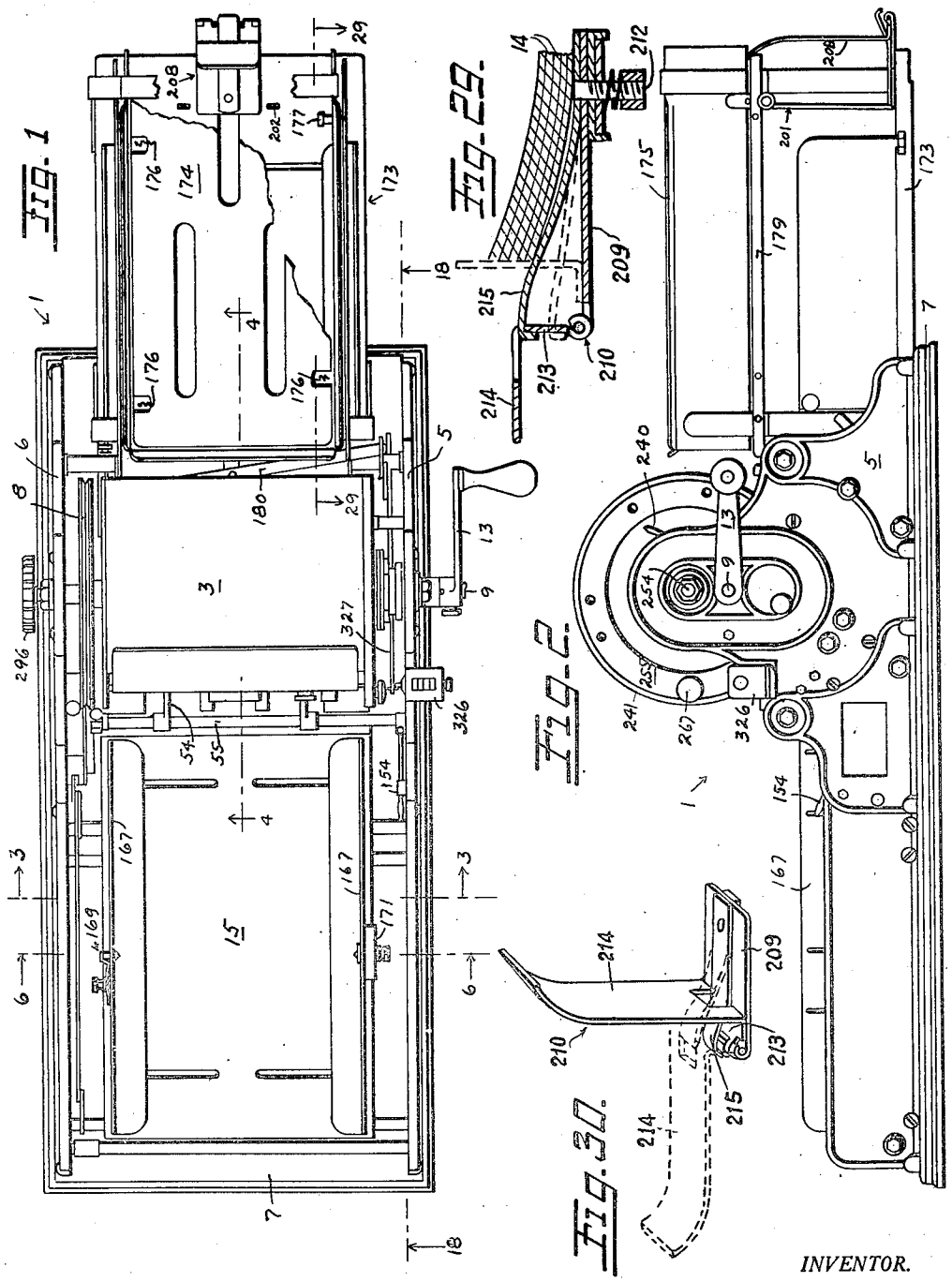
Aug. 17, 1937. F. NIGRA 2,089,979

DUPLICATING MACHINE

Filed Oct. 22, 1934 6 Sheets-Sheet 1



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Aug. 17, 1937. F. NIGRA 2,089,979

DUPLICATING MACHINE

Filed Oct. 22, 1934 6 Sheets-Sheet 2

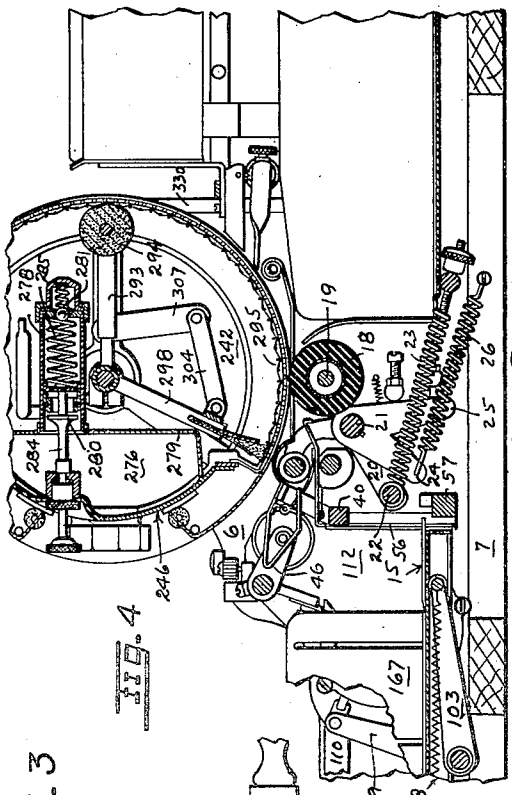


FIG. 4

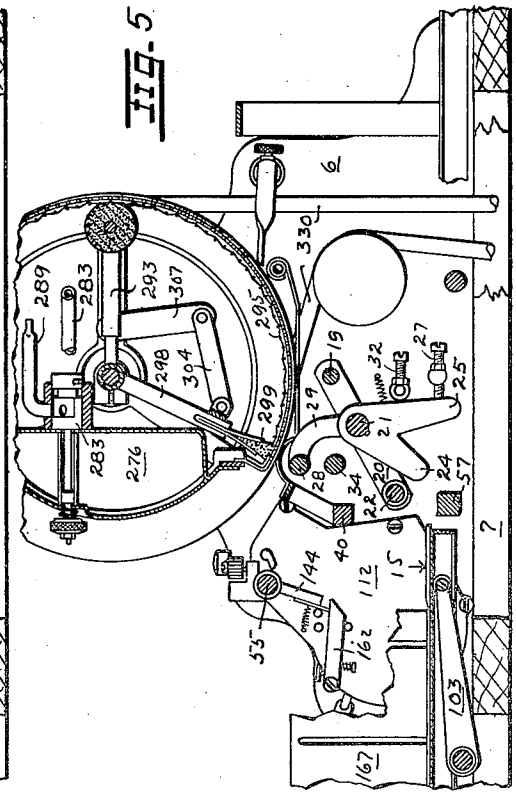


FIG. 5

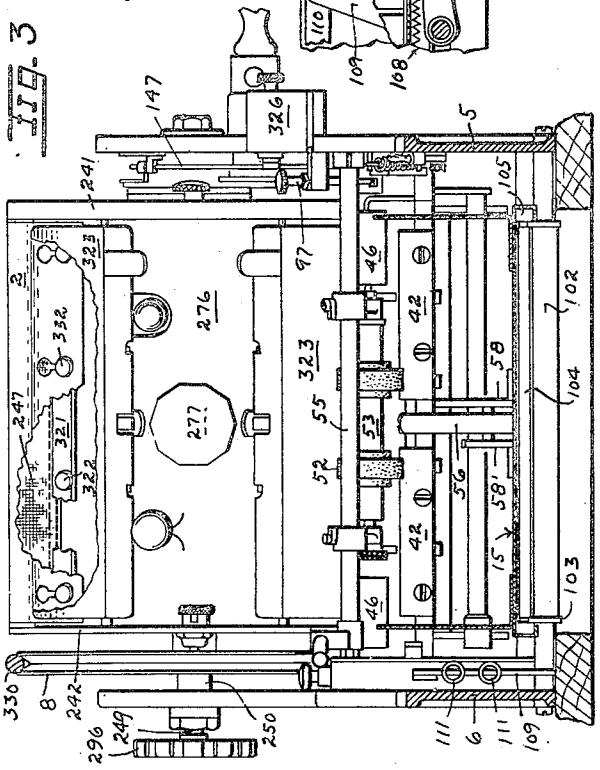


FIG. 3

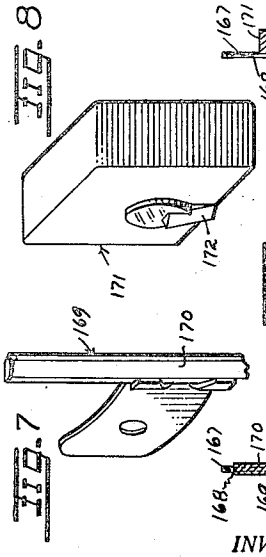


FIG. 8

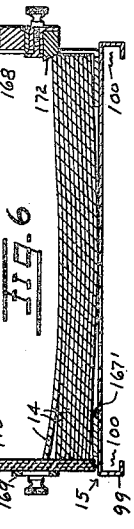


FIG. 6

FIG. 7

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Aug. 17, 1937. F. NIGRA 2,089,979

DUPLICATING MACHINE

Filed Oct. 22, 1934 6 Sheets-Sheet 3

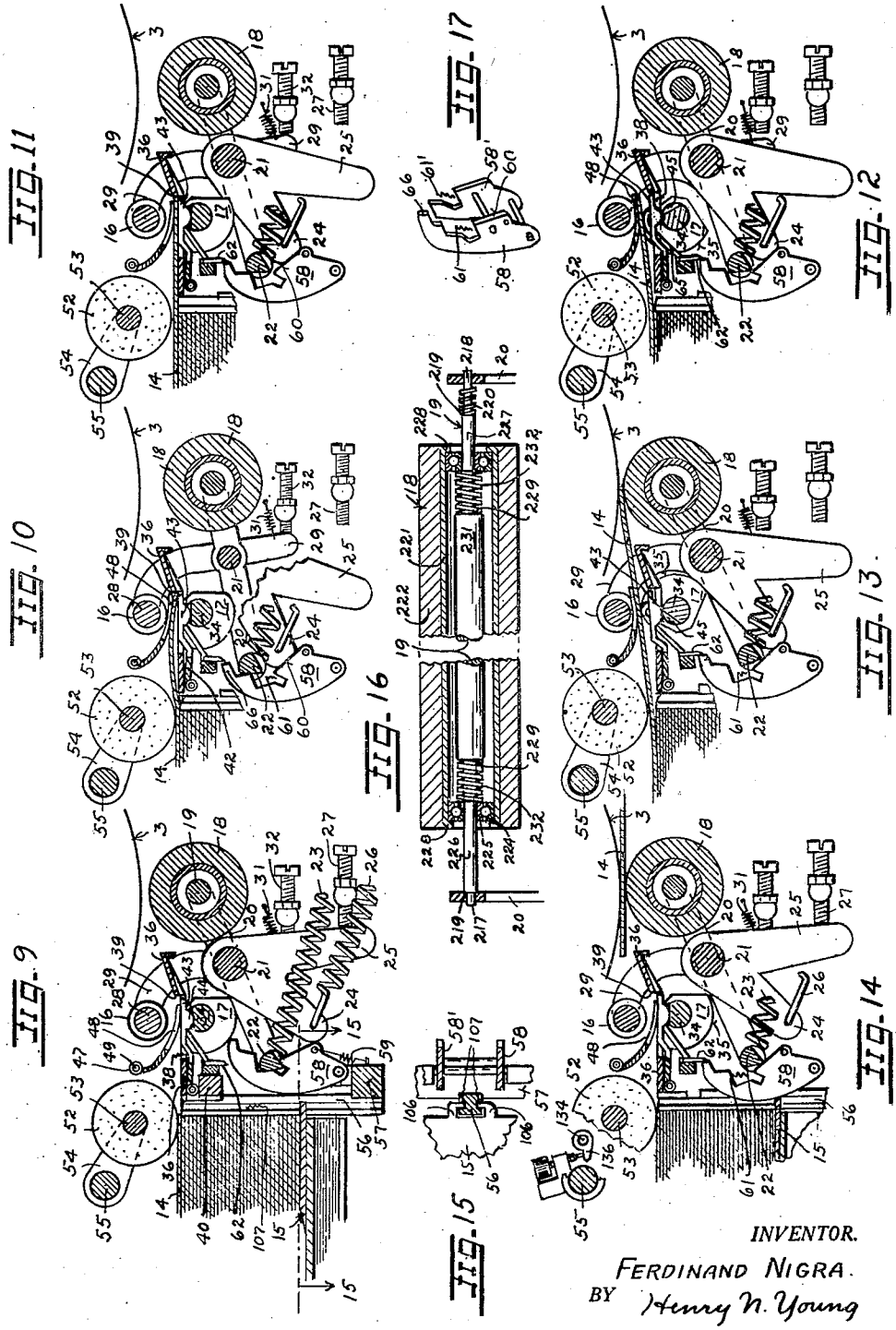


FIG. 11

FIG. 12

FIG. 10

FIG. 13

FIG. 16

FIG. 17

FIG. 9

FIG. 14

FIG. 15

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Aug. 17, 1937. F. NIGRA 2,089,979

DUPLICATING MACHINE

Filed Oct. 22, 1934 6 Sheets-Sheet 4

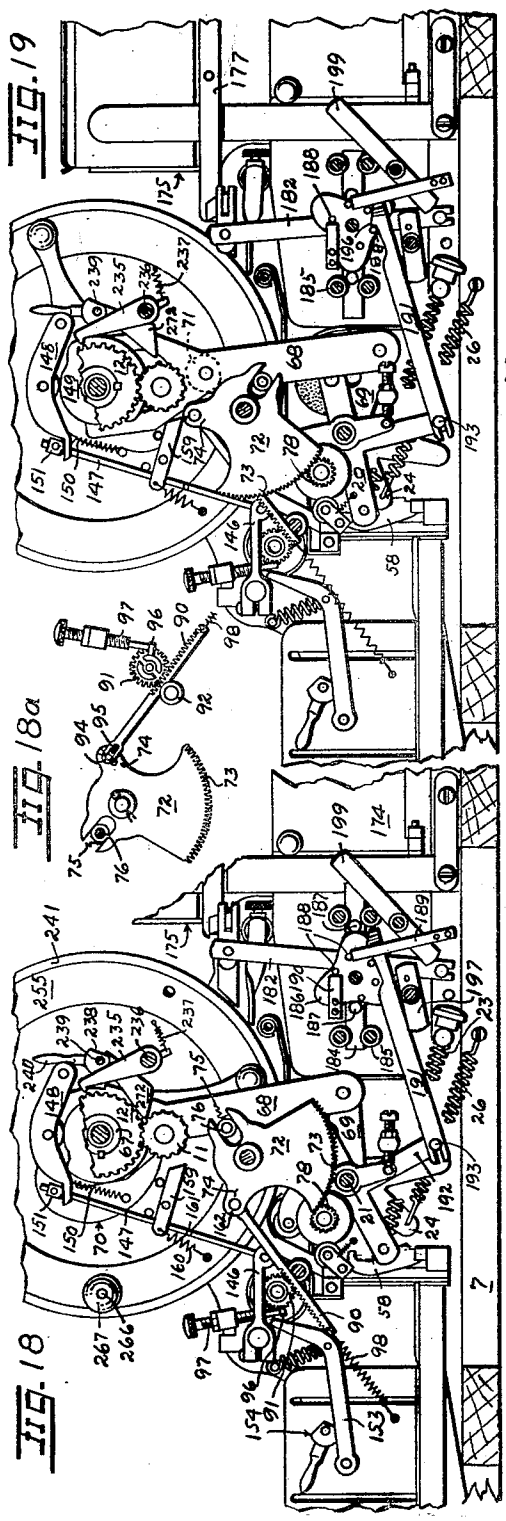


FIG. 19

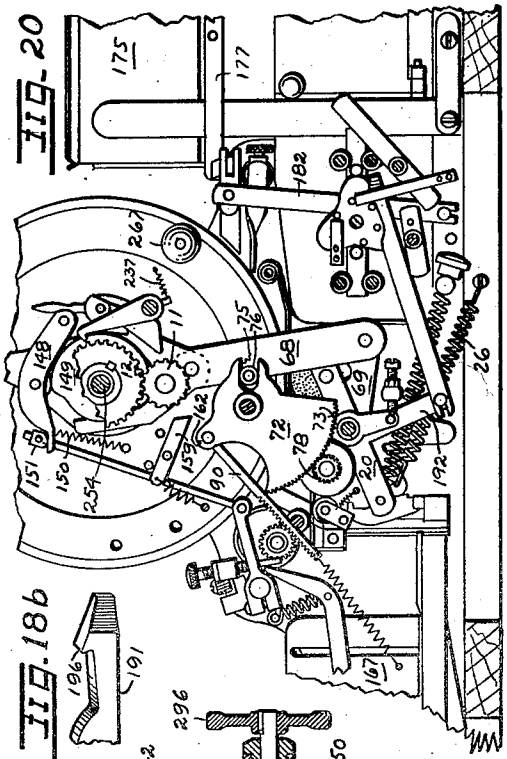


FIG. 20

FIG. 18a

FIG. 18

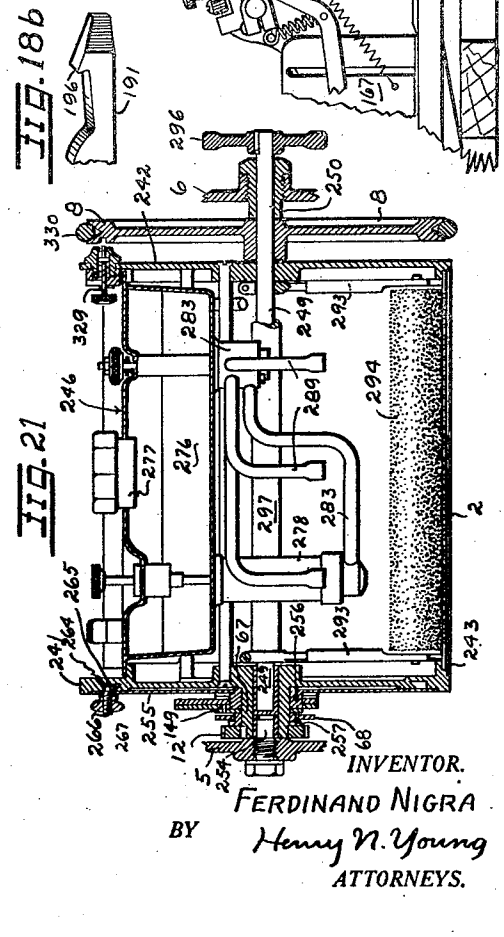


FIG. 21

FIG. 18b

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Aug. 17, 1937. F. NIGRA 2,089,979

DUPLICATING MACHINE

Filed Oct. 22, 1934 6 Sheets-Sheet 5.

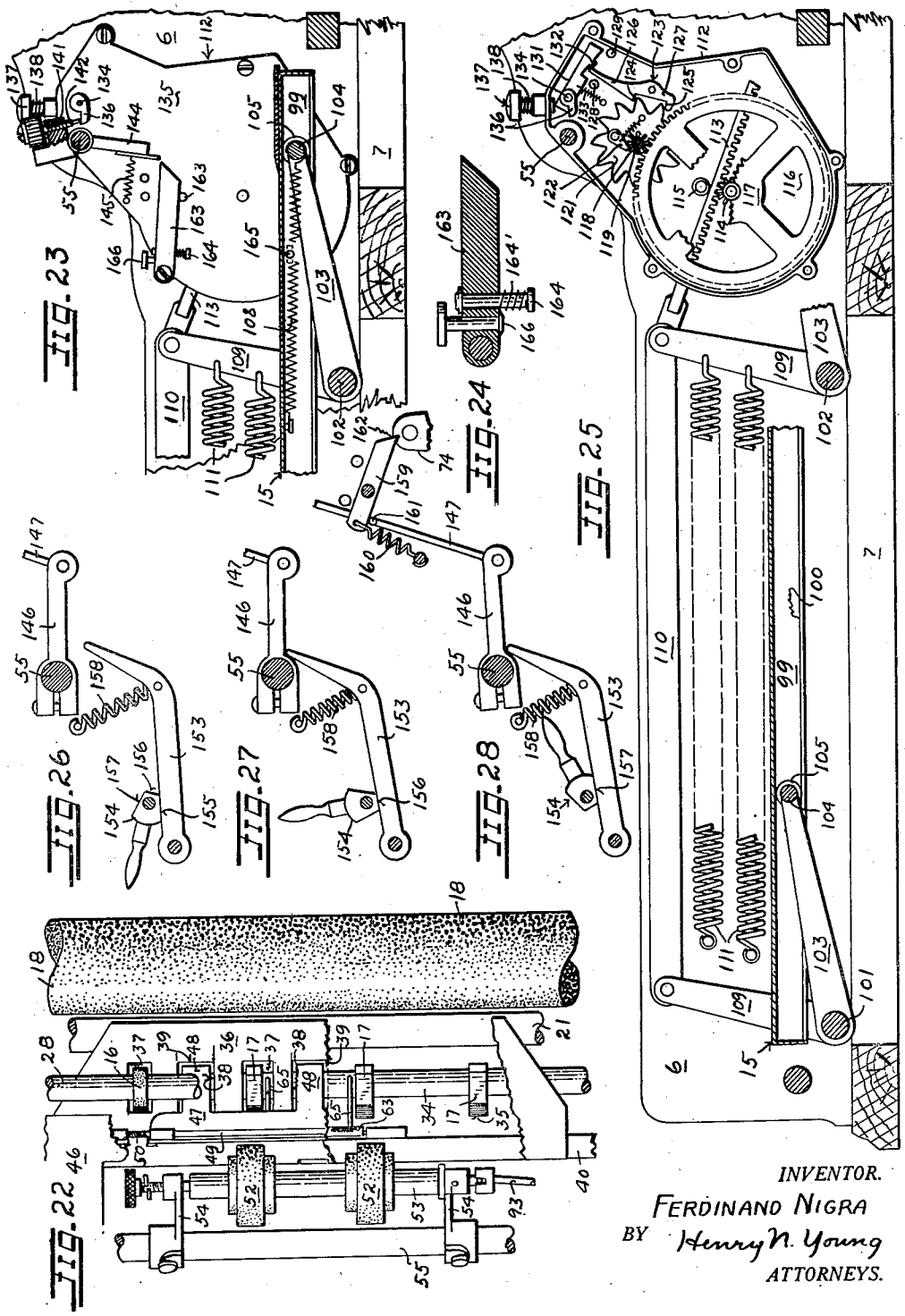


FIG. 23

FIG. 24

FIG. 25

FIG. 26

FIG. 27

FIG. 28

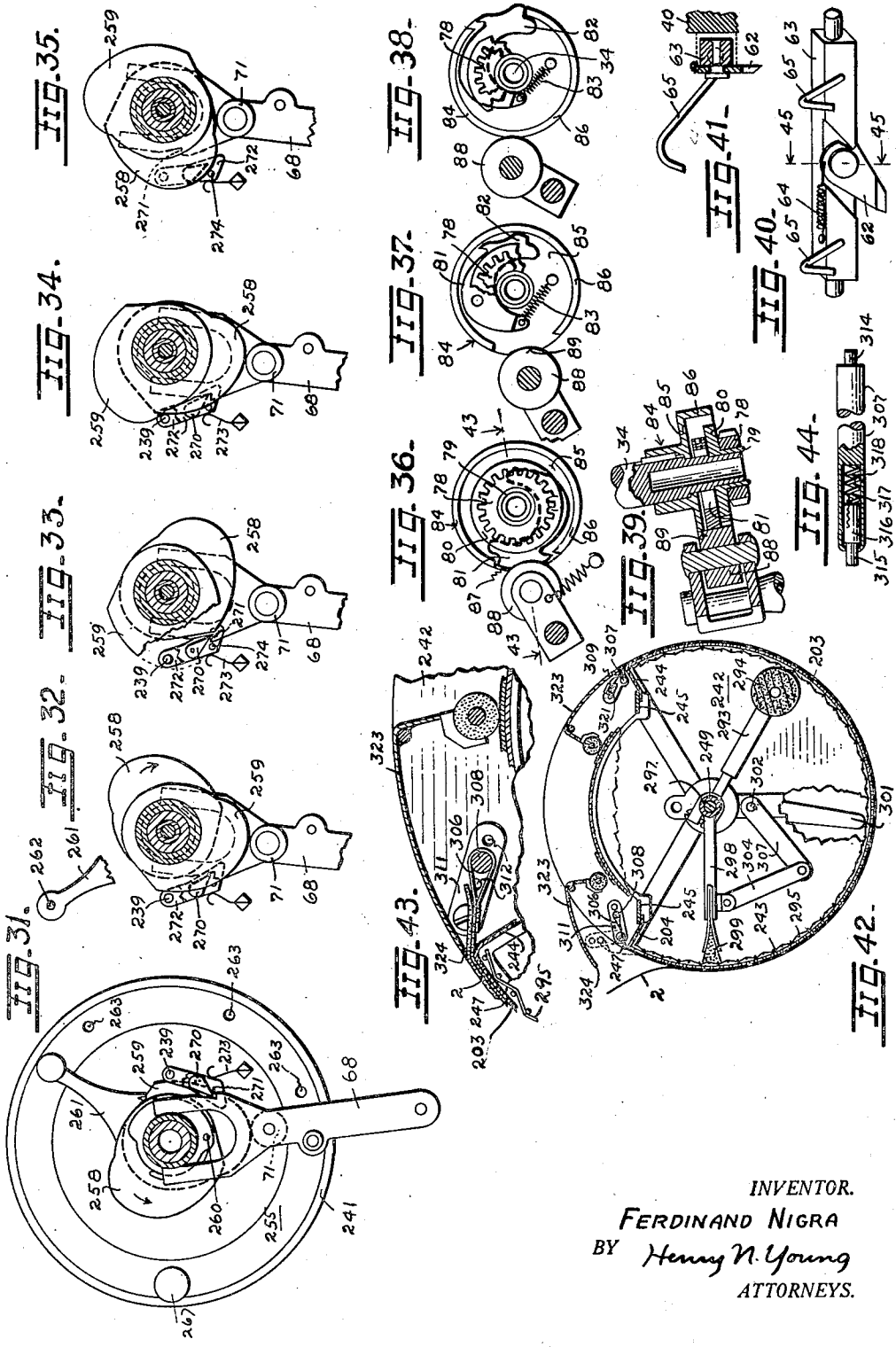
FIG. 22

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DUPLICATING MACHINE

Filed Oct. 22, 1934 6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,089,979

DUPLICATING MACHINE

Ferdinand Nigra, Oakland, Calif.

Application October 22, 1934, Serial No. 749,328

21 Claims. (Cl. 101—118)

The invention relates to a duplicating machine of the mimeograph type wherein a sheet of paper to be printed on is progressively fed between a stencil on a rotary cylinder and an impression roller.

Major objects of the present invention are,

1. To provide an improved and positively acting mechanism for advancing a sheet through the mechanism for printing the same as the cylinder rotates;

2. To provide an automatic means for feeding sheets to the sheet advancing mechanism, said means including an improved self-levelling feed table;

3. To provide means for automatically insuring the release of the sheets from the supply stack on the feed table as successive sheets are engaged for the advancement thereof for printing;

4. To provide a generally improved mechanism for actuating the sheet propelling mechanism of the machine;

5. To provide a means whereby different areas of a stencil on the cylinder may be independently utilized for printing therefrom, and printing may be effected on sheets of different lengths and located where desired on the sheets receiving the printing;

6. To automatically prevent an operative disposal of the impression roller except when a sheet is being advanced for the printing thereof;

7. To provide an improved mounting for an impression roller of a rotary duplicating machine.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of a preferred embodiment of the invention, and in the accompanying drawings, in which,

Figure 1 is a plan view of a duplicator embodying the invention.

Figure 2 is a side elevation of the duplicator.

Figure 3 is an enlarged elevation at 3—3 in Figure 1.

Figures 4 and 5 are upright and longitudinal sections through the central portion of the duplicator and at different transverse planes through the cylinder.

Figure 6 is a section at 6—6 in Figure 1 and through a stack of impression sheets on the feed table thereat.

Figures 7 and 8 are perspective views of members shown in Figure 6.

Figures 9 to 14 inclusive are enlarged fragmentary and somewhat diagrammatic views showing successive relations of operative parts of the feed mechanism in a cycle of operations of the machine.

Figure 15 is a fragmentary plan view at 15—15 in Figure 9.

Figure 16 is a longitudinal section through the impression roller and its mounting.

Figure 17 is a perspective view of a swinging stop member of the feed mechanism.

Figure 18 is an enlarged fragmentary view at 18—18 in Figure 1, and particularly shows details of the actuating means for the feed mechanism.

Figure 18a is a reverse side view of a portion of the actuating mechanism shown in Figure 18.

Figure 18b is an enlarged fragmentary view of an element shown in Figure 18.

Figures 19 and 20 show the mechanism of Figure 18 in different operating conditions thereof.

Figure 21 is a plan section taken at the plane of the cylinder axis with the cylinder disposed as in Figure 18.

Figure 22 is a fragmentary plan view of the feed mechanism.

Figure 23 is a fragmentary longitudinal elevation showing a portion of the feed table and the exterior of a housing for an escapement mechanism which controls the feed table positioning.

Figure 24 is a fragmentary and enlarged vertical section through a swinging stop member shown in Figure 23.

Figure 25 is a fragmentary elevation showing a major portion of the feed table in section and also the details of the escapement mechanism which controls the positioning of the feed table.

Figures 26 to 28 inclusive are fragmentary elevations showing different operative positions of a stop arm of the mechanism.

Figures 29 and 30 are respectively longitudinal section and perspective views of a stop unit of the receiving tray.

Figure 31 is an elevation showing certain details of a cam arrangement associated with the stencil cylinder and shown in Figure 18.

Figures 32 to 35 inclusive are reverse-side views of the arrangement of Figure 31, operative parts being shown in a succession of operative relations thereof in the different views.

Figures 36 to 38 inclusive are enlarged views of a clutch mechanism shown in Figure 18, the mechanical parts being shown in different operative relations in the different views, and portions of certain elements being broken away in Figures 37 and 38.

Figure 39 is a section at 29—29 in Figure 36.

Figure 40 is a perspective view of a detent assembly of Figure 9.

Figure 41 is a transverse section at 41—41 in Figure 40.

Figure 42 is a transverse section taken through the cylinder adjacent one end thereof, a reservoir of the cylinder assembly being omitted.

Figure 43 is an enlarged fragmentary view of the showing of Figure 42.

Figure 44 is a longitudinal and partly sectional view of an element shown in section in Figure 46.

The features of the present invention are incorporated in the illustrated duplicating machine 1 in which a stencil 2 is carried on a rotary cylinder 3 for printing engagement with a sheet of paper or other material for receiving printing. The printing cylinder 3 is supported for rotation by and between side frame members 5 and 6 which extend upwardly and in mutual opposition from a rectangular base frame 7 and receive the duplicator mechanism between them. Externally thereof, and at its end nearest the frame member 6, a belt pulley 8 is provided for optional use in effecting a power rotation of the cylinder. A shaft 9 is journalled in the frame member 5 in parallel relation to the rotative axis of the cylinder and is connected with the cylinder through constantly engaged gears 11 and 12 which are respectively provided on it and on the cylinder. At its outer end, the shaft 9 carries a hand crank 13 for use to manually rotate the cylinder through the coaction of the gears 11 and 12.

As is particularly brought out in the generally diagrammatic showing of Figures 9 to 14 inclusive, a sheet 14 of print-receiving material which has been moved from a feed table 15 to dispose its front end portion between pairs of upper and lower rollers 16 and 17, is thereafter engaged by and between said rollers and is thereby advanced forwardly for the disposal of its front end portion between the stencil on the rotary cylinder 3 and an impression roller 18, and is finally gripped between the cylinder and the impression roller to continue the feeding movement of the sheet while the latter is being printed.

The impression roller 18 is mounted for its free rotation on a shaft 19 which is carried by and between corresponding and rearward ends of lever-like members 20 which are intermediately pivoted on a fixedly disposed rock-shaft, said shaft being journalled in and between the frame members 5 and 6 and being disposed toward the rear or feeding end of the machine with respect to the roller 18.

The forward ends of the lever members 20 are connected by a bar 22, and a tension spring 23 extends generally forwardly from the bar 22 to an anchorage in the frame base 7 to constantly urge a resilient engagement of the impression roller 18 against the cylinder 3. The extremities of the shaft 19 and the bar 22 pivotally engage the ends of the levers 20 whereby the generally planar assembly of these members may be distorted transversely thereof if such is required to insure an even bearing of the impression roller with and along the cylinder.

Arms 24 extend rigidly and radially from the shaft 21 for simultaneous engagement with the bar 22 as a means to rock the levers 20 to dispose the roller 18 out of engagement with the cylinder. An arm 25 extends rigidly from the shaft 21 in angular relation to the arm 24 thereat, and a tension spring 26 connects the free end of the arm 24 with an anchorage on the base 7 whereby the arm 25 is resiliently urged to maintain an engagement thereof with an adjustable stop 27 mounted on a suitable bracket extending from the frame member 6; it will be understood that the stop 27 determines one limit of oscillation of the shaft 21.

The rollers 16 are mounted on a shaft 28 which is loosely journalled in and between the upper ends of lever-like members 29 which are disposed in generally upright position and are intermediately pivoted on the shaft 21 for rocking independently of the latter shaft. Preferably, and as shown, the upper lever portions are curved rearwardly whereby the shaft 28 may be disposed directly above the line of lower feed rollers 17 for cooperation of the pairs of feed rollers to grip a sheet 14 between them. The lower arms of the levers 29 are connected to the side frame members 5 and 6 by means of tension springs 31 operative in the planes of movement of the levers whereby the shaft 28 is yieldingly urged to maintain its engagement with adjustable stops 32 which are provided on the frame members 5 and 6 respectively and while the rollers 16 are in a limiting lowered position with respect to the axis of the rollers 17.

A fixedly disposed shaft 34 carries the rollers 17, and said rollers are segmental whereby their cylindrical face portions 35 extend through an arc which is somewhat less than a full circle. The rollers 17 have like perimeters and are similarly positioned on the shaft 34 whereby they may simultaneously coact in like manner with the rollers 16 above them.

As the rollers 17 are rotated, their faces 35 are arranged to engage and grip a sheet 14 between them and the rollers 16 at a line at or adjacent the common plane of the shafts 28 and 34. The remaining face portion of each roller 17 is at less distance from the roller axis than the faces 35. It will thus be understood that the rollers 17 coact with the rollers 16 only while their faces 35 are in opposition to said rollers. Preferably, and as shown, the circles of the faces 35 of the roller 17 are arranged to intersect the circles of the depressed rollers 16 whereby the latter rollers may be pressed upwardly against the resistance of the springs 31 and an equalized and resilient gripping of the sheet 14 between the sets of rollers 16 and 17 may be assured while the rollers are coactive in the described manner. It will thus be understood that the rollers 17 are operative as a sheet-feeding means for only a part of each rotative cycle thereof.

An elongated plate member 36 is mounted in generally horizontal disposition and in a plane slightly below the rollers 16, and, as is brought out in Figure 22, rectangular openings 37 are provided in the plate 36 opposite the segmental rollers 17 to permit the described periodic coaction of the rollers 16 and 17 therethrough. Other rectangular openings 38 are provided in the plate 36 between and in alignment with the openings 37, and the material at the advance edges of these openings is extended upwardly of the plane of the plate at the openings to provide a straight line of stops 39 against which the advance edge of a sheet 14 is arranged to abut when the sheet is supportedly moved over the top of the plate 36 to position its forward edge portion between the rollers 16 and 17; the engagement of a sheet edge with the stops 39 is disclosed in Figures 10 and 11.

As particularly shown, the plate member 36 is

mounted on a cross-bar 40 which is fixedly secured to and between the frame sides 5 and 6, and is disposed rearwardly of the shafts 28 and 34. Forwardly of the line of stops 39, the plate 36 slopes upwardly, as is particularly shown, whereby to support and direct the sheet upwardly thereat if such is needed.

Means are provided for lifting a front sheet edge out of engagement with the line of stops 39 at the proper time in a cycle of operations of the cylinder 3 whereby the sheet 14 may then be advanced in the described manner. As particularly shown, a member 42 is hingedly mounted on and beneath the plate member 36, and the member 42 provides a series of flat fingers 43 which are arranged for swinging into and through the various openings 38. One of the fingers 43 is provided with a projection 44 which is arranged to constantly ride on the top of the shaft 34, said shaft being cylindrical thereat except for a segmental notch 45 provided therein. When the projection 44 engages the bottom of the notch 45, the fingers 43 are arranged to be disposed in the openings 38 in coplanar relation therewith, whereby they then provide a portion of the support surface for the sheet as it is moved against the stops 39; the present disposal of the fingers 43 is shown in Figures 9 to 11. When the projection 44 of a finger 43 rides on the cylindrical part of the shaft surface thereat, the fingers 43 are raised to lift the front portion of the positioned sheet clear of the stops to thereafter permit an advance of the sheet for its printing.

Members 46 are fixedly mounted on the bar 40 adjacent the frame sides 5 and 6, and a member 47 is supported by and between the members 46 and above the plate 36. The member 47 provides a series of fingers 48 which resiliently register with the lifter fingers 43 or with a sheet 14 which is disposed over the latter fingers. As shown, in Figure 22, the member 47 is pivoted on a fixed shaft 49, and a helical spring 50 is coactive between the member and shaft to constantly and resiliently urge the fingers 48 downwardly. It will be understood that the fingers 48 insure a directing of the sheet 14 to an initial engagement with the stops 39 as the sheet is inserted between the then spaced rollers 16 and 17; no parts of the cam-like rollers 17 protrude above the plate 36 during the latter process.

In the present machine, the initial positioning of successive sheets 14 in engagement with the stops 39 is arranged to be automatically effected as the cylinder 3 is continuously rotated. As particularly illustrated, rollers 52 are provided for periodically engaging the top sheet 14 of a stack of sheets on the feed table 15 and for subsequent rotation to advance the engaged sheet to and against the stops 39. The rollers 52 are fixed on a common shaft 53 which is carried by and between arms 54 extending rigidly from a rock-shaft 55 which is journalled in and between the frame members 5 and 6, and is parallel to both the feed table top and the cylinder axis.

To insure a delivery to the machine of but one sheet 14 at a time for printing from the stencil, the advance end of the stack of sheets on the table 15 is engaged with an upright stop post 56 in such manner that only the top sheet lies above the top of the post 56 when the rollers 52 are actuated to advance a sheet to the stops 39. When the top sheet has been completely removed from above the stack, the table 15 is automatically raised to dispose solely the next sheet for removal by the rollers 52; this automatic control of the table 15 is hereafter described in detail. Preferably, and as shown, the post 56 is positioned in the longitudinal central line of the sheets of the stack and is fixed to and between the frame cross-bar 40 and a lower cross-bar 57 which generally underlies the bar 40.

By particular reference to Figure 9, it will be noted that a roller 52 is there shown in pressure engagement with the top sheet 14 of the stack of sheets on the table 15, the roller 17 is in an inoperative position, the lift finger 43 is depressed to the plane of the plate 36, a pressure finger 48 resiliently presses on the finger 43 beneath it, and the impression roller 18 is spaced from the cylinder 3. The foregoing positions and relations of the operative parts of the described sheet-feeding means of the present machine may be conveniently considered as representing the conditions at the beginning of a cycle of operations of the present duplicating machine.

As the cylinder 3 is rotated, the rollers 52 are rotated to advance the sheet 14 over the plate 36 and between the cooperating pairs of fingers 43 and 48 until it positively engages against the stops 39. Preferably, the feeding rotation of the rollers 52 is continued until the sheet is actually buckled between the rollers and stops in the manner shown in Figure 10; in this manner, a true registration of the forward paper edge with the line of stops 39 is assured. The rollers 52 are then lifted from the sheet 14 whereby the latter may flatten out with its forward edge retained against the stops 38 by the coaction of the fingers 43 and 48; this flattened condition of the sheet following its buckling is shown in Figure 11. Except for a slight shifting of the still inoperative roller 18 by reason of the engagement of the arms 24 of the rock-shaft 21 with the bar 22, the other elements have remained as in Figure 9.

The continued rotation of the cylinder 3 next results in a rotation of the shaft 34 to displace the finger 43 of the member 44 which engages it and so lift all of the fingers 43 to raise the front sheet edge above the stops 39. As the advance sheet edge is freed, the sheet is engaged and gripped between the rollers 16 and the working faces 35 of the segmental rollers 17 for thereafter advancing the sheet toward a position for its printing as the latter rollers are rotated. In Figure 12, the rollers 17 are shown as they first grip the sheet in the cooperation with the rollers 16, it being noted that the rollers 18 and 52 are now both inoperative.

In Figure 13, the relation of the operative parts is shown as it is when the working face 35 of the roller 17 approaches the limit of its coaction with the roller 16. At this time, the impression roller has just been allowed to grip the forward sheet edge between it and the stencil on the cylinder 3 whereby this engagement of the sheet between the roller and cylinder may thereafter and solely operate to carry the sheet forward for its printing. The operative relations are preferably such that the sheet is gripped between the cylinder and impression roller just as its forward edge reaches the plane defined by the axes of the cylinder and roller; in this manner, printing may be placed at the extreme top edge of the paper if such is desired.

After the rear end of the sheet has passed beyond the line of coaction of the rollers 16 and 17, as in Figure 14, the rollers 52 are lowered onto the stack of sheets on the table 15, and the rotation of the shaft 34 is stopped with the roller 17 in its initial inoperative position and with the

fingers 43 lowered to the plane of the plate 36. The aforesaid lowering of the rollers 52 is arranged to actuate suitable mechanism for elevating the table 15 to dispose the then engaged top sheet of the stack for advancement over the top of the post 56. Before the rollers are rotated to advance the new sheet and after the preceding sheet has been delivered from between the cylinder and the impression roller, the latter roller is disposed out of engagement with the cylinder whereby the relations of Figure 9 may again exist at the beginning of a new cycle of operations of the printing cylinder 3.

Means are preferably provided for preventing an operative disposition of the impression roller 18 unless a sheet 14 is actually on its way for printing engagement between the stencil on the cylinder and the roller 18. As particularly illustrated in Figures 9 to 14 and 17, a swinging stop member 58 is provided for such coaction with the bar 22 of the described rockable mounting for the roller 18 as to prevent the operative positioning of the roller which is shown in Figures 13 and 14 unless a sheet 14 is then engaged between the rollers 16 and 17. As is particularly brought out in Figure 9, the stop member 58 is pivoted to the frame cross-bar 57 and is resiliently urged to maintain contact with the bar 22 through the action of a tension spring 59 which is coactive between it and the cross-bar 57.

Intermediately in its bar-engaging face 60, the member 58 is provided with a notch 61 for receiving a complementarily formed portion of the bar 22 in such a manner as to prevent a further lowering of the bar while permitting a lifting of the bar from the notch. While the bar 22 is disposed in the notch 61, the impression roller 18 is held spaced from the cylinder 3, this being the condition shown in Figure 9. It will be understood that the positioning of the roller 18 is controlled by the position of the bar 22 which is in turn arranged for movement in an arcuate path through its periodic engagement with the arms 24 of the shaft 21 which are oscillated between limiting positions thereof; the bar is lifted positively as the arms 24 move upwardly and is lowered through the action of the spring 23 as the arms move downwardly until its further lowering is prevented either by its engagement in the notch 61 or by the engagement of the impression roller 18 against the under side of a sheet 14 at the cylinder.

A detent 62 is provided for operating to prevent the engagement of the bar 22 in the notch 61 of the stop member 58 as the bar moves downwardly along the face 60 of the member and while a sheet 14 is disposed in the machine for the printing thereof, said detent being directly coactive with said member. As is particularly brought out in Figures 9 to 14 and 40 and 41, the detent 62 depends from a shaft 63 which is journalled in and between bearing blocks provided on the frame cross-bar 40 and for oscillation about an axis parallel to the axis of the cylinder. The detent 62 is pivoted to the shaft 63 for rocking in a plane parallel to the shaft axis, and from a normal position thereof in which it is displaceably held by a tension spring 64 which is appropriately operative between the detent and the shaft 63 which carries it.

One or more fingers 65 extend generally radially from the shaft 63 to have their free ends overlie the shaft 34 at plate openings 37 for swinging upwardly through said openings to engage any sheet 14 thereabove. The detent 62 is arranged to be normally disposed in the arcuate path of movement of a top extension 66 of the member 58 whereby said extension may engage the detent to rock the shaft 63 and thereby lift the fingers 65.

If the fingers 65 encountered a sheet 14 as they are lifted, the sheet operates to prevent a further rocking of the shaft and a displacement of the detent, whereby the detent is then and thereafter operative to hold the member 58 out of engagement with the rod 22 while the latter is swung downwardly past the notch 61 of the member; this functioning of the detent 62 is brought out in Figures 12 and 13. If the fingers 65 encounter no sheet above them, the engagement of the member 58 with the rod 22 continues and the rod is permitted to seat in the notch as is shown in Figure 9; the latter is understood to be the condition of the sheet-feeding mechanism before the first sheet of a stack on the feed table is advanced for printing or following an actuation of the mechanism without a feeding of a sheet therethrough.

In order to insure an even spacing of the impression roller 18 from the stencil cylinder while the roller is held from engagement with the cylinder by reason of the engagement of the rod 22 in the notch 61, a second swinging stop member 58' is provided in spaced relation from the member 58. The member 58' is fixed to the member 58 and provides a notch 61' whereby the bar 22 may be parallel to the cylinder axis when the bar is seated in and across the notches 61 and 61'. The structure wherein the members 58 and 58' form parts of a unitary stop assembly is brought out in Figures 3 and 17.

Referring to the showing of Figure 10, it is noted that while the sheet 14 is being advanced to its engagement with the stops 39, the shaft 21 has been so rotated that its arm 24 has lifted the bar 22 above the notch 61 and, by reason of the engagement of the bar with the upper portion of the working face 60 of the member 58, has rocked the member to dispose the upper end 66 of the member behind the plane of the detent 62. While the roller 52 is being raised from the sheet, the arm 24 is gradually lowered to permit a lowering of the bar 22 and a movement of the end 66 toward and against the detent 62 whereby, just before the bar 22 is positioned opposite the notch 61, the engagement of the detent with the member 58 has rocked the fingers 65 against the sheet 14 at the rollers 16, as is shown in Figure 12.

The sheet 14, thereafter acting as a stop, holds the detent 62 fixed in front of the member 58 to prevent the further forward movement of the member as the arm 24 is lowered to its starting position to dispose the bar 22 below the notch 61, as is particularly shown in Figures 13 and 14. When the sheet 14 is advanced beyond the contact ends of the fingers 65, the fingers lift to release the member 58 for contacting the bar 22 at a point of the member below the notch 61 and the detent may be disposed on top of the member 58 which then underlies it; whenever the detent engages the top of the member 58, it is arranged to be displaced in its plane and against the resistance of the spring 64. A subsequent upward movement of the bar 22 as the next sheet 14 is advanced to the stops 39 restores the conditions found in Figure 10, and the described cycle of operations of the feed mechanism is thereafter repeated.

The various shafts 21 and 34 and 55 are arranged to be appropriately actuated in the desired manner and sequence by a suitable actuating mechanism which is shown generally in Figures 18 to 20. The required operations are primarily derived from the controlled reciprocative movement of a bar 68 which pivotally engages an arm 69 extending rigidly from the shaft 21 and is forked at its upper end to span a hub portion 67 of the cylinder. The bar 68 is disposed in generally upright position in parallel relation to the frame side 5, and a plate cam 70 is mounted on the cylinder adjacent and inwardly of the forked portion of the bar 68. At its inner side, and in the plane of the cam 70, the bar 68 carries a roller 71 for periodic engagement by the cam to lower the bar and so oscillate the shaft 21 as is required for controlling the disposal of the impression roller 18 in the previously described manner. It is noted that the spring 26 for the shaft 21 is operative to urge the upward disposal of the arm 69 and the bar 68.

An actuator element 72 is pivoted to the frame side 5 adjacent the plane of operation of the bar 68. The element 72 comprises a flat plate providing a segmental gear 73, an arm 74, and a radial slot 75. A roller 76 is mounted at the outer face of the bar 68 and constantly engages in the slot 75 whereby the element 72 is arranged for oscillation about its pivotal axis as the bar 68 is reciprocated, said axis being fixed.

The segmental gear 73 is utilized to effect the periodic rotation of the shaft 34 which carries the segmental feed rollers 17 through the operation of a pinion 78 which it constantly engages and which is connected with the shaft 34 through a suitable one-way clutch in such a manner that the shaft 34 is rotated only by and during a return movement of the element 72 to its normal position which is shown in Figure 18. It will be understood that it is this rotation of the shaft 34 which periodically effects the described operative rotation of the segmental rollers 17 at the appropriate time in each rotative cycle of the printing cylinder 3.

As is particularly illustrated in Figures 36 to 39, the pinion 78 is coaxially fixed on a sleeve member 79 which is rotatable on a reduced end portion of the shaft 34 and provides an annular flange 80 at the outer side of the pinion. The flange 80 carries a detent member 81 pivoted thereon and providing a catch head portion 82. A spring 83 is coactive between the member 81 and the flange 80 to constantly urge the disposal of the detent head 82 in a radially outward position thereof. Adjacent the end portion thereof which carries the pinion 78, the shaft 34 has fixed thereon a member 84 in which a cylindrical socket is defined for receiving the assembly of the pinion 78 and the sleeve 79 and the detent 81. The member 84 comprises an end wall 85 and a side wall 86 comprising a tubular flange extending axially from the end wall 85 to define the socket cavity. At one point thereof, the socket wall 86 is provided with an opening 87 through which the detent head 82 may protrude when the latter is disposed thereat. The arrangement is such that the detent may be pressed inwardly to have its head 82 within the socket for its rotation therein while the head contacts the bore of the wall 86 or may engage the wall 86 at an end of the opening 87 to cause a rotation of the shaft with the pinion 78.

It will now be noted that a spring-pressed roller 88 is mounted on the casing wall 5 in the plane of the member 84 and for resilient engagement with the outer periphery of said member axially across the same. Opposite the opening 87, the end wall 85 of the member 84 is provided with a relatively shallow notch 89 for receiving the roller 88 and shaped to complementarily receive said roller. When the roller 88 engages the notch 89, the segmental feed rollers 17 on the shaft 34 are arranged to be in the position shown therefor in Figures 9 to 11 and 14, and the detent head 82 is pressed inwardly by the roller 88 as is shown in Figures 36 and 37.

The detent member 81 is so mounted and its head 82 is so shaped that a rotation of the pinion 78 in a direction corresponding to an operative rotation of the shaft 34 engages the head with the member 84 at the forward end of the opening 87 as is indicated in Figure 38, it being noted that the return stroke of the segmental gear 73 of the element 72 is arranged to effect one complete revolution of the pinion 78 and so of the shaft 34. If the operation of the pinion 78 should be reversed while the catch head 82 engages the member 84 at the forward end of the opening 87, the head 82 is arranged to then engage the member at the forward end of the opening 87 by reason of the inoperativeness of the roller 88 and for effecting a reverse rotation of the member and the shaft 34; in this manner, the member 84 will always be brought to rest with the notch 89 engaging the roller 88 at the end of a working stroke of the segmental gear 73.

A rack bar 90 is pivoted at one end thereof to the arm 74 of the actuator element 72 and is constantly engaged between a pinion 91 and a roller 92 which are mounted on stub shafts extending from the frame member 5. The pinion 91 is connected with the shaft 53 which carries the rollers 52 by means of a shaft 93 (Figure 22) and universal joint connections whereby the rollers 52 may be rotated by and upon the reciprocation of the rack bar 90 and in accordance with the travel of said bar. The roller 52 is actuated in a paper-feeding direction when the roller engages the top sheet 14 of the stack on the feed table and in the reverse direction when the roller is lifted to an inoperative position in the manner previously stated.

Means are provided for adjusting the rotative feeding travel of the rollers 52 whereby the amount of the described buckling produced in a sheet 14 which has been projected by said rollers against the stops 39 may be adjusted as required. As is particularly brought out in Figure 18*a*, the pivotal connection between the rack bar 90 and the arm 74 is provided by the engagement of a pivot pin 94 fixed in the arm in a longitudinal slot 95 provided in the rack end thereat. An arm 96 extends radially from the hub of the pinion 91 and normally engages a stop pin 97 which is adjustably mounted on the frame member 5 in the plane of oscillation of the arm. The stop pin 97 is arranged to so engage the arm 96 as to limit the return, or inoperative, rotation of the rollers and thereby determine the full angle of oscillation of the rollers for both their working and return rotations, it being noted that the oscillation angle (and sheet buckling effect) is determined by the adjusted spacing of the pin 94 from the outer end of the slot 95 when the element 72 is in its inoperative position. It will be understood that a feeding rotation of the rollers 52 is arranged to cease before the rollers are lifted as described to release the sheet engaged by them, and that the desirable degree of buckling

will vary with sheets of different thickness and/or degrees of thickness. A tension spring 98 is constantly operative to urge the movement of the rack bar 90 and the pinion 91 to engage the arm 96 with the adjustable stop pin 97.

By particular reference to Figure 18, it will be noted that the described devices for actuating the shafts 21 and 34 and 53 are therein shown as at the beginning of a cycle of sheet-feeding operations with respect to the cylinder, whereby the various shafts are generally as in Figure 9. In Figure 19, the shaft-operating elements are shown in the coactive relation which exists therefor when the feeding mechanism shafts are disposed as in Figure 11. Figure 20 shows the relations of the shaft controlling mechanisms as they are when the paper-feeding conditions are those which are shown in Figure 13.

Referring now to the feed table 15 and its control, it will be noted, by particular reference to Figures 6 and 23 and 25, that the feed table is formed of sheet material providing an horizontal deck for receiving a stack of sheets and having downturned edge portions 99 defining mutually facing channels 100 beneath the deck. Mutually parallel rock-shafts 101 and 102 are journalled in and between the side frame members 5 and 6 beneath the table and near its ends, said shafts defining a plane which is parallel to the deck of the table. A pair of arms 103 extends generally forwardly from each of the shafts 101 and 102, said arms being fixed to the respective shafts in mutually parallel relation and being connected by rods 104 carrying rollers 105 beyond the arms and engaging in the table channels 100 for supporting the table on the arms 103.

As is brought out in Figure 15, the forward table edge is provided with extensions 106 at opposite sides of the post 56 and which engage in longitudinal grooves 107 provided in said post sides. As shown in Figure 23, a tension spring 108 is coactive between the table and a rod 104 to constantly urge the table forwardly in its contact with the post 56. In this manner the table is restrained against lateral displacement with respect to the post as it is raised or lowered by a rocking of the arms 104.

At the ends thereof adjacent the frame side 6, the shafts 101 and 102 carry arms 109 which extend generally upwardly, are fixed to the shafts in mutually parallel relation, and are connected by a link 110 which is pivoted to the arms at like distances from the shafts; in this manner, the arms 109 are constrained for swinging together and their rocking is arranged to effect like movements of the arms 103 to elevate or lower the table 15 while the same is retained in parallel relation to the plane of the shafts. Tension springs 111 extend rearwardly from the forward arm 109 to anchorages on the wall 6 whereby they are constantly operative to urge a swinging of the arms 109 to elevate the table 15.

When a stack of sheets 14 is first placed on the table 15, the latter is disposed in depressed position against the resistance of the springs 111 by manual pressure, and means are provided for securing the table in depressed position and for controlled and progressive raising thereof by utilizing the stored energy of the springs 111. As particularly illustrated, the table elevating control comprises an escapement mechanism which is provided in and on a casing 112 which is mounted on the frame member 6 in advance of the forward arm 109.

As is particularly shown in Figures 23 and 25, a rack bar 113 extends forwardly into the casing 112 from a pivotal connection with the forward arm 109 and between a pinion 114 and a roller 115 for actuating the pinion when the rack bar is reciprocated. The pinion and roller are rotatably mounted on stub shafts extending from the casing wall 116 adjacent the frame side 6, and the pinion is coaxially fixed to a relatively large gear 117 which meshes with a pinion 118 which is carried on a stub shaft 119 extending from the casing wall 116.

An escapement wheel 121 is rotatably mounted on the shaft 119 beside the pinion 118 and carries a spring-pressed pawl 122 at its pinion side for constant operation against the pinion in such a manner as to permit a relative rotation of the wheel and pinion only while the table is being depressed. An escapement lever 123 is pivoted opposite the wheel 121 and presents spaced teeth 124 and 125 toward the wheel, said teeth being provided on lever arms 126 and 127 respectively and being operative at opposite sides of the common plane of the wheel and lever axes and arranged to receive two adjacent wheel teeth between them. The lever arm 126 is extended somewhat and is arranged for movement between spaced stops 128 and 129 which are operative to limit the range of oscillation of the arm and lever.

Assuming that the lever 123 is free for oscillation and that the escapement wheel 121 is rotating in a direction to permit a raising of the table 15, teeth of the escapement wheel will alternately engage the different lever teeth 124 and 125 to effect an oscillation of the lever between its limiting positions. Means are provided for securing the lever when the elevation of the table is to be stopped; as shown, a bar 131 is intermediately pivoted opposite the free end of the lever arm 126 for the swinging of one end portion thereof against the extremity of the arm 126, and the bar face which opposes the arm extremity is provided with a stop projection 132 which is disposed generally midway of the arc of movement of the arm end. When the stop 132 is disposed in the path of movement of the arm 126 and the arm engages either side thereof, a ratchet wheel tooth is then arranged to engage one or the other of the lever teeth 124 or 125 to prevent a rotation of the ratchet wheel, this being a normal condition of the present escapement mechanism by reason of the action of a spring 133 which is constantly tensed between the bar 131 and an achorage on the casing wall 116.

The bar 131 is fixed on a shaft 134 which extends through and from a forward face plate or wall 135 of the casing 112 and carries a radial arm 136 thereon externally of the casing; in this manner, the bar 131 may be placed in inoperative position with respect to the escapement lever 123 by rocking the shaft 134 through rotatively displacing the bar from its normal position against the resistance of the spring 133. While the stop 132 of the bar 131 is inoperative, the escapement wheel may rotate by reason of the pull of the springs 110 acting through the connections provided by the rack bar 113, the pinion 114, the gear 117, pinion 118, and pawl 122; in this manner, the table is automatically elevated while, and only while, the stop 132 is inoperative with respect to the escapement lever 123. It will be noted that the disclosed elevating connections between the table and escapement wheel are such that an escape movement of one tooth of the

wheel represents a movement of the table which is preferably no greater than the thickness of the thinnest sheet 14 to be printed, in this manner the device will operate for sheets of all thicknesses.

A normally withdrawn plunger 137 extends through a slideway bore provided in the top of the casing 112 for engagement with the bar 131 to inoperably dispose the stop 132 of the bar. As is particularly illustrated in Figure 25, the plunger 137 is urged outwardly to an inoperative position by means of a compression spring 138 engaging between the head of the plunger and the casing wall through which the plunger is reciprocable, and an inner projection on the plunger limits its outward movement. It will be understood that the plunger 137 may be manually actuated at any time to release the escapement and cause a raising of the table independently of a rocking of the bar 131 through a displacement of the arm 136.

It will now be noted that one end of the rock-shaft 55 is disposed adjacent and parallel to the shaft 134 and fixedly mounts an arm 141 which carries a contact pin 142; preferably, and as shown, the pin 142 comprises a headed screw which is adjustably engaged in the arm. When the shaft 55 is rocked in a direction to lower the rollers 52, the pin 142 may engage the arm 136 of the shaft 134 to rock the latter for releasing the escapement mechanism in the described manner. With the rollers 52 depressed sufficiently to release the escapement mechanism, the resulting lifting of the stack of sheets 14 on the table against the rollers will rock the shaft 55 to displace the pin 142 to permit a return movement of the arm 136 and so of the bar 131 to operably dispose the stop 132 and prevent the further action of the escapement mechanism. The pin 142 would be so adjusted in the arm 141 that the top sheet 14 of a stack on the table may be appropriately disposed with respect to the top of the stop post 56 for a subsequent advancement of the sheet by the rollers 52 in the described manner. An arm 144 extends radially from the shaft 55 adjacent the casing plate 135, and a tension spring 145 is coactive between the plate and arm to constantly urge a rotation of the shaft 55 to depress the rollers 52.

Means are provided for controlling the positioning of the rollers 52 in accordance with the cyclic requirements therefor, said means being operated in accordance with the operation of the printing cylinder 3. Referring to Figures 18 to 20, it will be seen that a radial arm 146 extends generally horizontally from the end of the shaft 55 nearest the frame member 5 and that a rod 147 is pivoted to the arm end and extends upwardly through an eye provided at the free end of an arm 148 which extends adjacent the cylinder hub 67 and is pivoted to the frame member 5 at its other end. The arm 148 carries a roller which is arranged to constantly rest on the periphery of a plate cam 149 which is mounted on the hub 67 for rotation with the cylinder, and a tension spring 150 is constantly operative to pull the arm against the cam 149. A stop sleeve 151 is adjustably mounted on the rod 147 above the arm eye which receives it.

It will now be noted that the working periphery of the cam 149 is so shaped and is so related to the cylinder 3 that, when the sheet-feeding mechanism is generally as in Figures 11 and 12 and 13, the arm 148 engages the sleeve 151 to lift the rod 147 and the arm 146 to rock the shaft 55 to position the rollers 52 in their inoperative position. When it is time for the lowering of the rollers 52, the arm 148 is lowered to permit the functioning of the spring 145 to lower the rollers, as in Figure 14. If the lowering of the rollers 52 causes the release of the escapement mechanism, the table is lifted until the top sheet thereon is at the desired and adjusted limiting level; it will be understood that the latter occurs following each removal of a sheet from the stack as the machine is continuously operated.

Means are provided whereby the automatic elevation of the table may be prevented, as when starting a sheet by hand is desired. As is particularly brought out in Figures 18 and 26 to 28, an arm 153 is pivoted to the frame member 5 at its inner face and presents its free extremity below the arm 146 of the rock-shaft 55 and in the plane of operation of the arm. A rotary stop member 154 is mounted on the member 5 above the arm 153 and in its plane, said member including a radial handle for rotatably adjusting it and being formed to provide flat faces 155 and 156 and 157 at successively closer distances to the axis of the member. A spring 158 constantly pulls the arm 153 upwardly against the stop 154.

When the arm 153 engages the stop face 155, as in Figures 18 and 26, its tip is spaced from the arm 146 for permitting the described lowering of the rollers 52 below the delivery plane for sheets on the feed table. When the member 154 is rotated for the engagement of the arm 153 with the stop face 156, as is shown in Figure 27, the tip of the arm 153 engages the arm 146 to prevent its lowering to operably dispose the rollers 52.

When the arm 153 engages the stop face 157 of the member 154 (Figure 28), it is arranged to lift the arm 146 to the raised position which it assumes when the cam 149 is operative in the manner described therefor, and to retain the arm in such position. The latter disposal of the arm 146 is also arranged to render the remainder of the sheet-feeding mechanism inoperative through operatively disposing a pawl 159 which is arranged to engage and fix the actuator element against operating when the actuator bar 68 is in its lowest position; in this manner, the continued rotation of the cylinder is thereafter permitted without requiring an operation of the feeding means.

As is particularly shown in Figures 18 and 28, the pawl 159 is intermediately pivoted in the frame member 5 and is urged to dispose its point slightly above the line of operation of the element 72 through the action of a spring 160. The other end of the pawl 159 is disposed in the path of movement of a pin 161 extending laterally from the rod 147 whereby the pin 161 may engage the pawl to swing its point into the path of the end of the arm 74 and a notch 162 therein for engagement in said notch, it being noted that when the rod 147 is reciprocated by the normal action of the arm 146, the pawl 159 is inoperatively disposed when the arm 74 passes it. Following an operative engagement of the pawl 159 in the notch 162 and a subsequent release and lowering of the stop arm 153, a rotation of the cylinder is arranged to release the pawl.

Means are provided for automatically preventing a raising of the feed table 15 beyond a predetermined height therefor, thereby stopping the delivery of sheets from the table independently of the normal operation of the described feeding mechanism. As illustrated, the depending arm 144 of the shaft 55 is arranged to normally pass over the free end portion of a bar 163 which is

pivoted to the plate 135 at the end thereof farthest from the arm 141, and gravitationally rests upon a support pin 163 extending from the plate. As is brought out in Figures 23 and 24, a contact pin 164 depends from the bar 163 for engagement with a projection 165 of the table 15 as the latter reaches its desired limiting height, whereby the table is itself operative to dispose the bar for engagement by the arm 141 and so prevent a normal rocking of the shaft 55 to continue the sheet feeding.

The upward movement of the table 15 is preferably stopped while it still contains several sheets 14, and means are provided for manual operation to thereafter release the escapement mechanism to raise the table for the feeding removal of the remaining sheets therefrom. As particularly shown, the pin 164 slidably engages in a hole through the bar 163, is double-headed, and is constantly urged downwardly through the action of a spring 164' which is operative between the bar and the lower pin head, the spring preferably being stiff enough to withstand an appreciable compression thereof when the table projection 165 engages it for lifting the bar into operative relation with respect to the shaft arm 144. A headed pin 166 extends upwardly from the bar 163 with its head overlying and spaced from the upper head of the pin 164. When the bar 163 is operative as a stop means, it may be manually engaged and pressed downwardly against the resistance of the spring 164' to release the arm 144 and so permit a continuance of the feeding from the table through the permitted functioning of the table elevating mechanism. In this manner, the removal and printing of the last sheets on the table 15 may be effected following the described automatic termination of an automatic removal of the sheets.

Means are provided for insuring a freeing of the top sheet 14 of a stack of sheets on the table 15 as the sheet is individually advanced in the described manner. As particularly shown in Figures 1 to 8, side wall members 167 are mounted on the table 15 for receiving a stack of sheets 14 between them. The walls 167 are relatively adjustable to and from each other, have mutually inturned bottom flanges 167', and are provided with mutually opposite and upright slots 168. A member 169 is fixed externally on a wall 167 adjacent one slot 168 and mounts a bar member 170 within the slot, the latter member having a sharpened edge protruding slightly within the space for the stack and for the full length of the slot. The opposite slot 168 of the other wall 167 serves as a guideway for a weight member 171 from which a point 172 extends inwardly from the wall thereat. Preferably, and as shown, the point 171 is formed to provide an edge extending obliquely downwardly toward the wall from the tip of the point.

When a stack of sheets 14 is placed on the table in contact with the stop post 56, the weight member 171 is inoperatively disposed and the walls 167 are adjusted toward each other to closely fit the stack and firmly engage the bar 170 with the stack side thereat. The weight member is then lowered to gravitationally rest on the stack to have its point 172 obliquely engage on the top sheets 14, the relation being brought out in Figure 6. When the top sheet 14 is moved over the stack by the action of the rollers 52, the sheet is shifted laterally toward the bar 170 and is lifted adjacent the edge thereat whereby air is admitted beneath the sheet; in this manner, any cohesion with the underlying sheet is broken. The edge 170 and point 172 also cooperate to hold the remaining sheets of the stack in place, and the present arrangement has been found particularly valuable as a means to insure a proper feeding of sheets from the table by the described means.

Printed sheets 14 delivered from between the stencil 2 and the impression roller 18 are arranged to fall into a collecting tray 173, and means may be provided for interposing insert sheets 174 between the printed sheets 14 as the latter are delivered to the tray. As generally illustrated in Figures 1 and 2, a stack of the sheets 174 is arranged for support in a tray 175 mounted on and above the tray 173 and having an open bottom, and suitable means are provided for releasing the sheets 174 one at a time for falling upon a delivered sheet 14 in the lower tray before the next sheet is delivered, the device being known as slip-sheeting.

Since it will not always be necessary or desirable to use an interleaving, or slip-sheeting, device, independent means are provided for limit the movement of the printed sheets 14 in the receiving tray 173. As particularly illustrated in Figures 1 and 29 to 30, said means comprises a unit 208 having a base 209 from which a swinging member 210 extends. The base 209 has a depending portion slidably engaged in a longitudinal slot 211 provided in the tray bottom 206 whereby the base is guided for solely rectilinear adjustment in said slot, and a clamp-bolt assembly 212 is provided to fix the unit in adjusted position on the tray bottom 206.

The member 210 of the unit 208 is formed of sheet material, is hinged to the rearward edge of the base 209 for swinging movement about an axis which is parallel to the tray bottom 206 and perpendicular to the longitudinal tray axis, and comprises perpendicularly related portions 213 and 214. At its juncture with the portion 213, the portion 214 is provided with an opening which freely receives therethrough a leaf spring 215 which is fixed to the base and extends through said opening in generally parallel relation to the tray bottom 206 and in constant bearing engagement with the top edge of the portion 213. When the portion 214 of the member 210 is upright, as in Figure 29, it constitutes a stop for printed sheets delivered in the tray. When the portion 214 is swung to a prone position, as in Figure 30, the spring 215 operates to lift the advance end of a stack of delivered sheets 14 from the tray bottom thereat in the indicated manner for facilitating a removal of the stack from the tray. It will be noted that the spring 215 is operative to urge a retention of the member 210 in either one of its limiting positions.

By reference to Figures 9 and 16, it will now be noted that the mounting of the impression roller 18 includes certain improvements for rollers of this type. As particularly illustrated, the shaft 19 which carries the roller is stepped adjacent its extremities to provide reduced end portions 217 and 218 terminating at shoulders 219 and engaged in aligned eyes provided in corresponding extremities of the arms 20 which carry the roller to and from its described operative position. A helical spring 220 encircles the shaft portion 218 and is compressed between the shaft shoulder 219 and the adjacent arm 20, it being noted that the shaft portion 218 is long enough to permit a longitudinal shifting of the shaft to disengage its other

end from the other arm 20; in this manner, the roller 18 may be readily removed or replaced.

The roller 18 comprises a core tube 221 carrying a relatively thick and resilient tread 222 for engaging beneath a sheet 14 at the stencil on the cylinder. Suitable anti-friction bearing assemblies are mounted in the core tube 221 at opposite ends thereof, said bearings having their outer races 224 snugly fitting the bore of the tube 221 and their tubular inner races 225 slidably receiving intermediate shaft portions 226 and 227 which extend from the shoulders 219 and 220 respectively. The bearing races 224 may be retained in the tube 221 by turning end portions 228 of the tube inwardly to provide retaining lugs. The present arrangement for enclosing the bearings within the roller is understood to eliminate the probability of ink getting therein.

Inwardly of the different bearing races 225 and in spaced relation thereto, the shaft 19 is provided with radial shoulders 229; as shown, the shoulders 229 are defined at the ends of an enlarged central shaft portion 231. Helical compression springs 232 encircle the shaft portions 226 and 227 and are respectively operative between the shoulders 229 and 230 and the inner bearing races 225; it will be obvious that the springs 232 are coactive to yieldingly retain the roller in a longitudinally centered position on the shaft.

Recalling the fact that in sheet-handling devices where a sheet of material is gripped and advanced between rollers, a very slight variation from a true cylinder of uniform cross-section of one or both rollers will operate to urge a lateral motion of a sheet gripped thereat whereby the sheet may be wrinkled or even torn. In the present duplicator, the printing cylinder 3 is supported against a longitudinal shifting thereof, and the disclosed mounting of the impression roller 18 for a possible axial shifting thereof against the slight resistance of a spring 232 is designed to eliminate any lateral stresses in a sheet as it is advanced between the cylinder and roller; this feature has been found particularly valuable when applied to duplicating machines of the present type. It will be understood that the roller 18 is automatically recentered each time it is lowered to an inoperative position, the latter occurring after each sheet is printed and discharged.

A pawl 235 (Figures 18 to 20) is rotatably mounted on a stub shaft 236 which extends from the inner side of the frame member 5 and in the plane of the gear 12 of the manually operable drive for the cylinder, said pawl being normally inoperative and being arranged for locking engagement with the gear 12 for securing the cylinder against rotation when such is desired. A spring 237 is operative to maintain the pawl 235 in engagement with a cam 238 which is mounted for rotation about a stub shaft 239 extending from the frame side 5, said cam presenting flat faces at different distances from its axis whereby the pawl 235 may be operative when it engages one said cam face and inoperative when it engages the other. A handle 240 extends radially from the cam 238 for use in setting it as desired.

Referring now to the structure and mounting of the printing cylinder or drum 3, and with particular reference to Figures 3 and 18 and 21, and 42, it is noted that the cylinder essentially comprises a pair of circular end plates 241 and 242 connected by a cylindrically curved and perforated diaphragm plate 243 over which the stencil 2 is disposed. End portions 244 of the diaphragm plate are turned radially inwardly to provide distinct bends at the limits of its working area, and said portions are fixed to mutually spaced tie bars 245 which connect the end plates 241 and 242, are parallel to the cylinder axis, and mount an ink reservoir and ink-feeding assembly 246 within the cylinder space and generally between them. A fabric inking pad 247 is interposed between the stencil and the diaphragm plate, and suitable means are provided to secure the ends of the mounted stencil and pad to the cylinder.

A shaft 249 extends axially within the cylinder, engages through a bore in the end plate 242 for rotative adjustment in said bore, and extends through and from a sleeve bearing 250 which is mounted in the frame member 6. At its other end the shaft 249 is journalled in the tubular hub 67 which is integral with the plate 241, said hub extending outwardly from the plate toward the frame member 5 and carrying the gear 12 fixed to it at its outer end and in spaced relation to the plate. A stub-shaft or bearing pin 254 is mounted in the frame member 5 and extends within the bore of the hub 67 whereby the adjacent cylinder end is supported thereat and thereby. It will thus be understood that the cylinder 3 is rotatably supported by and between the bearing pin 254 and the sleeve bearing 250 which are engaged respectively by the hub 67 and shaft 249, and that the said hub and shaft are arranged for relative rotation independently of the rotation of the cylinder. Suitable anti-friction bearing bushings may be provided in the bores which rotatably receive the shafts 249 and 254, this being indicated in Figure 21.

Means are provided for varying the relative timing of the steps of the described cycle of sheet-feeding operations with respect to the rotative cycle of the cylinder, this feature providing certain advantages to be hereinafter brought out in detail and involving certain rotatively adjusted settings of the plate cams 70 and 149 with respect to the cylinder. As is particularly disclosed in Figures 18 and 21, a disc 255 is mounted at and against the outer face of the cylinder end 241, said disc being provided with a tubular hub portion 256 receiving the hub 67 and extending outwardly to present its outer end in spaced relation to the gear 12 on the latter hub whereby an annular groove is defined about the hub 67 and between the gear 12 and the opposed end of the hub 256, said groove receiving the plate cam 149 and a bearing ring 257 which is slidably engaged in the fork at the upper end of the actuator bar 68. The cam 149 and ring 257 are both rotatably carried and centered on the hub 67.

By particular reference to Figures 21 and 31 to 35, it will now be noted that the cam 70 comprises two flat disc members 258 and 259 having like profiles which are arranged to register when a full-length of stencil is to be printed from; the latter condition has been hereinbefore assumed in describing the present mechanism and its operation. The roller 71 on the actuator bar 68 extends into the zones of operation of both of the cams 258 and 259 whereby either and/or both of these cams may engage the roller as they are rotated. The outermost cam 258 is fixed on the outer end of the hub 256, and the cam 259 is arranged for rotative adjustment about said hub. A pin 260 extends rigidly from the cam 149 into the cam 259 through an arcuate slot provided in

the cam 258 whereby the cams 149 and 259 may be adjusted together in a fixed corelation.

A flat spring arm 261 is fixed to and extends radially from the cam 259 at the face thereof nearest the disc 255, and said arm is provided with a detent pin 262 for selective engagement in any one of a plurality of holes or sockets 263 provided in the disc opposite the circle of movement of the pin; in this manner, the cams 149 and 259 may be held against rotation on the hub 256 in any one of a plurality of rotatively adjusted relations to the cam 258, it being noted that the pin 262 engages a hole 263 when the profiles of the cams 258 and 259 are aligned.

A circular dove-tail groove 264 is provided in the face of the plate 241 opposite the outer edge portion of the disc 255 and engages the head 265 of a bolt member 266 which extends outwardly through a disc perforation and carries a thumb nut 267 at its outer end for tightening the bolt to lock the plate and disc in adjusted relation; the present assembly is illustrated in detail in Figure 21. It will be understood that the permitted relative adjustment of the plate and disc provides for a positive control and adjustment of the place on a sheet 14 where the stencil printing may begin and independently of the position of the printing characters on the stencil sheet. One particular advantage of the present device is that printing may be placed closer to the top of a sheet than the corresponding stencil characters are to the working top of the stencil sheet; conversely, the printing may be lower on the sheet than on the stencil.

When the cams 149 and 259 are advanced with respect to the cams 258, as is shown in Figures 31 to 35 inclusive, the operative movement of the actuator bar 68 is advanced with respect to a rotative cycle for the cylinder whereby the impression roller 18 is sooner displaced to an inoperative position with respect to the stencil, this being most desirable when the material to be printed does not extend to the end of the stencil or the sheets are shorter than the stencil. It is necessary, however, that the operations which follow the limiting displacement of the bar 68 occur at the same time in the rotative cycle of the cylinder as before, and to this end the bar 68 is suitably retained in the depressed position which it assumed by reason of the action of the cam 259 until the cam 258 is operative thereon, after which the actuation of the mechanism is controlled by the cam 258 as when the cams 258 and 259 act together as one.

It will be particularly noted that, by reason of the adjustments provided for the disc 255 with respect to the cylinder 3 and for the cam 259 with respect to the cam 258, the present duplicator machine may be used to provide printing on sheets of different lengths and at predetermined locations on said sheets. Furthermore, a stencil may contain two or more distinct sets of reading matter for placement on a like number of sets of sheets, and each set of sheets may be run through separately to receive the intended matter thereon merely by appropriately adjusting the disc 255 and/or the cam 259 for the successive sets of sheets; the latter is understood to make possible an important economy in the use of stencil sheets.

A pawl member 270 is provided for operation to maintain the actuator bar 68 in its depressed position while the cylinder rotates from its position where the cam 259 operatively engages the roller 71 of the bar to a position where the cam 258 operatively engages said roller, said pawl being downwardly operative during the indicated period in an upwardly directed notch 271 provided in the opposed edge of the bar 68. As particularly illustrated, the pawl 270 is carried by and between plates 272 which are arranged to slidably receive the opposed edge portion of the bar 68 between them for maintaining the cooperative alignment of the pawl with the opposed bar edge and notch 271 therein. The plates 272 pivotally receive the outer end portion of the stub shaft 239 which rotatably carries the cam 238, and a spring 273 is constantly coactive between the pawl assembly and the shaft 239 to urge the pawl toward the opposed bar edge. A pin 274 extends outwardly from the free end of the inner plate 272 for engagement solely with the working edge of the cam 258.

By particular reference to Figures 31 and 32, it will now be noted that the indicated full advancement of the cam 259 has effected a lowering of the bar 68 with a corresponding advancement of the cyclic operations resulting therefrom. As the cylinder rotates to take the cam 259 from above the roller 71, the normal return movement of the bar is stopped by the operative engagement of the pawl 270 in the bar notch 271, this condition being illustrated in Figure 33. Following a subsequent engagement of the roller 71 by the cam 258 to unseat the pawl 270, the latter cam engages the pin 274 to rock the pawl out of the path of the notch 271 for a period long enough to permit the simultaneous recessive movement of the bar 68 to position the notch above the pawl point; these latter relations are illustrated generally in Figures 34 and 35.

As shown in Figures 1 to 3, a suitable counter 326 is provided, said counter being mounted on the frame side 5 and being connected with the arm 20 of the rock-shaft 21 by means of a link element 327 for actuation each time said shaft is rocked to permit an operative disposal of the impression roller 18. In this manner, a true count of the sheets actually printed is automatically obtained.

By reference to Figures 1 and 3 and 21, it will now be noted that the belt pulley 8 is rotatably mounted on the cylinder shaft 249 and is disposed between the cylinder end plate 242 and the inner end of the sleeve bearing 250 for the shaft 249. A pin 329 extends axially from the plate 242 adjacent its periphery and at a point thereof between the diaphragm plate extremities and outwardly of the ink reservoir for engagement in the pulley whereby the latter may be constrained for rotation with the cylinder when the latter is to be power driven from a belt engaging the pulley 8.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains. While I have described the features and the principle of operation of a structure which I now consider to be a preferred embodiment of my invention, I desire to have it understood that the showing is primarily illustrative, and that such changes may be made, when desired, as fall within the scope of the following claims,

1. In a duplicator having a rotary printing cylinder and an impression roller for sheet-gripping coaction with the cylinder, a plate member over which a sheet is advanced for printing en-

gagement between the cylinder and the impression roller, a fixed stop extending upwardly from said plate, means to advance a sheet over said plate to dispose its advance edge against said stop, means to lift the advance sheet edge out of engagement with the stop, and means operative independently of said sheet-advancing means and said lifting means to advance the released sheet for engagement between the cylinder and the impression roller.

2. In a duplicator having a rotary printing cylinder and an impression roller for sheet-gripping coaction with the cylinder, a plate member against and along which a sheet is advanced for printing engagement between the cylinder and the impression roller, a fixed stop extending transversely from said plate, means to advance a sheet along said plate to dispose its advance edge against said stop, normally inoperative feed rollers for coaction in a line parallel to the line of coaction of the cylinder and impression roller and rearwardly of the line of said stop, means operative independently of the feed rollers to lift the advance sheet edge out of engagement with the stop, and means to thereafter render the feed rollers coactive to advance the released sheet for printing engagement between the cylinder and the impression roller.

3. In a duplicator having a rotary printing cylinder and an impression roller for sheet-gripping and printing coaction with the cylinder, a plate member against and along which a sheet is arranged to be advanced for engagement between the cylinder and the impression roller, a fixed stop extending transversely from said plate, means to advance a sheet along said plate to dispose its advance edge against the stop, a finger resiliently and yieldingly operative against the forward end portion of a sheet engaging the stop to retain the sheet against the plate thereat, a normally inoperative finger operative against the sheet opposite the first finger to displace the advance sheet portion from engagement with the stop, and means to actuate the second finger against the resistance of the first finger for freeing the sheet from the stop for its advancement for printing.

4. In a duplicator having a rotary printing cylinder and an impression roller for sheet-gripping and printing coaction with the cylinder, a plate member against and along which a sheet is arranged to be advanced for printing engagement between the cylinder and the impression roller, a fixed stop extending from said plate, means to move a sheet along said plate to engage its advance edge against said stop, a finger resiliently and yieldingly operative against the forward portion of a sheet engaging the stop to urge the disposal of the sheet against the plate thereat, a normally inoperative finger operative against the sheet opposite the first finger to displace the advance sheet portion to free it from the stop for advancement thereover, normally inoperative feed rollers for coaction with the freed sheet to advance the same, a driven shaft carrying one of said feed rollers, and means on said shaft to actuate the sheet-releasing finger.

5. In a rotary duplicator, a feed table for carrying a stack of sheets for printing, a plate along which a sheet from the feed table may be advanced for printing, a stop extending from said plate in the path of advancement of a sheet therealong and arranged for engagement with and along the front sheet edge, a feed roller operatively engaging the top sheet on the stack of sheets on the feed table for advancing the engaged sheet to and against the stop for buckling the sheet transversely thereof between the stop and roller for insuring a fixed disposition of the front sheet edge with respect to the printing mechanism and means to adjustably vary the degree of buckling produced in a sheet engaging the stop.

6. In a rotary duplicator, a feed table carrying a stack of sheets for printing, a plate along which a sheet from the feed table is arranged to be advanced for its printing, a stop extending from said plate in the path of advancement of the sheet therealong, feeding means operatively engaging the top sheet on the stack of sheets on the feed table for advancing the engaged sheet to and against the stop for buckling the sheet transversely thereof between the stop and feeding means, means operative to frictionally grip the forward sheet portion adjacent the stop for preventing a recessive movement thereof, and means operative to render said feeding means inoperative following said buckling of the sheet for permitting a flattening out of the sheet while its advance edge engages the stop and the forward sheet edge is held by said gripping means.

7. In a continuously operable duplicator having a rotary printing cylinder and an impression roller for printing coaction with the cylinder, a rockable frame carrying said roller for lateral movement toward and from said cylinder, sheet feeding mechanism for advancing a sheet for printing engagement between the cylinder and roller, a pivoted stop member normally engaging said frame for preventing an operative disposal of the roller, a normally inoperative swinging detent for engagement with said stop member to dispose it in inoperative relation to the frame, and a swinging arm controlling the operativeness of said detent and having a terminal portion arranged for movement transversely across the path of movement of the sheet through said feeding mechanism whereby its engagement with a sheet in the mechanism is operative to render said detent operative with respect to the stop member, and so permit the operative disposal of said roller, said detent and arm being arranged for swinging together about a common axis.

8. In a duplicator having a rotary printing cylinder and an impression roller for cooperative disposal with respect to the cylinder, a rockable frame carrying said roller, feeding mechanism for advancing a sheet for its printing engagement between the cylinder and the roller, a feed table for a stack of said sheets, means operative to deliver a sheet from a stack thereof on the table to said feeding mechanism, an actuator member arranged for reciprocation between limiting positions thereof, spring means normally operative to retain said member in a said limiting position thereof, means on the cylinder for coaction with said member to temporarily displace the member to its other limiting position during each revolution of the cylinder, means whereby the displacement movement of the member is arranged to operatively actuate said sheet delivery means, and means whereby the return movement of said member is arranged to actuate said feed mechanism to position a sheet for engagement between the cylinder and the roller and to thereafter rock said frame to operatively dispose the roller.

9. A structure in accordance with claim 8 wherein means are provided to adjustably vary

the timing of the displacement of the actuator member with respect to a rotative cycle of the cylinder.

10. A structure in accordance with claim 8 wherein means are provided to adjustably vary the relative timing of the displacement and return strokes of the actuator member in a rotative cycle of the cylinder.

11. A structure in accordance with claim 8 having mutually independent means to adjustably vary the timing of the displacement of the actuator member with respect to a rotative cycle of the cylinder, and means to adjustably vary the relative timing of the displacement and return strokes of the member.

12. A structure in accordance with claim 8 having means to render solely the sheet delivering means inoperative and thereby provide for a hand delivery of sheets to the fully operative feeding and printing mechanism.

13. In a continuously operable duplicator having a rotary printing cylinder and an elevator feed table, a sheet-feeding roller arranged for operation at a predetermined level to engage and primarily advance for printing the top sheet of a stack of sheets on the table, means automatically operative to temporarily displace said roller to an inoperative position thereof during each rotative cycle of the cylinder, and means whereby a return movement of the roller to a point below said level is arranged to effect a raising of said table to dispose the top sheet thereof at the aforesaid level.

14. A structure in accordance with that of claim 13 and characterized by the provision of means to adjustably vary the timing of said roller displacement with respect to the rotative cycle of the cylinder.

15. In a continuously operable duplicator having a rotary printing cylinder and an elevator feed table for movement between limiting lowered and raised positions thereof, a sheet-feeding roller arranged for operation at a predetermined level to engage and primarily advance for printing the top sheet of a stack of sheets on the table, means automatically operative to temporarily displace said roller to an inoperative position thereof during each rotative cycle of the cylinder, a table elevating means, means whereby a return movement of the roller below said level is normally arranged to automatically effect a raising of said table by the table elevating means to dispose the top sheet thereon at the aforesaid level, means controlled by and in accordance with the disposition of the feed table to prevent the automatic raising of the feed table above a predetermined level which is below its limiting raised position, and manually actuatable means to render the last means inoperative to so permit the lifting of the table to its limiting raised position.

16. In a continuously operating duplicator, a feed table for holding a stack of sheets for successive delivery to the duplicator from the top of the stack, a feed roller operative to engage the top sheet of the stack adjacent its forward edge to advance the sheet in its plane and to the duplicator for printing, and members on the table operative against the top sheet of the stack rearwardly of said roller for freeing the rear sheet portion from the underlying sheet of the stack while the roller is operative.

17. In a continuously operating duplicator, a feed table for holding a supply stack of sheets for successive delivery to the duplicator from the top of the stack, means operative to engage the top sheet of the stack adjacent its forward edge to advance the same in its plane to the duplicator for its printing, a member mounted at one side of the table and presenting a sharp upright edge against a side of the stack, and a weight member slidably mounted at the other side of the table and opposite said first member and presenting an edge obliquely against the top sheets of the stack, said members being coactive to effect a lateral shift and a partial raising of the top sheet adjacent the first member for releasing the sheet for its advancement.

18. In combination with a continuously operable duplicator; a tray for receiving printed sheets from the duplicator in horizontal disposition and from one end thereof; and a stop unit mounted in the tray bottom and comprising a base portion for longitudinal adjustment along the tray bottom, a stop arm portion hinged to said base portion and arranged for optional disposal in erect position as a stop means for printed sheets delivered to the tray, and a spring coactive between the base and stop arm portions of the unit for yieldingly retaining the latter portion in either of its set positions and operative to raise the advance end of printed sheets in the tray for their ready grasping when the stop arm portion of the unit is in prone position.

19. In a continuously operating duplicator or the like, a feed table providing a guideway for holding a stack of sheets for successive delivery to the duplicator from the top of the stack and longitudinally of the guideway, means operative to engage the top sheet of the stack adjacent the forward edge thereof to advance the same in its plane to the duplicator for its printing, a weight member slidably mounted at one side of the guideway and presenting an edge obliquely against the top sheets of the stack, said member being operative to effect a partial raising of the top sheet thereat for releasing the sheet for its advancement.

20. In a sheet-printing apparatus having a rotary printing cylinder and an impression roller for cooperative disposal with respect to the cylinder, a rockable frame carrying said roller, feeding mechanism for advancing a sheet for its printing engagement between the cylinder and the roller, means operative to deliver a sheet to said feeding mechanism, an actuator member arranged for reciprocation between limiting positions thereof, means normally operative to retain said member in a said limiting position thereof, means automatically operative to temporarily displace the member to its other limiting position during each rotary printing movement of the cylinder, means whereby the displacement movement of the member is arranged to actuate said sheet delivery means, and means whereby the return movement of said member is arranged to actuate said feed mechanism to position a sheet for engagement between the cylinder and the roller and to thereafter rock said frame to operatively dispose the roller.

21. In a continuously operable sheet printing apparatus having an elevator feed table for movement between limiting lowered and raised positions thereof, a sheet-feeding roller arranged for operation at a predetermined level to engage and primarily advance for printing the top sheet of a stack of sheets on the table, means automatically operative to temporarily displace said roller to an inoperative position thereof during

each printing actuation of the apparatus, a table elevating means, means whereby a return movement of the roller below said level is arranged to automatically effect a raising of said table elevating means to dispose the top sheet thereon at the aforesaid level, and means controlled by and in accordance with the disposition of the feed table to prevent the automatic raising of the feed table above the predetermined level which is below its limiting raised position.

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