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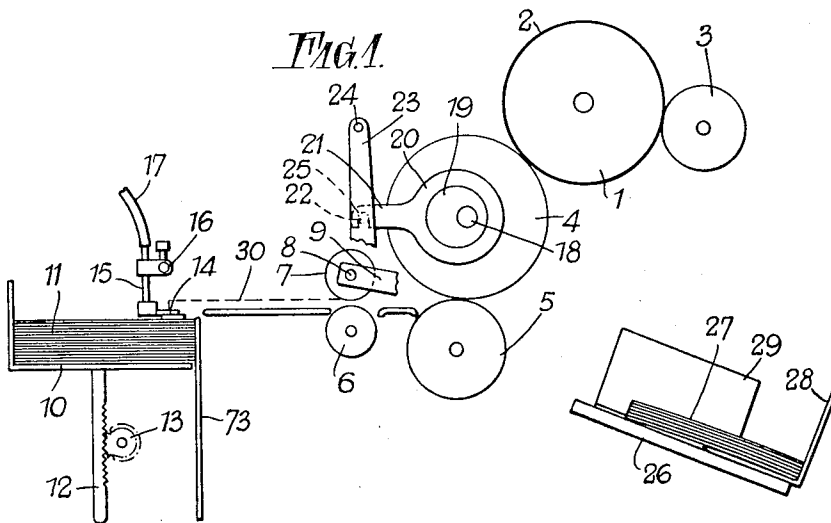
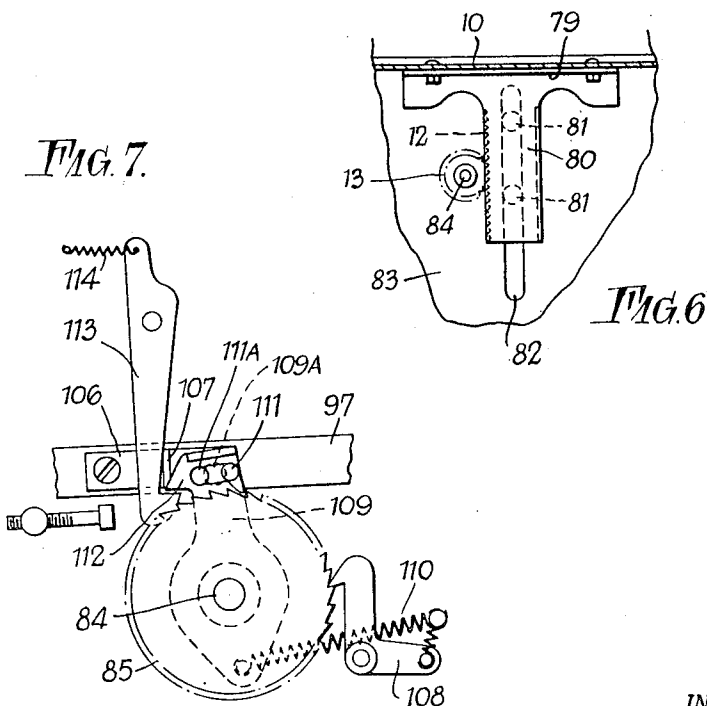
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2,999,686

FEEDING APPARATUS FOR ROTARY PRINTING MACHINES

Filed Jan. 26, 1959

3 Sheets-Sheet 1



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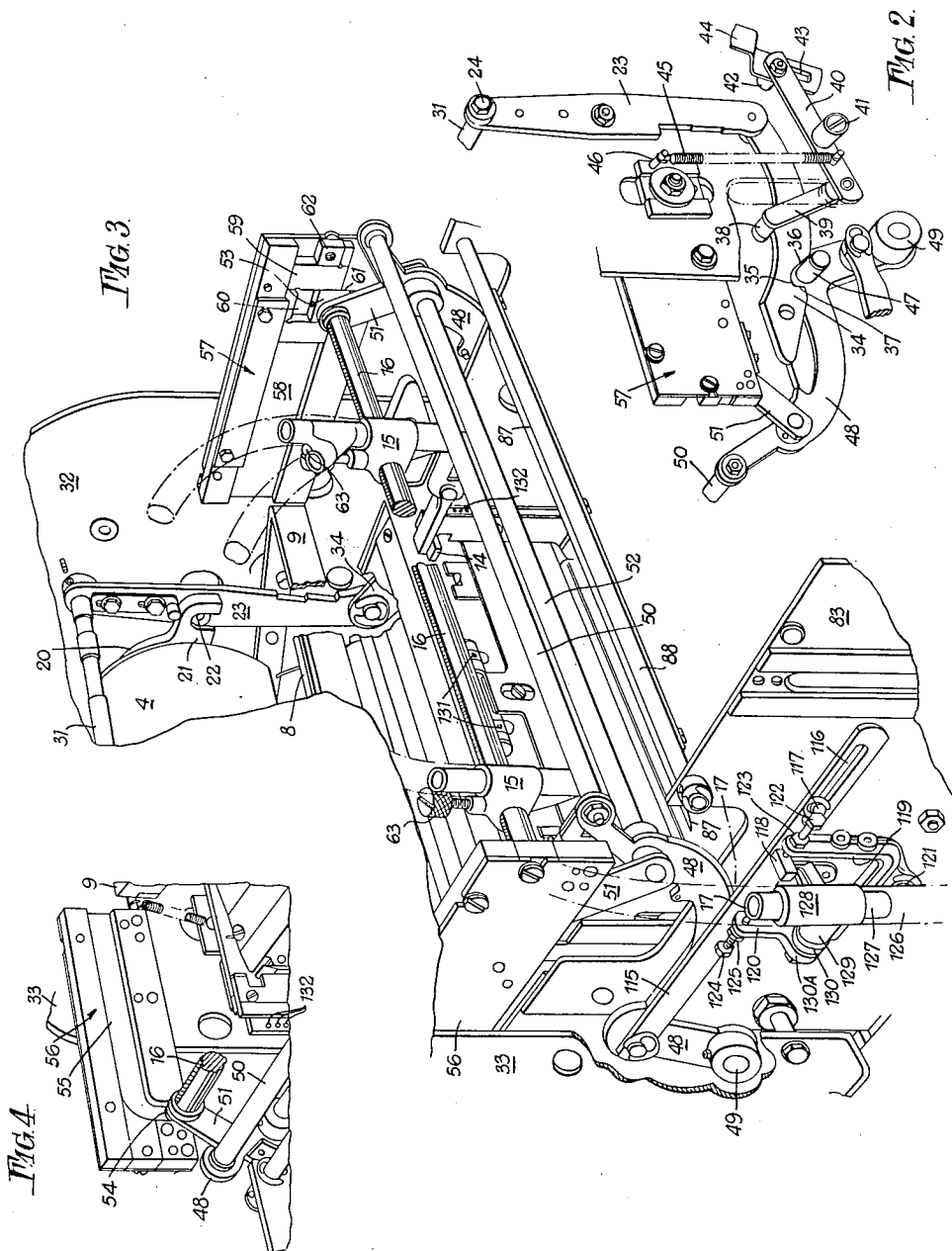
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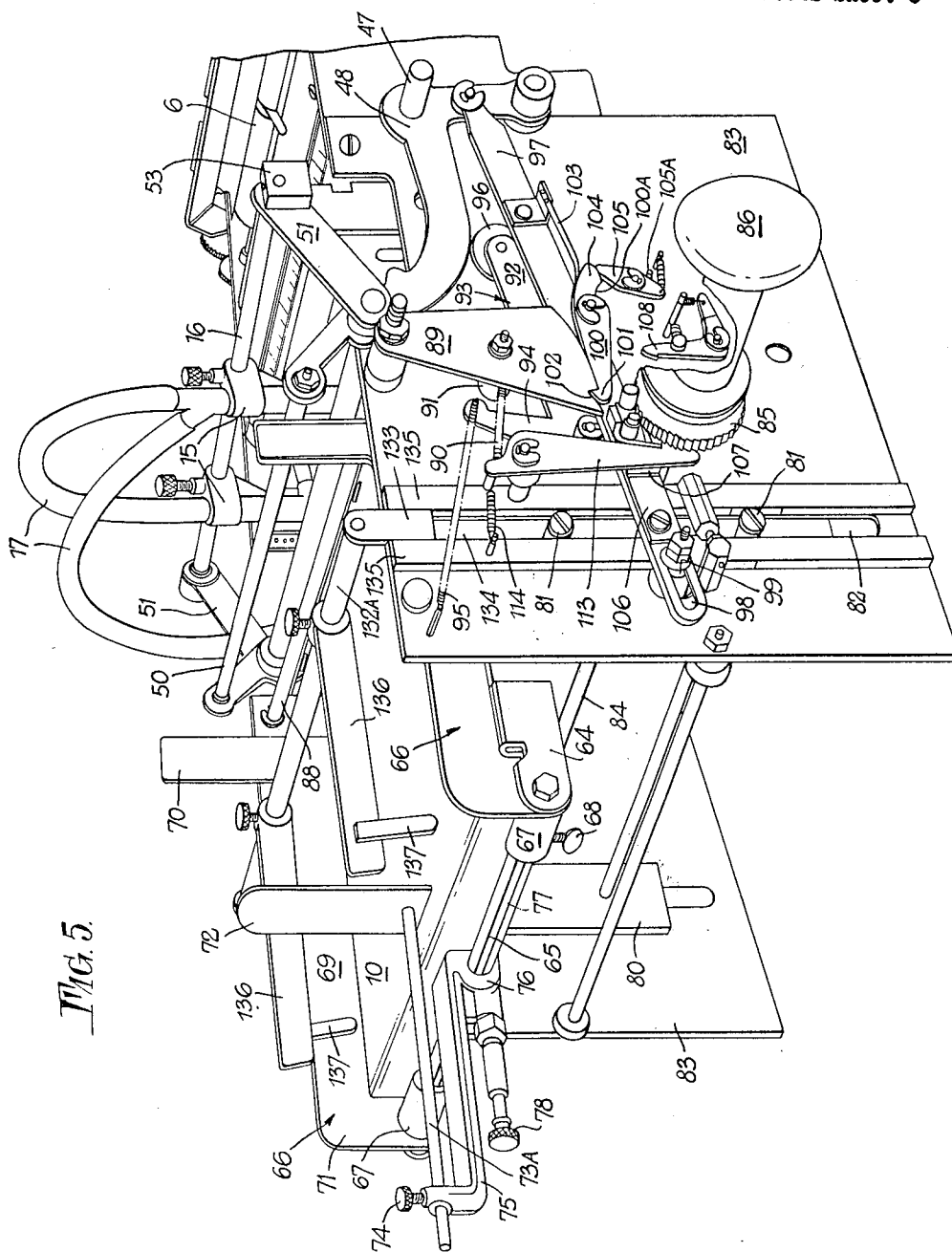


Fig. 5.

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2,999,686 FEEDING APPARATUS FOR ROTARY PRINTING MACHINES

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Filed Jan. 26, 1959, Ser. No. 789,184

Claims priority, application Great Britain Jan. 28, 1958
7 Claims. (Cl. 271-11)

This invention relates to rotary printing machines of the kind in which, in operation, the top sheet of a stack of sheets of paper is periodically fed, through the intermediary of suction pad means, to printing rolls of the machine. Driving mechanism is provided for appropriately rotating the rolls, the suction pad means being connected to be moved by the driving mechanism.

According to the present invention there is provided a machine of the kind referred to comprising a slide, a first upwardly extending guideway and a second substantially horizontally extending guideway, the two guideways intersecting and the slide being arranged for movement along the guideways, the suction pad means being connected to move with the slide which latter is arranged to be driven from the driving mechanism, the arrangement being such that in feeding the top sheet from the stack to the printing rolls, the slide first moves upwardly along the first guideway whereby the suction pad means lift and then moves horizontally along the second guideway whereby the suction pad means move towards the printing rolls, the slide and suction pad means being subsequently returned to their initial position.

For a better understanding of the invention and to show how the same may be carried into effect reference will now be made to the drawings accompanying the specification, in which:

FIGURE 1 is a diagrammatic side elevation of parts of a duplicating machine,

FIGURE 2 is a perspective view of linkage that drives the sheet feeding mechanism of the duplicating machine of FIGURE 1,

FIGURE 3 is a perspective view of the sheet feeding mechanism, the view being taken from the side opposite to that of FIGURE 2,

FIGURE 4 is a perspective view of part of the sheet feeding mechanism,

FIGURE 5 is another perspective view of the sheet feeding mechanism, the view being taken from the opposite side to that of FIGURE 3,

FIGURE 6 is an elevation of a detail of the sheet feeding mechanism, and

FIGURE 7 is an elevation of another detail of the sheet feeding mechanism.

General arrangement of the duplicating machine

The duplicating machine to which the sheet feeding mechanism of the present invention is applied, is of generally known form and essentially consists of a master cylinder 1 around the surface of which a plate or stencil 2 to be duplicated is secured. The master cylinder cooperates with an inking roller 3 to which ink is applied by any suitable known means (not shown). The master cylinder 1 also cooperates with a blanket cylinder 4 and this in turn cooperates with a platen 5. Feed rollers 6 and 7 are provided adjacent the bite between the blanket cylinder 4 and the platen 5. The rollers 7 are carried on a shaft 8 pivotally mounted on a pivoted frame 9. The frame 9 is pivoted in such a way that at the appropriate instant in the cycle of operations of the duplicating machine, the rollers 7 move downwardly towards the rollers 6 to grip the leading edge of any sheet inserted between

the rollers 6 and 7. Driving mechanism (not shown) is provided for driving the cylinders 1 and 4, the platen 5 and the rollers 3 and 6. A table 10 supports a stack of paper sheets 11 the table 10 being mounted for vertical movement and being provided with racks 12 (one behind the other in FIGURE 1) that cooperate with gear wheels 13 (also one behind the other in FIGURE 1). The gear wheels 13 are rotated by mechanism to be described hereinafter for raising the table 10 and the stack of sheets 11. Two suction pads 14 (one behind the other in FIGURE 1) are each supported by a foot 15 fixed to a cross-shaft 16. Flexible tubing 17 connects each foot 15 and thus each pad 14 to the suction side of a pump (not shown).

The blanket cylinder 4 is mounted on a shaft 18 having an eccentric 19 fixed thereto. An eccentric strap 20 having a projecting arm 21 cooperates with the eccentric 19. A pin 22 on a lever 23 which is pivoted at 24 is located in a recess 25 formed in the under side of the arm 21.

A shelf 26 is disposed adjacent the cylinder 4 and platen 5, for receiving printed sheets 27. The shelf 26 is provided with an end stop 28 and two laterally spaced plate-like side guides 29.

The lever 23 is connected by mechanism to be described hereinafter, to the shaft 16 to control the movement of the suction pads 14. In operation of the duplicating machine, rotation of the cylinder 4 causes oscillation of the lever 23 through the intermediary of the eccentric 19 and strap 20 whereby the suction pads 14 lift the top sheet 11 from the stack and then advance this sheet to the rollers 6 and 7. The path of movement of the pads 14 is indicated by the dotted line 30. When the leading edge of the sheet is between the rollers 6 and 7, the rollers 7 are swung downwardly so that the leading edge of the sheet is gripped between the rollers 6 and 7. The roller 6 rotates, and the rollers 7 being freely mounted in the frame 9 likewise rotate and the sheet is advanced to the bite between the cylinder 4 and the platen 5. The stencil or plate 2 on the master cylinder 1 is inked by the roller 3 and an inked impression is formed on the surface of the cylinder 4. This impression is transferred from the cylinder 4 to the sheet and the printed sheet is ejected from the bite between the cylinder 4 and the platen 5 onto the shelf 26.

Suction pad drive

The lever 23 (FIGURES 2 and 3) is carried at its upper end by a cross-shaft 31 which is pivotally mounted in side plates 32 and 33 of the machine. The lower end of the lever 23 is pivotally connected to a curved link 34. In its under side the link 34 has a notch 35, one side 36 of which is inclined and the other side 37 being substantially normal to the under side of the link 34. A roller 38 cooperates with the upper surface of the link 34, the roller being carried at the upper end of an arm 39 the lower end of which is pivotally secured to one end of a lever 40 that is pivoted to the side of the machine at 41. The other end of the lever 40 carries a pin 42 located in a slot 43 formed in a link 44.

The lower end of a spring 45 is secured to the lever 40 and the upper end of the spring 45 is secured to a pin 46 fixed to the side of the machine. The spring 45 urges said one end of the lever 40 upwardly.

A pin 47 on the arm 48 which is pivoted to the side of the machine at 49 cooperates with the notch 35 of the link 34. There are two arms 48 one on each side of the machine, the two arms being secured together by a cross-bar 50. One end of an arm 51 is pivotally secured to each arm 48 and the other ends of the arms 51 are connected together by the shaft 16. Said one end of the arms 51 are rigidly connected together by a cross-shaft 52. The shaft 16 is rotatably carried by the arms

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51 and has fixed thereon at one end a square slide 53 and carries at the other end a roller 54 (FIGURE 4). The roller 54 operates in a groove 55 formed in a guide plate assembly 56 which is effectively secured to the side plate 33. A guide plate assembly 57 which is effectively fixed to the side plate 32 has a horizontal guideway 58 in which slides a block 59. From the under side of the block 59 a square recess 60 is formed therein for receiving the slide 53. The assembly 57 also has a vertical guideway 61 for receiving the slide 53. A stop 62 limits rearward movement of the block 59 in the guideway 58.

It will be seen from FIGURE 3 that the feet 15 are rigidly secured to the shaft 16 by locking screws 63.

The link 44 is connected to a manually operated sheet feed control member (not shown). With this control member in the inoperative position the parts assume the position shown in FIGURE 2. When the control member is operated to effect sheet feeding, the link 44 is lifted so that the pin 42 engages with the lower end of the slot 43 whereby the roller 38 is caused to bear firmly on the upper surface of the link 34.

The mechanism so far described in connection with FIGURES 2, 3 and 4 operates as follows. With the link 44 in the position shown, oscillation of the lever 23 causes the link 34 to be moved bodily backwards and forwards. As, however, the roller 38 bears only very lightly on the upper surface of the link 34 with the parts in the position shown in FIGURE 2, the side 36 rides up the pin 47 when the link 34 is being moved backwardly whereby the link 34 lifts and no movement is imparted to the arm 48. When the control member (not shown) is operated to lift the link 44 the roller 38 bears heavily on the upper surface of the link 34 and as the latter is moved backwardly by the lever 23 the pin 47 does not ride out of the notch 35, so that the arms 48 are caused to oscillate. Assume that the link 34 is in its most rearward position, then the slide 53 will be at its lowest point in the guideway 61. The roller 54 will be in the position shown in FIGURE 4. Forward movement of the link 34 swings the arms 48 about their pivots 49 and the slide 53 moves up the guideway 61 into the recess 60 in the block 59, the arms 51 pivoting relative to the arms 48. This movement of the slide 53 causes the shaft 16 and thus the suction pads 14 to rise vertically. Continued forward movement of the link 34 continues the movement of the arms 48 and the block 59 with the slide 53 contained in the recess 60 slides along the guideway 58 until the forward swinging movement of the arms 48 ceases. The movement that is thus imparted to the slide 53 moves the shaft 16 and the suction pads 14 horizontally to the position where any sheet 11 carried by the pads 14 is positioned for gripping by the feed rollers 6 and 7. Reverse movement of the link 34, i.e. rearward movement thereof, returns the parts to their initial position.

Stack level control

The table 10 (FIGURE 5) has a rearwardly extending lug 64 at each side thereof. Only one such lug 64 is visible in FIGURE 5. A rod 65 is connected between the two lugs 64. Side members 66 resting on the table 10 are each provided with a boss 67 adjustably secured to the rod 65 by a thumb screw 68. The side members 66 each consist of a horizontally disposed strip portion 69, a vertical strip portion 70 which extends upwardly from one end of the strip portion 69, and a strip portion 71 that extends downwardly from the other end of the portion 69. The side members 66 serve to locate the sides of the stack of paper sheets 11 on the table 10. The positions of the members 66 laterally of the table top are, of course, adjusted in accordance with the width of the paper sheets. A back stop 72 in the form of a vertical strip is provided for locating the rear of

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the stack of paper, the front of the stack being guided by a plate 73 (FIGURE 1) fixed to the main body of the machine. The stop 72 is secured on one end of a rod 73A the other end of which is adjustably secured by means of a thumb screw 74 to a bracket 75 having a boss 76 through which the rod 65 is passed. The rod 65 has a groove 77 therein with which a spring-loaded plunger 78 carried by the bracket 75 engages. The plunger 78 is shown in the engaged position in FIGURE 5. When the plunger 78 is withdrawn the bracket 75 can be swung downwardly whereby the stop 72 is removed from the vicinity of the table 10 and a fresh stack of paper can be placed on the table 10.

The table 10 is supported at each side by a horizontal flange 79 (FIGURE 6) at the top of a T-piece 80. Each T-piece 80 carries two rollers 81 which are disposed one above the other in a slot 82 formed in an adjacent side plate 83 of the machine. The four rollers 81, two on each side of the machine, guide the table 10 for vertical movement. There is one rack 12 associated with each T-piece 80. Each rack 12 is disposed between the adjacent T-piece 80 and the adjacent side plate 83, the rack being secured to the T-piece. Each rack 12 cooperates with its associated gearwheel 13 and these gearwheels are mounted on a shaft 84. A ratchet wheel 85 (FIGURES 5 and 7) is releasably secured to the shaft 84. The connection between the ratchet wheel 85 and the shaft 84 is controlled by a release knob 86. In the normal operating position the ratchet wheel 85 is connected to drive the shaft 84. When, however, the knob 86 is pushed inwardly (against spring opposition) the ratchet wheel 85 is disconnected from the shaft 84 which can then be turned independently of the ratchet wheel 85 by turning the knob 86. The mechanism for effecting the releasable connection between the wheel 85 and the shaft 84 is not shown in the drawings since it is of relatively minor significance and the operation will be understood by anyone skilled in the art.

It will be understood that as paper is removed from the stack of sheets 11 by the pads 14 the table 10 must be periodically elevated so that the top sheet in the stack 11 is maintained sufficiently close to the pads 14 to be gripped thereby. The table 10 is, of course, elevated by turning the ratchet wheel 85 in the appropriate direction. The drive for the ratchet wheel 85 is taken from the arm 48 seen in FIGURE 5 and this drive is controlled by the height of the top of the stack of sheets 11. An inclined blade 87 (FIGURE 3) extends across the top of the machine and has the upper edge thereof fixed to a control shaft 88 (FIGURES 3 and 5). A triangular-shaped control cam 89 has one corner thereof fixed to an end of the shaft 88. The cam 89, shaft 88 and the blade 87 are urged in a clockwise direction (FIGURE 5) by a spring 90 secured between the cam 89 and the adjacent side member 83. A roller 91 fixed to the central part of the cam 89 cooperates with a bellcrank lever 93 having arms 92 and 94 the latter of which is connected by a spring 95 to the adjacent side member 83 so that the bellcrank lever 93 is urged in an anti-clockwise direction. The arm 92 carries a roller 96 that is urged into contact with the underside of the adjacent arm 48 by means of the spring 95. A drive link 97 has one end pivotally secured to the arm 48 seen in FIGURE 5 and the other end of the link 97 has a slot 98 therein through which is passed a pin 99 secured to the adjacent side member 83. The link 97 has a latching pawl 100 pivotally secured thereto. One end of the pawl 100 has a catch 101 which cooperates with a notch 102 formed in the cam 89. A spring strip 103 secured to the link 97 bears on the other end 104 of the pawl 100 to urge the catch 101 into cooperation with the notch 102. Said other end 104 is, by the spring 103, urged into contact with a spring-loaded trip pawl 105. The pawl 100 has in its underside a recess 100A adapted to receive the upper end of the trip pawl 105. A stop 105A limits anti-clockwise movement of the

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pawl 105. Also secured on the link 97 is an operating bracket 106, this bracket having a laterally and outwardly projecting tongue 107 (FIGURES 5 and 7).

A spring-loaded retainer pawl 108 is pivotally secured to the adjacent side member 83, this retainer pawl being arranged for preventing anti-clockwise (FIGURE 7) rotation of the ratchet wheel 85. An arm 109 pivotally carried about the shaft 84 and urged by a spring 110 in an anti-clockwise direction (FIGURE 7) has a drive pawl 111 pivotally secured thereto about 111A. The drive pawl 111 is arranged for advancing the ratchet wheel 85 in a clockwise direction. The tongue 107 is arranged to encounter a projection 109A on the rear of the free end of the arm 109 when the drive link moves from left to right (FIGURES 5 and 7). The arm 109 is provided with a tooth 112 that cooperates with the lower end of a release pawl 113 which is pivotally secured near its upper end to the adjacent side member 83. A spring 114 urges the pawl 113 in a counter-clockwise direction (FIGURES 5 and 7). The cam 89 and the pawl 113 are co-planar and the arrangement is such that the cam 89 is able to swing under the control of the spring 90 to encounter the pawl 113 and push the latter against the action of the spring 114 out of contact with the tooth 112 carried on the arm 109.

The drive mechanism just described with reference to FIGURES 5 and 7 operates as follows. The parts in FIGURE 5 are shown in the position where the suction feet 15 are most remote from the feed rollers 6 and 7 and the pads 14 are in their lowest position. To feed the top sheet from the stack of sheets 11 to the feed rollers 6 and 7 the arm 48 is rotated from the position shown in FIGURE 5 in a clockwise direction by the mechanism previously described in connection with FIGURE 2. Such movement of the arm 48 moves the drive link 97 from left to right. Assume that initially the release pawl 113 is in engagement with the tooth 112. Left to right movement of the link 97 eventually causes the tongue 107 to encounter the projection 109A on the arm 109 whereby the latter is turned a small angle clockwise (FIGURE 7) that the pawl 111 moves slightly in a clockwise direction. The amount of movement is, however, insufficient to advance the ratchet wheel 85 one tooth pitch so that the retainer pawl 108 remains in cooperation with the same tooth of the wheel 85. During initial left to right movement of the link 97 the cam 89 is turned in an anti-clockwise direction by the latching pawl 100 and the blade 87 lifts from the top of the stack of sheets 11 so that the top sheet 11 can be freely advanced to the feed rollers 6 and 7. With continued left to right movement of the link 97 the upper end of the trip pawl 105 eventually snaps into the recess 100A and in so doing rocks the pawl 100 so that the catch 101 disengages from the notch 102. The cam 89, under the influence of the spring 90, swings in an anti-clockwise direction so that its lower end approaches the pawl 113. The movement of the cam 89 is arrested when the blade 87 comes to bear on the top of the stack of sheets 11. Provided the top of the stack is sufficiently high for proper cooperation to take place between the pads 14 and the top sheet 11 no drive is required to be imparted to the ratchet wheel 85 and the cam 89 does not encounter the pawl 113. During the reverse movement of the arm 48 and the link 97, the tongue 107 disengages from the projection 109A but anti-clockwise movement of the arm 109 is limited by the engagement of the tooth 112 and the pawl 113. During the final part of the right to left movement of the link 97 the arm 48 encounters the roller 96 and the arm 94 swings clockwise to encounter the roller 91 and push the cam 89 in an anti-clockwise direction whereby the notch 102 is engaged again by the catch 101.

When, following disengagement of the catch 101 and the notch 102, the clockwise movement of the cam 89 exceeds a certain amount indicating that the blade 87 has to travel some way before encountering the top sheet 11, the cam 89 strikes the release pawl 113 so that it dis-

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engages from the tooth 112. The spring 110 moves the arm 109 anti-clockwise a sufficient amount for the pawl 111 to move onto the back of the next tooth on the wheel 85. During the next left to right movement of the link 97 the ratchet wheel 85 is advanced one tooth pitch, the wheel 85 being maintained in its new position by the pawl 108. The wheel 85 turns the shaft 84 and the gearwheels 13 move the racks 12 whereby the table 10 is lifted a small amount sufficient to bring the top sheet 11 sufficiently close to the pads 14 for the latter satisfactorily to grip the top sheet.

Air control

The arm 48 seen in FIGURE 3 has one end of a link 115 pivotally secured thereto, the other end of this link having a slot 116 through which is passed a pin 117 fixed to the adjacent side plate 83. The link 115 carries a lug 118 which is disposed between the two arms 119 and 120 of a U-shaped bracket which is pivoted at 121 to the adjacent side plate 83. A bolt 122 is threaded through the upper end of the arm 119 and the projecting part of the bolt 122 cooperates with the lug 118. A nut 123 on the bolt 122 locks the latter in the position to which it is adjusted. A bolt 124 is threaded through the arm 120 and the projecting part of this bolt cooperates with a lug 118. A nut 125 on the bolt 124 locks the latter in the position to which it is adjusted. A pipe 126 leads from the suction side of the pump (not shown) to the inlet 127 of a valve 128, the outlet of which communicates with the tubing 17. A short open-ended tube 129 extends from the valve 128 and cooperates with a cup-shaped washer 130 of rubber, leather or like material which is carried on a lug 130A projecting laterally from the arm 120.

During feeding of the top sheet from the stack of sheets 11, to the feed rollers 6 and 7, the arms 48 swing in a counter-clockwise direction (FIGURE 3) and the link 115 therefore moves from right to left. The lug 118 disengages from the bolt 122 and near the end of the counter-clockwise movement of the arms 48, the lug 118 encounters the bolt 124. The U-shaped bracket is thus rocked and the cup-shaped washer 130 is removed from the open end of the tube 129. The tubing 17 is thereby opened to atmosphere so that the suction pads 14 drop the leading edge of the sheet 11 that has been fed to the feed rollers 6 and 7. During reverse movement of the arms 48 to their initial position, the tubing 17 remains opened to atmosphere until the lug 118 encounters the bolt 122 whereby the U-shaped bracket is rocked in the opposite direction and the cup-shaped washer 130 again engages over the open end of the tube 129 whereby the suction at the pads 14 is reestablished.

The delivery side of the suction pump (not shown) is connected to deliver compressed air to jets 131 which are adjacent the front top edge of the stack of sheets 11 and to jets 132 which are adjacent the top front corners of the stack of sheet 11. The jets 131 direct a stream of air towards the rear of the stack whilst the jets 132 direct a stream of air towards the opposite side of the machine. These jets of air aerate the top of the stack and facilitate separation of the top sheet 11 from the next sheet 11 prior to feeding of the top sheet to the feed rollers 6 and 7.

It may be advantageous to weight the rear side edges of the sheets 11. To this end a shaft 132A (FIGURE 5) is provided, each end of the shaft being pivoted in a block 133 which is mounted in a guideway 134 formed by strips 135 secured to the adjacent side plate 83. Rearwardly extending levers 136 having downwardly depending fingers 137 are fixed to the shaft 132A. The lower ends of the fingers 137 bear on opposite sides of the stack to weight the rear side edges of the sheets 11.

We claim:

1. A rotary printing machine comprising in combination a frame, a table carried by the frame for supporting a stack of sheets of paper, a rotary printing couple sup-

ported by the frame, suction means for lifting the top sheet from the stack and presenting it to the printing couple, said means including a suction pad adapted to engage the top sheet of the stack, a carrier for the pad, drive means for moving the carrier, guiding means for the carrier, said guiding means embodying a slide, a first upwardly extending guideway and a second substantially horizontally extending guideway, the two guideways intersecting and the slide being arranged for movement along the guideways, there being a block slidably fitted within the horizontally extending guideway and having a recess therein for receiving the slide which is adapted to fit slidably in the first guideway, the arrangement being such that the carrier is moved first upwardly and then laterally to present a sheet to the printing couple and then in reverse direction to return the pad into position for engaging the next sheet and such that, during the feeding operation, the slide moves upwardly along the upwardly extending guideway into the recess in the block and then the block together with the slide is moved along the horizontally extending guideway.

2. A rotary printing machine comprising in combination, a frame, a table carried by the frame for supporting a stack of sheets of paper, a rotary printing couple supported by the frame, suction means for lifting the top sheet from the stack and presenting it to the printing couple and including a suction pad adapted to engage the top sheet of the stack, a carrier for the pad, drive means for moving the carrier, guiding means for the carrier operating to guide it upon movement thereof first upwardly then laterally to present a sheet to the printing couple and then in the reverse direction to return the pad into position for engaging the next sheet, said drive means including a link which is arranged to be reciprocated in the general direction of the length of the link, the drive being imparted to the link through a pivotal connection at one end thereof, a driving arm operatively connected to said carrier, the other end of the link having a pin and notch connection with said driving arm, there being means for pressing the pin into engagement with the notch and the notch being shaped such that during operation of the drive means, when the pressing means is operative, the drive is transmitted from the link to the driving arm and when the pressing means is inoperative the pin rides out of the notch and the drive is not transmitted from the link to the driving arm.

3. A machine according to claim 1, wherein the suction pad is carried by a supporting member which is fixed to the slide.

4. A machine according to claim 1, wherein the suction pad is carried upon a shaft which is fixed to the slide, and wherein guiding means are provided for guiding the other end of the shaft to move along a path parallel to that of the first-mentioned end of the shaft.

5. A rotary printing machine comprising in combination a frame, a table carried by the frame for supporting

a stack of sheets of paper, a rotary printing couple supported by the frame, and suction means for lifting the top sheet from the stack and presenting it to the printing couple, said suction means including a suction pad adapted to engage the top sheet of the stack, a carrier for the pad, drive means for moving the carrier, said drive means being operatively coupled to said printing couple for actuation of said drive means, and other means for guiding the carrier to move it first upwardly and then laterally to present a sheet to the printing couple, and then in the reverse direction to return said pad into position for engaging the next sheet, said other means comprising a pair of intersecting slotted guideways, including a first substantially horizontally extending guideway and a second upwardly extending guideway, a first member disposed in said first guideway for movement therealong, said first member having a recess therein defining an extension of said second guideway, a second member disposed in said second guideway for movement therealong and into and out of said recess, and said carrier being attached to said second member for movement with said second and said first members.

6. A machine in accordance with claim 5, wherein the drive means for moving the carrier includes a driving arm, one end of which is pivoted to said frame, and a second arm one end of which is pivoted to said driving arm, and the other end of said second arm being operatively connected to said second member for actuating said first and said second members.

7. A machine in accordance with claim 5, wherein a roller is positioned on the side of the carrier opposite to said second member connected side, for engaging another set of intersecting slotted guideways arranged in a generally similar manner as said first mentioned pair of slotted guideways, said roller and corresponding guideways operating to aid in guiding said carrier for movement first upwardly and then laterally to present a sheet to the printing couple, and then in the reverse direction to return said pad into position for engaging the next sheet.

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