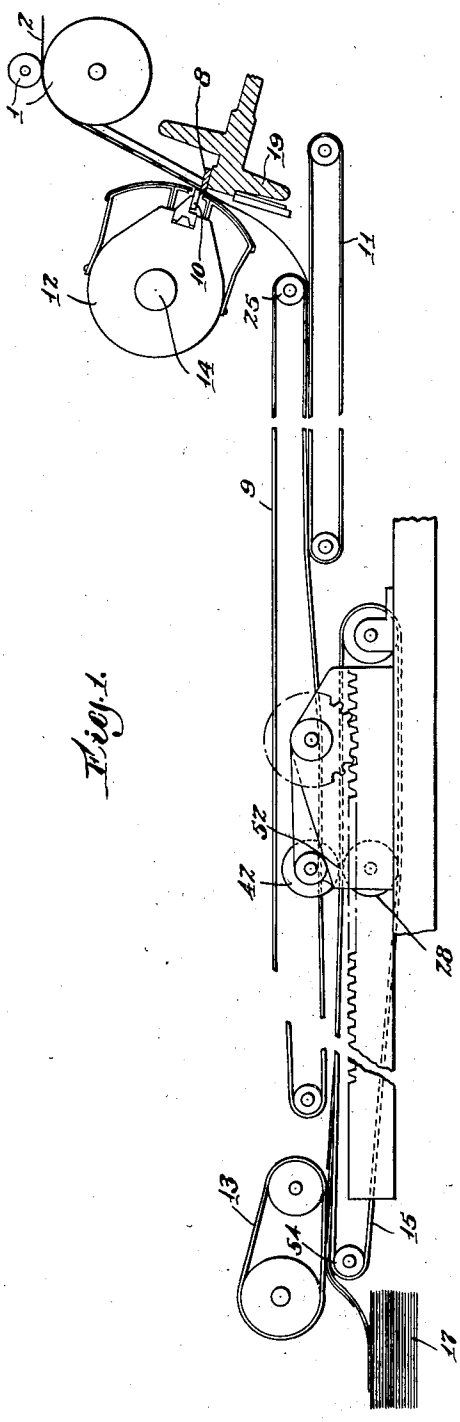


Fig. 1.

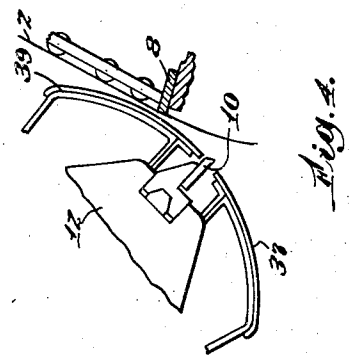


Fig. 4.

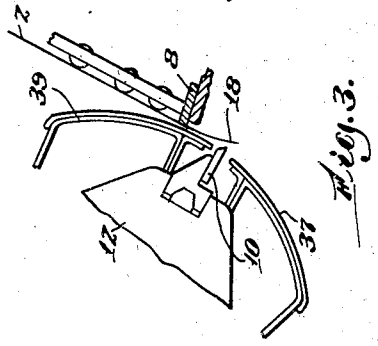


Fig. 3.

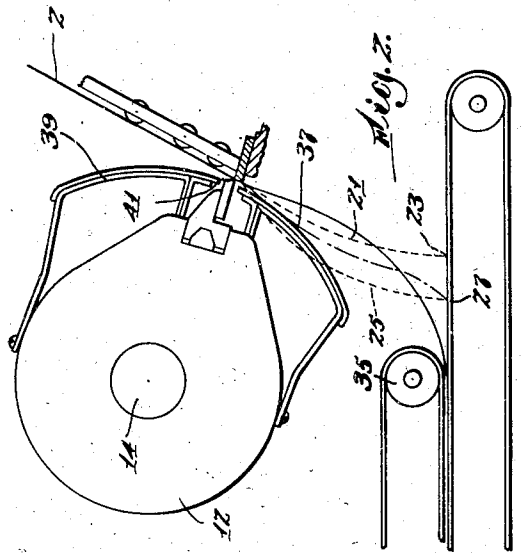


Fig. 2.

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UNITED STATES PATENT OFFICE

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METHOD OF AND MACHINE FOR CUTTING, FEEDING, AND STACKING SHEET MATERIAL

Application filed May 27, 1930. Serial No. 456,189.

The present invention relates to cutting, feeding and stacking methods and machines, and more particularly to methods of and machines for cutting, feeding and stacking sheet material.

A machine of a type in use today for cutting web material, like paper, into sheets, comprises a stationary knife with which cooperates a movable knife mounted upon a rotary drum. The web is fed from above and to one side of the knives at a downward incline, into the space between the stationary knife and the drum and toward the under side of the drum, and is cut once corresponding to every revolution of the drum. The sheet thus produced passes by its own momentum to downwardly inclined tapes which feed it forward to substantially horizontally disposed tapes. These latter feed the sheets formed singly to other, slower-speed, tapes, which, because of such slower speed, cause the sheets to become overlapped. In such overlapped condition, the sheets enter a lay-boy, where they become stacked.

The said downwardly inclined tapes have heretofore been regarded as essential to the carrying out of this process, as affording a suitable transfer medium for the sheets from the knives to the horizontally disposed tapes. The reasons for the necessity of this transfer medium will appear hereinafter. As the speed of operation of these machines has been further and further increased, however, it became necessary to build the knives, and more particularly the stationary knife, of more and more rugged character, and to support it more solidly near the point of cutting action, with the result that, ultimately, the knife-supporting mechanism took up the space that had previously been occupied by the downwardly inclined tapes.

It is, therefore, an object of the present invention to improve upon present-day methods and machines of the above-described character, to the end that they may be speeded up without destroying or even decreasing their efficiency but, on the contrary, increasing it. Other and further objects will be explained hereinafter and will be particularly pointed out in the appended claims.

With these ends in view, the invention resides in the improved method and machine a preferred embodiment of which is hereinafter described, illustrated in the accompanying drawing, and defined in the appended claims.

The invention will now be more fully explained in connection with the accompanying drawing, in which Fig. 1 is a diagrammatic view of a preferred machine embodying the present invention; and Figs. 2, 3 and 4 are similar views, upon a larger scale, of a portion of the machine, illustrating its operation.

A web of paper 2 is adapted to be fed by any suitable feed mechanism, such as the feed rolls 1, to a stationary knife 8 with which cooperates a movable knife 10 mounted upon a drum 12 that is disposed to one side of the rotary knife 8 and that rotates about an axis 14. The rotary knife 10 thus moves toward the stationary knife in a forward direction. Corresponding to each revolution of the drum 12, a sheet of paper, that is fed between the knives from a point to the other side of the stationary knife 8 in a direction towards the under side of the drum 12, will be cut by the knives.

After the sheets have been successively cut by the cutters 8 and 10, their forward ends or heads are fed, by reason of their downward-incline direction of progress, toward a substantially horizontally disposed series of tapes 11 that, with the corresponding cooperating horizontally disposed series of tapes 9, are intended to feed the sheets further. The speed of operation of the tapes 9 and 11 is so relatively high that, if the sheets were permitted to enter a magazine or lay-boy 17 directly, they would buckle and fly about therein in a manner that would make stacking impossible. The tapes 9 on one side of the sheets and the tapes 11 on the other side restrain the sheets from buckling while traveling at this high speed, but in the lay-boy 17, there is no such restraining influence.

To reduce the speed of the sheets before they are permitted to enter the lay-boy, the high-speed tapes 9 and 11 feed them succes-

sively to intermediately positioned, relatively low-speed tapes 15 which receive the sheets and feed them into the magazine at low speed. These tapes 15 are overlapped by the high-speed tapes 9, as shown, so that the sheets are received from the high-speed tapes at 52 between the high-speed tapes 9 and the low-speed tapes 15. The heads of the sheets are gripped or pressed at 52 between idler rolls 28 and 42, upon opposite sides of the tapes 15, and their speed of advance is thereafter slowed down. The roll 28 is frictionally driven by the low-speed tapes 15, and the rolls 42 are frictionally driven by contact with the roll 28. The heads of the sheets are thus effectively gripped at 52 between the tapes 15 and the rolls 42. As the tapes 9 and 15 are separated, as shown, the sheets are fed forward, unconfined by the tapes 9 on both sides of the point 52.

The head of the sheet, as it is delivered from between the high-speed tapes 9 and 11, will lap over the tail of the prior-fed sheet. As the former sheet continues to travel at higher speed than the latter, it will become superposed thereover, in overlapping relation thereto, but at a distance behind the value of which is dependent upon the relative speeds of the high-speed and the low-speed tapes. In similar fashion, a third sheet will become superposed over the second sheet, a fourth over the third, and so on. While the high-speed tapes feed the sheets singly, therefore, the low-speed tapes feed a plurality of sheets in successively lapped relation, one behind the other, in which fashion they arrive into the magazine or layboy 17.

Short, low-speed tapes 13 press the overlapped sheets against the ends of the tapes 15, near the point 54, prior to the entry of the sheets into the magazine.

In this manner, the sheets may be advanced to, and stacked evenly in, the layboy 17, at low speed, without buckling or curling or other defects incident to high speed, though the sheets are in reality advanced singly by the high-speed tapes at quite a high speed.

Heretofore, inclined tapes (not shown) have been utilized to receive the sheets from the cutters 8 and 10 and transfer them to the tapes 9 and 11. Owing to the high speed at which the machine operates, however, it is necessary to support the cutter 8 with a supporting frame member 19 disposed substantially directly below the cutting edge of the knife 8, and this makes the use of the inclined tapes (not shown) impracticable.

As the sheet leaves the cutters 8 and 10, therefore, its head has a tendency to become bowed out, as shown in dotted lines at 21, Fig. 2. In this condition, it would strike the tapes 9 at 23. As the tapes 11 advance, the bowed-out head of the sheet would assume the dotted-line position 25, Fig. 2, the point 23 having meanwhile advanced to the point 27. The speeds of travel of the head of the sheet and of the tapes 11 are sufficiently nearly the same, so that the bowed-out condition of the head of the sheet would remain substantially unchanged. When the sheet reaches and is struck by the pulley 35 of the tapes 9, therefore, it will become bowled over backward and will not enter between the tapes 9 and 11.

If the tapes 9 and 11 could be speeded up, this bend would readily become eliminated, but any such additional speeding up would introduce complications, and would, besides, destroy the relation between the overlapping speed and the speed of the tapes 9 and 11. The sheets, as delivered by the tapes 9 and 11 to the slow-speed tapes 15, would be too far apart, and if the speed of the low-speed tapes were changed to correspond, the degree of overlap would be too great.

According to the present invention, therefore, a shield 37 is provided for engaging the bowed-out sheet and positively bending the bow out of it, as illustrated in full lines in Fig. 2. An intermediate position is illustrated in dot-and-dash lines. Indeed, the bow is put into the sheet in the opposite direction, and the entry of the sheet between the tapes 9 and 11 is thus assured.

The shield 37 is shown substantially cylindrical in form and having the same axis as the axis 14 of the drum 12, the radius of the cylinder being substantially equal to the distance of the cutting edge of the knife 10 from the axis 14. In practice, there may be as much as ¼ inch difference between them. The distance should be as small as possible without jamming the sheets.

The shield 37 performs this described function when the sheet travels toward the tapes 11 at a speed as great as, or a little greater than, the speed of rotation of the knife 10. When the drum travels faster than the sheet, however, another and similar shield 39 may be employed to fulfill this function. By having the two shields 37 and 39, one on each side of the knife 10, therefore, the sheet will become unbowed irrespective of its speed relation to the speed of rotation of the drum.

In order to produce long sheets, it is necessary to feed the web at high speed. It is obvious, however, that the speed of the web must not be materially greater than the peripheral speed of the rotating knife. The provision of the support 19, among other things, has made it possible to speed up the knife 10. If the cutter 10 is operated at very high speed, and if the web is fed at a comparably high speed, there is a tendency for the cut end 18 of the web to lag behind the knife 10, as shown and described in Letters Patent No. 1,800,867, granted April 14, 1931, par-

ticularly, Fig. 3, and thus become deflected upward. This is because the speed of the said end 18 of the sheet in the direction of travel of the sheet is greater than the right-line component of the speed of the knife 10 in the same direction, even though their absolute speeds be the same. The result is that the knife 10, blocking the travel of the said end 18 of the sheet, causes the said end 18 to catch on the knife 10, and accumulate in loop form in back of the knife 10. The principle of the operation applies also to low speeds.

The end 41 of the shield 39 plays somewhat the same role as the projection 22 of the said application. Like the said projection 22, it is mounted, in spaced relation and in close proximity to the knife 10, at a point directly rearward of the knife 10 in the direction of rotation of the knife for engaging the cut end 18 of the sheet as soon as it is cut and deflecting the said cut end 18 of the sheet during the rotation of the rotary knife forward of the rotary knife and toward the underside of the drum, under the rotary knife. As the drum 12 rotates, the end 41 of the shield 39 rotates therewith and prevents the said end 18 of the web from buckling up.

Modifications will readily suggest themselves to persons skilled in the art, and all such are considered to fall within the present invention, as defined in the appended claims.

What is claimed is:

1. A sheet-feeding machine having, in combination, means for feeding sheet material in such manner as to produce a bow in the sheet, with the convex side of the bow facing in the direction of feed, and means for bending the bow out of the sheet.

2. A machine for cutting and feeding sheet material having, in combination, a stationary knife, a cooperating movable knife, substantially horizontally disposed tapes, means for feeding the sheet material at a downward incline between the knives and towards the tapes, whereby the material becomes cut by the knives into sheets and the forward portion of each sheet becomes bowed out with the convex side of the bow facing in the direction of feed, and means for bending the bow out of each sheet in preparation for the feeding of the sheet by the tapes.

3. A machine for cutting and feeding sheet material having, in combination, a stationary knife, a cooperating movable knife, means substantially directly under the cutting edge of the stationary knife for supporting the stationary knife, substantially horizontally disposed tapes, means for feeding the sheet material at a downward incline between the knives and toward the tapes, whereby the material becomes cut by the knives into sheets and the forward portion of each sheet becomes bowed out with the convex side of the bow facing in the direction of feed, and means for bending the bow out of each sheet in preparation for the feeding of the sheet by the tapes.

4. A machine for cutting and feeding sheet material having, in combination, a stationary knife, a cooperating movable knife, substantially horizontally disposed tapes, means for feeding the sheet material at a downward incline between the knives and towards the tapes, whereby the material becomes cut by the knives into sheets and the forward portion of each sheet becomes bowed out with the convex side of the bow facing in the direction of feed, a shield for bending the bow out of each sheet, and means for thereafter causing the tapes to feed the sheets.

5. A machine for cutting and feeding sheet material having, in combination, a stationary knife, a rotary drum disposed to one side of the stationary knife and having a cooperating knife that moves toward the stationary knife in a forward direction, substantially horizontally disposed tapes, means for feeding the sheet material at a downward incline between the knives from a point to the other side of the stationary knife in a direction toward the underside of the drum and towards the tapes, whereby the material becomes cut by the knives into sheets and the forward portion of each sheet becomes bowed out with the convex side of the bow facing in the direction of feed, two substantially circular shields for bending the bow out of each sheet, the shields being substantially coaxial with the drum and their radii being substantially equal to the distance of the cutting edge of the rotary knife from the axis of the drum, the shields being disposed one on each side of and adjacent to the rotary knife, and means for causing the tapes to feed the sheets.

In testimony whereof, I have hereunto subscribed my name.

CHARLES B. MAXSON.