United States Patent

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[73] Assignee **Southworth Machine Company**
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[54] **AUTOMATIC FEED FOR LIFTS OF LIMP PAPER**
8 Claims, 6 Drawing Figs.

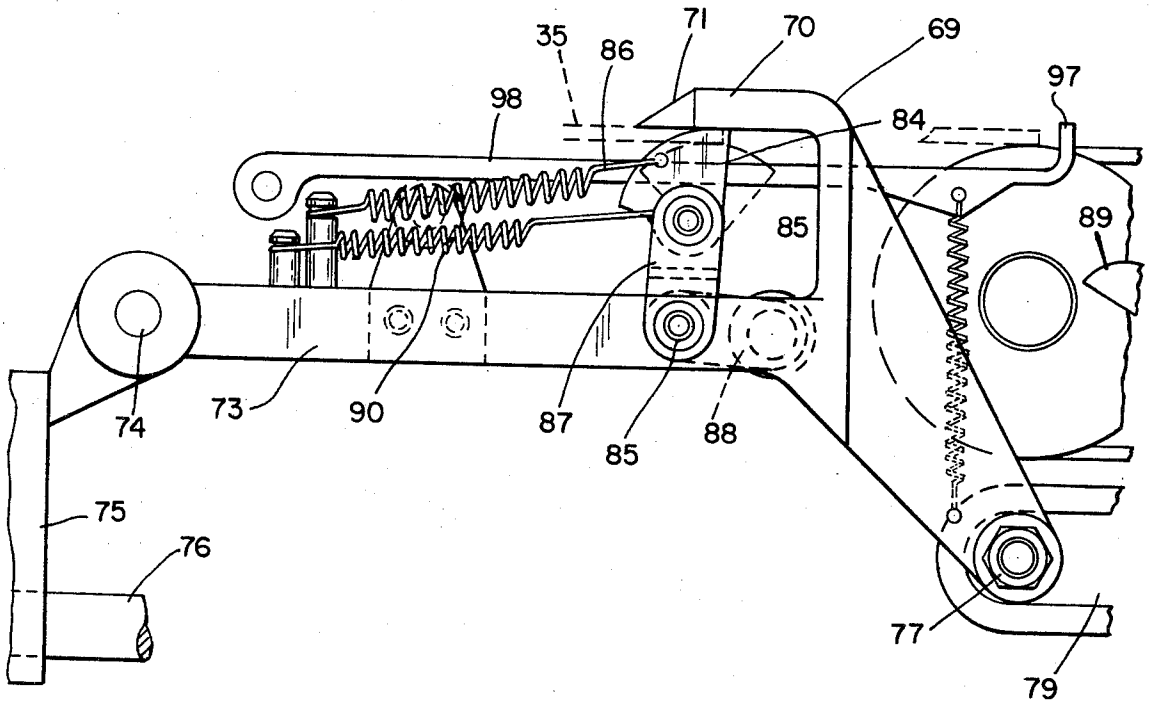
[52] **U.S. Cl.** **214/8.5**
[51] **Int. Cl.** **B65g 59/06**
[50] **Field of Search** 214/8.5
(A), 8.5 (C), 8.5 (SS), 8.5; 271/18, 37, 38

[56] **References Cited**
UNITED STATES PATENTS

3,327,873	6/1967	Malamood	214/8.5(C)
3,391,806	7/1968	Geis	214/8.5(C)

Primary Examiner—Gerald M. Forlenza
Assistant Examiner—George F. Abraham
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ABSTRACT: An automatic apparatus for feeding lifts of limp paper from a stack in a magazine to the bed of a paper treatment machine, such as a punch. A combined stabber gripper penetrates the stack, clamps onto the lowermost lift, partially withdraws the lift and then moves out of the path of the lift. A pair of driven rolls then descend on the lift to press it against a lower endless conveyor and complete the withdrawal of the lift. When the trailing edges of the lift emerge from the nip, lateral shifting pressure is exerted, whereupon the lift engages a stop and is in position for treatment.



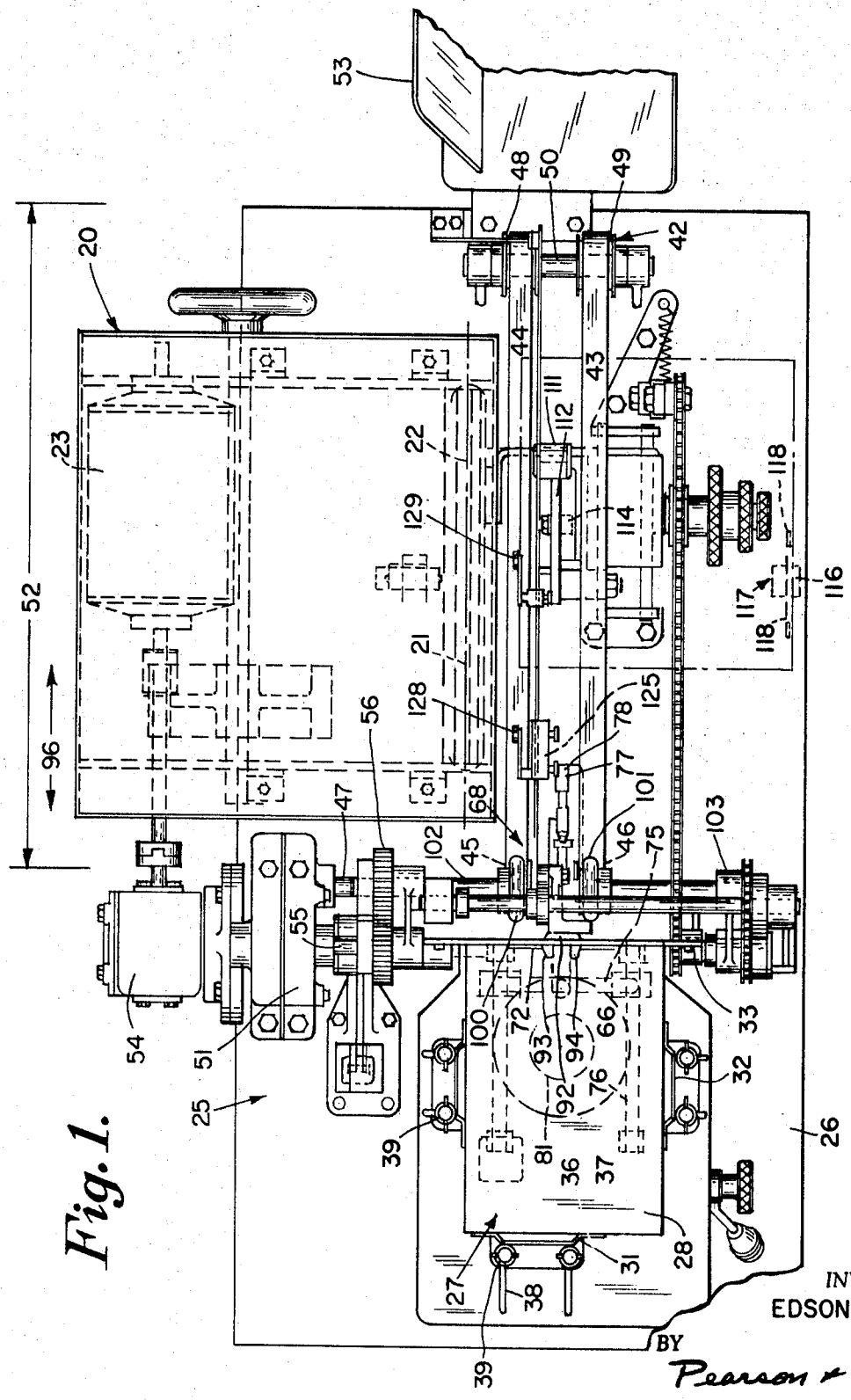


Fig. 1.

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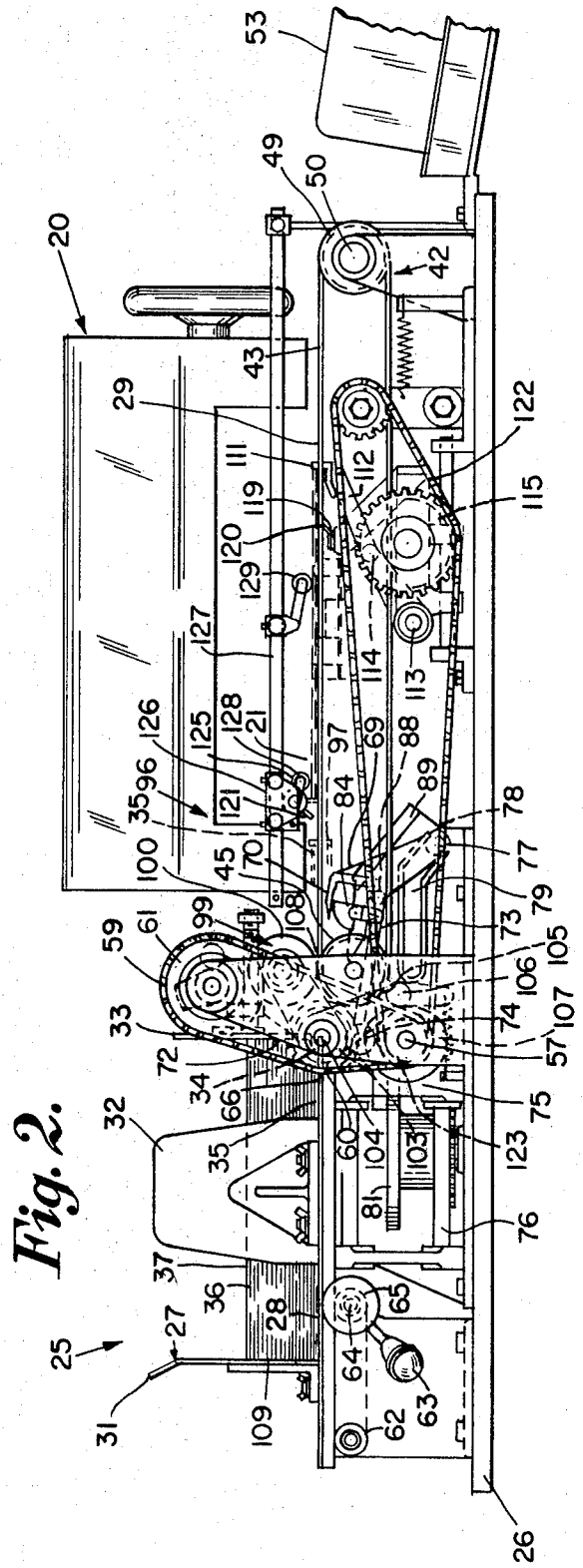


Fig. 2.

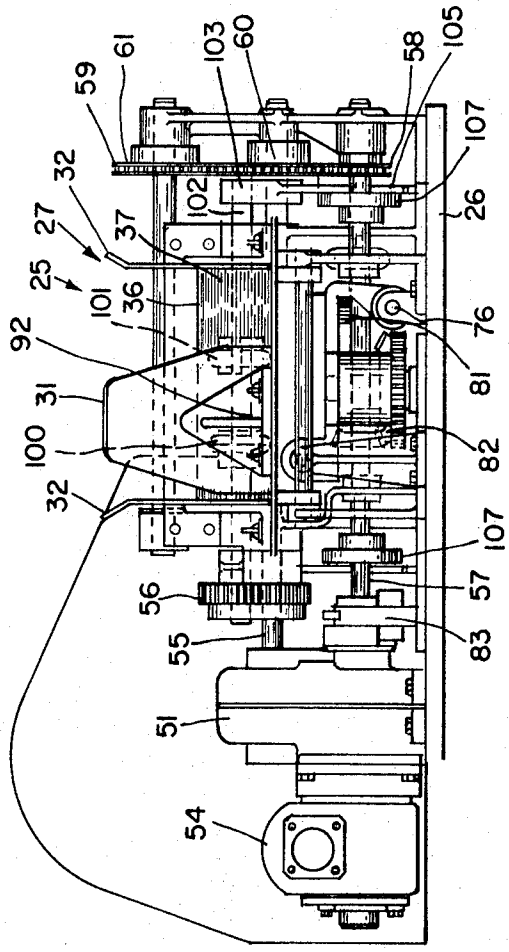


Fig. 3.

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Fig. 4.

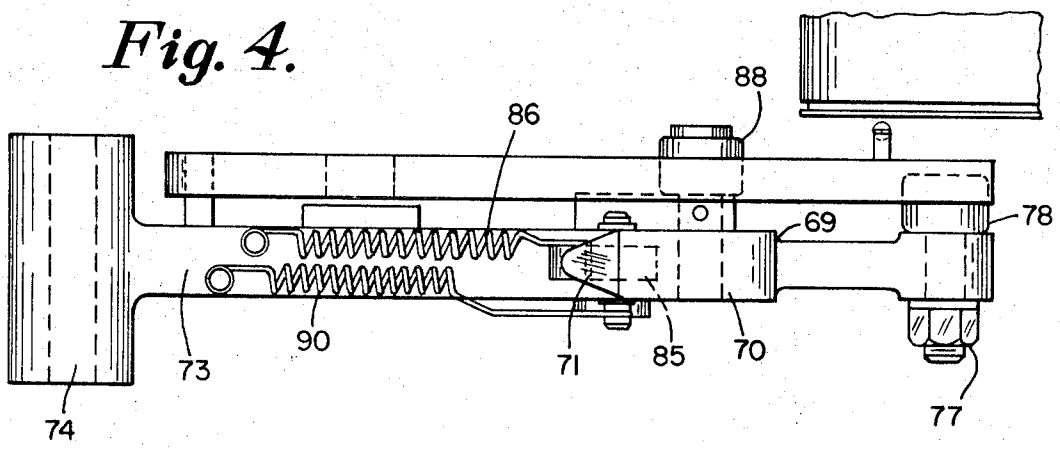


Fig. 5.

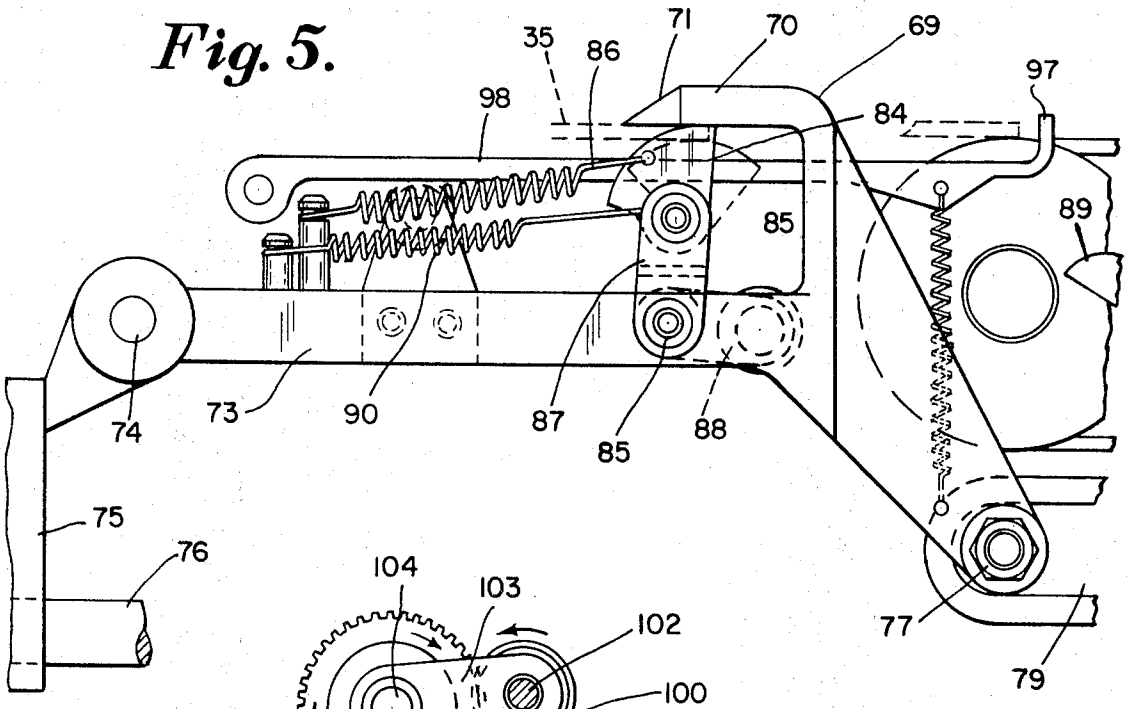
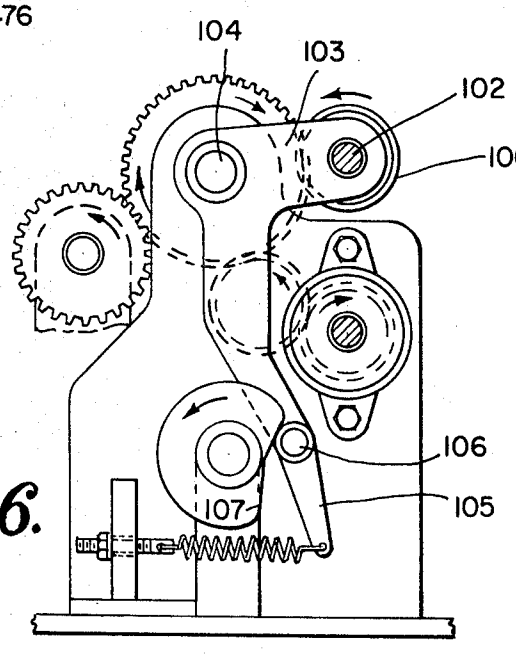


Fig. 6.



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AUTOMATIC FEED FOR LIFTS OF LIMP PAPER

BACKGROUND OF THE INVENTION

The feeding of relatively stiff individual sheets from a stack, can be accomplished by many well-known devices, such as reciprocating blades, suction cup arms, etc., for the reason that pressure on the rear edges does not cause buckling and suction does not penetrate to the next sheet. Feeding of a plurality of sheets, usually called a "lift," when the sheets are stiff, also prevents few problems.

However, this invention deals with limp, flimsy sheets of the onionskin, notebook paper grades, and is for the purpose of successfully feeding lifts of such flimsy sheets from a stack to a punch or the like. In U.S. Pat. No. 2,641,321, to Cruzan of June 9, 1953, a reciprocating pusher blade operates on the trailing edges of the sheets in a stack to push the lowermost lift in the direction of feed until the leading edges are caught in the nip of feed rolls. It has been found that such a pusher blade will not operate satisfactorily with limp flimsy paper.

In U.S. Pat. No. 3,327,873 to Malamood of June 27, 1967, it is proposed to solve the problem of feeding lifts of limp sheets by reciprocating a nipper carriage in front of the magazine, rather than to attempt to push the lift, as in U.S. Pat. No. 2,641,321. In the Malamood patent, a stabber first penetrates the stack to bend the leading edges of the lowermost lift down away from the stack, whereupon the nippers grip the leading edges and pull the lift in a straight line entirely out from under the stack and across the feed tapes, the lift being released to fall on the tapes. The magazine is at right angles to the path of the tapes and the tape bed is tilted to cause side registration as the lift advances.

It has been found that while the device of the Malamood patent is most satisfactory, it takes up considerable floor space and that there is a substantial market for a simplified, extraction-type feed such as disclosed herein.

SUMMARY OF THE INVENTION

In this invention, the magazine is aligned with the conveyor so that the lowermost lift may be extracted in the direction of advance of the tapes and may remain in side edge alignment with the back gauge of the punch from the magazine to the punch. The stabber gripper is unitary in that the upper jaw stabs into the stack to lift the sheets away from the segregated lift while the lower jaw opens to grip the leading edge portion of the lift. Instead of retracting a distance equal to the length of the sheets, to entirely extract the clamped lift, the stabber gripper retracts only to the nip of raised pressure rolls and then disappears below the path of the lift. The pressure rolls then descend to complete the withdrawal of the lift, by forming a nip with the feed tapes, the rolls preferably rotating at a greater surface speed than the tapes to slightly fan the leading edges of the lift. When the trailing edges of the lift emerge from the nip, sidewise pressure pushes the lift laterally against the back gauge of the punch just before the leading edges engage a stop. The tapes continue forward travel, while punching takes place on the stopped lift, and then the stop moves below the path to permit further advance of the lift. The punch control cycle actuates a limit switch which causes the stabber gripper to repeat its cycle.

DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of the apparatus of the invention;

FIG. 2 is a side elevation;

FIG. 3 is an end elevation thereof;

FIG. 4 is an enlarged fragmentary plan view of the stabber gripper;

FIG. 5 is a side elevation thereof; and

FIG. 6 is a side elevation showing the pressure roll mounting.

PREFERRED EMBODIMENT

As shown in the drawings, 20 is a typical paper treatment machine such as an automatic punch of the type which punches a row of rectangular holes in one edge of a lift of sheets, so that plastic bindings can form the sheets into a notebook. Machine 20 includes an adjustable back gauge 21 and the male punch head 22 is powered by the drive motor 23, all in a well-known manner forming no part of this invention.

The automatic feed apparatus 25 of the invention includes a suitable base 26, to which the punch 20 is bolted.

Magazine means 27 includes the platform, or magazine bottom 28, 28 which is at the level of the plane of the bed 29 of punch 20. Magazine 27 also includes the rear upstanding stack guide 31, at least one upstanding side stack guide 32, and an upstanding forward wall, or gate 33, having a gateway 34 therebelow for passage of the lowermost lift 35 of sheets 36 of the stack 37. The stack guides 31 and 32 are adjustable by the slots 38 and wingnuts 39, in a well-known manner.

Conveyor means 42 includes a pair of endless tapes 43 and 44 trained around laterally spaced-apart sheaves 45 and 46, sheave 45 being fast on shaft 47 just in front of magazine 27 and trained around laterally spaced-apart sheaves 48 and 49, fast on shaft 50 at the other end of machine 20. Sheave 46 is an idler sheave on a stub shaft. The upper stretches of the parallel tapes 43 and 44 thus run across the front of machine 20, parallel to back gauge 21, from just in front of magazine 27 through the lift treatment station 52 to a hopper 53 at a lift discharge station.

The feeder drive comes from the punch motor 23, through a flexible coupling, to a ten-to-one gear reducer 54, and thence to a gear box 51, having three output shafts. One output shaft 47 continuously drives the tapes 43 and 44 at a predetermined speed. The second output shaft 55, through the continuously meshed gear train 56, drives the pressure rolls 100 and 101, the rolls having slightly greater predetermined surface speed than the tapes by reason of an increased outside diameter. The third output shaft 57 drives a single revolution clutch 83, of a commercially available type known as a "Hilliard" clutch. Clutch 83 is operated by a solenoid, and the clutch output shaft 57 operates a stabber gripper crank rotor 81, the cam 107 which raises and lowers the pressure rolls 100 and 101 and also operates the hold-back elements 93, 94 through drive sprockets 58, chain 59, tension sprocket 60, and driven sprocket 61.

The magazine bottom 28 is pivoted at 62 and a turn knob 63, shaft 64 and eccentric cam 65 are provided to permit the forward portion 66 of the magazine bottom to be raised or lowered with relation to gateway 34 and forward gate 33. Thus the amount of paper, or thickness of a lift, to be fed out of the magazine can be adjusted by adjusting the level of the forward portion 66 of magazine bottom 28.

The combined segregation and extraction means 68 of the invention comprises partial extraction means including the stabber gripper 69, which has an unyieldable, upper jaw 70, with a tapered upper edge 71 adapted to lift the stack as the jaw 70 pierces into the forward face 72 of the stack. The jaw 70 is mounted on an elongated carriage 73 pivoted at 74 to a bracket 75, slidable on rods 76 and supported at 77 on a cam follower 78, slidable in the cam track 79. The horizontal crank rotor 81, rotated by bevel gears 82 from drive shaft 57 causes the carriage to reciprocate through a cycle under the control of the single revolution clutch 83. Stabber gripper 69 includes the movable clamping jaw 84 pivoted to carriage 73 at 85 and spring-biased toward closure by the coil spring 86. The yieldable jaw 84 is itself pivotally mounted on a pivoted arm 87, arm 87 having a cam follower projection 88 arranged to engage the cam 89 fixed to the tracks 79 and arm 87 being spring-biased toward closure by spring 90, which is stronger than spring 86.

It will thus be seen that as the stabber gripper pierces into the stack, segregating off the desired number of sheets at the bottommost lift, the jaw 84 is forced open by the leading edges of the paper, against the pressure of spring 86. The contact

position of the yieldable cam 84 with the lift of paper is approximately 5° of angular distance from the vertical in the direction of retraction. Jaw 84 can thus adjust to the particular thickness of the lift being stabbed from the stack and upon retraction, the harder the pull the more firm the grip.

Part of the segregation and extraction means 68 is preferably unitary separator 92, formed with two straddle fingers 93 and 94, each on an opposite side of the path of the stabber gripper 69. As the upper jaw 70 and its tapered upper edge 71 penetrate into the forward face 72 of stack 37, a gap is created by the lifting of the stack, and the fingers 93 and 94, each on an opposite side of the path of the stabber gripper 69. As the upper jaw 70 and its tapered upper edge 71 penetrate into the forward face 72 of stack 37, a gap is created by the lifting of the stack, and the fingers 93 and 94 enter the gap to hold back the sheets above the bottom lift 35.

It should be noted that while the stabber gripper could entirely extract each individual lowermost lift 35, from under the stack, as in prior art devices, the path of travel would be undesirably long, the return path would consume time, and the trailing edges of the lift would lack control. In this invention, therefore, the stabber gripper 69 retracts horizontally for a predetermined short distance to a release zone 96, at which location the projection 88 strikes cam 89 to open the nipper jaw 84 and release the lift, whereupon the stabber gripper travels downwardly to a level below the path, on paper line, of the lift.

The partially extracted lift 35 is held at zone 96 by a stop 97, until final extraction means 99 comes into operation. Means 99 comprises a pair of pressure rolls, 100 and 101, fast on shaft 102, shaft 102 being carried in bracket arms 103, pivoted at 104 and having a downwardly extending arm 105 carrying a roller cam follower 106 engageable by rotating face cam 107. The continuously rotating rolls 100 and 101 are preferably friction faced and are normally poised at a spaced distance above the tapes 43 and 44 to form nips 108 of predetermined large clearance capable of permitting the stabber gripper to pull the leading edges of lift 35 into the nip 108 without obstruction. When the drive rollers 100 and 101 are lowered onto the upper face of the lift, the lift is gripped and conveyed in the direction of feed until the trailing edges 109 emerge from the nip 108, in other words, for the length of the lift.

Stop 97 is mounted on the arm 98, which falls when the stabber gripper retracts below the paper line and rises when the stabber gripper rises to gripping level.

The magazine is aligned with the back gauge 21 of the punch so that each successive lift is maintained in side edge registration with the back gauge from the stack to the punch.

Preferably the rollers 100 and 101 are rotated at greater surface speed than the surface speed of the tapes, so that as the lift is advanced in nip 108, the front edges of the sheets are urged to fan forwardly, upon release from the nip. The front edges then impact the leading edge stop 111, which orients and aligns the front edges, whether one or more sheets may be shorter or longer than the other sheets.

Leading edge stop 111 is carried on an arm 112, pivoted at 113 and having a roller cam follower 114, which engages roller cam 115 so that it stops each lift at the punch station, but retracts below the path of the lift after punching.

Lateral shifting means 117 is operable while the lift is riding on the tapes, after release from nip 108, and before impact with stop 111 to apply gentle sidewise pressure on the edge of the lift to urge the sheets toward the back gauge 21. A series of leaf springs may be used for the purpose, but one, or more, arms 118 actuated by a rotary solenoid 116 are preferred.

A limit switch 119 in the path of each lift 35 at the punch station is energized by the leading edges of the lift depressing the switch arm 120 to close a control circuit. The control circuit triggers the register fingers 121 to jog the trailing edges of the lift against the stop 111, while also triggering the punch control circuit to repeat the punching and feeding cycle. Thereupon clutch 83 is triggered, stabber gripper 69 moves into the stack and stop 97 is lowered. The cam 84 secures a firm grip on the bottom lift, and the stabber gripper 69 then retracts to the release zone 96, releases the lift and moves below the path. Rolls 100 and 101 are then lowered to complete the extraction of the lift and stop 97 raised. The lift then engages stop 111 and the speed of the tapes causes the lift to be jogged, while the friction of the tapes holds the lift against the stop during punching.

Upon reaching stop 111, limit switch 120 causes the punch to cycle, and that cycle causes the stabber gripper to repeat its path while causing stop 111 to lower for the advance of the punched lift to the discharge zone, or hopper.

The cam 115 is rotated by the chain 122, which is turned by sprocket 123 on the drive shaft 57, so that the stop 111 is synchronized with the actuation of the drive rolls.

Register fingers 121 are actuated by a rotary solenoid 125, similar to rotary solenoid 116, carried on the bracket 126, longitudinally adjustable on framepieces 127. A holddown roller 128 is also carried on bracket 126 to assist infeed, and a similar holddown roller 129 is adjustable along framepiece 127 to assist out-feed.

I claim:

1. In paper feed apparatus for automatically feeding lifts of limp sheets to a sheet-treatment machine, said apparatus being of the type having a bottom feed magazine supporting a stack of said sheets; conveyor means for conveying individual and successive lifts along a path from said magazine means through said machine, and a leading edge stop for halting each successive lift on said path for treatment in said machine, the combination of:

combined segregation and extraction means comprising partial extraction means including a stabber gripper arranged to penetrate said stack to segregate a lift, to clamp on the front edges of said lift for extracting the same, and to release said lift;

actuation means operatively connected to said stabber gripper, including mechanism guiding said stabber gripper from a position above said path at said magazine means to a position below said path, at a lift release zone along said path in front of said magazine means;

said stabber gripper disappearing below the path of each lift after partially withdrawing a portion of the same from said magazine and releasing its grip on said lift; and

final extraction means, on said apparatus, for gripping each said partially extracted lift and completing the withdrawal thereof from said magazine.

2. Apparatus as specified in claim 1, wherein:

said stabber gripper includes an unyieldable upper jaw and a yieldable lower jaw, resiliently pivotable relative to said upper jaw, said jaws sliding onto a lift with minimal resistance, but firmly clamping the same, when moved in a direction away from said lift.

3. Apparatus as specified in claim 1, wherein:

said stabber gripper includes a pivoted clamping jaw spring biased toward closure, and said actuation means includes cam means for opening said jaw during retraction of said stabber gripper.

4. Apparatus as specified in claim 1, wherein:

said final extraction means comprises pressure roll means on said path in rear of said magazine means and operatively connected to said actuation means, said means cooperating with said conveyor means to grip each successive lift, partially extracted from said magazine means by said stabber gripper, and complete the extraction thereof.

5. Apparatus as specified in claim 4, wherein:

said actuation means includes means for rotating said pressure roll means at a surface speed greater than the surface speed of said conveyor means for fanning the upper sheets in each lift forwardly;

whereby the leading edges of said fanned sheets are aligned by engaging said leading edge stop.

6. Apparatus as specified in claim 4, plus:

lateral shifting means mounted alongside said path in rear of said magazine means, said means continuously exerting gentle pressure on the side edges of each lift being advanced thereby in the grip of said pressure roll means;

whereby said pressure is effective to shift said lift laterally upon release of the trailing edges thereof by said pressure roll means.

7. In paper feed apparatus for automatically feeding lifts of limp sheets to a sheet-treatment machine, said apparatus being of the type having a bottom feed magazine, endless conveyor means extending along a path from said magazine through a treatment station of said machine to a discharge zone, and a leading edge stop for halting each successive left at said treatment station, the combination of:

extraction means including a stabber gripper movable above said path for penetrating into said magazine, segregating the leading edges of the lowermost lift therein, gripping said leading edges, partially withdrawing said lift a predetermined distance over said endless conveyor means, releasing said grip, and then movable below said path until said released lift has advanced thereover; and

pressure roll means just in rear of said magazine means and cooperable with said conveyor means, said pressure roll means including at least one driven roll normally spaced from said conveyor means but arranged to move into a pressure nip relationship therewith to grip the leading edges of each lift released by said stabber gripper and to complete the withdrawal thereof from said magazine.

8. Apparatus for feeding lifts of limp sheets individually and successively along a path to a paper punch, said apparatus comprising:

magazine means supporting a stack of said sheets at one end of said path;

conveyor means extending along said path from said magazine means to said paper punch;

partial extraction means, including a stabber gripper arranged to enter said stack, grip and partially withdrawn each successive bottommost lift, and release the same at a predetermined location along said path: and

final extraction means, at said location on said path just in rear of said magazine means, including a pair of rotating pressure rolls, each on an opposite side of the path of said stabber gripper and normally raised above said path, said rolls being movable downwardly to engage each lift released by said stabber gripper in a pressure nip with said conveyor means and complete the extraction of said lift from said stack.