United States Patent

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[54] PAPER FEED TABLE LIFTING DEVICE FOR A PRINTING PRESS

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[73] Assignee: **Kabushiki-Kaisha Ricoh,** Tokyo, Japan

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[51] **Int. Cl.**.....**B65h 1/14**

[58] **Field of Search**.....101/232-238; 271/22, 24, 25, 28, 30, 31, 43, 62

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[57] **ABSTRACT**

A lifting device for a paper feed table for a printing press which operates to lift a table, by rotation of a pinion meshing with a rack connected to the table and disposed substantially vertically, when the height of a stack of printing sheets on the feed table is decreased during printing. A ratchet wheel is rotatable with the pinion and a pawl means is movable into and out of engagement with the ratchet wheel, for intermittently rotating the latter. The pawl means normally is retained out of engagement with the ratchet wheel, and is brought into engagement therewith only responsive to a predetermined reduction in the height of the stack of sheets on the printing table. Thereupon, the feed table is lifted through a distance corresponding to the reduction in the height of the stack of sheets thereon.

5 Claims, 6 Drawing Figures

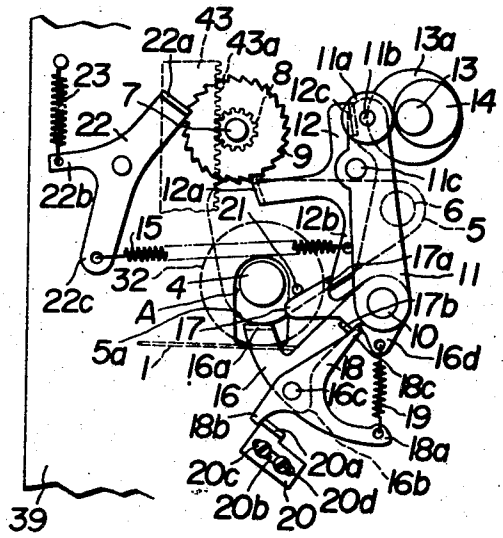

FIG. 1 (PRIOR ART)

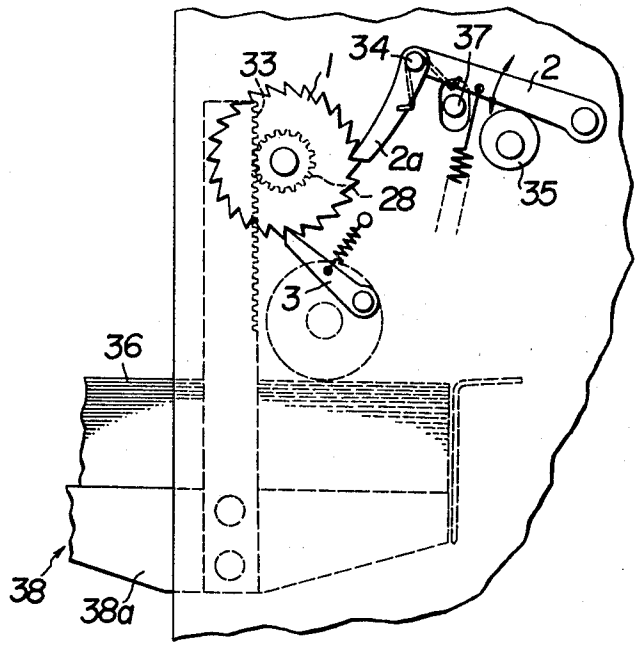

FIG. 2 (PRIOR ART)

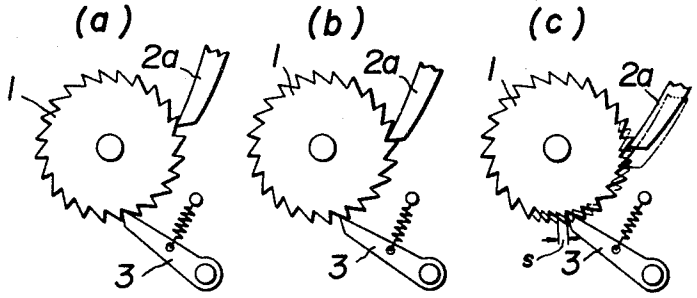

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FIG. 3

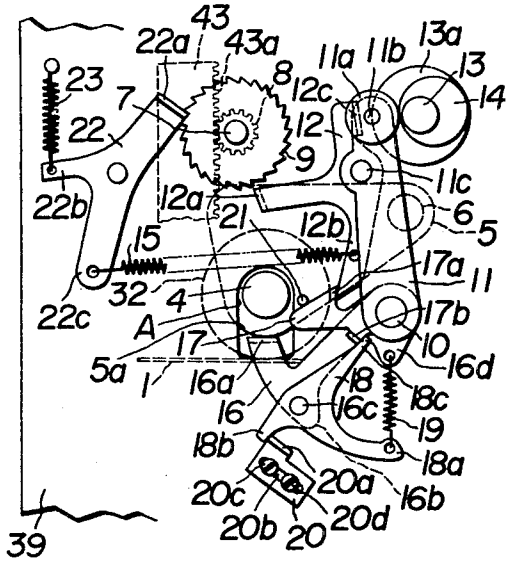


FIG. 4

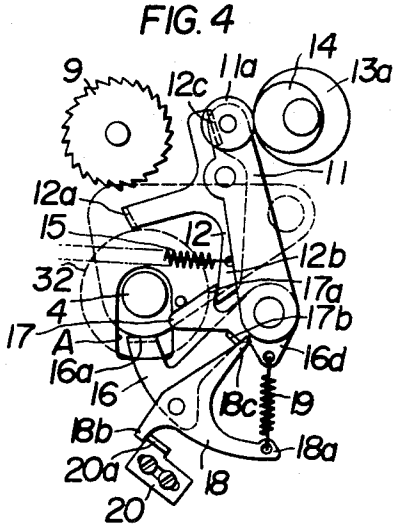


FIG. 5

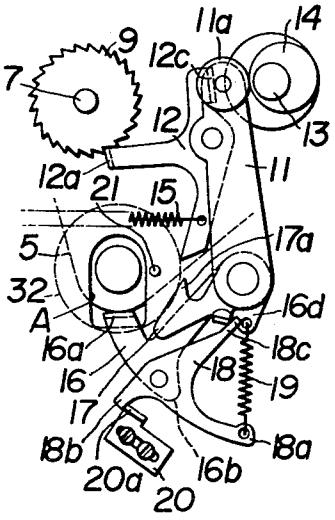
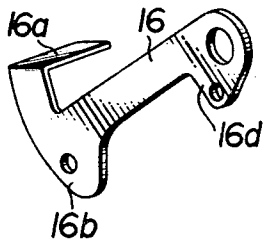


FIG. 6



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PAPER FEED TABLE LIFTING DEVICE FOR A PRINTING PRESS

BACKGROUND OF THE INVENTION

In one type of printing press, known in the art, a stack of printing sheets is piled on a paper feed table and the sheets are successively fed to the printing cylinder. In such printing press, it is necessary that a paper feed roller bear against the stack of printing sheets under a suitable pressure, and it is necessary to maintain the top of the stack of sheets at a suitable level so that the printing sheets may be fed smoothly. This requirement generally is met by lifting the paper feed table as the height of the stack of sheets is decreased.

FIGS. 1 and 2 illustrate an example in which a paper feed table is lifted in a conventional manner. Referring to FIG. 1, a ratchet wheel 1 mounted on a shaft is formed integrally with a pinion 28 meshing with a rack 33 extending vertically of a side plate 38*a* of a paper feed table 38. A pawl 2*a* is pivoted at 34 to the free end of a pivoted pawl lever 2 oscillated by a cam 35 rotatable in conjunction with a printing cylinder, and is biased at all times into engagement with the teeth of ratchet wheel 1. Responsive to each oscillation of lever 2, ratchet wheel 1 is advanced a distance corresponding to the spacing of two teeth, and is held in check, against reverse rotation, by a pawl 3. Pawl 2*a* is maintained constantly in frictional engagement with the teeth of ratchet wheel 1.

As the printing operation progresses, the number of printing sheets 36 stacked on feed table 38 is reduced, thus reducing the height of the stack. When the height of the stack has been reduced a predetermined amount, a stop 37 descends a distance corresponding to the reduction in the height of the stack, with the result that the range of pivotal movement of lever 2 is increased and pawl 2*a* advances ratchet wheel 1, as best seen in FIG. 2*b*. Thereby, rack 33 is lifted a distance corresponding to the reduction in the height of the stack of printing sheets on feed table 38, as a result of rotation of pinion 28 as a unit with ratchet wheel 1. The upward movement of rack 33 lifts feed table 38 to a position in which printing sheets 36 can be fed smoothly to the printing cylinder.

The prior art arrangement shown in FIGS. 1 and 2 have certain disadvantages. A variation in the range of pivotal movement of pawl lever 2, caused by a reduction in the level of the uppermost sheet of the stack of printing sheets 36, is not necessarily proportional to the reduction in the level of the uppermost sheet. Consequently, the degree of angular movement of ratchet wheel 1 may not be in conformity with the reduction in the level of the uppermost sheet. Furthermore, since pawl 2*a* is maintained in engagement with ratchet wheel 1 at all times, a backlash of ratchet wheel 1, relative to pawl 3, may occur as shown in FIG. 2*c*, so that pawl 2a often pushes and moves the same ratchet wheel tooth several times. This causes play to occur in the vertical position of paper feed table 38.

SUMMARY OF THE INVENTION

This invention relates to lifting devices for paper feed tables of printing presses or the like and, more particularly, to a lifting device in which play, in the vertical direction of movement of the feed table, is eliminated.

In accordance with the invention, a lifting device for a paper feed table comprises a pawl which is normally maintained out of engagement with a ratchet wheel meshing with a rack secured to the feed table, but which is arranged to engage the ratchet wheel when the feed table is to be lifted. The lifting device includes a mechanism which senses a predetermined variation in the level of the uppermost sheet of the stack of printing sheets, and transmits the information to the pawl lever.

An object of the invention is to provide an improved lifting device for a paper feed table for printing presses or the like.

Another object of the invention is to provide such a lifting device in which play, in a vertical movement of the lifting table, is prevented.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings

FIG. 1 is a schematic side view of essential portions of a drive section of a conventional paper feed table lifting device for printing presses;

FIG. 2 shows the manner of operation of the essential portions of the device of FIG. 1;

FIG. 3 is a schematic side view of essential portions of a paper feed table lifting device embodying this invention;

FIGS. 4 and 5 show the manner of operation of these essential portions of the device, according to this invention, shown in FIG. 3; and

FIG. 6 is a perspective view of a first pivotal member adapted to engage a roller support arm.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 3, a stack 1, of printing sheets, rests on a paper feed table (not shown) and a paper feed roller 32 bears against the uppermost sheet under a suitable force. A vertically oriented rack means 43 is connected to opposite sides of the paper feed table. Paper feed roller 32 is mounted on a shaft 4 which is rotatably supported, at opposite ends, by a pair of roller support plates 5 secured to a rotary shaft 6 rotatably supported by opposite side plates 39 of a printing press. Rack means 43 comprises racks 43*a* which mesh with pinions 8 secured to a shaft 7 which is rotatably supported, at opposite ends, by side plates 39. A ratchet wheel 9 is secured to the outer end of shaft 7.

A shaft 10 is secured to one of the side plates 39, which plate is formed with an opening A, and shaft 10 pivotally supports a follower lever 11 having a shaft 11*b* at its free end rotatably supporting a roller 11*a*. A pivot 11*c* intermediate to the ends of follower lever 11 pivotally supports a pawl means 12. Follower lever 11 normally is biased, by a suitable spring which has not been shown, to swing about shaft 10 in the clockwise direction as viewed in FIG. 3. Thus, roller 11a is constantly pressed against a cam 14 secured to a drive shaft 13 rotatably supported by side plates 39, so that roller 11a causes follower lever 11 to oscillate as cam 14 rotates. Shaft 13 is rotatable with the printing cylinder.

Pawl means 12 has a first arm projecting laterally and bent at its forward end to form a pawl 12*a* arranged to engage the teeth of ratchet wheel 9. Pawl means 12 also has a second arm 12*b* which projects downwardly and which is connected to one end of a spring 15 normally biasing pawl means 12 to swing clockwise as viewed in FIG. 3.

A first pivotal member 16 is formed, at its forward end, with a bent portion 16*a* (FIG. 6) which extends through opening A into contact with a lower end edge 5*a* of one of the roller support plates 5. Member 16 is evidently mounted at the outer end of shaft 10. A second pivotal member 17 is also pivotally mounted at the outer end of shaft 10, and is formed with a hook 17*a* for engaging a lower end of second arm 12*b* of pawl means 12, and member 17 is biased, by a suitable spring which has not been shown, to swing in the counterclockwise direction. The first pivotal member 16 has a projection 16*b* pivotally supporting an intermediate pivotal member 18 on a pivot 16*c*.

Intermediate pivotal member 18 has a projection 18a connected by a spring 19 to an ear 16d of first pivotal member 16. Thus intermediate pivotal member 18 is biased by spring 19 to swing about pivot 16*c* in the counterclockwise direction. Member 18 has one arm 18*b* which is pressed against an abutment 20*a* of a stop 20 secured to one of the side plates 39, and member 18 has another arm 18*c* which is pressed against a contact portion 17*b* of the second pivotal member 17. Thus, hook 17*a* of member 17 is thereby moved upwardly. Pivotal movement of member 17 by arm 18*c* of member 18 is limited by a pin 21 secured to a side plate 39.

When feed roller **2** is in a normal position, as shown in FIG. **3**, hook **17***a* of second pivotal member **17** holds the second arm **12***b* of pawl means **12** in check. Thus, movement of follower lever **11**, effected by rotation of cam **14**, from the position shown in FIG. **3** to the position shown in FIG. **4**, will not bring pawl **12***a* of pawl means **12** into engagement with ratchet wheel **9**.

Since rack means **43** tends to move downwardly under the weight of the paper sheets and under its own weight, ratchet wheel **9** normally is urged to rotate in a counterclockwise direction, as viewed in FIG. **3** . Such counterclockwise rotation of ratchet wheel **9** is prevented by engagement of the teeth of ratchet wheel **9** with a bent portion **22***a* of a reverse rotation stop or pawl **22** pivoted on one of the side plates **39**. Stop pawl **22** has a projection **22***b* connected by a spring **23** to a side plate **39**, so that stop pawl **22** is biased to move in the clockwise direction so that bent portion **22***a* is maintained in engagement with a tooth of ratchet wheel **9**. Spring **15**, which has one end connected to second arm **12***b* of pawl means **12**, has its other end connected to an arm **22***c* of stop pawl **22**.

In operation, as printing sheets are fed successively to the printing cylinder and as paper feed roller **32** moves downwardly a distance corresponding to the reduction in the height of the stack of paper sheets, roller support plates **5** are pivoted in the counterclockwise direction so that, through their lower edges **5***a*, the bent portion **16***a* of first pivotal member **16** is moved to cause member **16** to pivot counterclockwise about pivot shaft **10**. The counterclockwise movement of first pivotal member **16** causes intermediate pivotal member **18** to move in a clockwise direction about the point of engagement between its arm **18***b* and the upper portion **20***a* of stop **20**. Thereby, the pressure of the other arm **18***c* of member **18** against contact edge **17***b* of second pivotal member **17** is released. Member **17** thus moves counterclockwise about shaft **10** to follow the swinging movement of member **18** in a clockwise direction.

As a result, second arm **12***b* of pawl means **12** is released from engagement with hook **17***a* of second pivotal member **17**, as illustrated in FIG. **5**, so that pawl **12***a* of pawl means **12** is engaged with one of the teeth of ratchet wheel **9** under the bias of spring **15**. By virtue of the oscillation of follower lever **11** by cam **14**, pawl means **12** is thus caused to rotate ratchet wheel **9** clockwise as viewed in FIGS. **3**, **4** and **5**. Clockwise rotation of ratchet wheel **9** effects, through pinion **8** and rack **43**, upward movement of rack means **43** and the paper feed table which operates substantially as a unit with the rack means. The paper feed table is moved upwardly a distance corresponding to the reduction in the height of printing sheets on the paper feed table.

When the paper feed table is thus moved upwardly, paper feed roller **32** is restored to its normal position as are also the plates **5** so that the lower end edges **5***a* of the plates are released from pressure engagement with the bend portion **16***a* of first pivotal member **16**. This allows member **16** to pivot clockwise about shaft **10**, and intermediate pivotal member **18** to pivot about the point of contact between itself and the portion **20***a* of stop **20**, in the counterclockwise direction. Arm **18***c* of member **18** pushes upwardly contact edge **17***b* of member **17**. This causes member **17** to pivot clockwise about shaft **10**, thereby bringing hook **17***a* to a position in which it is engageable with second arm **12***b* of pawl means **12**, as viewed in FIG. **4**.

Pawl means **12** has an upwardly directed arm which is formed, at its forward end, with a bent portion **12***c* arranged to abut a flange **13***a* of a bearing journaling shaft **13**. Hook **17***a* and second arm **12***b*, which are disengaged from each other responsive to a predetermined reduction in the height of the stack of printing sheets on the paper feed table, are reengaged with each other after the paper feed table has been moved upwardly. This occurs when follower lever **11** is pivoted to its rightmost position by following movement of cam **14**. If follower lever **11** is pivoted to the right, or clockwise, then end portion **12***c* of pawl means **12** abuts flange **13***a*. The result of this is that pawl means **12** is positioned as if it had pivoted counterclockwise about the point of engagement of bent portion **12***c* and flange **13***a*. This causes hook **17***a* to engage the lower end of second arm **12***b* of pawl means **12**.

As illustrated in FIG. **3**, stop **20** is formed with a slot **20***b* through which there extend screws **20***c* and **20***d* securing the stop to a side plate **39**. It will be noted that the point of contact between arm **18***a* of intermediate pivotal member **18** and portion **20***a* of stop **20** can be adjusted, within the limits of stop **20***b*, by loosening screws **20***c* and **20***d* and then retightening the screws.

From the foregoing description, it will be clear that the lifting device embodying the invention is so constructed that pawl means **12**, supported by follower lever **11**, for operating ratchet wheel **9**, is brought into abutting engagement with ratchet wheel **9** only when the pawl means is operated to actuate the ratchet wheel, and is maintained out of engagement with ratchet wheel **9** when it is inoperative to actuate ratchet wheel **9**. This eliminates vertical play of the paper feed table and reduces wear and tear on ratchet wheel **9** and pawl **12***a* of pawl means **12**. The lever mechanism, consisting of first pivotal lever **16**, second pivotal lever **17** and intermediate pivotal lever **18**, can sense and transmit, to pawl means **12**, a variation in the position of paper feed roller **32** caused by a predetermined reduction in the height of the stack of printing sheets on he paper feed table, whereby the height of the stack can be constantly maintained at a suitable level.

Additionally, when the stack of printing sheets is exhausted, it has hitherto been customary to disengage both the pawl and the reverse rotation preventing stop from the ratchet wheel and then to move the paper feed table downwardly. In the lifting device embodying the invention, it is necessary only to disengage reverse rotation preventing stop **22** from ratchet wheel **9**, because pawl means **12** normally is held out of engagement with ratchet wheel **9**. This facilitates supplementing the stack of printing sheets.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a lifting device for a paper feed table supported, for substantially vertical movement, on a printing press having a printing cylinder, the feed table supporting a stack of sheets to be printed, feed means engageable with the sheets to feed the sheets to the press and resulting in a reduction of the height of the stack on the table, and lifting means operable, responsive to a reduction of the height of the stack, to lift the feed table to compensate for such reduction; the improvement comprising, in combination, rack means secured to said table and extending substantially vertically; rotatable pinion means meshing with said rack means; a ratchet wheel secured for rotation with said pinion means; a cam rotatable with said printing cylinder; a pivotally mounted follower lever oscillatable by said cam; pawl means pivotally mounted on said follower lever for oscillation by the latter; means biasing said pawl means to engage said ratchet wheel to rotate the latter in a direction to lift said rack means; means engaged with said ratchet wheel and preventing reverse rotation thereof; releasable latch means normally engaged with said pawl means and pivoting said pawl means to a position in which said pawl means is inoperative to engage said ratchet wheel during oscillation of said follower lever; release means operatively associated with said latch means and operable by said feed means, responsive to a predetermined reduction of the height of said stack, to release said latch means for pivoting of said pawl means to engage said ratchet wheel during oscillation of said follower lever; and means operable, responsive to a preset upward movement of said feed table to reengage said latch means with said pawl means.

2. In a lifting device for a paper feed table, the improvement claimed in claim **1**, in which said pawl means has a first arm extending toward said ratchet wheel and formed with a pawl

on its free end engageable with said ratchet wheel, and a second arm extending at an angle to said first arm; said releasable latch means comprising a pivotal member formed with a hook portion engageable with said second arm.

3. In a lifting device for a paper feed table, the improvement claimed in claim 1, in which said feed means is a sheet feeding roller mounted for movement downwardly in accordance with the reduction in height of said stack; said release means comprising a first pivotal member operable to detect a predetermined downward movement of said feed roller, and an intermediate pivotal member pivotally supported, intermediate its ends, by said first pivotal member and having an end engaging a stop for pivotal movement of said intermediate pivotal member about said stack as a fulcrum; said releasable latch means comprising a second pivotal member engaged with the other end of said intermediate pivotal member for pivoting by the latter and formed with a hook engageable with said pawl means and disengageable from said pawl means, by pivoting of said second pivotal member by said intermediate pivotal member, when said first pivotal member detects a predetermined downward movement of said feed roller.

4. In a lifting device for a paper feed table, the improvement claimed in claim 2, in which said pawl means has a third arm formed with a bent portion at its free end engageable, during oscillation of said follower lever, with a fixed stop to form a fulcrum for pivoting of said pawl means on said follower lever in a direction to provide for engagement of said hook with said second arm of said pawl means.

5. In a lifting device for a paper feed table, the improvement claimed in claim 3, including means mounting said stop for adjustment.

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