May 3, 1955 C. E. JACKSON 2,707,568

SHEET FEEDING MACHINE

Filed May 2, 1951 3 Sheets-Sheet 1

Fig. 2.

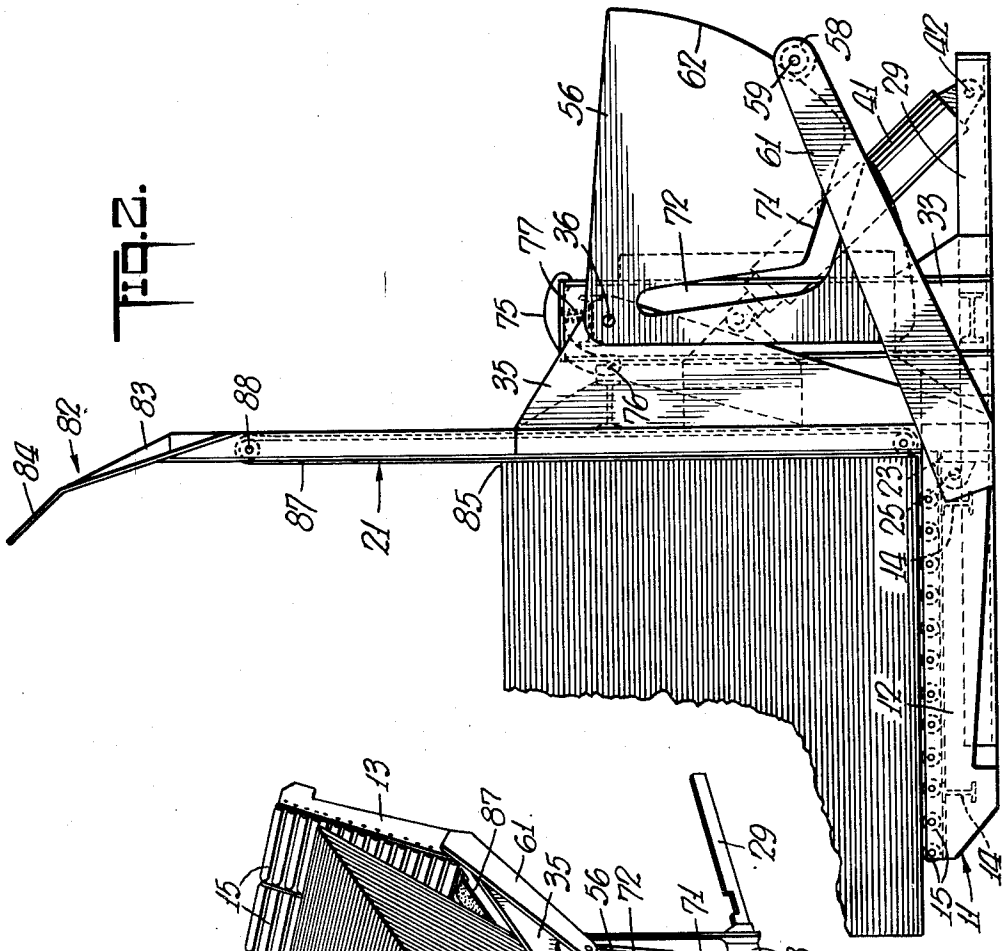
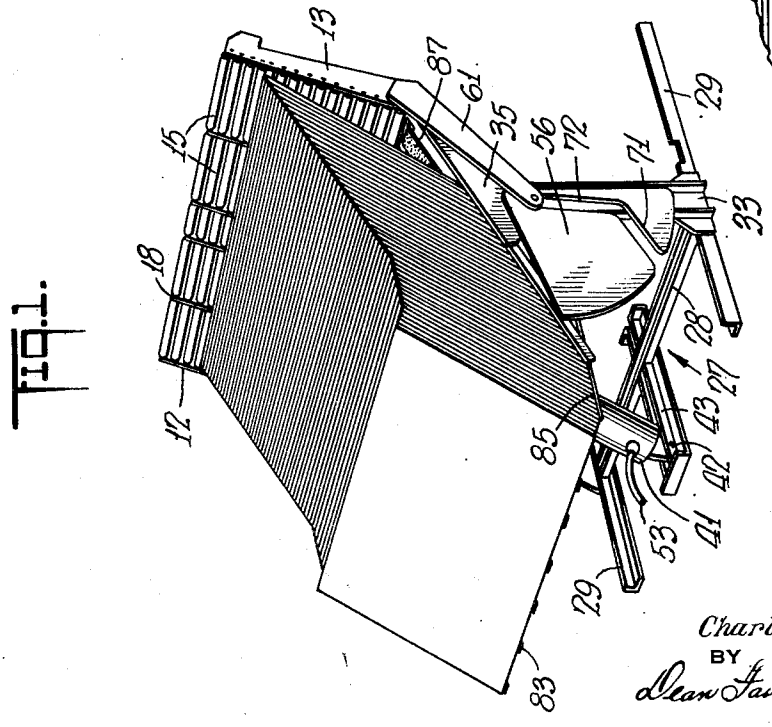


Fig. 1.

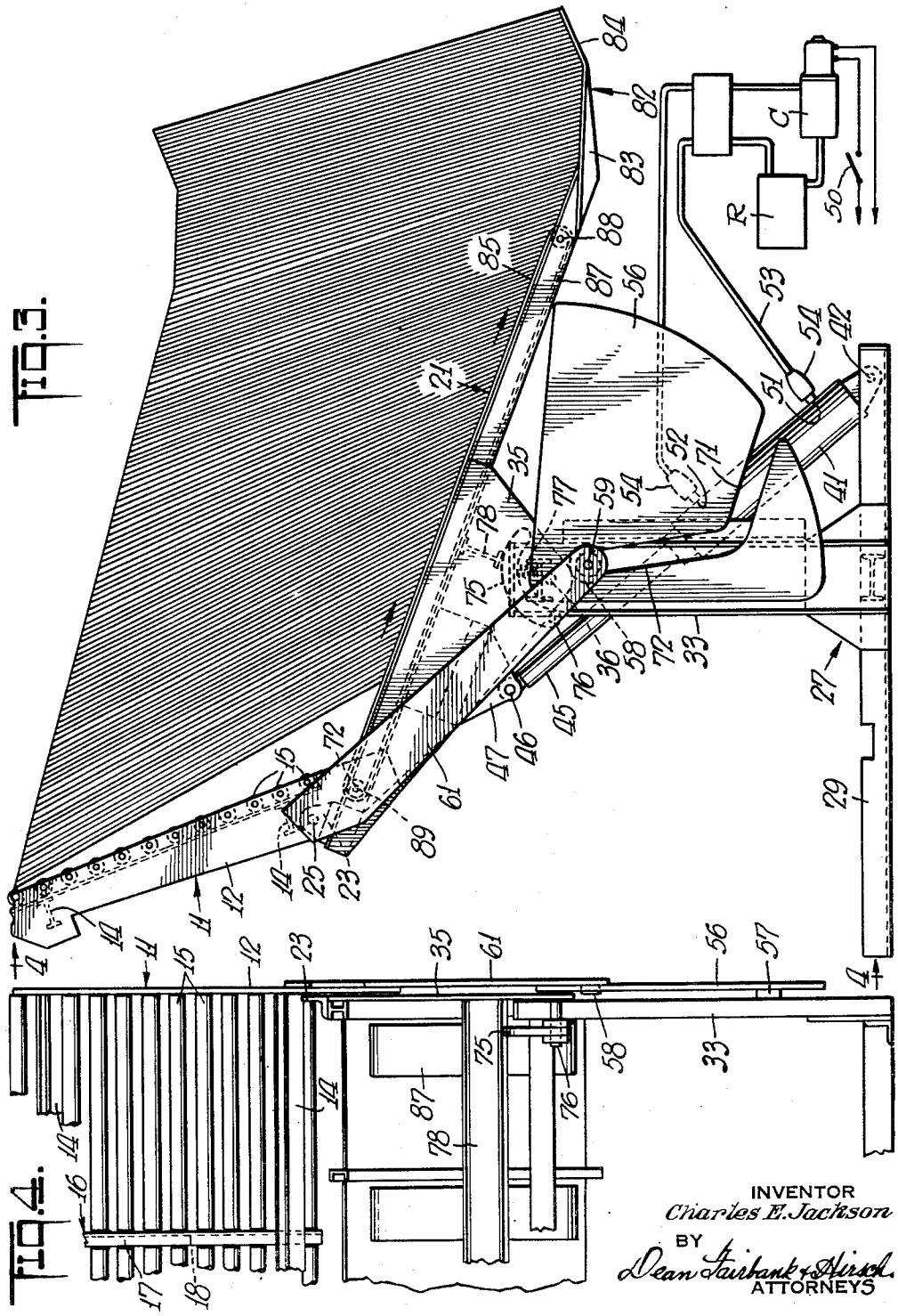


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Filed May 2, 1951 3 Sheets-Sheet 3

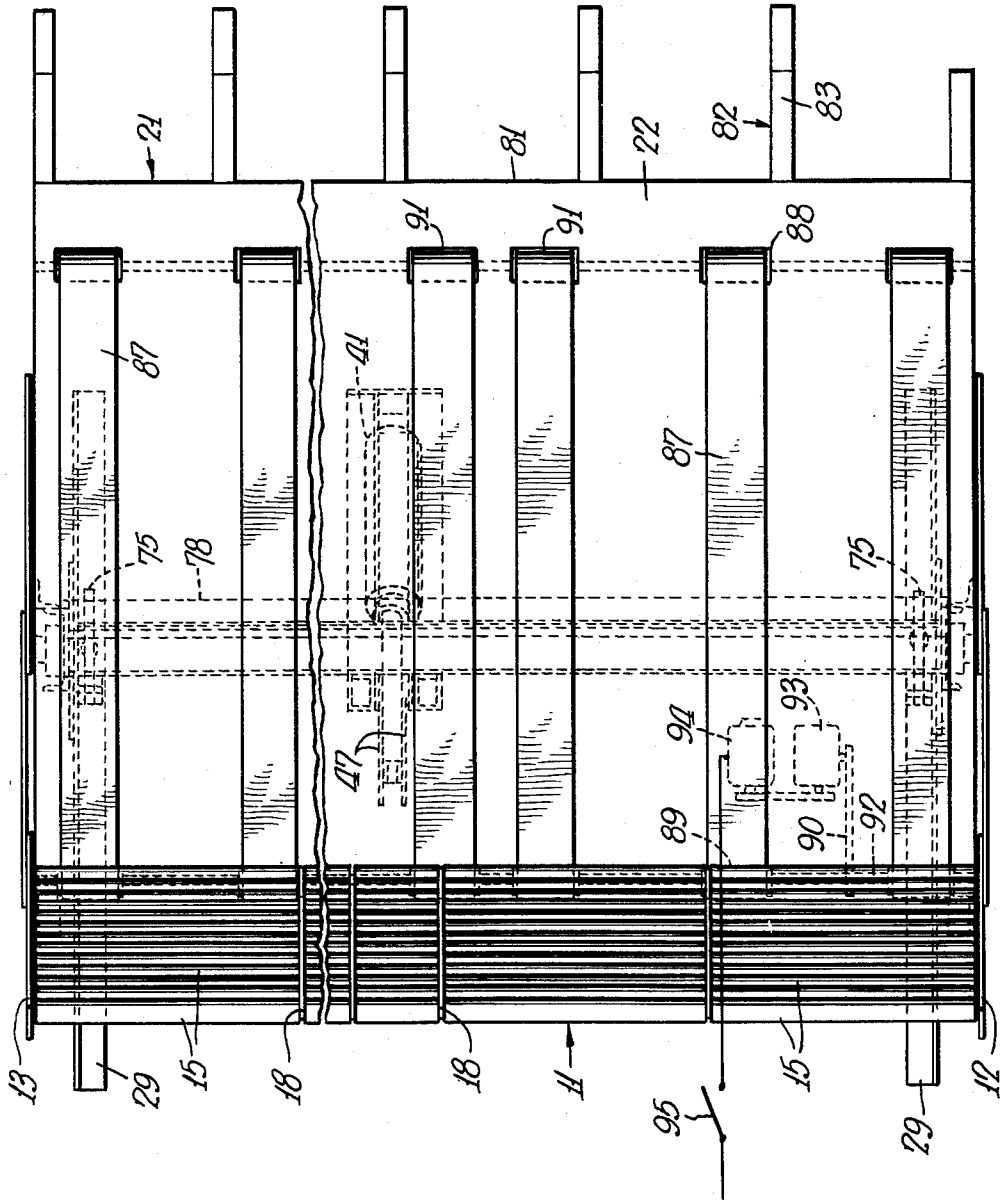


FIG. 5.

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SHEET FEEDING MACHINE

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Application May 2, 1951, Serial No. 224,128

13 Claims. (Cl. 214—8.5)

This invention relates to sheet feeding machines, more particularly of the type for presenting sheets of stacked material, such as corrugated board, to a machine for performing one or more operations thereon.

As conducive to an understanding of the invention, it is noted that where, in the manual removal of sheets of material, such as corrugated board one by one from the top of a stack for insertion into a machine that performs one or more operations upon such sheets such as slotting, cutting, printing, or the like, considerable physical effort is involved in overcoming the suction that retains the top sheet upon the stack, and this, together with the fact that the sheets are generally large, heavy and cumbersome, necessitates the services of at least two workmen who must be relieved frequently by reason of the fatiguing character of their work.

It is accordingly among the objects of the invention to provide, in a sheet feeding machine, mechanism for relatively shifting the component sheets of a stack of heavy sheet material, reliably to orient such sheets without likelihood of misalignment, in order to admit of advancing of successive sheets from such stack with the need for little or no physical effort on the part of an operator.

According to the invention the sheet feeding machine comprises a loading platform, which is of course substantially horizontal in loading position and a discharge table which extends substantially vertically in such loading position. Power actuated means is provided to move both the loading platform and the discharge table in the same direction through an angle toward feeding position so that part of the load of the stack rests against the discharge table. In the continued angular movement thereof, the loading platform and discharge table are caused to be angularly moved with respect to each other, so that the loading platform assumes a markedly obtuse angle with respect to the discharge table and the sheet material is rearwardly inclined and leans at its upper edge against said loading platform and as the operation progresses and the discharge table becomes inclined downward, the edges of the sheet material thereagainst will tend to slide forward therealong. Motor driven conveyer belt means are desirably provided along the discharge table to aid the forward movement of the edges of sheet material thereagainst.

Any of a wide variety of mechanical expedients may be resorted to in order to effect the desired angular movement of the loading platform and the discharge table and the relative angular movement therebetween, as for instance by operating the loading platform and the discharge table by independent but interconnected mechanisms, but it is preferred to move said platform and table as a unit about a pivot in the initial stage and thereupon in the continued movement to cause one of said elements to pivot with respect to the other for increase of the angle therebetween.

In a desirable embodiment the loading platform and discharge table are pivotally connected together and

means is provided to prevent a change in the angular relation therebetween during the initial portion of the movement thereof and progressively to increase the angle between said platform and said table in the course of the movement of the machine toward feeding position.

In a specific embodiment the discharge table is pivotally mounted on a suitable support and the operating end of a power unit, desirably a hydraulic cylinder, is connected to said table between its pivot support and the loading platform and the loading platform has an extension cam arm pressed against a fixed cam disc which controls the initially fixed relation of the platform relative to the table and progressively increases the angle therebetween in the course of the movement from loading to feeding position.

In the accompanying drawings, in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a perspective view of the machine in feeding position,

Fig. 2 is a side elevational view on a larger scale of the machine in loading position,

Fig. 3 is a view similar to Fig. 2 of the machine in feeding position,

Fig. 4 is a fragmentary front elevational view of the machine taken along line 4—4 of Fig. 3, and

Fig. 5 is a top plan view of the machine as shown in Fig. 3.

Referring now to the drawings, the sheet feeding machine, desirably comprises a substantially rectangular loading platform **11** lying in a horizontal plane as shown in Fig. 2, when in position to receive a stack of sheet material. The platform **11** desirably has a pair of side plates **12** and **13** retained in spaced parallel relation by transverse beams **14** affixed to said side plates as by welding.

Rotatably mounted on the platform between side plates **12** and **13** are a plurality of rollers **15** on which the stack of sheet material may be placed as by a conventional fork lift (not shown). Although the rollers may be idly mounted in any suitable manner, in the embodiment herein shown a plurality of equally spaced angle irons **16** are desirably provided, the bases **17** of which are affixed to the transverse beams **14** at right angles thereto between said side plates **12** and **13**, which, together with the upright portions **18** of the angle irons, serve to support the rollers **15**.

Associated with the loading platform **11** is a discharge table **21**, in vertical position as shown in Fig. 2, when the loading platform **11** is in horizontal position to receive a stack of sheets. The discharge table may comprise a substantially rectangular plate **22** desirably having an outstanding ear **23** at each of the lateral edges thereof which preferably is straddled by the side plates **12** and **13** of the loading platform **11** near the rear ends thereof. The loading platform **11** and discharge table **21** are pivotally connected by means of a pin or bolt **25** extending through side plates **12** and **13** and the associated ear **23** and are mounted on a suitable frame or support **27**. The latter desirably comprises a base piece **28**, illustratively an I beam, having a cross angle bar **29** affixed at each end thereof at right angles thereto as by welding. Each end of the base piece **28** desirably has an upstanding post or standard **33** affixed thereto, which mount the loading platform and the discharge table **21**. In the embodiment herein shown, it is preferred pivotally to mount the discharge table on said support. To this end, as shown in Figs. 3 and 4, the discharge table **21** desirably has a pair of plates **35** affixed respectively to each of the lateral edges thereof as by welding, said plates each having a bearing opening therethrough to receive

a pin 36 which extends laterally through each of said posts 33 respectively near the upper ends thereof.

Means are desirably provided to rotate said discharge table 21 during the feeding cycle about its pivot 36 while retaining said loading platform 11 at right angles to said discharge table so that the direction of pressure of the stack of sheets on the loading platform 11 shifts, to be also applied against the discharge table and means are also provided progressively to increase the angle between said discharge table and said loading platform to ensure that the sheets on the discharge table will be inclined rearwardly after said discharge table has rotated a predetermined amount. Although any of a wide variety of possible means may be used to accomplish these results, in the embodiment herein shown, the discharge table is pivotally advanced by means of the hydraulic system shown in Fig. 3, controlled preferably by means of a foot switch 50.

This system desirably comprises a double acting cylinder 41 pivotally mounted at its lower end, as at 42, between and near the outer ends of spaced rails 43 that are rigidly affixed as by welding to base piece 28 and extend outwardly therefrom, substantially midway between cross bars 29. The piston rod 45 of the hydraulic cylinder 41 is desirably pivotally connected at its upper end as at 46 between spaced parallel plates 47 as shown in Figs. 3 and 4, which in turn are rigidly affixed substantially midway between the lateral edges of the undersurface of the discharge table and between pivotal points 25 and 36.

Although the hydraulic cylinder may be of any suitable type, in the preferred embodiment herein shown, the cylinder has two ports 51 and 52 for the passage of fluid, one on each side of the piston (not shown) in said cylinder. Although the ports could be connected by feed lines 53 in conventional manner directly to the reservoir R and compressor C for the hydraulic cylinder it is preferred to have a restrictor valve 54 in each of said lines adjacent the ports, so that if either of the lines should rupture, the flow of fluid from the cylinder would still be controlled by the restrictor valves thereby ensuring slow descent of either the loading platform 11 or discharge table 21, as the case may be, even under a heavy load. As a result, any likelihood of violent impact with resultant injury to or destruction of the machine or injury to the operator is substantially eliminated.

The loading platform 11 as illustratively shown herein may be maintained at right angles to the discharge table 21 at the beginning of the feeding cycle and the angle between the loading platform and the discharge table thereupon progressively increased by means of suitable cam means which, as shown in Figs. 3 and 4 comprises a pair of cam plates 56, each desirably a segment of a circle, and affixed respectively to the standards or posts 33 being spaced therefrom as by spacer members 57.

Associated with each of the cam plates 56 are cam follower rollers 58, each rotatably mounted as at 59 at the free end of arms 61. The latter are affixed respectively at their other ends as by welding to the side plates 12 and 13 of the loading platform so as to extend obliquely upward therefrom as shown in Fig. 2, each riding on the arcuate periphery 62 of the associated cam plate 56.

With this construction, as the discharge table 21 is rotated in clockwise direction about its pivot 36 under the action of hydraulic cylinder 41 from the position shown in Fig. 2, thereby also moving the pivoted end of the loading platform upwardly in clockwise direction, the loading platform and the stack thereon, will tend to rotate in counterclockwise direction by gravity about its pivot 25. Such movement of the loading platform is, however, restrained by the cam follower rollers 58 mounted on arms 61 which engage the arcuate edges 62 of cams 56. Thus any tendency of the loading platform to rotate in a counterclockwise direction about its pivot, would cause a similar rotation to be imparted to arms 61 and by reason of the abutment of rollers 58 against the periphery of the associated cam plate, such rotation of arms 61 and hence of the loading platform is prevented.

Thus, so long as the rollers 58 of arms 61 move along the arcuate peripheries of the cam plates 56, there will be no relative pivotal movement between discharge table 21 and loading platform 11, and hence the two will be retained at right angles to each other.

After the discharge table 21 has been pivoted by the hydraulic cylinder 41 in a clockwise direction, a predetermined amount sufficient to cause the direction of pressure of the stack of sheets on the loading platform to shift so that it is also applied against the discharge table 21, the angle between the discharge table and the loading platform is progressively increased to an amount greater than 90 degrees. This is accomplished in the embodiment herein shown, by providing each of the cam plates 56 with a cam slot 71 leading from the arcuate periphery 62 thereof inwardly at an angle to a radius of the segmental cam plate 56 for a predetermined amount, which slot thereupon extends substantially radially, as at 72, toward the pivot 36 of the discharge table 21.

Each of the cam slots 71 serves as a track for the associated roller 58 so that as the discharge table 21 is further pivoted, the upward movement of the pivotal points 25 of the discharge table 21 and the loading platform 11 by the hydraulic cylinder, will cause the rollers 58 to be drawn through the cam slots. As a result of such path of travel of the rollers 58, the arms 61 will be rotated on their pivots 25 thereby to rotate the loading platform 11 with respect to the discharge table 21 to increase the angle therebetween.

To prevent the discharge table 21 from moving too rapidly to the position shown in Fig. 3, which would cause considerable strain on the machine and possible injury thereto, shock absorbing means are desirably provided. Although such means may be of any suitable type, in the embodiment herein shown, a pair of curved arms 75 are desirably provided, each pivotally connected at one end as at 76 to the standards or posts 33 and having the undersurface thereof normally resting on a heavy duty coil spring 77 seated on the top of the standard. The undersurface of the discharge table desirably has a rail 78 affixed thereto and extending thereacross which normally rides on the curved upper surface of the arm 75 which is so conformed that as the rail rides thereover and the discharge table 21 reaches the limit of its clockwise rotation, the coil spring 77 will be compressed resiliently to take up the shock of impact.

As a result of the increase of the angle between the loading platform 11 and the discharge table 21, the stack of sheets on the discharge table will never reach vertical position, so that the sheets will not fall and there is avoided any considerable impact and possible injury to the machine or to the operator.

To prevent accidental discharge of the sheets when the discharge table has rotated beyond the horizontal, as for example, to the position shown in Fig. 3, the forward edge 81 of the discharge table has a plurality of arms 82 spaced therealong and extending outwardly and upwardly therefrom. Each of the arms desirably has a rear portion 83 which extends upwardly at an acute angle with respect to the plane of the top surface of discharge table 21 and a front portion 84 which extends upwardly at an acute angle with respect to the plane of arm portion 83. Thus, as the leading edges 85 of the sheets slide down the inclined discharge table 21, as shown in Fig. 3, they will be restrained by the arm portions 83, 84 with little or no chance of their sliding off the ends of the arms.

As an added precaution against falling over of the sheets, and to aid in the removal of such sheets from the discharge table, the latter has conveyor means thereon preferably a plurality of spaced conveyer belts 87 ex-

tending at right angles to the forward edge 81 of the discharge table 21.

As shown in Fig. 5, the upper run of each of the conveyer belts desirably rides on the top surface of the discharge table, each of said belts encompassing a pair of rollers 88 and 89 rotatably mounted on discharge table 21 so as to extend through slots 91 therein. Although the conveyer belts may be actuated in any suitable manner, it is preferred to mount the rollers 89 on a common shaft 92 driven through a belt 90 by a suitable reduction gear drive 93 from a motor 94 mounted to the undersurface of the discharge table and controlled by a switch 95 preferably of the type to be controlled by the foot of the operator.

Thus, upon movement of the conveyer belts, the edges 85 of the sheets in contact therewith will be moved forwardly as shown in Fig. 3 and such sheets will be advanced to the arms 82 so that the outermost sheet may readily be grasped by the operator for removal.

Operation

The feeding machine is generally positioned so that the discharge platform 21 may be presented to the input of the machine that performs the slotting, cutting, printing or other operation upon the sheet material, all in the manner hereinafter to be described.

With the feeding machine in the position shown in Fig. 2, a stack of sheet material, illustratively corrugated board, is placed by means of a conventional fork lift upon the loading platform 11. Although the stacked material to be fed to the operating machine may comprise a large number of sheets which are large in size and of relatively great weight (in many cases a stack totaling more than two thousand pounds), by reason of the rollers 15 the stack, once it is deposited upon the loading platform, may readily be manually pushed so that the leading edges 85 thereof abut against the conveyer belts 87 riding on the surface of discharge platform 21, as shown in Fig. 2. The operator may thereupon press the foot switch 50 associated with the hydraulic system to actuate the motor thereof, thereby to force hydraulic fluid into the hydraulic cylinder 41. As a result, the piston rod 45 thereof will slowly be expelled from the cylinder to exert pressure against the undersurface of the discharge platform 21, thereby to rotate the latter about its pivot 36 in a clockwise direction, as shown in Fig. 2.

As the discharge platform initially turns in such clockwise direction from the position of Fig. 2 through a small angle which may be in the order of as little as 15 to 30 degrees, the lower end thereof will move upwardly in an arcuate path, thereby lifting the loading platform 11. As a result, the weight of the stack of sheet material will be gradually shifted, causing the stack to slide down the now inclined loading platform over the rollers 15 thereon, thereby to retain the leading edges 85 of the stack against the conveyer belts 87 on the surface of the discharge platform 21.

The weight of the stack of sheet material on such platform will tend to rotate it downward in a counterclockwise direction about its pivot 25, thereby tending to raise the roller ends of cam follower arms 61. However, such counterclockwise rotation of the loading platform is initially restrained by the rollers 58 mounted on the follower arms 61 and which ride along the arcuate edges of cams 56. Consequently, as the discharge platform is rotated about its pivot 36, the loading platform will follow therealong and not rotate about its pivot 25 thereby maintaining the angular relation of 90 degrees therebetween.

As the pivotal movement of the discharge table proceeds, the cam rollers 58 will reach and then be drawn into and along the cam slots 71. During the movement of rollers 58 in cam slots 71, while the pivotal movement of discharge table 21 continues about its pivot 36, the loading platform 11 no longer stays at right angles to the discharge table but by reason of the camming action of slots 71 on the arms 61, it is caused to move about its pivot 25 to assume an angle greater than a right angle with respect to the discharge platform until the parts bear the relation to each other shown in Fig. 3.

By reason of the configuration of the cam slots 71, as the cam rollers 58 are advanced therethrough, they will be urged by the weight of the loading platform and the stack thereon against the upper edge of the slots 71 and such upper edge will restrain the downwardly pivotal movement of such loading platform so that it is only controlled by the camming action of such slots.

As a result of the progressive increase of the angle between the loading platform and the discharge table, as the operation proceeds, the sheet material will lean against such loading platform and will not tend to tilt over and fall upon the discharge platform which might otherwise occur if the 90 degree relationship between the loading platform and discharge table were maintained. As the movement progresses to the final or feeding position shown in Fig. 3, in which the discharge table is tilted downward, the conveyer motor 94 may be actuated by the closing of foot switch 95 to move the conveyer belts 87 in the direction indicated by the arrows in Fig. 3.

As the belts are of relatively rough material, they will dependably advance the leading edges 85 of the stack of sheet material toward the outlet end 81 of the discharge table 21, the upper or rear edges of the stack leaning more heavily against the upwardly extending loading platform. With continued pivotal movement of the discharge table 21 and the loading platform 11 and continued movement of the conveyer belts the sheets will assume the position shown in Fig. 3, at which time the leading edges 85 of the sheets will reach the rear ends of the arms 83 and by reason of the movement of the conveyer belts 87 and the downward inclination of the discharge table 21 ride along such arms until they reach the ends thereof. At this time the foot switch 95 is actuated to stop the conveyer belts and the foot switch 50 is actuated to stop the motor controlling the hydraulic system as the machine is now in operating position.

Although the conveyer motor could be continuously actuated as the discharge table moves to feeding position, it is preferred to have the operator intermittently energize said motor by means of the foot switch 95 so that as the upper or rear edges of the stack leans backward due to the inclination of the loading platform the lower or leading edges of the stack will be advanced forwardly.

It is a relatively simple matter for the operator to grasp the lateral edge of the foremost sheet of the stack and slide the latter off the ends of the arms onto the operating machine, one of the arms 82 adjacent the operator being shorter than the others to facilitate the removal of such sheet. After the operator has removed a number of sheets from the stack on the discharge table he may then press the conveyer switch 95 to move the conveyer belts slightly, again to advance the foremost sheets to the ends of the arms 82, thereby to facilitate removal of such sheets without need for the operator to move the same along the discharge platform for any appreciable distance.

After the last sheet has been removed from the discharge table, the operator may energize the hydraulic motor in reverse direction to retract the plunger rod into the cylinder 41 thereby pivoting the discharge table in a counterclockwise direction as shown in Fig. 3, to restore the machine to its loading position, shown in Fig. 2.

Although the angular relation between the loading platform and discharge table in the embodiment herein shown is controlled by means of the cam 56 and the associated mechanism, it is, of course, to be understood that the principles of operation could be accomplished in other manners, such, for example, as by means of a hydraulic cylinder connecting the pivotally joined loading platform and discharge table and normally retaining such platform and table at a 90 degree angle and increasing such angle by energization of the hydraulic cylinder when the dis-

charge table has pivoted a predetermined amount. As other equivalent expedients for accomplishing this result would be readily apparent to a mechanic skilled in the art once the principles of operation of the machine are clearly understood, they need not be further described.

With the feeding machine herein described, it is a relatively simple matter for large bulky and heavy sheets arranged in a large stack to be fed to a finishing machine, one by one, without requiring any considerable effort on the part of the operator, and hence permitting continuous operation of the finishing machine with resultant great output.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A sheet feeding machine comprising a discharge table movable from substantially vertical to inclined position, a support pivotally mounting said discharge table, a loading platform pivotally connected to said discharge table near the lower end thereof, means to pivot said discharge table about said support to move the lower end thereof upwardly in substantially an arcuate path and means to effect relative pivotal movement between said discharge table and said loading platform progressively to increase the angle therebetween in the course of pivoting of said discharge table.

2. A sheet feeding machine comprising a discharge table movable from substantially vertical to inclined position, a support pivotally mounting said discharge table, a loading platform pivotally connected at one edge to the lower end of said discharge table and normally extending therefrom substantially at an angle of ninety degrees, means to effect pivotal movement on said support of said discharge table to move the lower end thereof upwardly in substantially an arcuate path, and means to retain said loading platform at said ninety degree angle with respect to said discharge table during the initial pivotal movement of the latter and in the course of pivotal movement of said discharge table after the latter has pivoted a predetermined amount progressively to increase the angle between said discharge table and said loading platform.

3. The combination set forth in claim 2 in which shock absorber means are associated with said discharge table, said means comprising a curved arm pivoted at one end to said support, resilient means interposed between the undersurface of said arm and said support, said table having means rigid therewith and movable in an arcuate path normally riding on the top surface of said arm, the latter being conformed so that it will be gradually forced downwardly to compress said resilient means with continued pivotal movement of said discharge table.

4. A sheet feeding machine comprising a discharge table movable from substantially vertical to inclined position, a support pivotally mounting said discharge table, a loading platform pivotally connected to said discharge table near the lower end thereof and normally extending therefrom at an angle of substantially ninety degrees, means to effect pivotal movement on said support of said discharge table through an angle of more than ninety degrees to move the lower end of said discharge table upwardly in substantially an arcuate path until it is above the opposite end thereof thereby to incline said discharge table downwardly and means to retain said loading platform at said ninety degree angle with respect to said discharge table during the initial pivotal movement of the latter and after said discharge table has pivoted a predetermined amount, progressively to increase the angle between said discharge table and said loading platform.

5. The combination set forth in claim 4 in which said discharge table has conveyer means thereon extending from near the lower end thereof to near the opposite end thereof.

6. The combination set forth in claim 4 in which said loading platform has a plurality of rollers thereon extending thereacross parallel to the ends of said discharge table.

7. The combination set forth in claim 4 in which said discharge table has a plurality of arms extending outwardly from the front edge thereof, said arms extending upwardly at an acute angle with respect to the plane of the top surface of said discharge table.

8. The combination set forth in claim 4 in which said discharge table has a plurality of arms extending outwardly from the front edge thereof, said arms having a rear portion extending upwardly at an acute angle with respect to the plane of the top surface of said discharge table and a front portion which extends upwardly at an acute angle with respect to the plane of said front arm portion.

9. A feeding machine for a stack of sheet material, comprising a discharge table movable from substantially vertical to inclined position, a support pivotally mounting said discharge table, a loading platform to receive such stack of sheet material pivotally connected to said discharge table near the lower end thereof and normally extending therefrom at an angle of substantially ninety degrees, means to effect pivotal movement of said discharge table to inclined position to move the stack of sheet material so that the edges of such sheets adjacent said discharge table move against the latter and means progressively to increase the angle of said loading platform with respect to said discharge table during the course of movement of the latter and after such edges are moved against said discharge table.

10. A sheet feeding machine comprising a discharge table movable form substantially vertical to inclined position, a support pivotally mounting said discharge table, a loading platform pivotally connected to said discharge table and normally extending therefrom at substantially ninety degrees with respect thereto, means to effect pivotal movement of said discharge table about said support and cam means associated with said loading platform to retain the latter at such ninety degree angle at the initial portion of the pivotal movement of said discharge table and during the course of movement of said discharge table after it has pivoted a predetermined amount progressively to increase the angle between said discharge table and said loading platform.

11. A sheet feeding machine comprising a discharge table movable from substantially vertical to inclined position, a support pivotally mounting said discharge table, a loading platform pivotally connected to said discharge table and normally extending therefrom at substantially a ninety degree angle with respect thereto, means to effect pivotal movement of said discharge table on said support, a cam arm affixed to said loading platform extending at right angles beyond the axis of the pivotal connection between said discharge table and said loading platform, a cam follower affixed to said cam arm at the end thereof, a cam rigidly mounted with respect to said support having an arcuate periphery concentric with the pivoted mount of said discharge table on said support, said cam follower riding on said periphery a predetermined distance during the initial pivotal movement of said discharge table to retain the platform at an angle of ninety degrees with respect to said table, said cam having a slot therein through which said cam follower rides during the course of movement of said discharge table after it has pivoted said predetermined amount, said slot being conformed to pivot said platform with respect to said table progressively to increase the angle therebetween.

12. A sheet feeding machine comprising a loading platform to receive a stack of sheet material and movable from substantially horizontal to inclined position, a discharge table movable from substantially vertical to inclined position and extending at substantially right angles to said loading platform when the latter is in horizontal position, said table having a pair of slots therein near the ends thereof respectively, a roller associated with each of said slots and extending therethrough, a conveyer belt encompassing said rollers and having its upper run riding on the top surface of said table, means simultaneously to effect movement of said loading platform from horizontal to inclined position and said discharge table from vertical to inclined position, whereby the edges of the stack of sheet material will rest against said conveyer belt on said discharge table, means progressively to increase the angle between said loading platform and said discharge table in the course of movement of the latter from its vertical to its inclined position to incline such stack, and means to

advance said conveyor belt to move the edges of the stack thereagainst forwardly along said table thereby further to incline such stack.

13. The combination set forth in claim 12 in which a plurality of parallel conveyor belts are provided each having a pair of rollers associated therewith, and a motor is mounted on said discharge table and operatively connected to said rollers to drive the latter to advance said belts.

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