July 14, 1925. 1,545,911

C. B. MAXSON

FEEDING AND STACKING METHOD AND MACHINE

Filed March 28, 1924

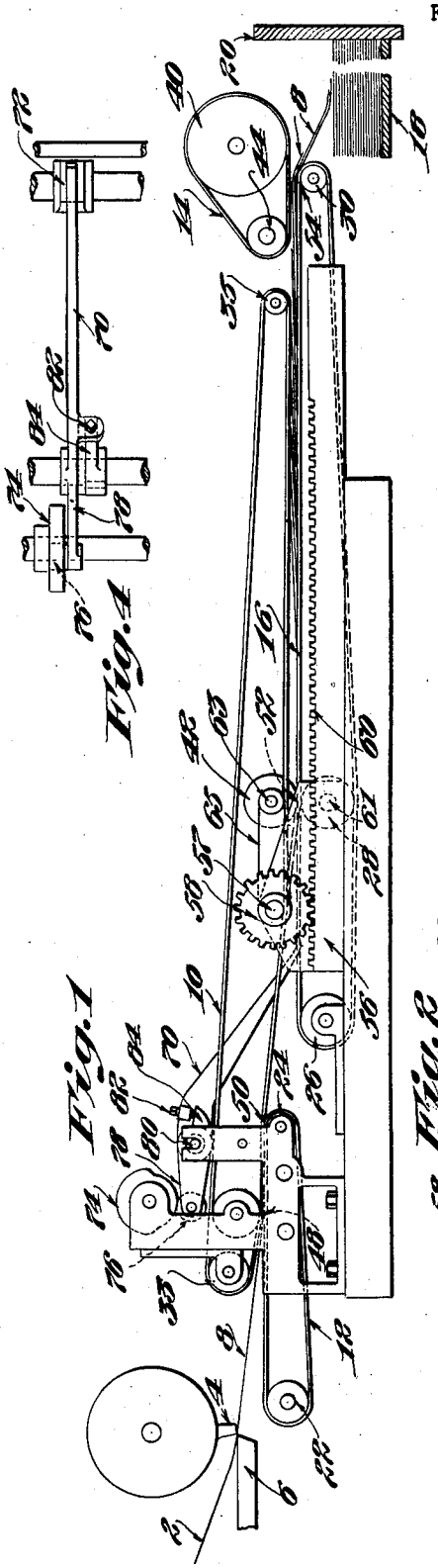


Fig. 1

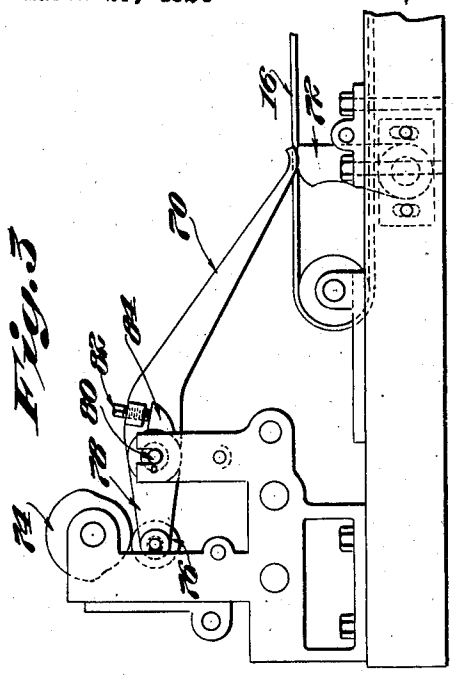


Fig. 3

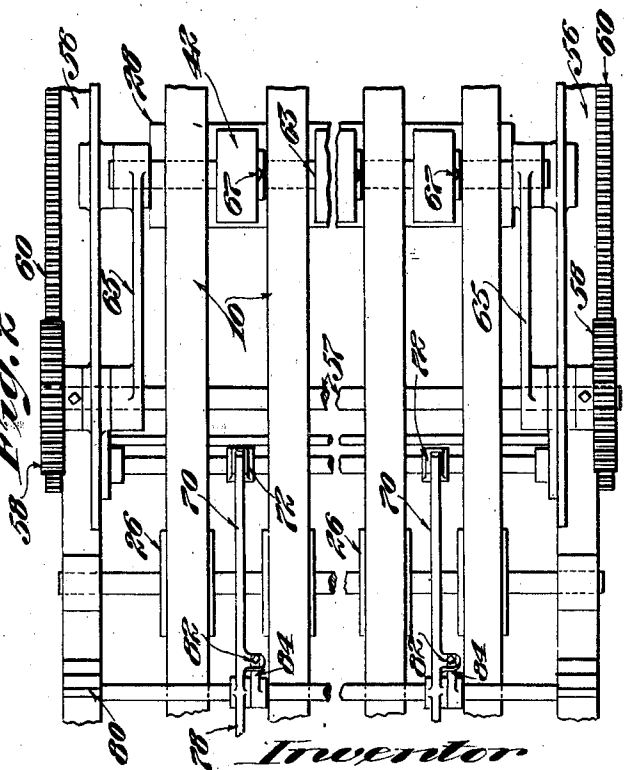


Fig. 2

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# UNITED STATES PATENT OFFICE.

CHARLES B. MAXSON, OF WESTERLY, RHODE ISLAND.

## FEEDING AND STACKING METHOD AND MACHINE.

Application filed March 28, 1924. Serial No. 702,699.

*To all whom it may concern:*

Be it known that I, CHARLES BENJAMIN MAXSON, a citizen of the United States, and a resident of Westerly, in the county of Washington and State of Rhode Island, have invented a new and useful Improvement in Feeding and Stacking Methods and Machines, of which the following is a specification.

This invention relates to feeding and stacking methods and machines, and more particularly to methods of and machines for feeding and stacking sheet material, like paper.

According to the invention disclosed in a copending application, Serial No. 540,085, filed March 1, 1922, sheets of material are fed singly or in small unit bundles successively past a predetermined point at a speed so high that, if they were fed at the said speed into a magazine, they would buckle and fly about therein; and they are fed past a second predetermined point at relatively low speed, whereby the single sheets or the bundles become overlapped and are fed at the said low speed, in overlapped relation, into a magazine, where they become easily stacked.

When it is desired to operate upon sheets of varying length, however, difficulty may be encountered, due to the sheets becoming spaced apart at varying intervals. A short sheet, for example, may be fed forward so far ahead of the next-following sheet as to cause the latter to strike the former instead of becoming lapped over it. Once this happens, the sheets that follow become crumpled into a hopeless jumble, necessitating stopping the machine, and starting afresh. Similar mishaps occasionally occur even when sheets of equal length are operated upon, for the tail of a prior fed sheet will sometimes curl up into the path of travel of the head of the next following sheet.

It is therefore among the objects of the present invention positively to move the tail of each sheet out of the path of travel of the next-following sheet, and to hold each sheet against further feed movement until after the next-following sheet has become lapped thereover. With these and other objects in view, the invention consists of the method and machine hereinafter described, illustrated in the accompanying drawings, and defined in the appended claims.

The invention will be better understood when studied in connection with the accompanying drawings, in which Fig. 1 is a diagrammatic view of a preferred machine embodying the present invention; Fig. 2 is a plan view of a part of the same, enlarged as compared to Fig. 1; Fig. 3 is a similarly enlarged elevation of a portion of the machine; and Fig. 4 is a fragmentary plan corresponding to Fig. 3.

As is described in the above-mentioned application, any suitable feed mechanism (not shown) may be employed to advance a web 2 of material, like paper, to a rotating cutter 4 which cooperates with a cutter block 6 to sever the paper into sheets 8 of predetermined length. A plurality of webs of material may be led to the feed mechanism in superposed relation from a plurality of rolls, or the roll or rolls and the cutter may be dispensed with and previously cut sheets operated upon directly, as described below. The forward ends or heads of the sheets are successively gripped by and fed between relatively high-speed tapes 10 on one side and 12 on the other. It will be understood that the term "tape" is employed in the specification and the claims in a generic sense, and includes within its scope other feeding mechanisms, like belts, cylinders, aprons and the like. The high-speed tapes are driven at a speed somewhat higher than that of the feed mechanism (not shown) and therefore at a speed higher than that at which the sheets are delivered to the tapes. The head of each sheet is consequently gripped by the tapes 10 and 12 and the sheet is pulled taut and away from the next succeeding sheet, leaving a gap (not shown) between each two successive sheets. In the interest of economy of time, the speed of the high-speed tapes is so high that if the sheets were permitted to enter a magazine or layboy 18 directly, they would buckle and fly about therein in a manner that would make stacking impossible. The tapes 10 on one side of the sheets and the tapes 12 on the other side restrain the sheets from buckling while traveling at this high speed, but in the magazine, there is no such restraining influence.

To reduce the speed of the sheets before they are permitted to enter the magazine, the high-speed tapes 10 and 12 feed them successively to intermediately positioned, relatively low-speed tapes 16 which receive the sheets and feed them into the

magazine at low speed. These tapes 16 are overlapped by the high-speed tapes 10, as shown, so that the sheets are received from the high-speed tapes at 52 between the high-speed tapes 10 and the low-speed tapes 16. The heads of the sheets are gripped or pressed at 52 between idler rolls 28 and 42, upon opposite sides of the tapes 16, and their speed of advance is thereafter slowed down. The roll 28 is frictionally driven by the low-speed tapes 16, 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 16 and the rolls 42. As the tapes 10 and 16 are separated, as shown, the sheets are fed forward, unconfined by the tapes 10 on both sides of the point 52.

The head of the sheet, as it is delivered from between the high-speed tapes 10 and 12, hugs the tapes 10 for a short distance, usually five to eight inches. Were it not for this, the head of a sheet fed at high speed would be liable to engage the tail of the prior-fed sheet just after the latter had been slowed down by the action of the idler rolls 28 and 42, and, causing the sheets to crumple, clog the machine. Before the head of the sheet that is traveling at high speed can reach the sheet that is traveling at low speed, however, the tail of the latter, owing to the above-described hugging effect on the head of the next-following high-speed sheet, has been afforded time to move downward transversely to the direction of feed, from the high-speed tapes 12 to and upon the low-speed tapes 16, as will be evident from an inspection of Fig. 1. The head of the sheet that is traveling at high speed, therefore, by the time that it emerges from between the high-speed tapes 10 and 12, 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, as shown more particularly in Fig. 1, in which fashion they arrive into the magazine or lay-boy 18. There, a stop 20 acts successively upon the forward ends or heads of the sheets to limit their further movement, so that the sheets become stacked or piled in the magazine evenly.

In this manner, the sheets may be advanced to, and stacked evenly in, the magazine, 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. The high-speed advance, for example, may be as high as 850 feet per minute or higher, while the speed of advance of any single sheet in the magazine itself may be as low as 75 feet per minute. The high speed, indeed, need be limited only by the speed at which the cutter 4 will operate safely. The significance of this will become apparent when it is reflected that the average speed employed with present-day methods,—which speed, of course, is uniform throughout,—is in the neighborhood of only 150 feet per minute.

The high-speed tapes 12 are mounted over actuating rolls therefor 22 and 24 that are driven from any suitable source of power. The roll 22 may be driven by a chain gear and the roll 24 may be geared thereto. The low-speed tapes 16 are mounted over rolls 26 and 30 and also over the idler roll 28. The roll 26 is driven from a belt (not shown). The high-speed tapes 10 are mounted over rolls 33 and 35 and also over an idler roll 36. The rolls 24 are raised somewhat above the plane between the tapes 10 and 16, the raised position of the rolls 24 aiding the above-described transverse movement of the tails of the sheets. A very simple machine is therefore provided for feeding sheets of material successively past a predetermined point at a speed so high as to make it impracticable to feed them at the said speed directly into the magazine, and for successively feeding the sheets at a relatively low speed past a second predetermined point into the magazine. The first-named predetermined point may, for example, be the point 48 at which the high-speed tapes 10 and 12 commence to feed, or the point 50 at which the high-speed tapes separate, or any intermediate point. For convenience, this point may be referred to as a high-speed point. The second predetermined point, which may be designated a low-speed point, may, for example, be the point 52 at which the rolls 28 and 42 grip the heads of the sheets as the latter are delivered from the high-speed tapes.

Short, low-speed tapes 14 press the overlapped sheets against the ends of the tapes 16, near the points 54, prior to the entry of the sheets into the lay-boy 18. These low-speed tapes 14 are mounted over rolls 40 and 44. The rolls 40 extend forward beyond the point 54, the better to guide the overlapped sheets into the lay-boy.

The tapes 16 slope upward from their receiving end, at the rolls 26, towards the plane of feed of the sheets as they are delivered from between the high-speed tapes, the rolls 30 being preferably at about the same level as the rolls 24. The head of the

sheet, as it is delivered upon the low-speed tapes, is thus directed upward, away from the prior-fed sheet, and this, for the moment, tends to prevent the sheet sticking to the prior-fed sheet, even though the head of the sheet strike the prior-fed sheet considerably to the left of the point 52, as viewed in Fig. 1. As the sheet slidingly advances over the prior-fed sheet, therefore, an air layer accumulates between the sheets. By the time that the head of the sheet reaches the point 52, when it comes to rest upon the prior-fed sheet, therefore, and the tail of the sheet has become released at the point 50, the accumulated layer of air between the sheets will prevent their sticking together too closely. The generation of objectionable static electricity is thus reduced to a minimum.

With the rolls in the position of Fig. 1, it is possible to operate upon many kinds of paper cut into sheets of a length approximately equal to the distance between the points 50 and 52, the tail of the sheet advancing beyond the point 50, and out of the influence of the high-speed tapes, just before the head becomes gripped at the point 52 between the rolls 28 and 42.

The roll 28 is mounted upon a shaft 61 journaled upon the support 56. It is of uniform width throughout. The rolls 42 are mounted at scattered points between the tapes 10 upon a shaft 63 that is carried upon a freely pivoted arm 65. The rolls 42 thus rest upon the roll 28 by their own weight and the weight of the arm 65. It is not necessary that the rolls 42 be provided between every two tapes 10. The positions of the rolls with respect to the various tapes, may be adjusted by means of set screws 67.

The lay-boy 18 is automatically successively lowered by degrees to maintain the top of the stack of sheets at substantially constant height, thereby permitting the overlapped sheets to enter the lay-boy without hindrance from sheets already there. The lowering mechanism is not illustrated or described herein because forming no part of the present invention.

As is also described in the above-designated application, the same apparatus may be adapted to operate upon sheets of different or varying length. To this end, the rolls 28 and 42 are mounted upon the support 56 that is longitudinally movable to adjust the relative positions of the points 50 and 52. The adjustment may be effected through the medium of two gear wheels 58 meshing with two rack gears 60 upon opposite sides of the frame of the machine. The gear wheels are fixed to the opposite ends of a shaft 57 that is journaled upon the support 56. The support may be locked in adjusted position in any desired manner, as by set screws. The point 52 may in this manner be moved closer to, or farther from, the point 50 to adapt the machine for operation upon shorter or longer sheets, as desired.

Once the machine is adjusted, of course, it will be used for feeding sheets of uniform length, corresponding to the adjustment. A short sheet, for example, will not be followed directly by a long sheet, or vice versa. It is not possible to effect a single adjustment that shall be applicable to sheets of all sizes. As the machine is adapted to feed both short and long sheets, therefore, and as the tapes are travelling at constant speed, each short sheet is naturally likely to be fed so far forward on the tapes 16 before the next following sheet is delivered by the high-speed tapes that the head of the said next following sheet may strike the tail of the prior-fed sheet and cause the sheets to become jumbled together and stop the further operation. One or more fingers 70 are therefore provided, according to the present invention, for engaging the tail of each sheet just after it has passed the high-speed point, and holding it against too far forward movement until after the next following sheet shall have been advanced sufficiently to ensure an overlapping relation of the sheets. The fingers 70 are constructed and arranged to fall by gravity towards upstanding lugs 72, between which and the fingers 70 the tails of the sheets are adapted to become successively imprisoned and held. Rotatable cams 74 are actuated in timed relation to the operation of the machine for lifting the fingers 70 by engaging rollers 76 that are mounted upon extensions 78 of the fingers 70. The cams 74 cause the fingers to pivot, in opposition to the force of gravity, about pivotal points 80. Adjustable stops 82, shown as screws, are adapted to engage fixed lugs 84 to govern the binding action of the fingers against the imprisoned sheets.

Not only do the fingers 70 hold each sheet against feeding movement for a limited time after it has passed the high-speed point, as described, to enable the next succeeding sheet to be fed into lapped relation thereto, but they also positively move the tail of each sheet down out of the path of travel of the head of the next following sheet, thereby further ensuring proper operation.

The same difficulties that are met with in present-day methods and machines when it is attempted to feed and stack single sheets at high speed are encountered when it is attempted to operate upon small bundles of sheets, particularly if the sheets be constituted of very light or thin paper, or paper that is not stiff from other causes. The present invention, obviously, is as applicable to the feeding and stacking of bundles of sheets as to single sheets. Although, for concreteness, therefore, the term

"sheet" is employed in the claims, it is to be understood that the term is intended to embrace within its scope not only a single sheet, but a unit which may be constituted of a single sheet or of a bundle of sheets.

What is claimed as new is:

1. A method of feeding material that comprises feeding the material at a predetermined speed past a predetermined point, engaging a rear portion of the material to hold the material against feeding movement after the said rear portion has passed the point, and then feeding the material at a different speed past a second predetermined point.

2. A method of feeding sheet material that comprises feeding a plurality of sheets at a predetermined speed successively past a predetermined point, engaging the tail of each sheet to hold each sheet against feeding movement after the said tail has passed the point, and feeding the sheets at a second predetermined speed past a second predetermined point.

3. A method of feeding sheet material that comprises feeding a plurality of sheets at relatively high speed successively past a high-speed point, holding each sheet against feeding movement after it has passed the point, and continuously feeding the sheets at a relatively low speed past a low-speed point.

4. A method of feeding sheet material that comprises feeding a plurality of sheets at relatively high speed successively past a high-speed point, engaging each sheet to hold it against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, disengaging each sheet to release it prior to the feeding of the said next-succeeding sheet into lapped relation thereto, and feeding the sheets at relatively low speed past a low-speed point, whereby the sheets are fed past the low-speed point in lapped relation.

5. A method of feeding sheet material and stacking them in a lay-boy that comprises successively feeding a plurality of sheets past a high-speed point at a speed so high that they would have a tendency to buckle and fly about, restraining the sheets against said tendency while they are so fed, holding each sheet against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, successively feeding the sheets past a low-speed point, whereby the sheets are fed past the low-speed point in lapped relation, and feeding the sheets in lapped relation at the said low speed into the lay-boy.

6. A method of feeding sheet material that comprises feeding a plurality of sheets at relatively high speed successively past a high-speed point, engaging the tail of each sheet to move the said tail out of the path of travel of the next following sheet and to hold the said tail against feeding movement after the said tail has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, and feeding the sheets at relatively low speed past a low-speed point, whereby the sheets are fed past the low-speed point in lapped relation.

7. A method of feeding sheets of material into a lay-boy and stacking them therein that comprises feeding a plurality of sheets successively past a high-speed point at a speed so high that, if they were fed singly at the said speed into the lay-boy, they would buckle and fly about therein, engaging each sheet to hold it against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, disengaging each sheet to release it prior to the feeding of the said next-succeeding sheet into lapped relation thereto, and feeding the sheets past a low-speed point into the lay-boy at a speed low enough to permit their entering the lay-boy without buckling or flying about, whereby the sheets are fed past the low-speed point in lapped relation and become easily stacked in the lay-boy.

8. A machine of the class described having, in combination, means for feeding material at a predetermined speed past a predetermined point, means for engaging a rear portion of the material to hold the material against feeding movement after the said rear portion has passed the point, and means for thereupon feeding the material at a different speed past a second predetermined point.

9. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets at relatively high speed successively past a high-speed point, means for holding each sheet against feeding movement after it has passed the point, and continuously-acting means for feeding the sheets at relatively low speed past a low-speed point.

10. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets at relatively high speed successively past a high-speed point, means for engaging each sheet to hold it against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, means for rendering the engaging means ineffective so as to release each sheet prior to the feeding of the said next-succeeding sheet into lapped relation thereto, and means for feeding the sheets at relatively low speed past a low-speed point, whereby the sheets are fed past the low-speed point in lapped relation.

11. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets at relatively high speed successively past a high-speed point, means for engaging the tail of each sheet to move the said tail out of the path of travel of the next-following sheet and to hold the said tail against feeding movement after the said tail has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, and means for feeding the sheets at relatively low speed past a low-speed point, whereby the sheets are fed past the low-speed point in lapped relation.

12. A machine for feeding sheets of material into a lay-boy and stacking them therein having, in combination, means for feeding a plurality of sheets at relatively high speed successively past a high-speed point, means for engaging each sheet to hold it against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, means for rendering the engaging means ineffective so as to release each sheet prior to the feeding of the said next-succeeding sheet into lapped relation thereto, and means for feeding the sheets at relatively low speed past a low-speed point into the lay-boy.

13. A machine for feeding sheets of material into a magazine and stacking them therein having, in combination, means for feeding a plurality of sheets successively past a high-speed point at a speed so high that, if they were fed singly at the said speed into the magazine, they would buckle and fly about therein, means for engaging the tail of the sheet to hold each sheet against feeding movement after the said tail has passed the point to enable the next succeeding sheet to be fed into lapped relation thereto, and means for feeding the sheets past a low-speed point into the magazine at a speed low enough to permit their entering the magazine without buckling or flying about, whereby the sheets are fed past the low-speed point in lapped relation and become easily stacked in the magazine.

14. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets successively past a predetermined point, means for engaging each sheet to hold it against feeding movement, means for actuating the engaging means alternately into engagement with a sheet to hold the sheet against feeding movement after it has passed the point to enable the next succeeding sheet to be fed into lapped relation thereto, means for moving the engaging means out of engagement with the sheet to release the sheet prior to the feeding of the next-succeeding sheet into lapped relation thereto, and means for feeding the sheets past a second point, whereby the sheets are fed past the second point in lapped relation.

15. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets successively past a predetermined point, a finger, means for moving the finger into engagement with each sheet to hold it against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, means for moving the finger out of engagement with the sheet to release the sheet prior to the feeding of the said next-succeeding sheet into lapped relation thereto, and means for feeding the sheets past a second point, whereby the sheets are fed past the second point in lapped relation.

16. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets successively past a predetermined point, two holding members, means for relatively actuating the holding members alternately towards each other to engage the sheet between them to hold the sheet against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, and away from each other to release the sheet prior to the feeding of the next-succeeding sheet into lapped relation thereto, and means for feeding the sheets past a second point, whereby the sheets are fed past the second point in lapped relation.

17. A sheet-feeding machine having, in combination, means for feeding a plurality of sheets successively past a high-speed point, a finger for holding each sheet against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, means for moving the finger into and out of contact with the successive sheets first to hold the sheets against feeding movement and then to permit the sheets to be fed further, and means for feeding the sheets at relatively low speed past a low-speed point, whereby the sheets are fed past the low-speed point in lapped relation.

18. A sheet-feeding means as defined in claim 17 in which the means for moving the finger comprises a rotary cam.

19. A machine for converting sheet material into a stack of sheets having, in combination, a knife for severing the material to form sheets, means for operating the knife, means for feeding the sheets as they are severed successively past a high-speed point, a finger for holding each sheet against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, means controlled by the knife-operating means for moving the finger into and out of contact with the successive sheets first to hold the sheets against feeding movement and then to permit the sheets to be fed further, a

magazine, and means for feeding the sheets at relatively low speed past a low-speed point into the magazine, whereby the sheets are fed into the magazine in lapped relation.

20. A method of feeding sheets of material into a lay-boy and stacking them therein that comprises feeding a plurality of sheets successively past a high-speed point at a speed so high that, if they were fed singly at the said speed into the lay-boy, they would buckle and fly about therein, holding each sheet against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, feeding the sheets past a low-speed point that is separated from the high-speed point by a distance substantially equal to the length of a sheet into the lay-boy at a speed low enough to permit their entering the lay-boy without buckling or flying about, and directing each sheet towards the prior-fed sheet after its head has left the high-speed point to prevent the sheets from buckling and flying about while fed at the said high speed, whereby the sheets are fed past the low-speed point in lapped relation and become easily stacked in the lay-boy.

21. A machine for feeding sheets of material into a lay-boy and stacking them therein having, in combination, means for feeding a plurality of sheets successively past a high-speed point at a speed so high that, if they were fed singly at the said speed into the lay-boy, they would buckle and fly about therein, a plurality of holding members, means for relatively actuating the holding members towards each other to engage each sheet and hold it against feeding movement after it has passed the point to enable the next-succeeding sheet to be fed into lapped relation thereto, and for relatively actuating the holding members from each other to release each sheet prior to the feeding of the said next-succeeding sheet into lapped relation thereto, and means for feeding the sheets past a low-speed point into the lay-boy at a speed low enough to permit their entering the lay-boy without buckling or flying about, whereby the sheets are fed past the low-speed point in lapped relation and become easily stacked in the lay-boy.

In testimony whereof, I have hereunto subscribed my name this 12th day of March, 1924.

CHARLES B. MAXSON.