

April 7, 1959

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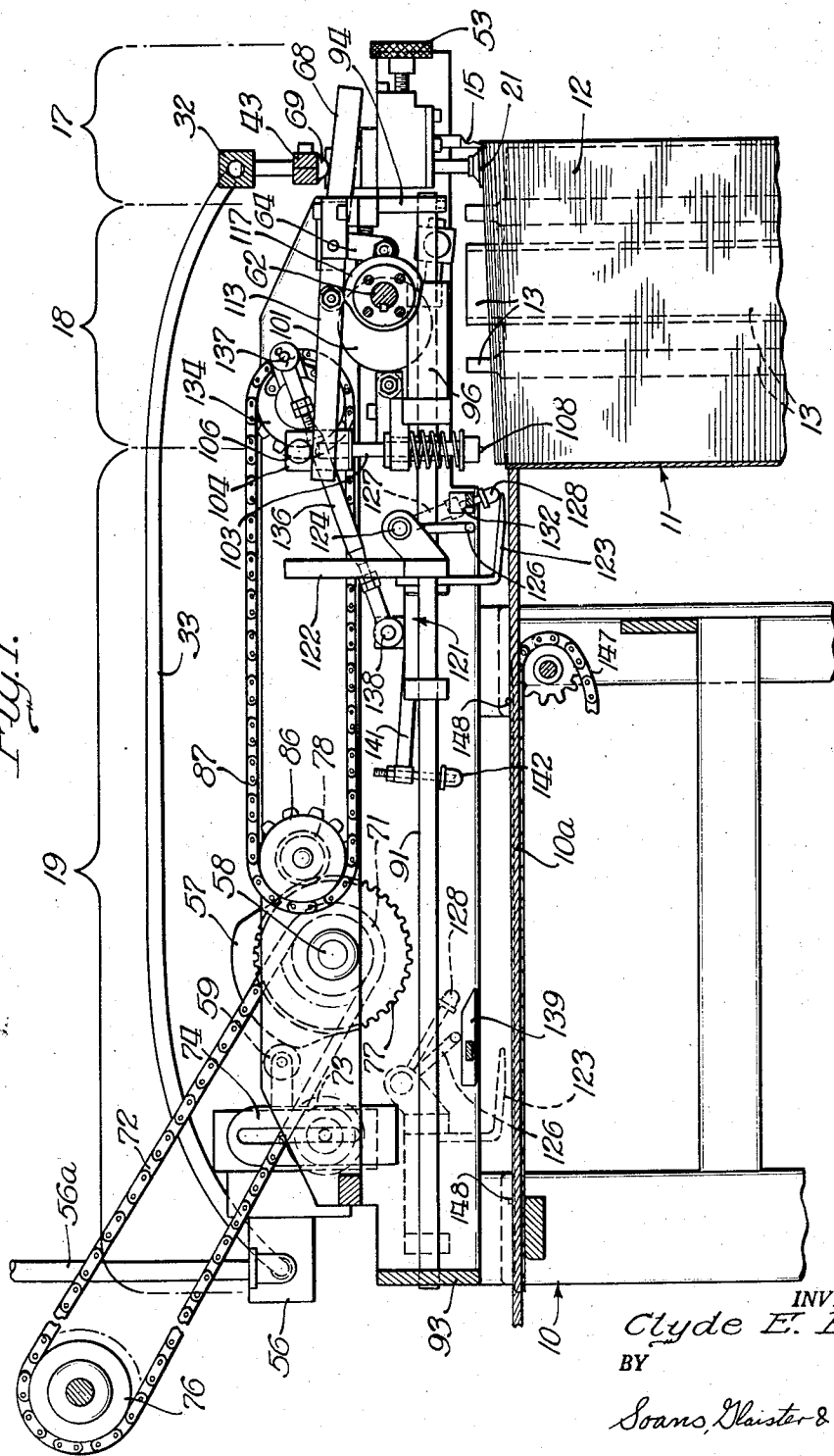
2,880,995

SHEET FEEDING MACHINE

Filed Sept. 3, 1954

5 Sheets-Sheet 1

Fig. 1.



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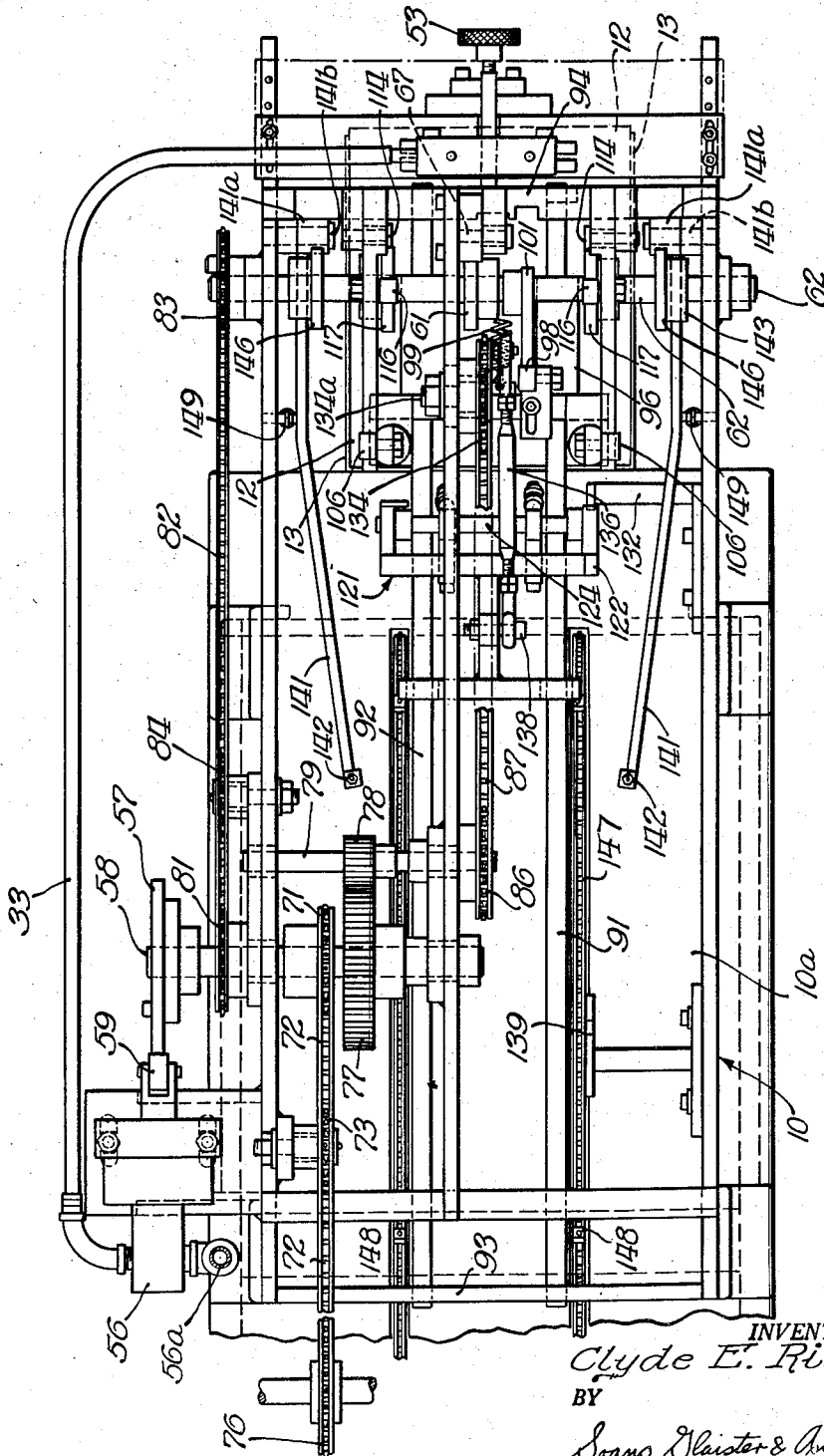
2,880,995

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Filed Sept. 3, 1954

5 Sheets-Sheet 2

FIG. 2.



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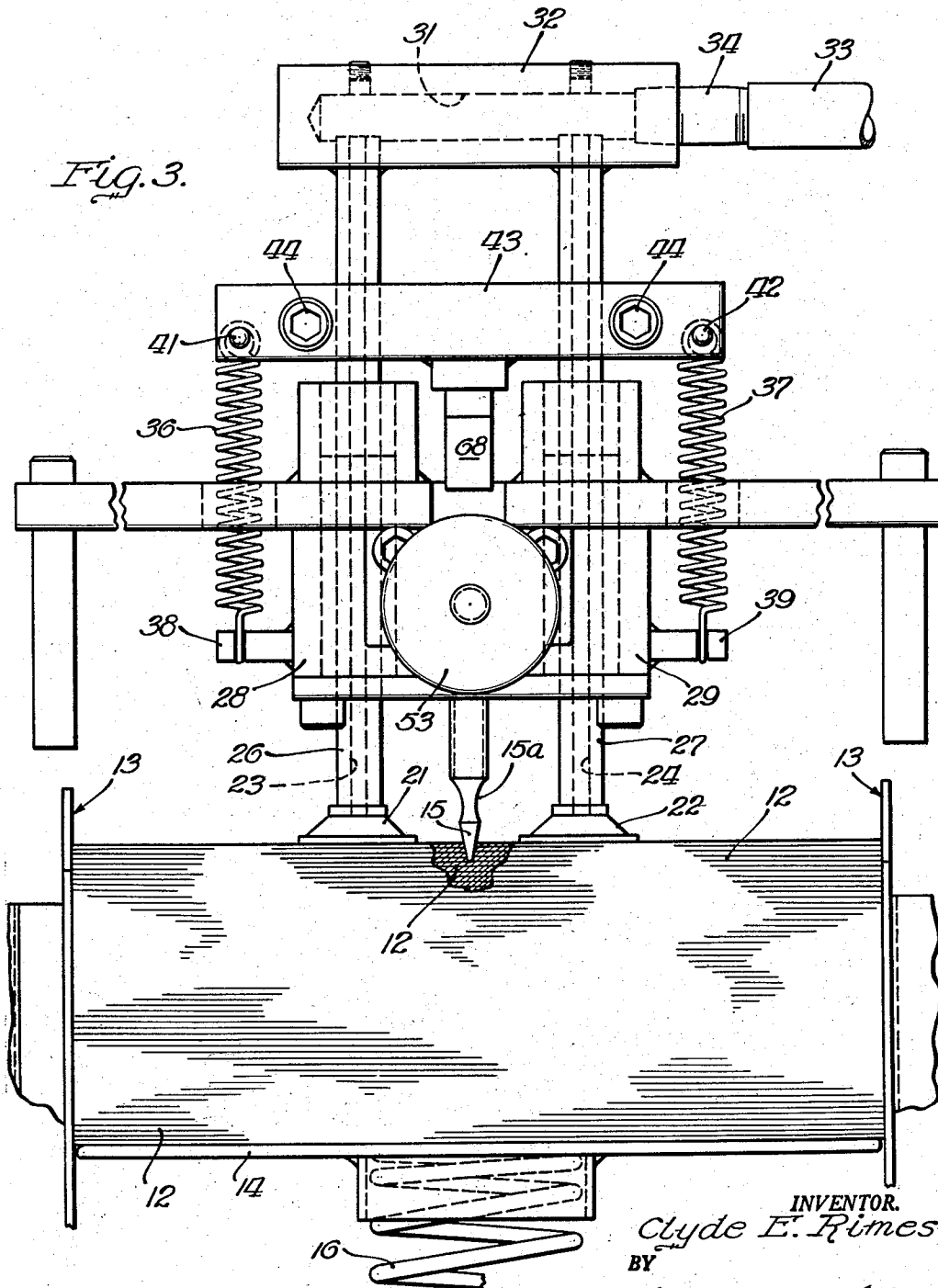
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5 Sheets-Sheet 3

Fig. 3.



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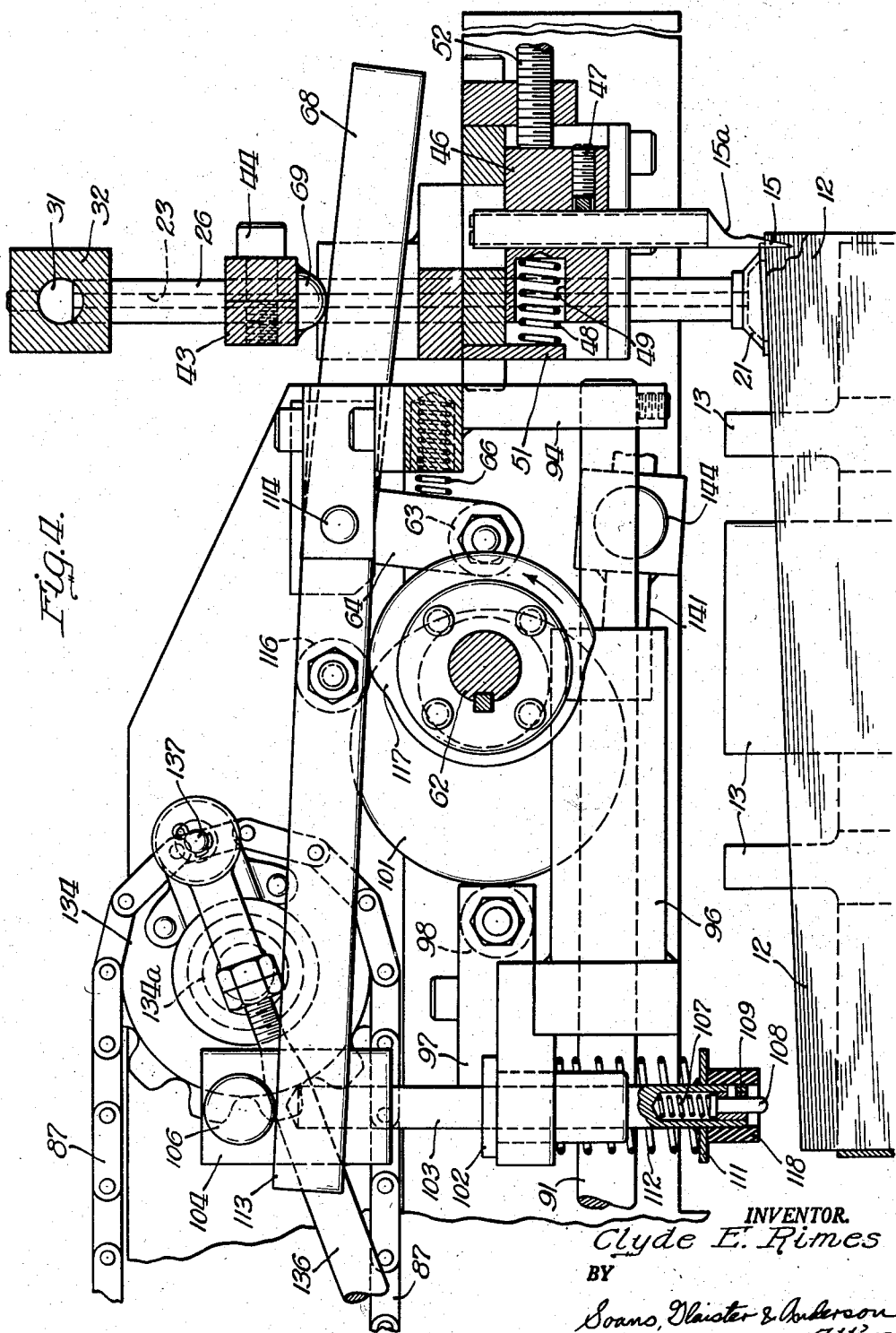
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2,880,995

SHEET FEEDING MACHINE

Filed Sept. 3, 1954

5 Sheets-Sheet 4



April 7, 1959

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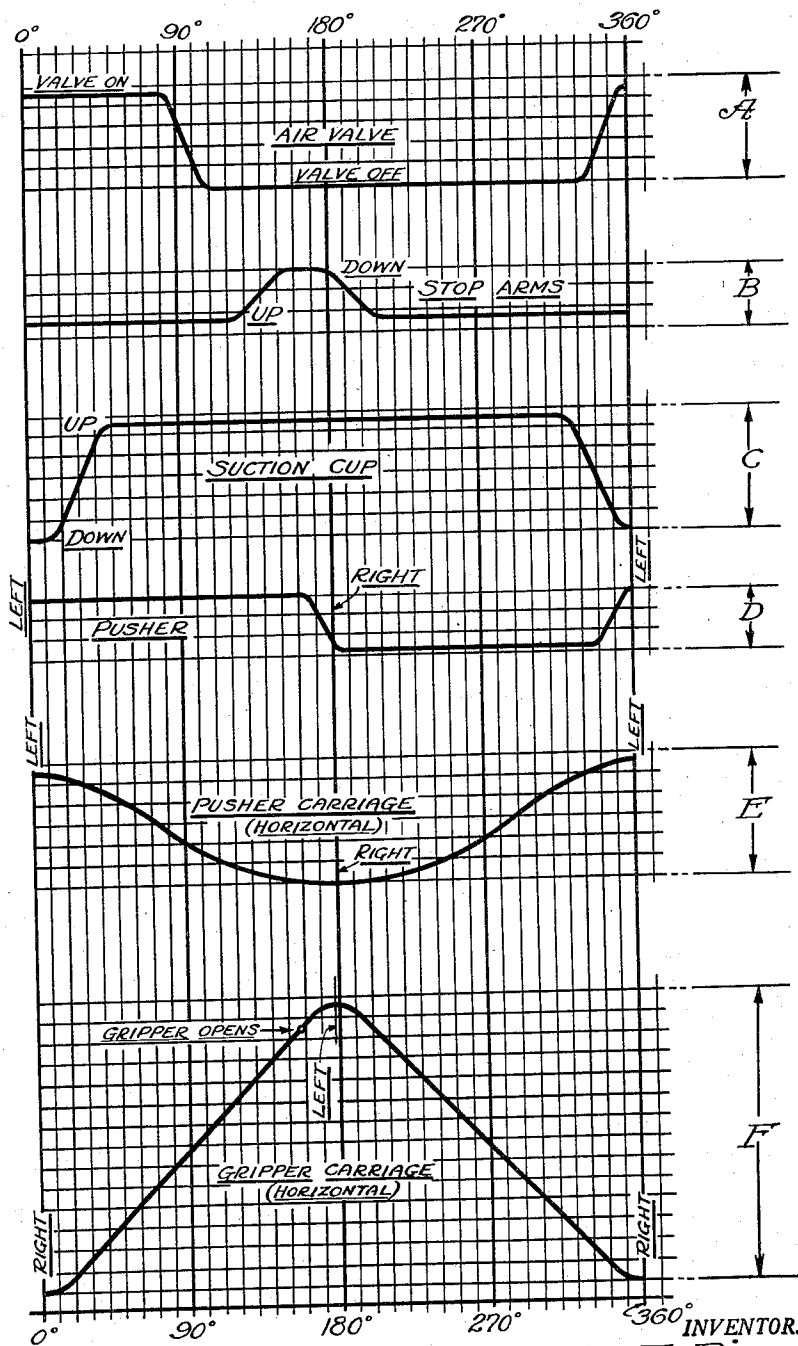
2,880,995

SHEET FEEDING MACHINE

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5 Sheets-Sheet 5

Fig. 5.



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SHEET FEEDING MACHINE

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Application September 3, 1954, Serial No. 454,137

5 Claims. (Cl. 271-14)

The present invention is concerned with an improved machine for feeding and transporting sheets of paper, resin films, and similar materials. The invention is particularly applicable to the feeding of individual sheets of wrapping material from a stack as received from a supplier to a packaging machine in which the individual sheets are folded and wrapped around, for example, a food product before the food product is inserted into a suitable box. While the feeding mechanism of the present invention is applicable for use with any type of packaging machine, particular reference is made to Palmer, U.S. Patent No. 2,394,935 as an example of one type of packaging machine with which the present invention finds utility.

The problem of separating individual sheets from a stack of sheets is particularly troublesome with certain coated wrapping materials. The coating materials applied to the base sheets to decrease the moisture permeability and gas permeability of the base sheet frequently result in a surface tackiness which becomes troublesome when a large number of sheets are stacked together. For example, wax coated cellophane sheets of the type frequently employed in the packaging of cheese and other food products have a pronounced tendency to stick together in stacked form with the result that prior to this invention, the sheets had to be separated and fed into the packaging machine by hand. Clearly, this disadvantage results in increased cost of operation and decreased output.

An object of the present invention is to provide an improved sheet feeding mechanism for feeding sheets one by one from a stack of such sheets.

A further object of the invention is to provide an automatically operating sheet feeding mechanism which is capable of delivering individual sheets of wrapping material, in a flat condition into a packaging machine or similar equipment.

A further description of the present invention will be made in conjunction with the attached sheets of drawings which illustrate a preferred embodiment thereof.

Figure 1 is a view in elevation, partially in cross section of the sheet feeding mechanism;

Fig. 2 is a plan view of the mechanism;

Figure 3 is an enlarged end view of the machine, illustrating the manner in which the stacked sheets are received by the machine;

Figure 4 is an enlarged view of a portion of the structure seen in Figure 1, partly in section, and

Figure 5 is a timing diagram illustrating the sequence of operation of the various mechanisms.

The machine shown in the drawings can be broken down into several cooperating sections, in the first of which a single sheet is lifted from the stack of sheets by the aid of a source of vacuum which is periodically applied to the top sheet of the stack, and a second section in which a pusher means operates in timed relation to the operation of the lifting means and receives a sheet from engagement with the lifting means. In order to

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facilitate this cooperation, the source of vacuum is cut off shortly after the top sheet of the stack has been lifted from the remaining sheets by the operation of the lifting means. The pushing means is so timed that the time interval between the removal of the vacuum and the engagement of the sheet by means of the pusher means is short enough so that the lifted sheet does not settle down into engagement with the remainder of the stack. In this way, there is provided a small cushion of air between the lifted sheet and the remainder of the sheets at the time that the pusher means engages the sheet.

The pusher means cooperates with a gripper means also operating in timed relation to the remainder of the elements, the pusher means being effective to deliver the liberated sheet into the gripper means. The latter then delivers the sheet in a flat condition into a suitable packaging machine or the like.

General assembly

In Figure 1, reference numeral 10 denotes generally a framework or a table which supports the sheet feeding mechanism in a position in which it can deliver sheets into packaging machines or similar equipment. At one end of the table 10 there is provided an open-ended sheet carrying frame or sheet magazine 11 which receives a stack 12 of sheets of wrapping material. A plurality of spaced side guides 13 (Figures 1 and 4) are disposed along the sides of the stack 12. The stack 12 is urged upwardly by a follower plate 14 (Figure 3) which is biased upwardly by means of a helical spring 16 disposed inside the walls of the sheet carrying frame 11. The upward pressure on the stack 12 causes several of the top sheets to be impaled on a needle 15 which tapers outwardly from a pointed end and which is provided with an inwardly recessed portion 15a above the top of the stack as best seen in Figures 1 and 4.

Individual sheets are lifted from the stack 12 by the operation of a lifting section which has been designated generally at numeral 17 in Figure 1. After the sheet is lifted from the top of the stack 12, it is moved by a pusher mechanism generally indicated at numeral 18 in Figure 1 to a feeding or gripping mechanism illustrated at numeral 19. Incident to the movement of the sheet by the pusher mechanism 18, the top sheet is torn free from the needle 15 on which it is impaled. The structural relationships and the timing relationships between these three sections will become apparent from a description of each section individually.

The lifting section

The lifting section 17 is best described with reference to Figures 3 and 4. As seen in these figures, the lifting section 17 may include a pair of hollow suction cups 21 and 22 arranged to engage the uppermost sheet of the stack 12. The suction cups 21 and 22 are in fluid communication with the central bores 23 and 24 of a pair of hollow rods 26 and 27, respectively. The rods 26 and 27 are free to reciprocate vertically in a pair of support blocks 28 and 29, the latter providing bearing surfaces which permit such sliding movement.

The hollow rods 23 and 24 communicate with the hollow interior 31 of a block 32 which is connected to a vacuum line 33 by means of a bushing 34.

The suction cups 21 and 22 are urged into contact with the uppermost sheet of the stack 12 by the action of a pair of helical springs 36 and 37, one end of each spring being secured to extensions 38 and 39 provided in the blocks 28 and 29. The opposite ends of the springs 36 and 37 are held by a pair of spaced pins 41 and 42 of a split block 43, the two sections of the block 43 being

rigidly secured to the rods 26 and 27 by means of spaced bolts 44.

As best seen in Figure 4, the needle 15 is received within a collar 46 and is held in a vertically adjustable position by means of a set screw 47. In order to accommodate different sized sheets in the machine, the collar 46 is slidable in the support members against the action of a coiled spring 48 (Figure 4). One end of the spring 48 is bottomed against the base of a bore 49 in the collar 46 and the other end engages a depending stop plate 51. An adjusting screw 52 having a knob 53 at one end is threadedly received within a portion of the frame structure, adjustment of the knob 53 being sufficient to move the collar 46 and the needle 15 into the desired position.

As best seen in Figure 1, the vacuum line 33 is controlled by a cam operated valve, indicated schematically at numeral 56. The valve 56 communicates with a source of reduced pressure by means of a line 56a. The opening and closing of the valve 56 is controlled by means of a cam 57 which is keyed or otherwise secured to a main drive shaft 58. A cam follower 59 is urged into continuous contact with the surface of the cam 57, and through suitable mechanical linkages (not shown) operates to open and close the valve 56 depending upon the displacement of the follower 59 which, in turn, depends upon the shape of the cam 57.

The opening and closing of the valve 56, i.e., the application and removal of the vacuum from the suction cups 21 and 22 must be coordinated with the vertical movement of the suction cups 21 and 22. For this purpose there is provided a suction cup cam 61 (Figure 2) which controls the upward and downward movement of the entire lifting carriage. The cam 61 is one of a series of operating cams disposed on a cam shaft 62 as best seen in Figure 2. The suction cup cam 61 is in continuous engagement with a cam follower 63 supported for rotation on one arm of a bell crank lever 64 (Figure 4). A spring 66 urges the follower 63 against the surface of the suction cup cam 61. The lever 64 is pivoted about a pin 67 (Figure 2) and has an arm 68 engaging a button 69 at the base of the block 43, all of which is best seen in Figure 4. Thus, rotation of the cam shaft 62 is effective to periodically pivot the lever 64 about the pin 67 and to raise the suction cups 21 and 22 by virtue of engagement of the arm 68 with the block 43.

Drive mechanism

By reference to Figures 1 and 2 it will be seen that the main drive shaft 58 carries a driven sprocket 71 about which is trained a chain 72. A tensioning sprocket 73, mounted for vertical adjustability within a slotted bracket 74, is disposed between the sprocket 71 and a drive sprocket 76 driven by a suitable source of power.

Keyed to the drive shaft 58 is a spur gear 77 which meshes with a gear 78 on a second shaft 79. A drive for the cam shaft 62 is provided by means of a sprocket 81 secured to the drive shaft 58 and a chain 82 which engages a sprocket 83 at one end of the cam shaft 62. A vertically adjustable tensioning sprocket 84 is included between the sprocket 81 and the sprocket 83.

Movement of the feeding or gripping means in the feeding section 19 is controlled by means of a sprocket 86 disposed on the second shaft 79 and a chain 87 trained about that sprocket and extending to a sprocket 134 rotatably mounted on a stub shaft 134a carried by the frame 10 above the sheet carrying frame 11.

Pusher mechanism

As best seen in Figures 1, 2, and 4, a pair of cylindrical rods 91 and 92 extend lengthwise of the machine, with one end of each rod secured to plate 93 on the frame 10, and the other end held by a support 94. A carriage 96 is mounted for reciprocatory movement along the rods 91 and 92, the carriage 96 including an arm 97 (Figure 4) which carries a cam follower roller 98. A spring 99

(Figure 2) having one end secured to the carriage 96 and having its opposite end held to a fixed part of the assembly urges the cam follower 98 into continuous contact with an eccentric 101 mounted on the cam shaft 62.

At the forward end of the carriage 96, there is provided a pair of collars 102 which slidably receive a pair of rods 103 arranged for vertical reciprocation. The rods 103 are received at their upper ends within a block 104 on which a pair of rollers 106 are mounted at opposite ends.

The base of the rods 103 each include a bore which receives a spring 107 and a pin 108, the two being held within the bore by a keyed collar 109.

An annular collar 111 is secured to each rod 103 near its lower end to serve as a stop for a helical spring 112 which is disposed between the collar 111 and a portion of the carriage 96. It will be seen from Figure 4 that the action of the spring 112 urges the roller 106 into continuous contact with the levers 113. The levers 113 are pivoted by means of pins 114 (Figure 2) and, intermediate their ends, are provided with cam followers 116. Each cam follower 116 is in continuous contact with the periphery of a pusher cam 117 arranged, as evident from Figure 4, to raise the levers 113 during approximately one half of the period of revolution of the cam shaft 62. Raising of the levers 113 also serves to raise the pusher mechanism because of the vertical movement given to the rollers 106 by the levers 113. Thus, the pusher mechanism remains in the elevated position shown in Figure 4 until the carriage 96 moves to its farthest point to the right as viewed in Figure 4, whereupon the pusher mechanism is lowered by the action of the cam 117. As will hereinafter appear, at this instant, the single sheet may be suspended from the suction cups above the remainder of the stack 12. Even if the sheet has been released, however, it does not have sufficient time to settle down by gravity onto the stack 12 by the time the pusher mechanism engages the sheet, as a small pocket of air remains between the sheet and the remainder of the stack 12. The left end of the sheet (Figure 4) is then contacted by the resiliently biased pin 108 and also by the pieces of the rubber tubing 118 which fit snugly about the end of the rods 103. The pin 108 pushes the left end of the top sheet (Figure 4) down on the remainder of the stack and the resistance of the stack causes the resiliently biased pin 108 to be pushed upwardly into its bore against the force of the spring 107 until the tubing 118 also contacts the top sheet. The pins 108 and the tubing 118 exert a gripping action on the sheet and tear the sheet off from the needle 15 as the carriage 96 moves to the left (Figures 2, 3, and 4) in response to rotation of the eccentric 101 against the follower 98 on the carriage. The recessed portion 15a of the needle 15 facilitates such tearing. The sheet is then pushed by the pusher mechanism into engagement with the gripping means subsequently to be described. At the end of its travel, the pusher mechanism is then elevated by the action of the pusher cams 117 and the followers 116 and returned by the action of the tension spring 99.

The gripper mechanism

The gripper mechanism is best illustrated in Figures 1 and 2 of the drawings. As shown in these two figures, the mechanism may consist of a carriage 121 arranged for reciprocatory horizontal movement along the rods 91 and 92, the carriage 121 including a bracket 122 and a pair of gripper shoes 123 fixedly secured to it. The bracket 122 carries a horizontally extending pin 124 to which is rotatably secured an angle arm 126 and a pair of sleeves 127 for movement in unison. A pair of rubber-covered paws 128 are tightly received within the sleeves 127 and cooperate with the shoes 123 to provide gripping jaws for the sheet delivered by the pusher mechanism as previously described.

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In order to close the gripper jaws provided by the shoes 123 and the movable paws 128, there is provided a stop 132 in the path of movement of the angle arm 126. Thus, when the gripper carriage is moved to its farthest righthand position, as viewed in Figure 1, the angle arm 126 hits the stop 132 and closes the gripper jaws after a sheet has been delivered to the jaws by the pusher mechanism.

The gripper mechanism is reciprocated by the provision of the sprocket 134 which receives the chain 87 being driven by the sprocket 86. A rod 136 is provided with one end pivotally secured by means of a pin 137 to the chain 87 and its other end secured in pivotal engagement with a pin 138 carried by the carriage 121.

The position of the gripper mechanism is correlated with the movement of the pusher carriage as will appear more fully subsequently, so that the gripper jaws are closed as a sheet of the wrapping material is fed into the jaws. The jaws remain closed while the gripper carriage 121 moves to the left as viewed in Figure 1 until the angle arm 126 strikes a stop 139 fixed to the frame near the lefthand or delivery end of the machine. When the angle arm 126 strikes the stop 139, the jaws of the gripper mechanism are pivoted into an over-center position where the jaws remain open during the return of the gripper mechanism 121. The furthestmost position of the gripper jaws in the lefthand direction is illustrated by the dotted line showing of Figure 1. The jaws then remain open until such time as the carriage is returned to the opposite side and the angle arm 126 strikes the stop 132.

It will be observed that the reciprocatory motion of the gripper carriage 121 and the pusher carriage have the same period, i.e., they complete one cycle during the same time interval, but they operate 180 degrees out of phase.

In the machine shown in the drawings, it has been found desirable to stop the motion of the wrapper sheet just prior to the time the gripper jaws are disengaged. For this purpose, there is provided a pair of angularly converging arms 141 at whose forward ends a pair of rubber-coated fingers 142 (Figure 1) are threadedly engaged. The arms 141 terminate at their rearward ends in transverse bearings 141a (Figure 2) which are mounted on pins 141b secured to the frame to afford vertical swinging movement of the arms 141. Adjacent the rearward end of each of the arms 141 is a collar 143 which rotatably receives a roller 144 (Figure 4). The rollers 144 are arranged to engage a pair of cams 146 (Figure 2) keyed to the cam shaft 62. The arrangement of the cams 146 on the cam shaft is such that the arms 141 are pivoted downwardly about the pins 141b to engage the traveling sheet, while it is still being carried to the left by the action of the gripping means. The described action of the arms 141 removes the sheet from between the gripping jaws provided by the shoes 123 and the rubber paws 128, and preferably deposits the sheet upon a conveyor belt or similar mechanism which transports the sheet to the packaging machine or similar equipment. As indicated in Figure 1, the top 10a of table 10 is slotted to accommodate a pair of endless chains 147 having spaced apart lugs 148 thereon to engage the rear edge of each sheet as it is removed from the gripping jaws by the arms 141. A pair of springs 149 are provided to hold the rollers 144 against the cams 146 and thereby return the stop mechanism to its normal position in which the fingers 142 are in an elevated position, as best seen in Figure 1, after depositing the sheet on the table 10.

Timing

In Figure 5 there is illustrated the operation of the various cams and carriages during a complete cycle of operation of 360 degrees. The first chart labeled "A" illustrates graphically the condition of the valve 56 which controls the operation of the vacuum to the suction cups 21 and 22. The second chart "B" illustrates the

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timing of the stop arms 141 during a complete cycle. The third chart "C" illustrates the timing involved in moving the suction cups 21 and 22 into and out of engagement with the stack 12. The fourth chart "D" illustrates the timing of the portion of the pusher mechanism which periodically engages the sheet previously lifted by the suction cups. The fifth chart "E" illustrates the movement of the pusher carriage in a horizontal direction, and the sixth chart "F" illustrates the movement of the gripper carriage.

Starting at the reference point (0 degree), it will be seen from chart "C" that the suction cups 21 and 22 are engaged with the stack 12 at the time the valve 56 is operative to apply vacuum (chart "A"). At this position the stop mechanism is still raised (chart "B") and the pusher carriage, controlled by the position of the eccentric 101, is at its extreme lefthand position as viewed in Figure 4. Similarly, the gripper carriage 121 is at its extreme righthand position and commencing its movement to the left.

As the pusher carriage commences moving to the right and the gripper carriage to the left, the suction cups are raised by the action of the suction cup cam 61. Shortly thereafter, as evident from chart "A," the valve 56 is closed so that vacuum is no longer applied to the suction cups 21 and 22. The sheet remains elevated by the gripping action of the suction cups 21 and 22 or starts to settle by gravity. Shortly thereafter, however, the pusher mechanism, as illustrated in chart "D," is brought down into contact with the raised sheet and engages the sheet when the pusher carriage is at its extreme righthand position. The pusher moves the sheet to the left where it is engaged by the gripper when the gripper is substantially at its extreme righthand position.

During this interval, a preceding sheet has been carried by the gripper mechanism and the stop arms 141 have become operative (chart "B") just shortly before the gripper arms have been opened (chart "F"). The sheet is then released from the machine and travels to suitable auxiliary equipment.

The apparatus of the invention is particularly adapted to feeding individual sheets of wrapping materials such as wax-coated cellophane. The positive action provided by the suction cups and the applied vacuum readily lifts the sheet from the stack without the necessity of peeling each sheet individually from the stack as was frequently necessary in the past. The apparatus has the further advantage that it is capable of adjustment in timing and other variables to accommodate sheets of different sizes.

It will be evident that various modifications can be made to the described embodiments without departing from the scope of the present invention.

I claim:

1. A sheet feeding machine adapted to feed single sheets of material having a cohesive surface from a stack of such sheets comprising a magazine arranged to hold a stack of the sheets, vertically movable lifting means arranged to periodically lift a single sheet from the stack and to then release the lifted sheet, reciprocating means operating in timed relation with said lifting means to draw the lifted single sheet from said stack after the single sheet is released by said lifting means, and means bearing on the stack of sheets at all times, the lifting and reciprocating means being operable to tear the single sheet from said bearing means thereby maintaining the remainder of said sheets in a closely stacked relationship.

2. A sheet feeding machine adapted to feed single sheets of material having a cohesive surface from a stack of such sheets comprising a magazine arranged to hold a stack of the sheets, vertically movable lifting means arranged to periodically lift a single sheet from the stack and to then release the lifted sheet, reciprocating means to draw the lifted single sheet from said stack after the single sheet is released by said lifting means, and an impaling

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device which extends through at least the single sheet and the next adjacent sheet to maintain the remainder of said sheets in a closely stacked relationship, the lifting of the single sheet by said lifting means and the drawing of the sheet from the stack by said reciprocating means serving to tear the single sheet from said impaling means.

3. A sheet feeding machine adapted to feed single sheets of material having a cohesive surface from a stack of such sheets comprising a magazine arranged to hold a stack of the sheets, vertically movable lifting means which includes suction cup means arranged to periodically lift a single sheet from the stack and to then release the lifted sheet, reciprocating means operating in timed relation with said lifting means to draw the lifted single sheet from said stack after the single sheet is released by said suction cup means, and an impaling device comprising a tapered pin having a pointed end which extends through at least the single sheet and the next adjacent sheet to maintain the remainder of said sheets in a closely stacked relationship.

4. A sheet feeding machine adapted to feed single sheets of material having a cohesive surface from a stack of such sheets comprising a magazine arranged to hold a stack of the sheets, vertically movable lifting means arranged to periodically lift a single sheet from the stack and to then release the lifted sheet, reciprocating means to draw the lifted single sheet from the stack after the single sheet is released by said lifting means, and an impaling device which is positioned above the edge of the stack opposite from the direction of travel of the single sheet, said impaling device and the stack being biased together so that said impaling device extends through at least the single sheet and the next adjacent sheet to maintain the remainder of said sheets in a closely stacked relationship,

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the lifting of the single sheet by said lifting means and the drawing of the sheet from the stack by said reciprocating means serving to tear the single sheet from said impaling means.

5. A sheet feeding machine adapted to feed single sheets of material having a cohesive surface from a stack of such sheets comprising a magazine arranged to hold a stack of the sheets, vertically movable lifting means which includes suction cup means arranged to periodically lift a single sheet from the stack and to then release the lifted sheet, a reciprocating pusher mechanism operating in timed relation with said lifting means to draw the lifted single sheet horizontally from said stack after the single sheet is released by said suction cup means, a reciprocating gripper mechanism operating in timed relation with said pusher mechanism to grip said sheet after it has been engaged by said pusher mechanism to entirely withdraw said sheet from the remainder of the stack, and a fixedly positioned impaling device comprising a tapered pin having a pointed end positioned over said stack, said magazine including a biasing means which is operable to urge said stack against said impaling pin so that the pointed end of said impaling device extends through at least the single sheet and the next adjacent sheet to maintain the remainder of said sheets in a closely stacked relationship.

References Cited in the file of this patent

UNITED STATES PATENTS

1,145,405	Cheshire	July 6, 1915
1,206,005	Lev	Nov. 28, 1916
1,608,298	Blaine	Nov. 23, 1926
2,278,449	Jenner	Apr. 7, 1942