Oct. 26, 1965 F. L. WARNER 3,214,165

ELEVATOR MECHANISM FOR PRINTING PRESS

Filed July 16, 1962 2 Sheets-Sheet 1

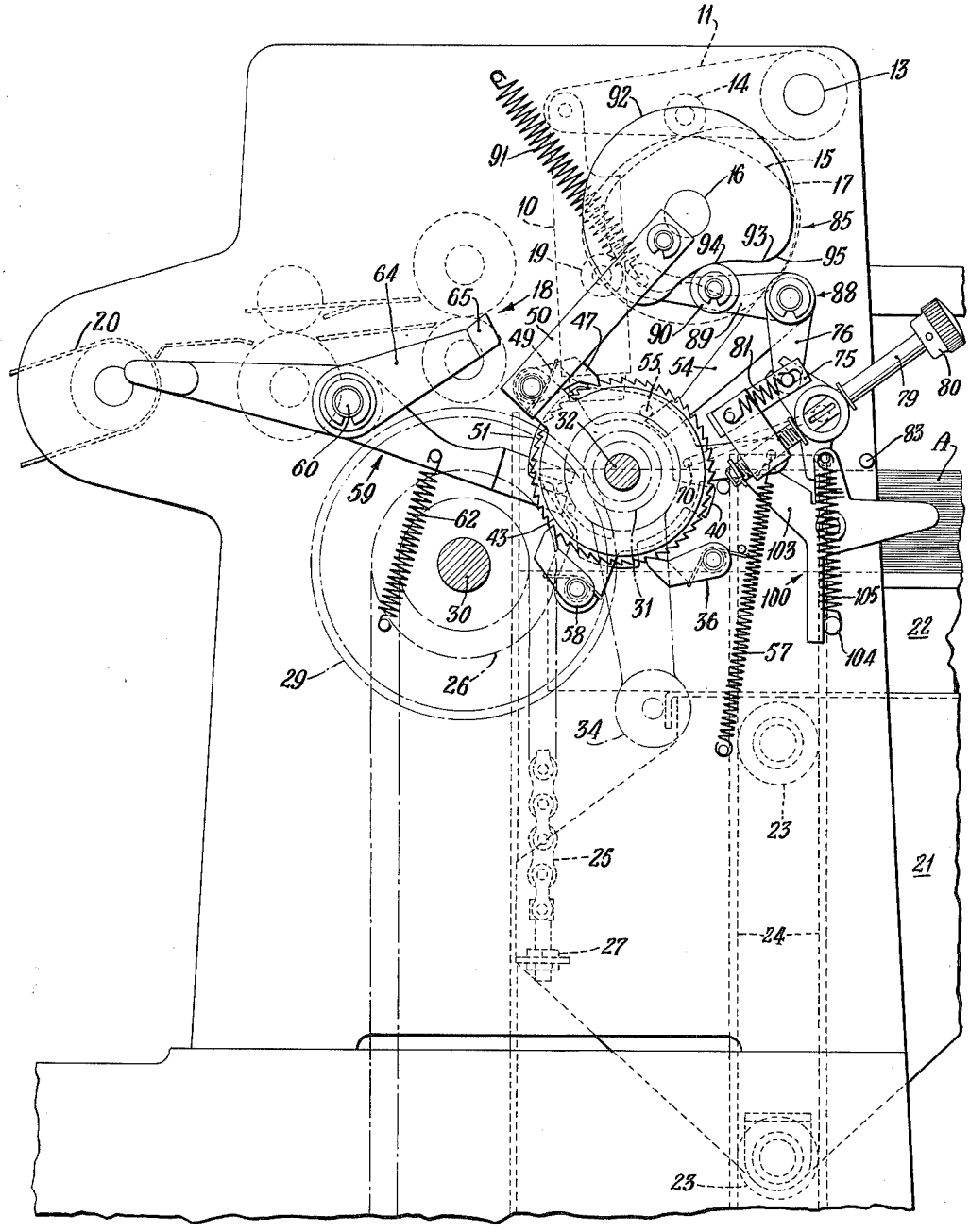

Fig. 1.

INVENTOR.
FREDERICK L. WARNER
BY William P. Keegan
ATTORNEY

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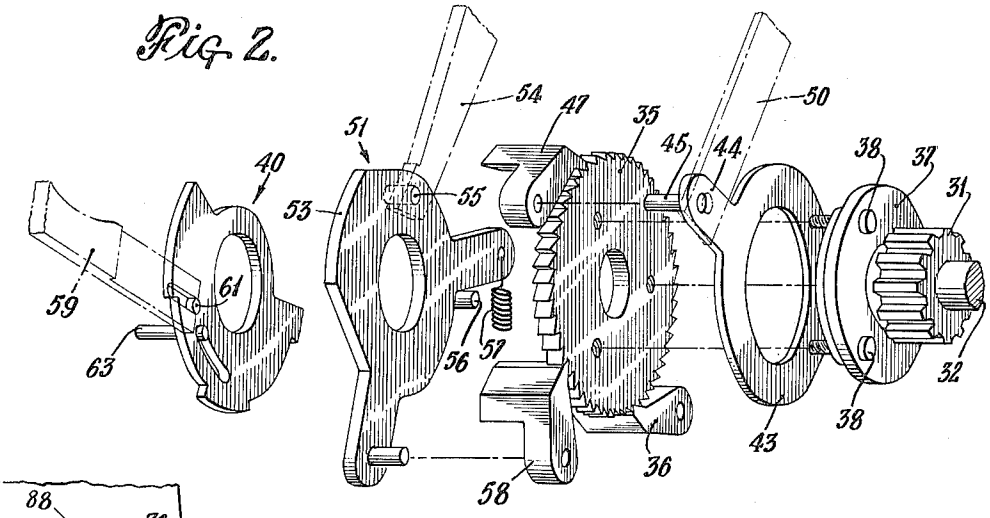
Fig. 2.



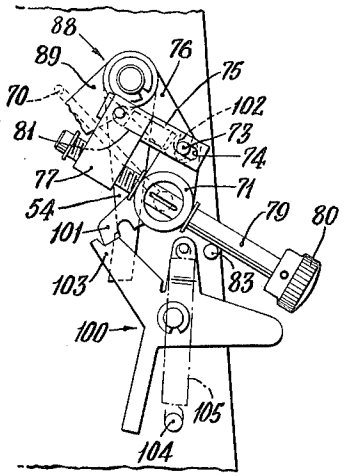


Fig. 3.

Fig. 4.

INVENTOR.
FREDERICK L. WARNER

BY William P. Hogan

ATTORNEY

United States Patent Office

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ELEVATOR MECHANISM FOR PRINTING PRESS

Frederick L. Warner, Brooklyn, N.Y., assignor, by mesne assignments, to Fairchild Camera and Instrument Corporation, a corporation of Delaware

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5 Claims. (Cl. 271—62)

This invention relates to improvements in sheet feeding machines and more particularly it relates to improved means for controlling the operation of the sheet pile elevator to maintain the top sheet of the pile at a desired operating level.

The operating level of the pile is a variable that depends, in general, on the characteristics of the paper stock being fed in the machine. For example, with a suction feeder, the dimensions of the sheet stock, its weight and porosity, and the amount of suction exerted by the feeder are determinative of the operating level of the pile. Generally, when heavy sheet stock is used, the operating level is set high, but not too high or the likelihood of feeding double sheets increases, and not below the desired height or the possibility of intermittent feeding is present. On the other hand, when a light sheet stock such as onion skin paper is to be fed, the operating level of the pile is set relatively low to insure reliable operation of the feeder.

The control mechanism for determining whether or not the top sheet of the pile is at the desired operating level generally includes an oscillating feeler wire device that controls the pile elevator mechanism to maintain the pile at the desired operating level. If the top sheet of the pile falls below the operating level, the feeler wire device responds to that occurrance by actuating the elevator mechanism to advance the pile until desired operating conditions prevail. The feeler wire device continues to test the position of the top sheet of the pile and when it falls below the desired operating level the elevator mechanism is again actuated to elevate the pile of sheets.

It is the object of this invention to provide an improved control and operating mechanism for the elevator of a sheet feeding machine.

In carrying out the invention there is provided a sheet feeding machine having a ratchet actuated mechanism for elevating the pile elevator. A pawl having a fixed periodic stroke is employed to rotate the ratchet but the pawl is ordinarily disengaged from the ratchet by a camming member which determines the operative portion of the pawl stroke. The camming member is controlled by an oscillating feeler wire device that can be adjusted in accordance with the desired operating level of the pile of sheets. A lockout mechanism is provided to prevent oscillation of the feeler wire when it is desired to adjust the throw of the wire for determining different operating levels.

Features and advantages of this invention may be gained from the foregoing and from the description of a preferred embodiment thereof which follows.

In the drawings:

FIG. 1 is a front elevational view of a sheet feeding apparatus embodying the present invention;

FIG. 2 is an exploded view of the elevator operating mechanism shown in FIG. 1;

FIG. 3 is an enlarged view of the lockout mechanism of FIG. 1 shown in its lockout position; and

FIG. 4 is an enlarged fragmentary right side view of FIG. 1.

In FIG. 1 of the drawings there is shown a sheet feeding apparatus embodying the improved elevator mechanism of the present invention. The apparatus selected for illustrative purposes is a suction feeder having a suction foot 10 which is pivotably fastened to an arm 11 which in turn is pivotably supported on shaft 13. Arm

11 is provided with a follower 14 that engages a cam 15 keyed to shaft 16. This latter shaft is continuously rotated so that cam 15 pivots arm 11 downwardly to lower suction foot 10 into proximity with the top sheet of pile A. As arm 11 is pivotted upwardly the suction foot lifts the top sheet from the pile. At this time a cam 17 also mounted on shaft 16 pivots suction foot 10 forwardly to present the sheet to the pullout roller assembly 18. A follower 19 rotatably mounted on suction foot 10 is the means whereby cam 17 advances the suction foot and the sheet carried thereby to the pullout roller assembly. After a sheet is delivered to pullout roller assembly 18 it is translated thereby to a conveyor board 20 which transports the sheet to a printing press (not shown).

An elevator mechanism 21 supports sheet pile A upon a horizontal member 22 which is adjustable to accommodate sheet stocks of various types and sizes. Elevator mechanism 21 is confined to move in a vertical direction by the engagement of rollers 23, mounted on the elevator mechanism, with guide grooves 24 provided in the side walls of the machine frame. A chain 25 is trained over a sprocket 26 and its end is fastened to elevator mechanism 21 by a clamp 27. The sprocket and a gear 29 are keyed to the shaft 30. Thus clockwise rotation of shaft 30 causes the elevator mechanism to be lowered and counterclockwise rotation of the shaft causes it to rise.

A pinion 31 in constant mesh with gear 29 is keyed to a shaft 32 which is journaled in the side frames of the machine. The remote end of the shaft projecting through one of the side frames is provided with a handle 34 for rotating the shaft to thereby manually raise and lower the elevator. Also secured to shaft 32 is a ratchet wheel 35 which, because of retaining pawl 36, can be rotated in a clockwise direction only. The ratchet wheel is fastened to the flange 37 formed on pinion 31 by machine screws 38 and is thereby secured to shaft 32 as noted above. Therefore, the means so far described permits the elevator to be raised manually, but pawl 36 prevents it from being lowered. A releasing member 40, which will be more fully described hereinafter with reference to the automatic operation of the elevator mechanism, can be actuated by hand lever 59 to disengage pawl 36 from ratchet wheel 35 and thereby allow the ratchet wheel to be rotated counterclockwise to lower the elevator mechanism.

Attention will now be directed to the mechanism for effecting the elevation of the sheet pile as sheets are fed therefrom to the printing press.

A collar 43, freely rotatable on flange 37, is provided with a projecting arm 44 on which a pin 45 is mounted. The pin pivotally supports a pawl 47 that is resiliently biased towards engagement with ratchet wheel 35 by a wire spring 49, one end of which is fixed to collar 43. As will later be described, a periodically reciprocating link 50 is pivotably connected to pin 45 to give an oscillatory motion to collar 43 and hence to pawl 47. It is this motion of pawl 47 that drives ratchet wheel 35 and so raises the pile elevator.

Inasmuch as pawl 47 is cyclically actuated, means have to be provided to prevent each forward movement of the pawl from raising the elevator since otherwise the pile of sheets would be advanced too rapidly toward the sheet feeder. This is accomplished by a camming member 51 that is rotatable on shaft 32 and is located adjacent ratchet wheel 35. Member 51 is provided with a raised surface 53 that supports pawl 47 and maintains it out of engagement with wheel 35. Consequently, as collar 43 and pawl 47 periodically move backwardly and forwardly with a fixed stroke, pawl 47 rides on surface 53 of member 51 and does not engage the ratchet wheel. However, if member 51 is pivoted counterclockwise as by the actuating

arm 54 striking a pin 55 projecting from member 51, pawl 47 will in its forward motion ride off surface 53 and engage the ratchet wheel and rotate it in a clockwise direction to raise the pile elevator. The extent of the counterclockwise movement of member 51 will determine the point in its forward stroke at which pawl 47 will engage wheel 35 and hence will determine the distance elevator 21 is raised. The control of the amount of movement of member 51 by actuating arm 54 will be considered more fully hereinafter. Suffice it to say now that the pivotting movement of arm 54 takes place in a very short time so that member 51 would immediately return from its counterclockwise to its normal position against stop pin 56 by the action of spring 57. The net result would be that member 51 would again cam pawl 47 out of engagement with ratchet wheel 35 before it had an opportunity to rotate the wheel and raise the elevator. To avoid this happening, member 51 is provided with a pawl 58 that is resiliently biased into engagement with wheel 35. Thus, when member 51 is pivoted counterclockwise by actuating arm 54, pawl 58 engages the ratchet wheel and prevents the return of member 51 to its normal position even though arm 54 no longer engages pin 55. Now when pawl 47 advances to rotate wheel 35, pawl 58 and member 51 can follow until restrained by stop pin 56.

Also mounted on shaft 32 but free to rotate thereon is the releasing member 40, previously referred to, which is formed with three lobes which cam the three pawls 36, 47 and 58 out of engagement with ratchet wheel 35 when it is desired to lower the pile elevator manually. Of course, the member is normally positioned such that the lobes do not engage the pawls. This normal position is determined by a pawl release handle 59 that is pivotally mounted on stub shaft 60 fixed to the machine frame. The remote end of handle 59 is provided with an elongated slot into which a pin 61 mounted on member 40 projects. A spring 62 urges the handle in a clockwise direction abutting pin 63. When it is desired to release the pawls to enable the elevator to be lowered, handle 59 is depressed to rotate member 40 clockwise whereupon pawls 36, 47 and 58 are cammed out of engagement with the ratchet wheel thereby permitting handle 34 to be rotated counterclockwise to lower the elevator.

To prevent rapid lowering of the elevator under the weight of a pile of sheets should handle 59 be inadvertently depressed, the handle is provided with an arm 64 having an arresting lug 65 projecting into the path of the dowel 66 on handle 34. Therefore, the elevator would only fall until the dowel struck lug 65. When the elevator is being purposely lowered, dowel 66, which is urged by spring 67 into its projected position, is withdrawn so as to clear lug 65 by pulling on crank handle 34 to compress spring 67.

Having described the elevator raising and lowering mechanism, the mechanism for adjusting the operating level of the top sheet of the pile and for maintaining it by controlling the elevator raising and lowering mechanism remains to be described. This latter mechanism employs a reciprocating feeler wire for detecting the position of the top sheet of the pile as is well known in the art.

The feeler wire 70 is formed from a sturdy strip of wire bent substantially at right angles and secured by set screws in holes formed in trunnions 71. The trunnions are rotatably in the machine frame and support the feeler wire in such a position so as to be able to contact the lead edge of the top sheet of pile A at a line adjacent to where suction foot 10 engages the sheet. Contact of the feeler wire near this edge tends to break any adhesions between the sheets and thereby helps to insure against feeding double sheets.

Feeler wire 70 is reciprocated in such a manner that the upper limit of its swing is fixed in space relation to the suction feeder while its throw can be adjusted. This is accomplished by varying the position where a periodically pivotted pin 73 engages the end of a slot 74 formed in a connecting member 75. Pin 73 is formed on an arm 76, whose operation will be described later. Pin 73 rides in slot 74 and when it engages the end thereof it causes counterclockwise rotation of trunnions 71 which in turn reciprocate feeler wire 70 downwardly. Pivotting of connecting member 75 causes rotation of trunnions 71 as the connecting member is pinned to a member 77, that is in turn in threaded engagement with the end portion of a shaft 79 mounted in the left side trunnion. Adjustment of a thumb nut 80 formed on shaft 79 results in changing the position where pin 73 engages the end of slot 74 and hence adjusts the throw of the feeler wire, as will be described shortly hereinafter. A tension spring 81 fastened to pin 73 and member 77 resiliently urges the end of slot 74 towards engagement with pin 73; however, a stop pin 83 secured to the machine frame is adapted to engage shaft 79 at a preset position and prevents further clockwise rotation of connecting member 75. As shown in the drawings, movement of pin 73 in slot 74 is not limited by stop pin 83 but by the dimensions of a drive cam 85 to be described. The relative space relationship of distance between pin 73 and the end of slot 74 prior to any pivotting movement of pin 73 determines the throw of the feeler wire. Clockwise rotation of thumb nut 80 causes connecting member 75 to translate on shaft 79 away from pin 73 thereby increasing the lost motion of free travel of pin 73 in slot 74 before it can engage the end thereof. This reduces the extent of counterclockwise pivotting of connecting member 75 and consequently the throw of the feeler wire. Conversely, counterclockwise rotation of thumb nut 80 moves connecting member 75 towards pin 73, thus decreasing the lost motion travel of pin 73, which in turn increases the throw of the feeler wire. For adjustment purposes a click stop mechanism (not shown) is provided in the left hand trunnion 71 in engagement with shaft 79. It allows an operator, after he has set the operating level for a particular sheet stock, to use this same setting on any subsequent feeding operation with this stock.

The reciprocating pin 73 and link 50 are both driven by means of drive cam 85 that is keyed to shaft 16. Link 50 is rotatably mounted on the face of cam 85 and is driven thereby with the previously described oscillatory motion. Arm 76, which carries pin 73, is formed on a bell crank 88. Bell crank 88 is pivotted on the machine frame and is provided with two additional arms, actuator arm 54 and a third arm 89, provided with a roller 90, biased towards engagement with the periphery of cam 85 by the action of a spring 91. Spring 91 is secured to arm 89 and the machine frame. It is the driving action of cam 85 against roller 90 that causes the pivotting of pin 73 and actuator arm 54. The periphery of cam 85 comprises a circular section 92 extending through approximately 270° having as its center of rotation the axis of shaft 16 and an arcuate section 93 which slopes towards the axis of shaft 16. Point 94 on arcuate section 93 is the low point of the cam or that point closest to shaft 16. This point limits the maximum throw of the feeler wire as will be seen shortly. When roller 90 rides on circular section 92, bell crank 88 will have been pivotted to its extreme counterclockwise position and feeler wire 70 will be in its fixed upper position. Pin 73 is now in a position fixed in space relation to the sheet feeder and as has been described it is the distance at this position between the end of slot 74 and pin 73 that determines the throw of the feeler wire. When roller 90 engages point 95 on the periphery of arcuate section 93, bell crank 88 will have pivotted actuator arm 54 to a position where it just contacts the pin 55 formed on camming member 51. The position of the feeler wire at this time in its downward swing, corresponds to the operating level. If the top sheet of the pile is at this level the feeler wire will contact same and cause roller 90 to dis-

engage from the periphery of cam 85. If feeler wire 70 swings downward past the operating level, the roller will remain in engagement with cam 85 and actuator arm 54 will pivot camming member 51 counterclockwise uncovering a number of teeth on ratchet wheel 35. This action determines the point in the forward strike of pawl 47 where it engages and drive ratchet wheel 35 and thereafter returns the top sheet of the pile to the desired operating level. When roller 90 engages point 94 the maximum throw of feeler wire 70 and actuating arm 54 will have been reached. Thereafter, as roller 90 remains in contact with cam 85, feeler wire 70 reciprocates upwardly and actuating arm 54 disengages from its contact with pin 55.

To provide for close and accurate adjustment of the throw of the feeler wire and consequently adjustment of the operating level, a lockout mechanism 100 is provided. When actuated, it disconnects bell crank 88 from the periphery of cam 85 without shutting off the power supply to cam 85. The lockout mechanism will now be described. A forked member 101 rotatably mounted on trunnion 71 is driven in a periodic manner by pin 73 riding in a catch portion 102 formed in the forked member. Rotatably mounted on the machine frame is engaging member 103 that in its inoperative position is biased into engagement with a stop pin 104 by the action of spring 105 secured to the stop pin and the engaging member itself. However, if engaging member 103 is manually rotated clockwise, it engages the forked member and causes same to pivot bell crank 88 to a position where roller 90 disengages from the periphery of cam 85. Spring 105 as seen in FIG. 3 now urges member 103 clockwise and is sufficiently strong enough to hold it in that position by overcoming the force exerted by spring 91 on bell crank 88. This lockout action prevents bell crank 88 from pivotting which in turn prevents any subsequent movement of feeler wire 70 or elevator mechanism 21. Accurate adjustment of thumb nut 80 on shaft 79 can now be accomplished to vary the throw of feeler wire 70. In order to return the sheet feeder to operation member 103 is rotated counterclockwise. By this movement the lockout mechanism is returned to its inoperative position and bell crank 88 again engages the periphery of drive cam 85.

In operation the pivotting action of pin 73 against the end of slot 74 formed in connecting member 75 causes the oscillation of trunnions 71. Feeler wire 70 fastened to trunnions 71 reciprocates therewith. By changing the position where pin 73 engages the end of slot 74 the operating level determined by the space relation of feeler wire 70 when actuating arm 54 engages pin 55 formed on the camming member 51 can be varied. Actuating arm 54, as has been explained, engages pin 55 when roller 90 reaches point 95 on the periphery of cam 85. Thereafter when feeler wire 70 rotates down past the operating level, actuating arm 54 rotates camming member 51 counterclockwise. When the feeler wire contacts the sheet pile A, bell crank 88 is held stationary and roller 90 disengages from its contact with cam 85. Actuating arm 54 is thereby prevented from rotating the camming member any further. When cam 85 engages bell crank 88 the feeler wire is reciprocated upwardly and actuating arm 54 withdraws from contact with pin 55. The more feeler wire 70 rotates down past the operating level before encountering sheet pile A, the greater distance actuating arm 54 rotates camming member 51 uncovering more teeth, thereby allowing pawl 47 to drive the elevator mechanism 21 a correspondingly greater distance. As the downward limit of swing of feeler wire 70 approaches the operating level, camming member 51 rotates less and thereby uncovers a corresponding fewer amount of teeth until when less than one tooth has been uncovered, lifting movement of the elevator mechanism ceases. The actuating arm is so synchronized that it withdraws from engagement with the camming member before pawl 47 engages ratchet wheel 35, thus preventing any possible interference therebetween.

It is to be understood that many changes can be made in the disclosed embodiment without departing from the spirit and scope of the invention and, therefore, the description and drawing are to be interpreted in an illustrative rather than a limiting sense.

What is claimed is:

1. An elevator mechanism for a sheet feeding machine comprising an elevator, a ratchet wheel for raising said elevator, a shaft on which said ratchet wheel is mounted, a collar member mounted adjacent said ratchet wheel but freely rotatable with respect to said shaft, a fixed throw pawl mounted on said collar member to engage and turn said ratchet wheel, a cam member mounted adjacent said fixed throw pawl for disengaging said pawl from said ratchet wheel, spring means for biasing said cam member to a normal position wherein said pawl is disengaged from said ratchet wheel for the full throw of said pawl, a cam adapted for continuous rotation, a link member connecting said cam to said collar member for imparting a fixed throw to said pawl, a bell crank member pivotted by said cam and adapted to move said cam member to permit said pawl to engage said ratchet wheel, a pivotally mounted feeler mechanism for sensing the level of the pile of sheets carried by said elevator, an adjusting mechanism including a lost motion device connected to said feeler mechanism for controlling the amount of pivotable movement of said feeler mechanism to set the operating level of the pile of sheets, and means connecting said bell crank member and said adjusting mechanism whereby said feeler mechanism is pivotted into and out of sensing position as said bell crank member is pivotted by said cam.

2. An elevator mechanism according to claim 1 including mechanism for latching the feeler mechanism so that it is not pivotted whereby it can be adjusted while stationary to vary the level at which the feeler mechanism controls actuation of the sheet elevator.

3. An elevator mechanism according to claim 1 including a pawl carried by said cam member which engages said ratchet wheel to prevent said cam member being returned to its normal position and thereby disengaging the fixed throw pawl from said ratchet wheel before it is actuated to rotate the ratchet wheel.

4. An elevator mechanism according to claim 3 including a retaining pawl for engaging said ratchet wheel to prevent its reverse rotation, a crank handle connected to the ratchet wheel for rotating said wheel in either direction to raise or lower the elevator, and a manually operated cam means for disengaging all of the pawls from the ratchet wheel to permit the crank handle to be rotated to lower the elevator.

5. An elevator mechanism according to claim 4 wherein the manually operated cam means includes a handle having an arresting abutment formed thereon and the crank handle carries a normally projected retractable pin that will engage said abutment in the event said handle is inadvertently operated to disengage all of the pawls from the ratchet wheel.

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ROBERT B. REEVES, *Primary Examiner.*

ROBERT A. LEIGHEY, ERNEST A. FALLER,

Examiners.