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Fig. 39.

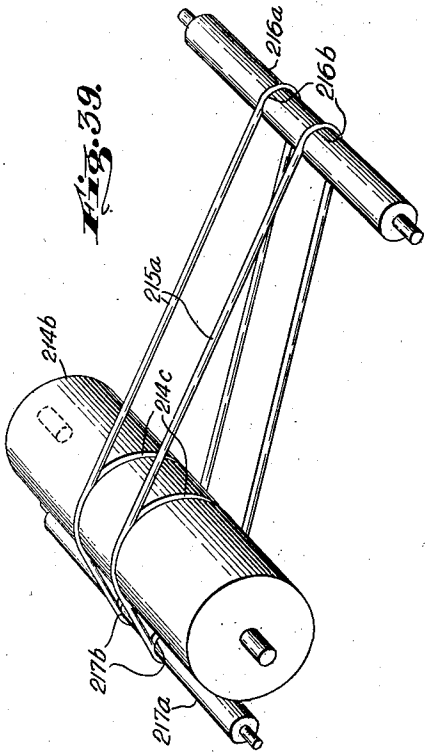


Fig. 21a.

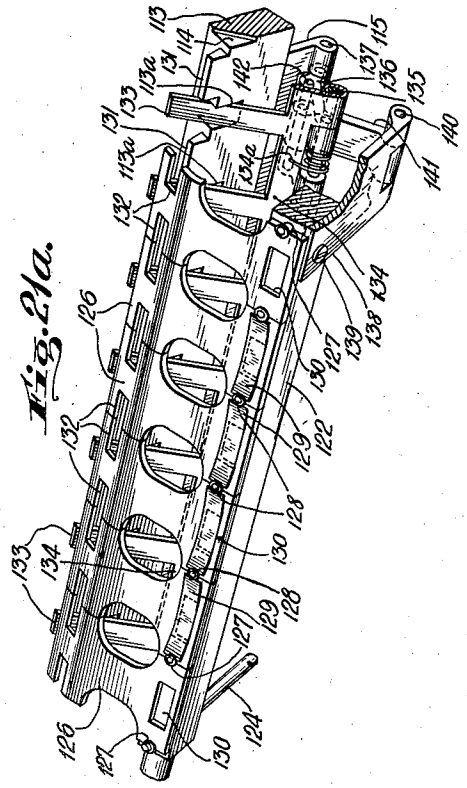


Fig. 1.

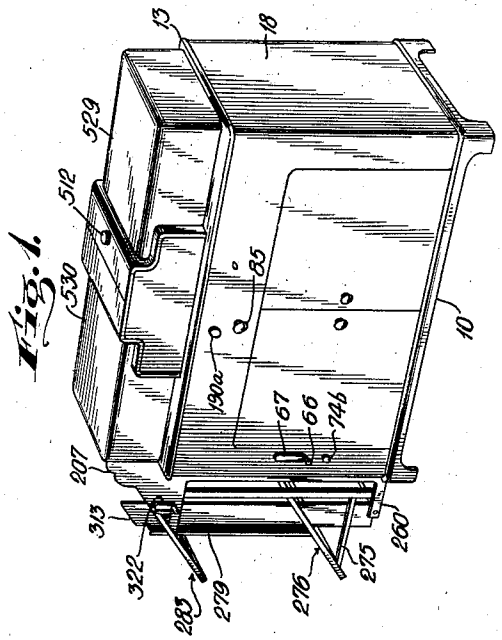
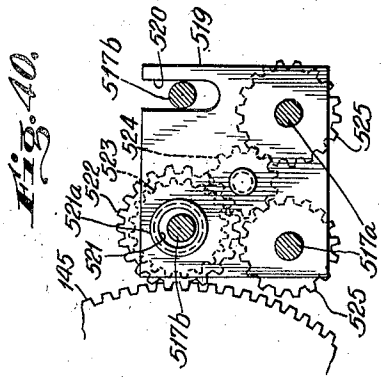


Fig. 40.



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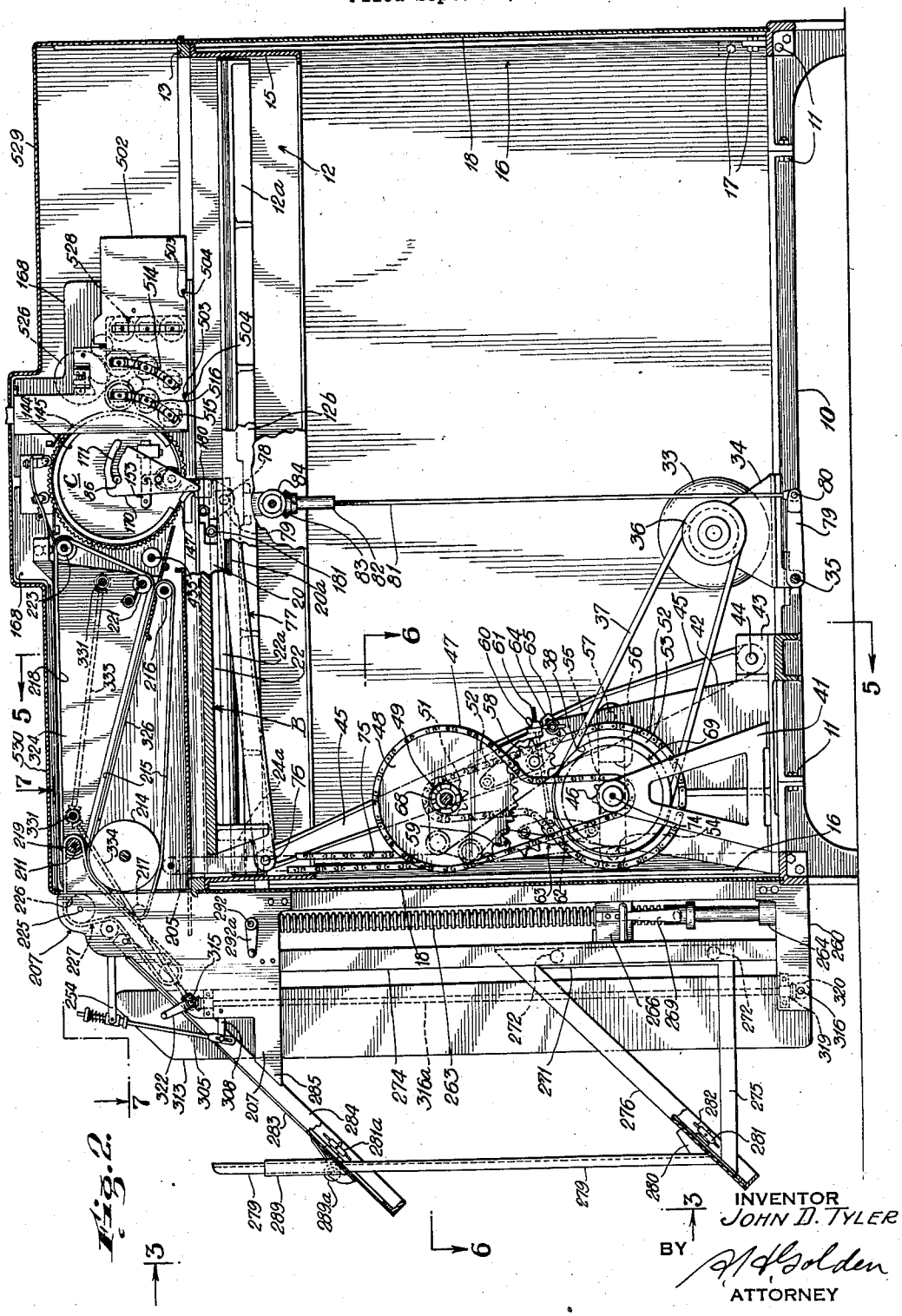


Fig. 2.

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Fig. 3.

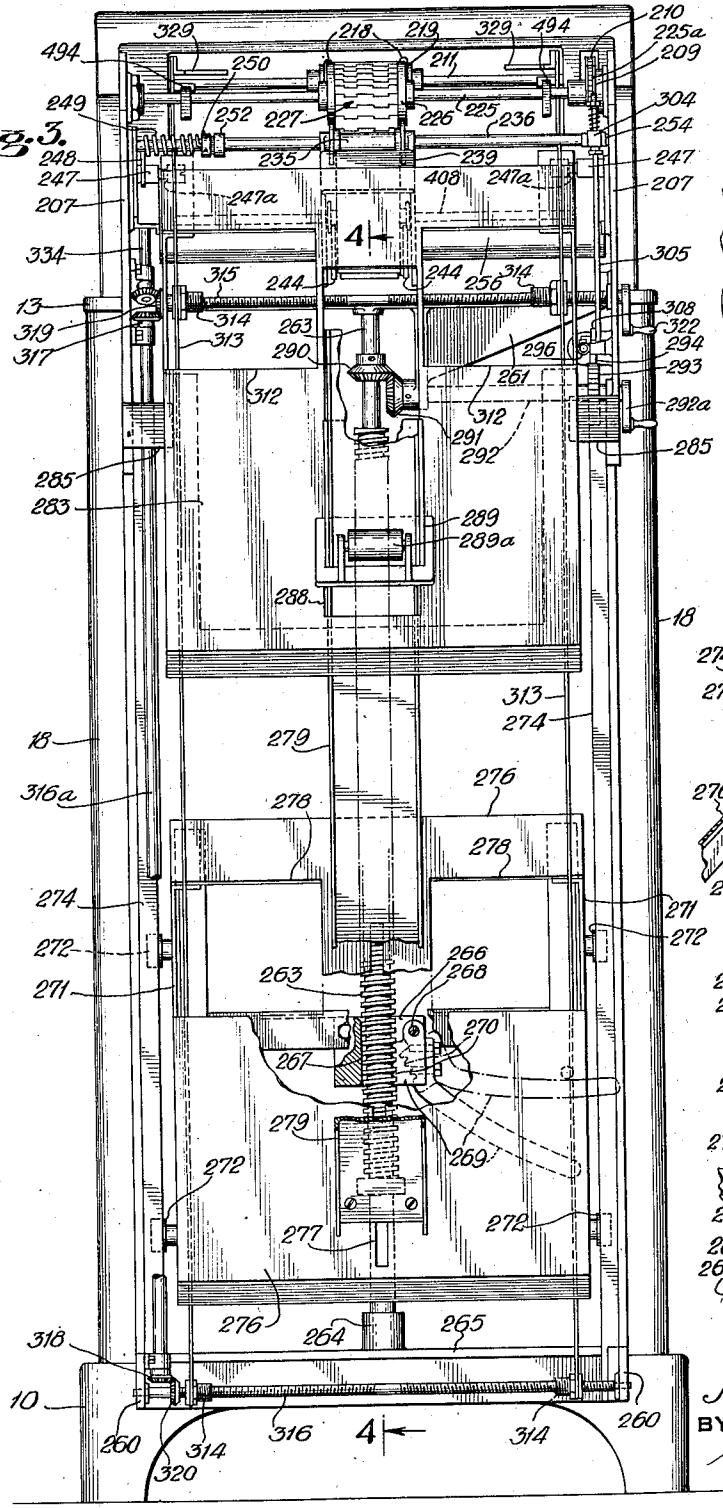
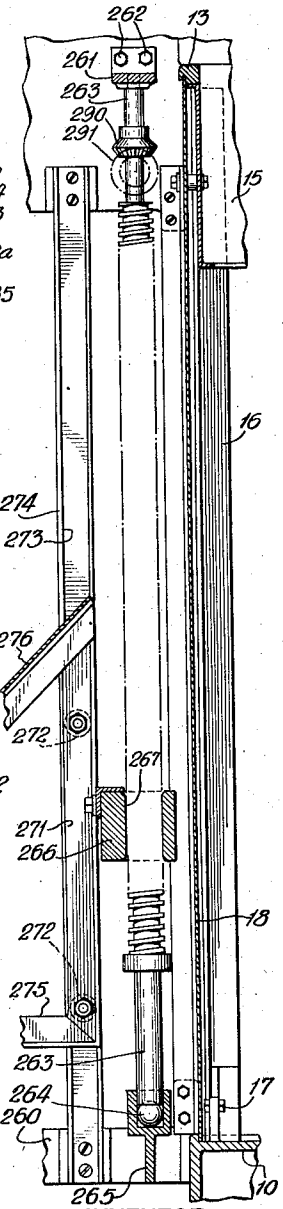


Fig. 4.



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Fig. 5.

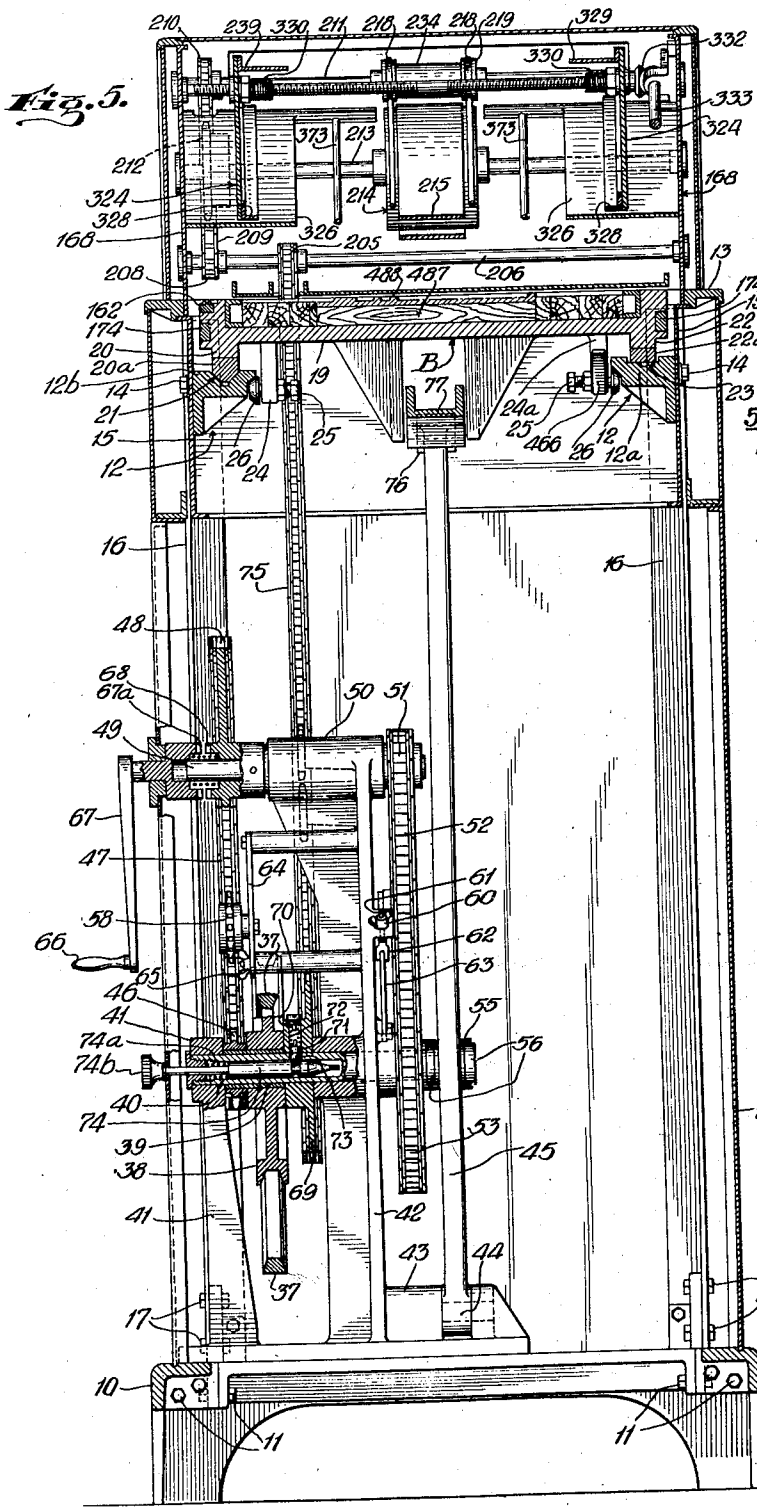
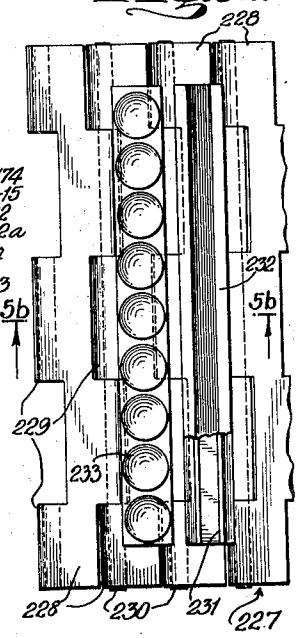


Fig. 5a.



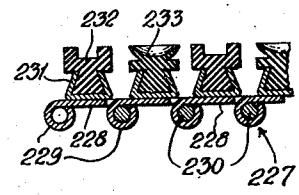


Fig. 5b.

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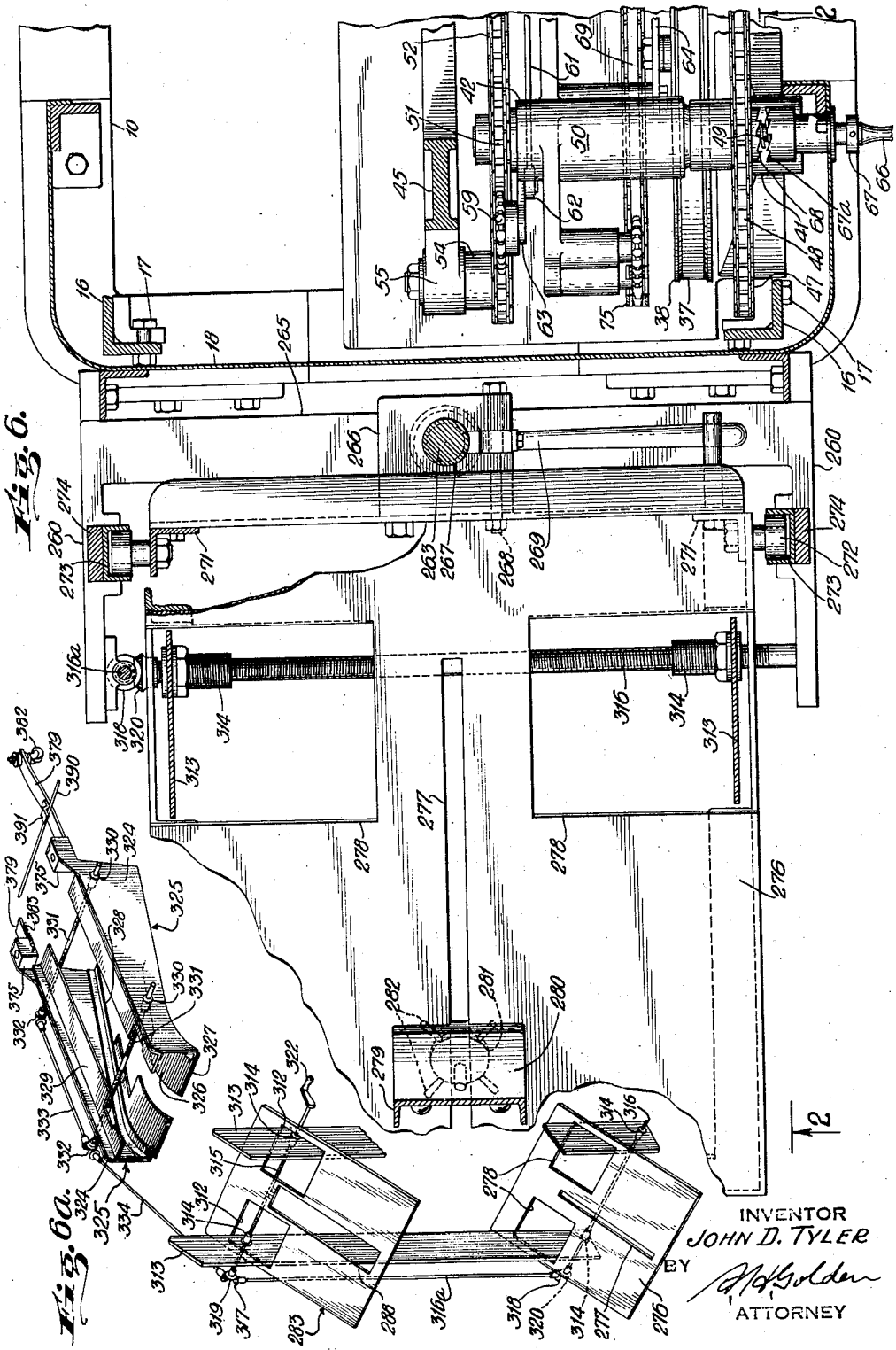


Fig. 6.

Fig. 6a.

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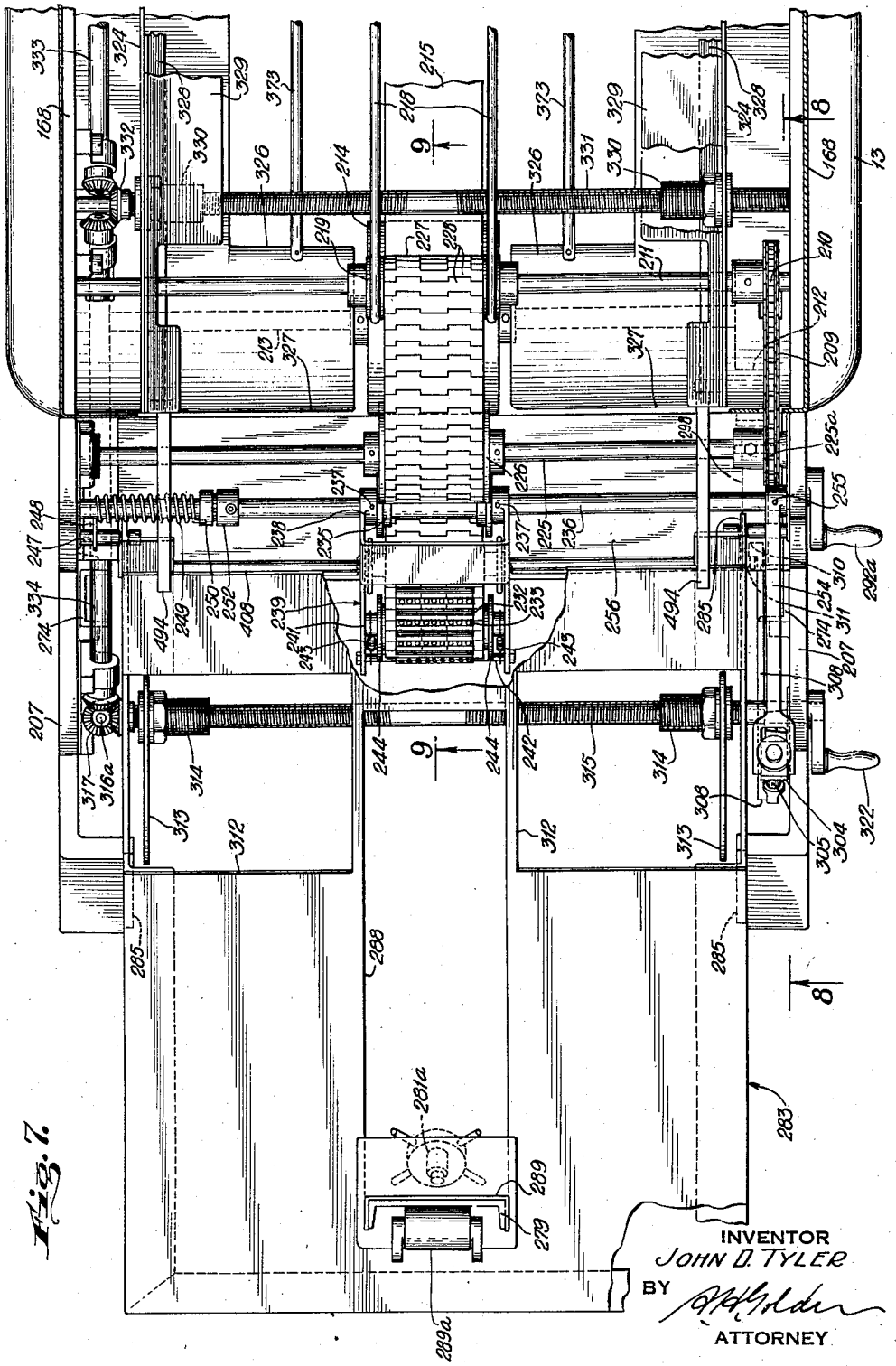


Fig. 7.

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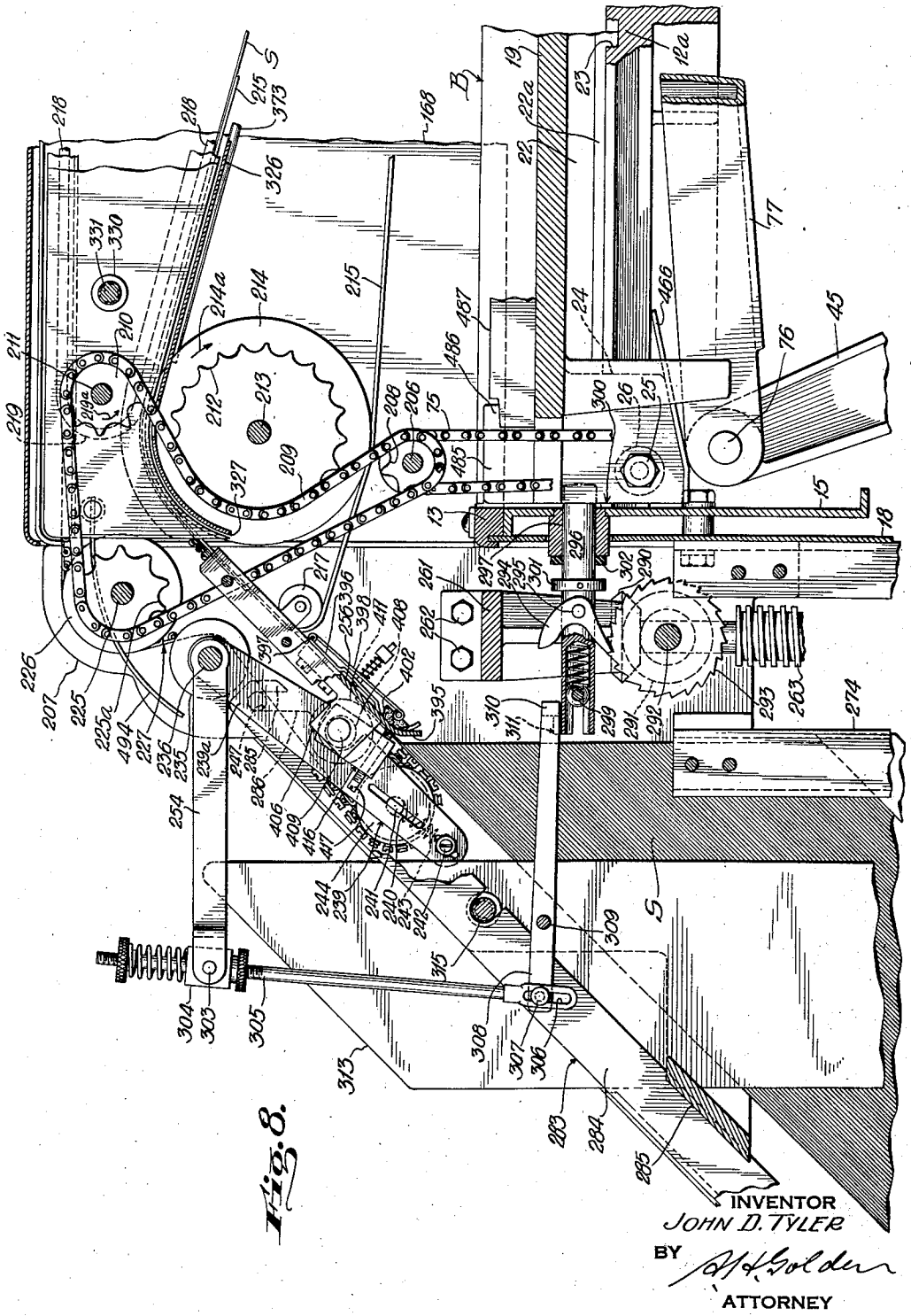


Fig. 8.

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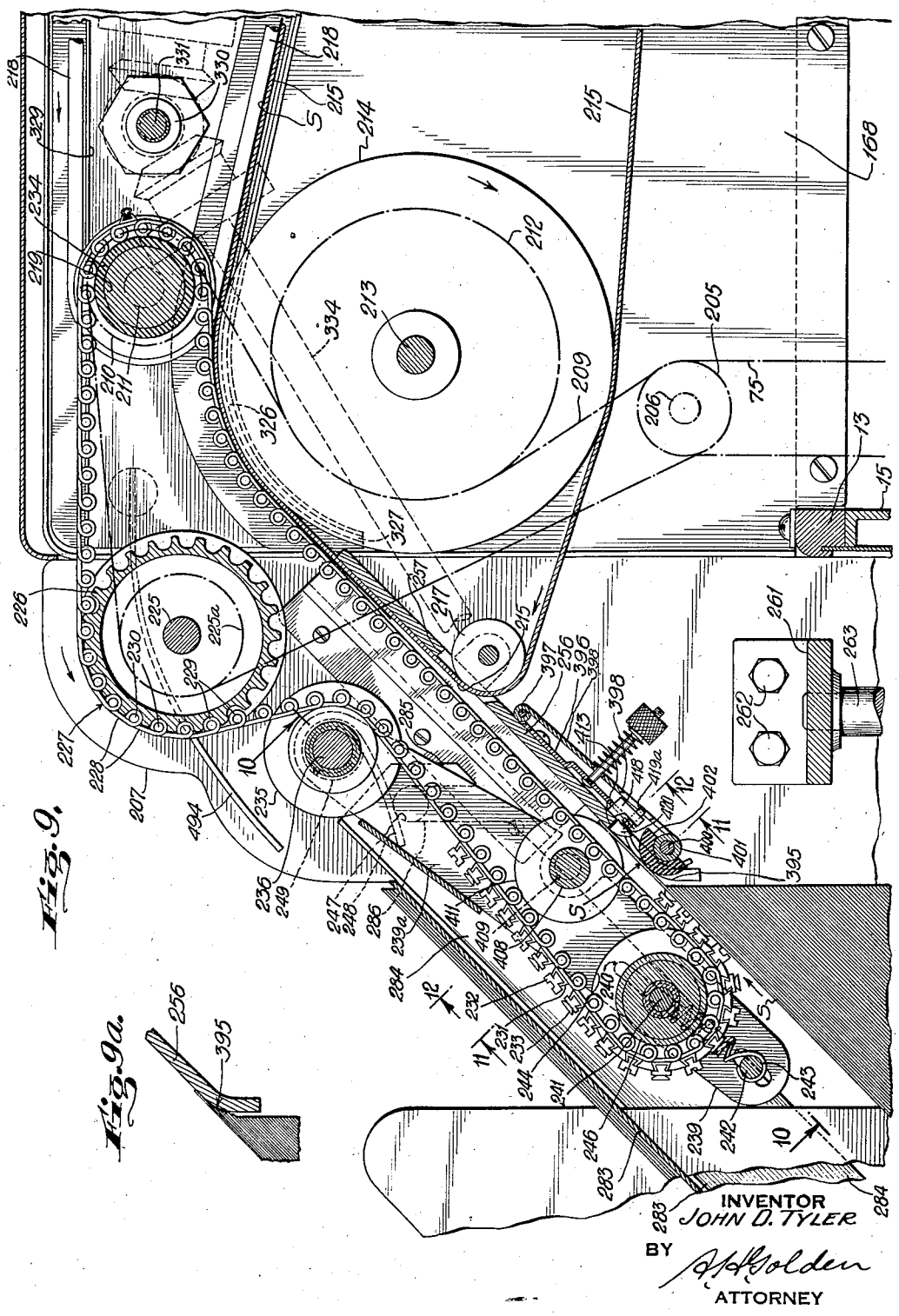


Fig. 9.

Fig. 9a.

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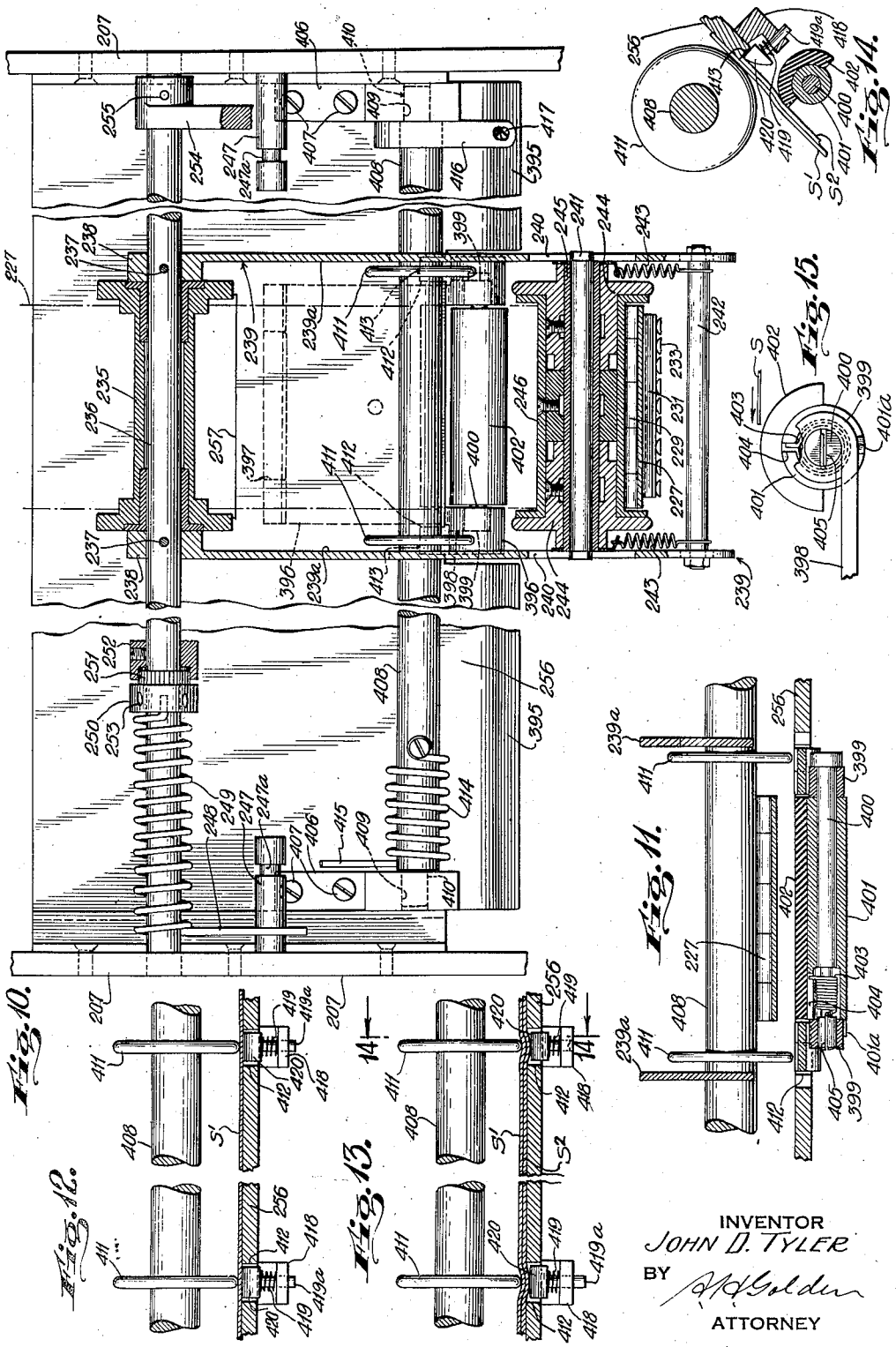


Fig. 10.

Fig. 12.

Fig. 13.

Fig. 11.

Fig. 14.

Fig. 15.

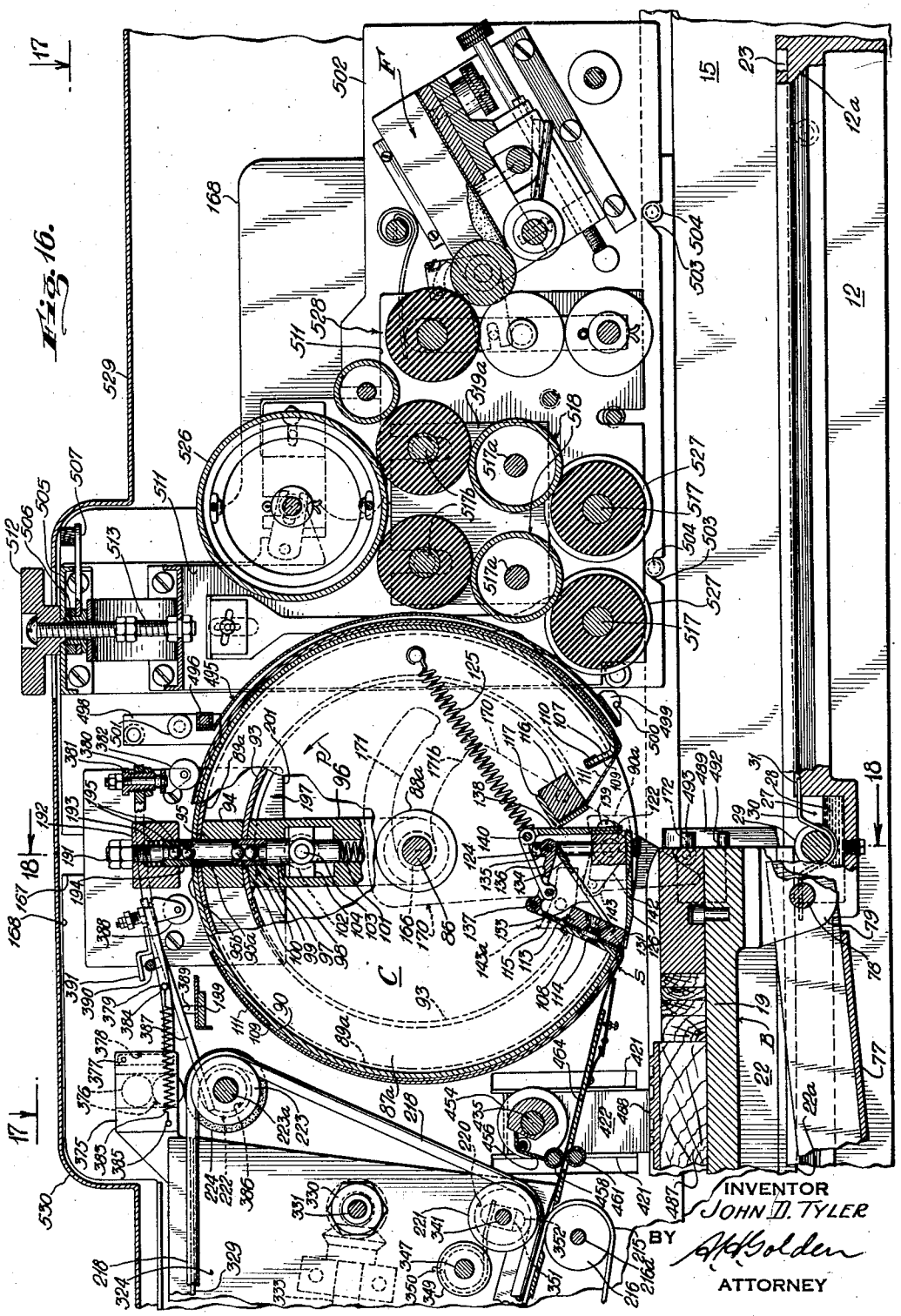
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Fig. 16.



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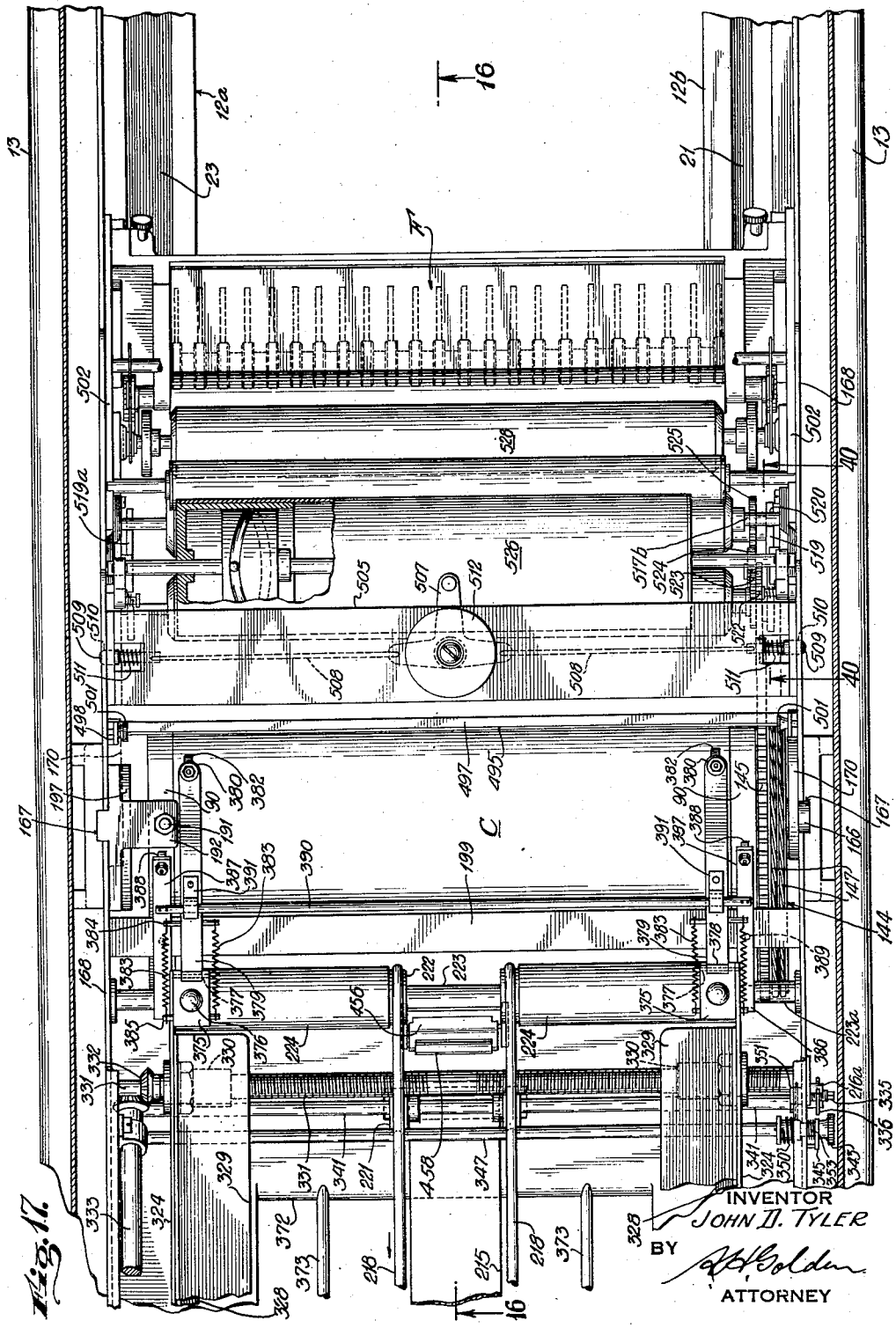


Fig. 17.

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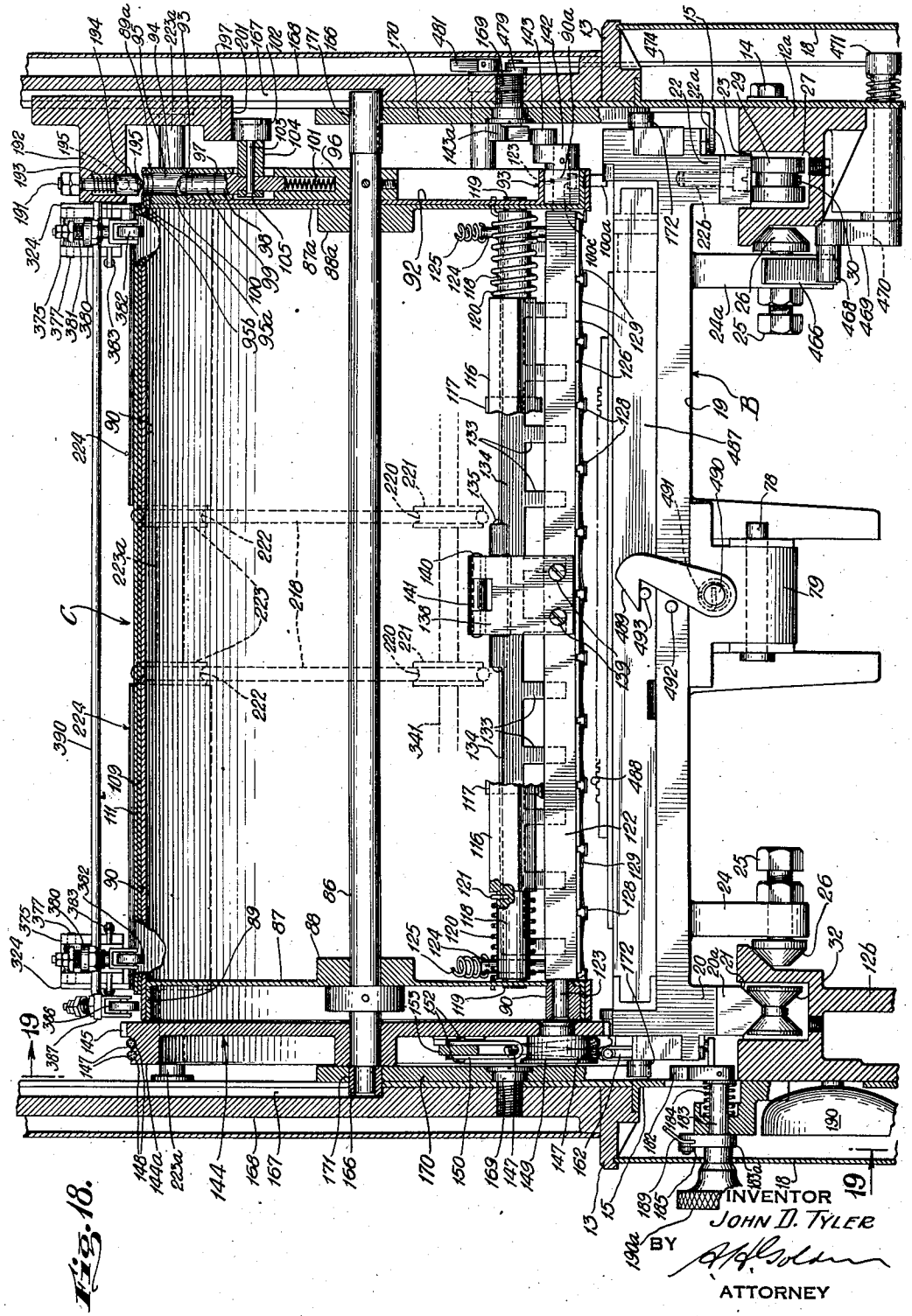


Fig. 18.

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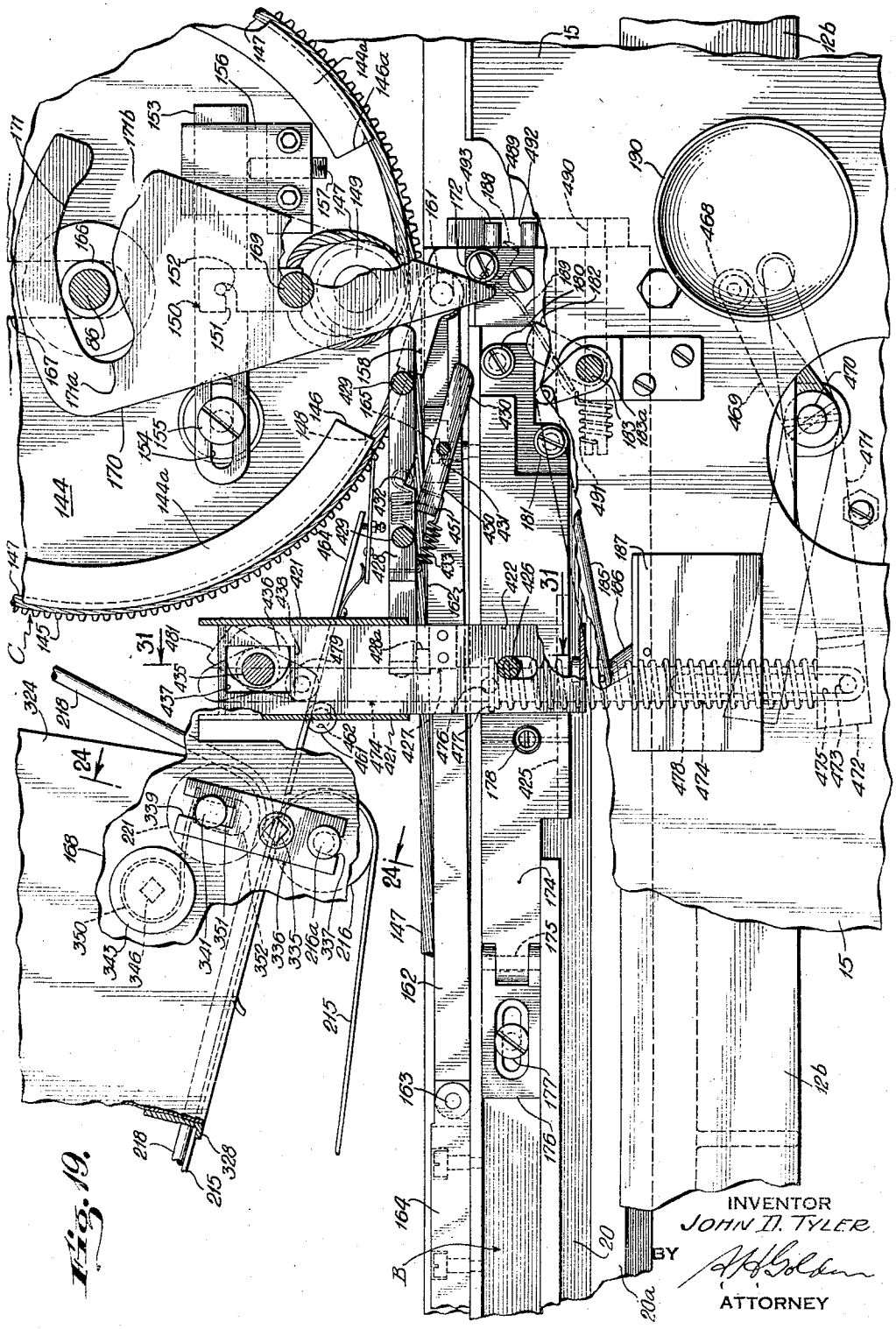


Fig. 19.

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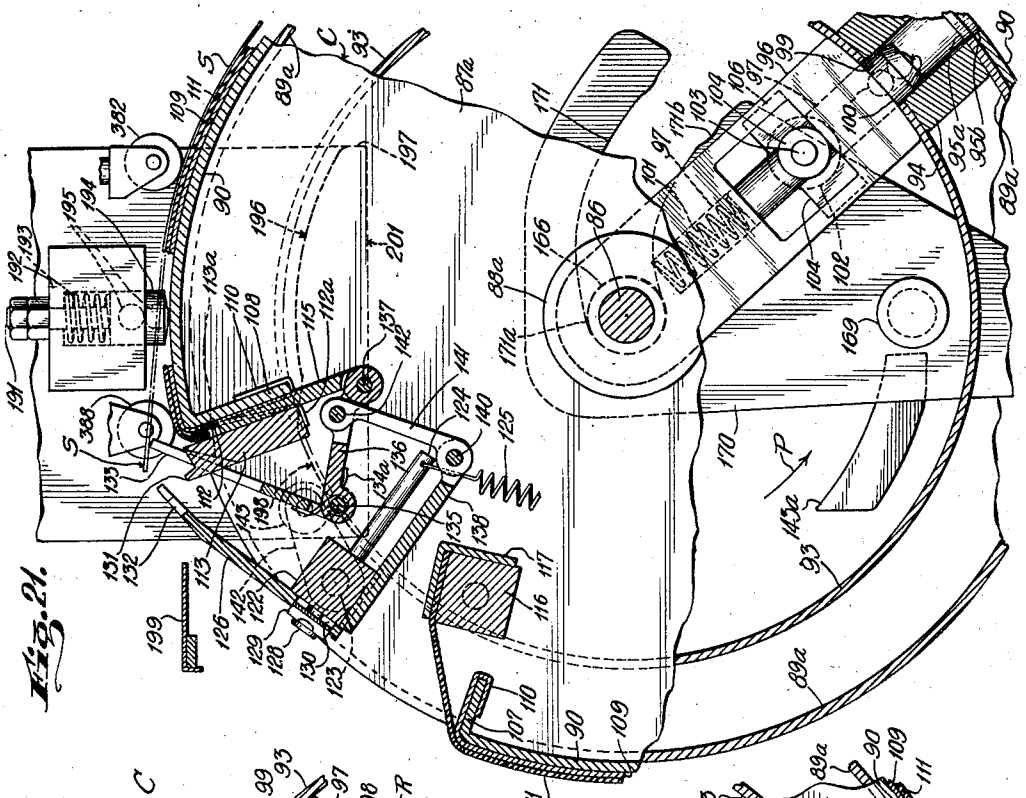


Fig. 21.

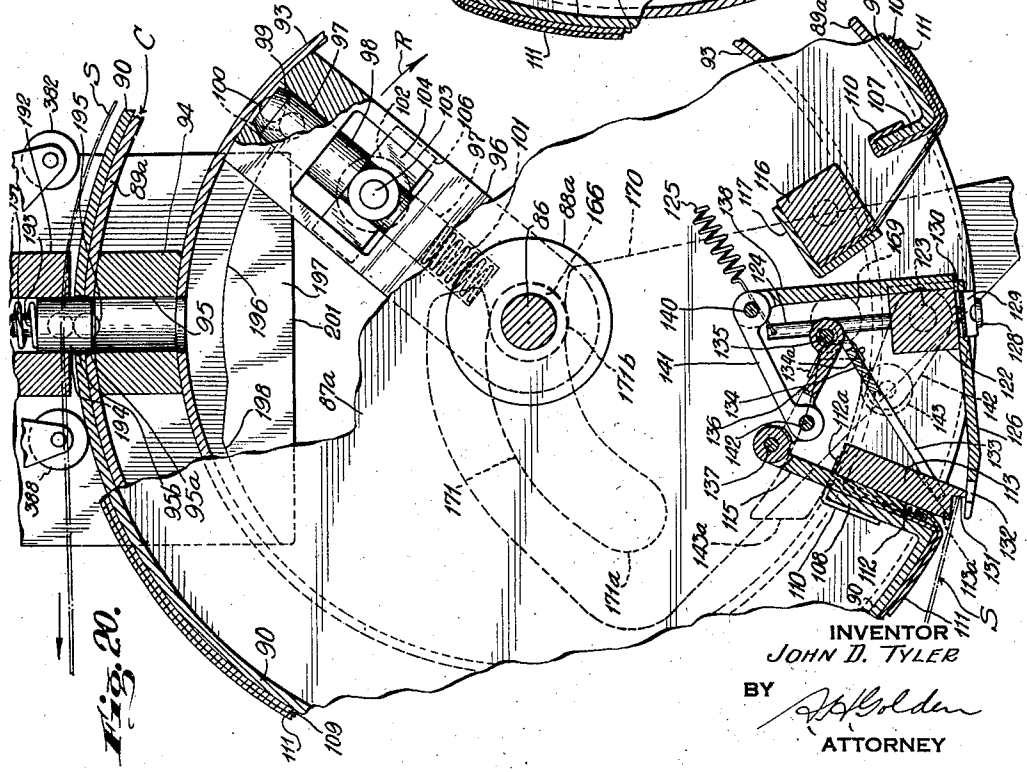


Fig. 20.

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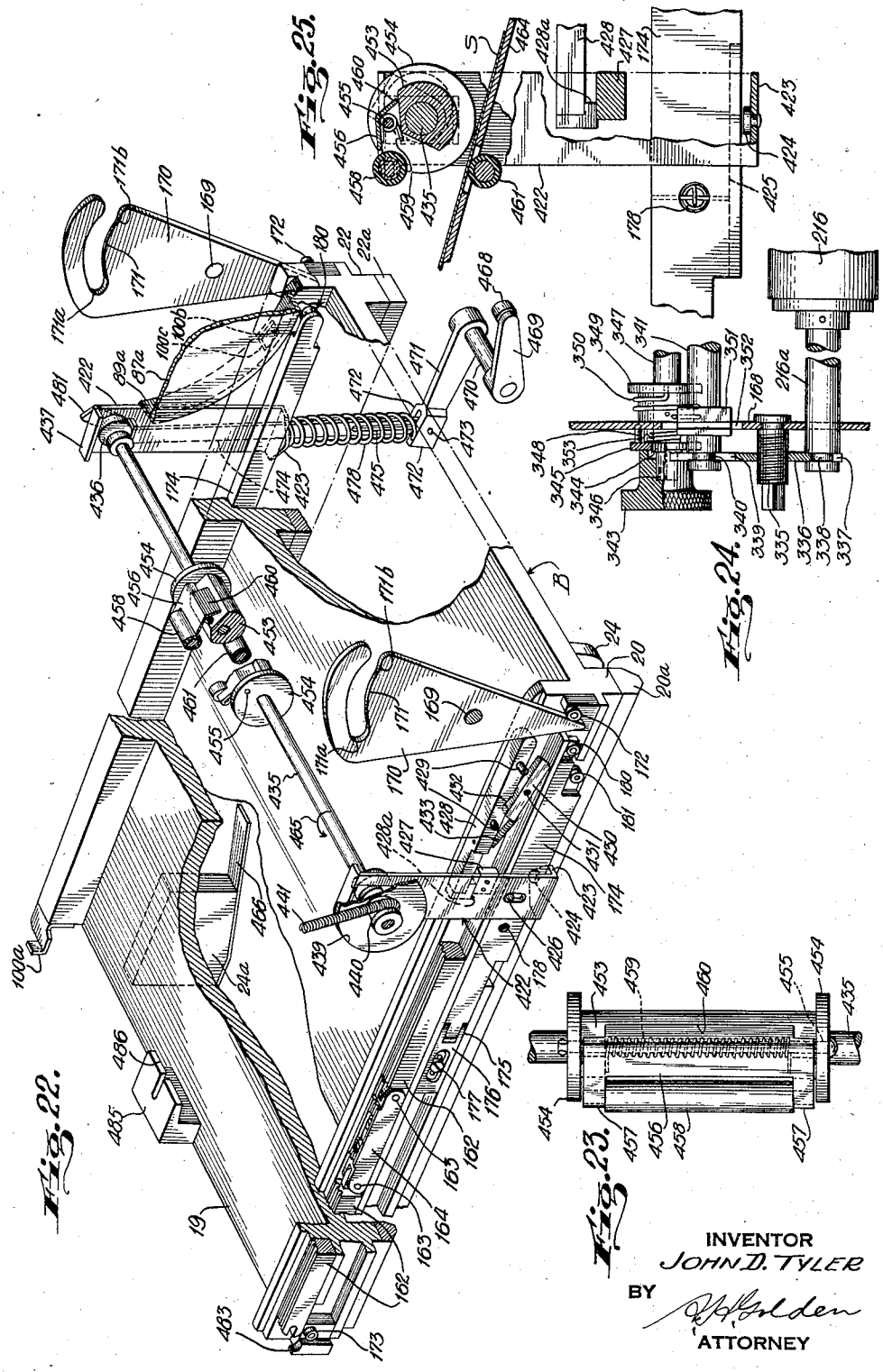


Fig. 22.

Fig. 24.

Fig. 23.

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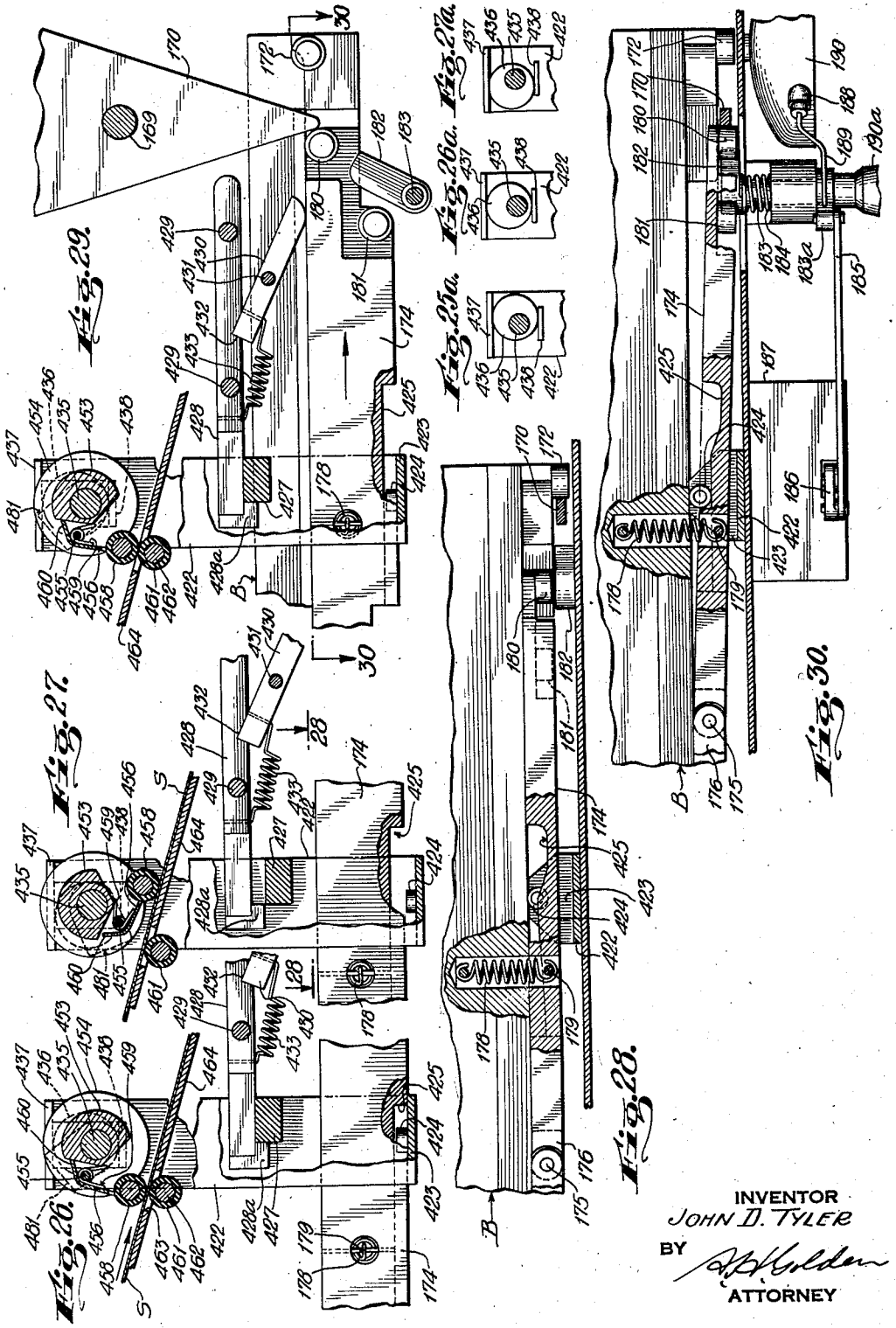


Fig. 29.

Fig. 26a.

Fig. 25a.

Fig. 30.

Fig. 27.

Fig. 28.

Fig. 26.

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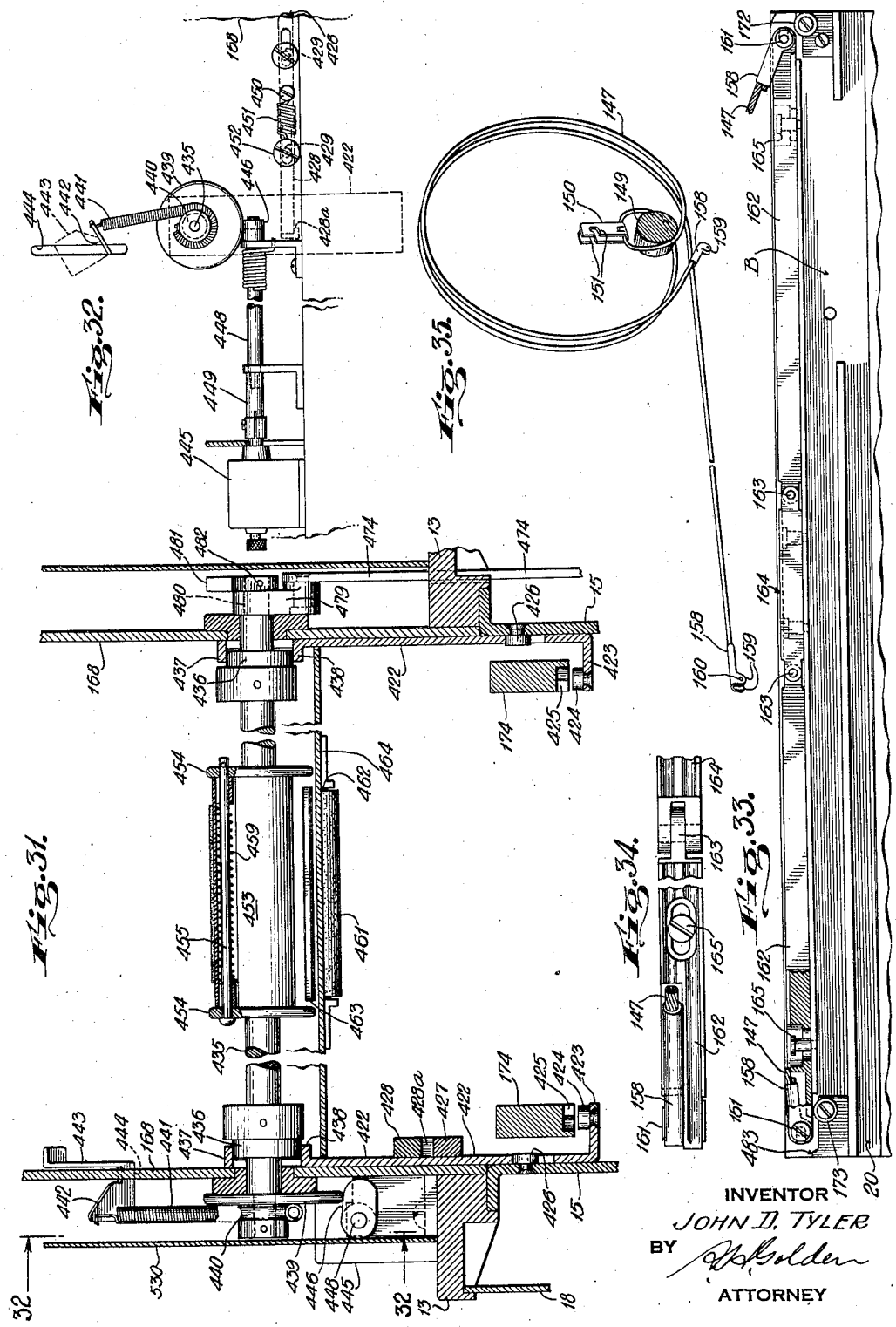


Fig. 31.

Fig. 32.

Fig. 33.

Fig. 34.

Fig. 35.

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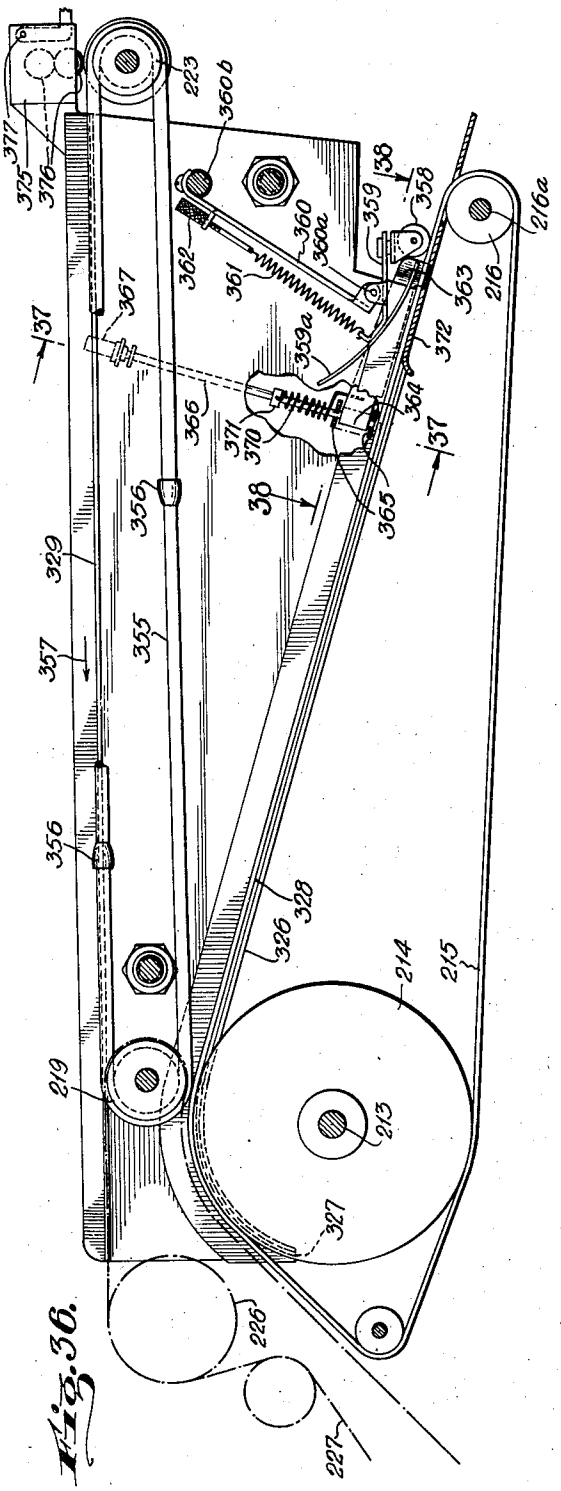


Fig. 36.

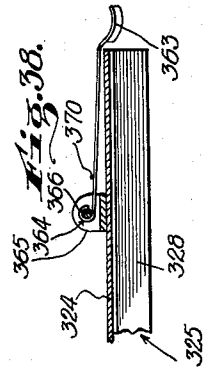


Fig. 38.

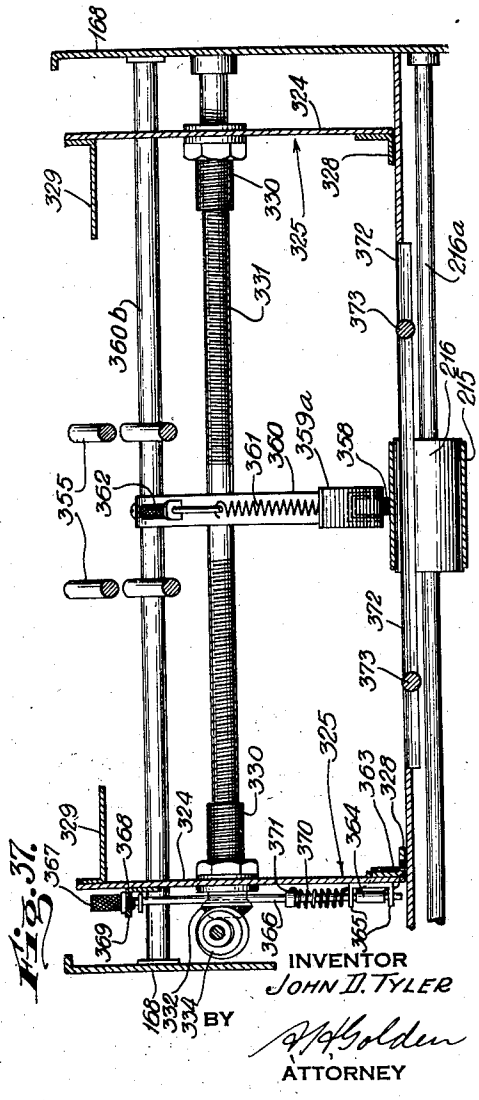


Fig. 37.

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Patented Feb. 5, 1946 2,394,026

UNITED STATES PATENT OFFICE

2,394,026

PRINTING PRESS

John Duke Tyler, Stamford, Conn.

Application September 20, 1940, Serial No. 357,555

49 Claims. (Cl. 101—276)

This invention relates to a printing machine. More particularly, this application is a continuation in part of my application Serial No. 164,726, filed September 20, 1937, which has matured into Patent No. 2,224,886, December 17, 1940.

While in this application I shall show and describe a number of features which are divided from my earlier application, several of these features will be shown in physical embodiments somewhat different from those of my earlier application. This is due to the fact that since filing my application supra, I have been continuously developing and improving the structure thereof, as will be appreciated by those skilled in the art. Moreover, I shall in this application make claim to certain basic features which are shown in my earlier application, but are not therein emphasized nor claimed.

The printing machine of my invention has the same general arrangement as the printing machine of my earlier application in that it utilizes a reciprocating bed and a rotatable cylinder operable relatively to that bed. A basic and important feature of the machine is the arrangement of the bed and its bed bearing relatively to the impresion cylinder so that the bed is fully exposed on its bearing when at the end of its printing stroke, whereby the chase thereon is readily available for operation by the printer, as may be required for the setting of type, etc. In addition, this presents a large area over which my inking assembly may be placed.

The paper feed mechanism of my machine is at that end of the machine to which the bed moves in its return stroke, portions of the paper feed mechanism being arranged over one end of the bed bearing and substantially covering that end, since the bed is available at the other end as indicated already.

It is a further feature of my machine that the feed and delivery racks, on which are positioned the feed and delivery stacks of sheets, are both located at the same end of the machine with one superimposed over the other. This arrangement is effective, in conjunction with the paper feed means, to contribute a feature of great utility. This feature comprises the feeding of the paper from the feed rack to a point tangential with the under portion of the periphery of the impression cylinder, so that the paper may be carried about and over the impression cylinder, and then moved rearwardly towards the delivery rack in a line parallel to the line in which the paper is fed to the cylinder, but superimposed thereover. Those skilled in the art will readily appreciate the several advantages of this particular feature. It is interesting to note that this arrangement makes it possible to utilize a single pair of side guides for both the feed and delivery racks, with said guides capable of simultaneous adjustment to the width of the paper sheets, without the need for complicated controls.

As a further feature of my invention, I arrange for the cylinder to be rotated by the bed through flexible cables connected between the cylinder and bed in a novel and unique manner. This novel drive arrangement contributes many advantages, and is especially effective for permitting the upward and downward movement of the impression cylinder relatively to the bed, that is, the movement of the cylinder into and out of the printing plane. This movement of the cylinder into and out of the printing plane is controlled by the reciprocating bed, it being the function of the bed to move the cylinder into the printing plane for the printing stroke, and to move the cylinder out of the printing plane for the reverse stroke of the bed, and also under certain emergency conditions, such as when there is no paper to be fed, and in the event the paper is being fed in an improper manner. For thus controlling the cylinder, I utilize a novel type of feeler and control mechanism including as its salient feature a feeler which is operable by a pull on the paper when the paper is being fed by the cylinder, and between the cylinder and the bed. Since it is the actual pull on the paper which operates the novel feeler of my invention, it will be appreciated that the feeler will operate correctly under almost every condition.

A further feature of the drive for the cylinder, which is of extreme importance, is the feature whereby the cylinder is driven through suitable clutch means only when the bed is moving through its printing stroke, the cylinder remaining at rest when the bed is moving through its reverse or feed stroke. It is therefore possible to feed the paper to the cylinder when the cylinder is stationary, at which time the grippers on the cylinder are arranged to be open and ready to accept the paper. In this manner, extremely accurate end register is obtained. Moreover, a very simple type of gripper mechanism may be utilized. This gripper mechanism is per se an important part of my invention.

As a further feature of this phase of my invention, I utilize the up and down movement of the cylinder to actuate the clutch mechanism between the cylinder and the bed. This up and down movement of the cylinder is further utilized

for controlling the grippers and other means, all as will be set forth hereinafter. A further feature of the invention is the utilization of the up and down movement of the cylinder for controlling paper feed means other than the grippers for feeding the paper from the cylinder toward the delivery rack.

A further feature of my invention is provided in the novel type of belt utilized for feeding the paper from the feed rack toward the machine. The novel belt of my invention is in the form of a metal link belt to which may be secured in a very novel manner, a series of feed elements, all as will be hereinafter set forth in detail. My belt is mounted so that it is readily counter balanced, the counter balancing means being utilized also for controlling the paper feed whereby to maintain the paper on the feed rack at a predetermined level relatively to the belt, all for reasons which will be understood by those skilled in the printing art.

In my machine, I have several novel means for obtaining side register. One of these means comprises a feed belt arrangement in which a feed belt, or feed belts, are movable for angular alignment relatively to the machine whereby as the paper sheets are fed towards the impression cylinder, they receive side pressure urging them against their side guides. A modification of my invention utilizes a spring finger for contributing side register, all as will be explained hereinafter.

A still further feature of my invention which is of extreme importance is what I term a caliper gap separator which I have conceived and developed, and which contributes not only a caliper gap operation, but functions as a separator as well. Thus, when several sheets of paper are presented to my caliper gap, one of the said sheets will be allowed to pass through the gap, while the remaining sheets will merely move portions of the gap out of obstructing relation so that there will be no jamming of the entire group of sheets approaching the gap. This arrangement will be set forth in detail in the specification which follows, and will be claimed broadly. I shall also lay considerable emphasis on the cooperation with my caliper gap separator, of means utilized for fanning the several sheets, as well as the angular stacking of the sheets of paper on the feed rack.

A further feature of the invention is the arrangement whereby the ink assembly is driven directly by the impression cylinder so as to effect a continuous drag on the operation of the rollers of the ink assembly during the printing stroke. This, as will be appreciated, prevents back lash between the several parts, and especially between the cylinder and the bed, when there are gaps between cuts or other copy in the printing form. Those skilled in the art will appreciate that this arrangement makes it unnecessary to utilize the friction means which are normally required in prior art machines for maintaining the impression cylinder in proper timing relation to the bed.

As still a further feature of my machine, the inking assembly is so arranged relatively to the cylinder and the bed that the form rollers thereof are capable of vertical movement relatively to the bed and out of the plane of the type on the bed, making it possible to utilize mimeograph and inking ribbon units as part of the chase carried by the bed.

I have thus described generally a number of the features of my machine in order that a proper appreciation thereof may be had, and in order that the detailed description which follows may be better understood. Naturally, I have not described generally all of the features of my new and novel printing machine, since many of those features will best be understood when their detailed descriptions are presented hereinafter. I should like to have it understood that those skilled in the art will readily conceive that the features of my invention may be incorporated in physical embodiments other than those shown. Therefore, I shall expect to obtain a monopoly of sufficient breadth to prevent the utilization of my contribution in such other forms as may readily suggest themselves to those skilled in the art.

Referring now to the drawings, Fig. 1 is a perspective view of my assembled machine, with the operating parts thereof protected by ornamental coverings. Fig. 2 is a vertical section through my machine showing the several operating parts thereof. Fig. 3 is an end view of Fig. 2 showing parts of the paper feeding mechanism. Fig. 4 is a section taken along lines 4—4 of Fig. 3. Fig. 5 is a section taken along lines 5—5 of Fig. 2. Fig. 5*a* is a view of the underside of the feed belt, while Fig. 5*b* is a section along lines 5*b*—5*b* of Fig. 5*a*. Fig. 6 is a section taken along lines 6—6 of Fig. 2. Fig. 6*a* is a perspective view showing the relationship of the various paper guides utilized in my machine. Fig. 7 is a section taken along lines 7—7 of Fig. 2. Fig. 8 is a section taken along lines 8—8 of Fig. 7. Fig. 9 is a section taken along lines 9—9 of Fig. 7. Fig. 9*a* illustrates the cooperation between certain of the parts of Fig. 9. Fig. 10 is a section taken along lines 10—10 of Fig. 9 showing the mounting of the bracket in which is supported my paper feed belt. Fig. 11 is a section taken along lines 11—11 of Fig. 9 illustrating the construction of a form of separator which may be utilized in my invention. Fig. 12 is a section taken along lines 12—12 of Fig. 9. Fig. 13 shows the parts of Fig. 12 and illustrates the action of those parts when two sheets of paper attempt to pass through the caliper gap of my machine. Fig. 14 is a section taken along lines 14—14 of Fig. 13 illustrating further the action of my caliper gap. Fig. 15 is an end view illustrating the mounting of a separator shown in section in Figs. 11 and 14.

Fig. 16 is a section taken along lines 16—16 of Fig. 17 illustrating the relationship of the important operating parts of my invention. Fig. 17 is a view looking downwardly on the parts of Fig. 16 with the ornamental cover plates removed. Fig. 18 is a section taken along lines 18—18 of Fig. 16. Fig. 19 is a view taken substantially along lines 19—19 of Fig. 18, and illustrates the coaction of the bed and cylinder of my invention near the completion of the return stroke of the bed. Fig. 20 is a view of the cylinder and the driving and positioning mechanism cooperating with the cylinder, together with illustrations of the action of the grippers and strippers. Fig. 21 is a view similar to Fig. 20 illustrating the cylinder as it strips the paper therefrom near the completion of the printing strike. Fig. 21*a* is a perspective view of the grippers and strippers, shown in the same relation to one another as in Fig. 21. Fig. 22 is a perspective view of the bed and the control and feeler mechanism. Fig. 23 is a view looking downwardly on the feeler mechanism. Fig. 24 is a section taken along lines 24—24 of Fig. 19, illustrating means for maintaining driving tension on the paper moving toward the cylinder, and for obtaining side register. Fig. 25 is a section taken through the feeler mechanism,

and illustrating the relationship thereof with a sheet of paper and the cam slides controlled by the feeler mechanism, the parts being shown in the position of Figs. 19 and 22. Figs. 26 and 27 illustrate the sequential operation of the feeler mechanism. Figs. 25*a*, 26*a* and 27*a*, illustrate the relation between the feeler shaft and its cams relatively to the cam slides, in the positions of the feeler shaft in Figs. 25, 26 and 27, respectively. Fig. 28 illustrates the operation of a controlling side latch carried by the bed when the feeler mechanism is properly actuated. Fig. 29 shows the positioning of the feeler mechanism and the control of the parts when a sheet of paper is not presented to the feeler mechanism. Fig. 30 is a section taken along lines 30—30 of Fig. 29. Fig. 31 is a section taken along lines 31—31 of Fig. 19 illustrating the means whereby the feeler mechanism controls the counter. Fig. 32 is a section taken along lines 32—32 of Fig. 31 further illustrating the relationship of the parts. Fig. 33 is a view showing the pivoted bars carried by the bed and to which are connected the ends of the cable wrapped about the impression cylinder. Fig. 34 is a view in plan of the pivoted bars to which the ends of the cable are connected. Fig. 35 illustrates in perspective the relationship of the cable to the impression cylinder, and certain of the means used for securing the cable to the impression cylinder. Fig. 36 is a view of certain parts which may be utilized by me for feeding the paper sheets to the impression cylinder, and for moving the paper sheets thereafter from the impression cylinder to the receiving rack. The parts of Fig. 36 may actually be substituted by me for the assembly of the parts illustrated in the previous figures. Fig. 37 is a section taken along lines 37—37 of Fig. 36, while Fig. 38 is a section taken along lines 38—38 of Fig. 36. Fig. 39 is a perspective view illustrating a modified form of feed belt structure which may be used in my machine, with the inking assembly adapted for mounting relatively to the impression cylinder to be driven by the impression cylinder. Fig. 40 is a section along lines 40—40 of Fig. 17.

Referring now more particularly to the drawings, and especially to Figs. 1, 2 and 5, my machine comprises a main frame having a base 10, which is preferably formed as one casting, as shown in Fig. 1, but which may be fabricated from a series of castings united by bolts 11, as illustrated in Figs. 2 and 5. The main frame of my machine includes further a bed mounting 12, which is preferably formed as one casting with the upper rectangular rim 13 of my machine.

In the drawings, the bed mounting 12, best shown in section in Fig. 5, has right and left bearing rails 12*a* and 12*b*, and is secured as by bolts 14 to a plate 15 which in turn is suitably secured to the rim 13. These parts, as I have already indicated, are preferably formed as a single unitary casting. For supporting the bed mounting 12 and the rim 13 of the machine relatively to the base 10, I utilize a series of angle irons 16 bolted as at 17 to the several parts and forming the main frame unit of my machine. For decorative purposes, that portion of the machine between the rim 13 and the base 10, is covered by sheet metal 18 suitably held in place by screws or other means, all as will be apparent to those skilled in the art. I do not consider as vital the means whereby the main frame is formed, it being necessary only that the bed bearing 12 be properly supported relatively to the base structure of my main frame for the proper operation of the several parts to be described hereinafter.

The reciprocating bed of my printing machine is designated by the reference character B, and is preferably formed as a unitary casting having a plate portion 19, as shown in Figs. 5 and 18, from which depends at one side a longitudinal bearing lug 20 having a bearing bar 20*a* secured thereto, and slidably mounted in a bearing way 21 of the bearing rail 12*b*. At the right hand side of the bed B in the said figures, there is a downwardly depending longitudinal lug 22 having a bearing bar 22*a* which rests in a bearing groove 23 formed in the bearing rail 12*a*. The bars 20*a* and 22*a* may be secured as by screws 22*b* to their respective lugs 20 and 22.

Brackets 24 and 24*a* extend downwardly from the plate portion 19 of the bed B, and each carries an adjusting bolt 25 on the end of which is a cam roll 26. It is readily seen that by rotating the adjusting bolts 25 relatively to one another and suitable cooperating surfaces formed on the sides of the bearing rails 12*a* and 12*b*, the position of the bed relatively to the bed bearing 12 may be adjusted, facilitating the smooth travel of the bed relatively to the bed bearing.

Referring now to Figs. 16 and 18, I shall describe a further feature of the mounting of the bed relatively to its bearing 12. Considering now the right bearing rail 12*a* and the bearing groove 23, it will be noted that intermediate this bearing groove, there is formed a depressed chamber 27 in which is adapted to be placed a lubricating oil 28. A roller 29 is mounted within the chamber 27, and is held in place yieldingly by a clip 30 fitting into shallow grooves 31 leading into the bearing groove 23. It will now be readily appreciated that when the bearing lug 22*a* slides relatively to the bearing groove 23, it picks up lubricating fluid from the roller 29, all as is quite apparent.

At the left side of Fig. 18, there is shown an assembly similar to that just described, for lubricating the movement of the bearing bar 20*a* relatively to the V-shaped bearing groove 21 formed on the left bearing rail 12*b*. In the case of the bearing bar 20*a*, the spool 32 which is utilized in the place of the spool 29 of the bearing bar 22*a*, is shaped for particular coaction with the bearing bar 20*a*, all as will be quite apparent.

For reciprocating the bed B, and for supplying power to other parts of my printing machine, I utilize the power unit probably best illustrated in Figs. 2, 5 and 6. In those figures, the drive motor is designated by the reference numeral 33, and is supported on a bracket 34 pivoted at 35 to the base 10. An adjustable pulley of the type well known in the art, and designated by reference numeral 36, is secured on the shaft of the motor and drives a belt 37, the belt in turn being in operative relation to a pulley 38 which is mounted for rotation through the intermediary of a sleeve 39, best illustrated in Fig. 5, relatively to the hollow shaft 40. This shaft 40 is suitably supported at one end in a standard 41 secured to the base 10, and at its other end in a standard 42 also secured to the base 10. The standard 42 has a lateral lower extension 43 in which is pivoted at 44 the lever 45. It is this lever 45 which is moved back and forth on its pivot 44, to impart reciprocating movement to the bed B through suitable means to be described hereinafter.

Secured for rotation with the pulley 38 is the sprocket 46 which drives the chain 47. This

chain 47 is in driving connection with a sprocket 48 fixed to a shaft 49 mounted for rotation within a sleeve bearing 50 formed as an integral part of the vertical standard 42. At the right hand end of the shaft 49 there is fixed a sprocket 51 for driving a chain 52, which in turn drives the sprocket wheel 53. The sprocket wheel 53 is fixed to the hollow shaft 40 already described, and has extending therefrom a crank pin 54 which is in driving engagement with a crank 55. The extreme right hand end of the crank 55, as viewed in Fig. 2 and shown also in Fig. 5, is bifurcated as at 56 for the mounting of a crank pin 57 which traverses a suitable bearing in the lever 45. It now becomes quite apparent that as the motor rotates and drives the belt 37, it rotates the pulley wheel 38 and therefore the sprocket 46. Rotation of the sprocket 46 drives the chain 47, which in turn drives the sprocket 48. Rotation of the sprocket 48 in turn drives the shaft 49 and small sprocket 51. Sprocket 51 in turn drives the chain 52 and the sprocket 53. Sprocket 53, through the crank pin 54 thereon, actuates the crank 55 which in turn through pin 57, moves the lever 45 on its bearing pin 44.

For maintaining suitable tension within the sprocket chains so far described, there are utilized adjustable idler sprockets, such as those designated in the several figures by reference numerals 58 and 59. Sprocket 59 is adjustable through the use of the thumb turn 60 operating on the shaft 61 connected at 62 with the pivoted lever 63 at one end of which the sprocket 59 rotates. The sprocket 58, which is mounted on the plate 64, is adjusted through the use of a thumb turn 65 in a manner which will be quite obvious to those skilled in the art, and which need not be herein further described.

For rotating the sprocket 48 and shaft 49, in the event that it is desired to operate the machine by hand power, there is provided the crank 67 actuated by the handle 66 and having suitable teeth 67*a* for cooperation with the ratchet teeth 68 formed integrally with the sprocket 48, all as will be apparent to those skilled in the art.

Mounted for rotation about the hollow shaft 40 is a sprocket gear 69 having a flange 70, which as best shown in Fig. 5, is drilled for a plunger 71 maintained downwardly spring pressed by a spring 72 against a ball 73 riding in the groove of a clutch control rod 74. When the control rod 74 is in its position of Fig. 5, the sprocket 69 will obviously be free of the shaft 40 with the plunger 71 riding on the periphery of the shaft. When the clutch rod 74 is moved by its knob 74*b* to the left in Fig. 5 against the pressure of its spring 74*a*, it allows the plunger 71 to move into position to lock the sprocket 69 and its collar 70 to the shaft 40 for rotation therewith. As will be indicated more in detail later, the sprocket 69 through the chain 75 which it drives, actuates the paper feed for my machine. By the operation of the clutch rod 74, this paper feed is connected for actuation, or is disconnected relatively to the power drive mechanism.

The upper end of the crank lever 45 is pivoted at 76 to a further lever 77, which in turn is pivoted at 78 to the downwardly extending bracket 79 of the bed B. In this manner, the reciprocating pivotal movement of the crank lever 45 is utilized for reciprocating the bed B relatively to the bed bearing 12, and on the rails 12*a* and 12*b* of the bed bearing, all as will be readily understood.

For controlling the speed of the power mechanism, the pulley 36 of the motor 33 is of a variable type in which the tension on the belt is utilized for moving the faces of the pulley relatively to one another for thereby varying the effective diameter of the pulley 36, and consequently the speed at which the motor drives the belt. For thus varying the tension in the belt and spreading the drive faces of the pulley 36 in the usual manner understood by those skilled in the art, the bracket 34 on which the motor is mounted relatively to the pivot 35 is controlled by a suitable lever 79. This lever in turn is pivoted at 80 to a vertical rod 81 in screw threaded engagement with a threaded collar 82 on the end of which is formed a bevel gear 83. This bevel gear 83 is in turn in driving contact with a bevel gear 84, which is rotated by any suitable means, as for instance, a knob 85 in Fig. 1. It is obvious that by the rotation of the knob 85, the collar 82 will be rotated and will move the rod 81 longitudinally through its threaded engagement therewith. The movement of the rod 81 vertically will move the bracket 34 and the motor 33 to control the spacing of the plates of the variable pulley 36, all as will be clearly understood at this time.

I shall now refer more particularly to Figs. 2, 16, 18 and 19 to describe the impression cylinder of my invention, designated generally by the reference letter C. For supporting the cylinder C there is provided a shaft 86, suitably supported as will be indicated later. One end of the cylinder is defined by a flanged end plate 87 having an abutment 88 rotatable on the shaft 86. The circular flange 89 of plate 87 carries a bearing lug 90, for a purpose to be hereinafter set forth. A similar flanged end plate 87*a* is utilized for the other end of the cylinder C, and is equipped also with an abutment 88*a* similar to abutment 88 whereby it is mounted on the shaft 86. The end plate 87*a* has a flange 89*a* similar to flange 89, and secured about the flanges 89 and 89*a* is the metal peripheral member 90 of the cylinder C. In effect, the end plates 87 and 87*a* form with the peripheral member 90 the impression cylinder C.

A flanged plate 92 having a flange 93 is suitably secured to the plate 87*a* to form an integral part of the cylinder. A bearing lug 90*a*, similar to bearing lug 90, is supported between the flange 93 and the flange 89*a* of the plate 87*a*, for a purpose to be described hereinafter. Also supported between the flanges 89*a* and 93 is a clutch block 94, which is bored out at 95 in alignment with suitable openings 95*a* and 95*b* formed respectively in the flange 89*a* and the outer peripheral member 90 of the cylinder, all as is apparent from Figs. 16, 18 and 20.

Secured to the shaft 86 is what I term a clutch plate 96. Clutch plate 96 lies against the plate 92 and is entirely within the rim 93 thereof. A bore 97 is formed in the plate 96, as best seen in Fig. 20, for a plunger 98 at the end of which is pinned a plunger cap 99 containing a pair of anti-friction balls 100. A spring 101 presses the plunger 98 outwardly of the bore 97, as shown in the drawings, the plunger being movable against the spring 101 through coaction of a cam roller 102 with suitable means to be hereinafter described. This cam roller 102 is fixed to the plunger 98 through the intermediary of the bolt 103 passing through the plunger 98 and a guide member 104, and riveted at 105 to this guide member. As is probably best shown in Figs. 20 and 21, the guide member 104 has a rectangular surface 106 which fits against the outer surface of the clutch plate

96 for suitably guiding the roller 102, while preventing rotation of the roller 102 with the plunger 98 relatively to the bore 97 in the clutch plate 96.

The outer peripheral metal member 90 of the cylinder C does not cover the entire periphery of the cylinder, but leaves a rectangular opening in the said outer periphery of the cylinder defined by inwardly turned portions 107 and 108 through which access may be had to the interior of the cylinder (Figs. 20 and 21). It is relatively to the inwardly turned portions 107 and 108 that the gripper and stripper assembly is mounted, as well as certain tympan securing means and a flexible backing for the tympan.

The flexible backing for the tympan is designated by reference numeral 109 in Figs. 20 and 21, and comprise a copper plate covered with a resilient rubber coating. This backing is secured completely about the cylinder, and with the copper end portions 110 thereof extending behind the bent over portions 107 and 108 of the outer metal peripheral member 90. The tympan 111 is secured at one end thereof to a long metal strip 112 which is bent at 112a to form a retaining surface, the metal strip and the end of the tympan being then securely held relatively to the bent over portion 108 of the peripheral metal member 90 by the register bar 113 of the gripper assembly. This register bar (Fig. 21a), as is probably best shown in Fig. 16, is secured as by screws 114 extending into threaded openings in the bent over portion 108. It is the function also of the register bar 113 to secure relatively to the bent over portion 108 a hinge supporting plate 115, to which reference will be made hereinafter.

The other end of the tympan 111 extends about the flexible backing 109 and the metal peripheral member 90 of the cylinder, and into cooperation with a square rotating block 116, relatively to which it may be held by any type of suitable securing means, one form of which may be the right angle plate 117. The square rotating block 116 (Fig. 18) terminates in round shaft portions 118 at each end thereof, which in turn terminate at 119 in small shaft portions mounted in the flanged plates 87 and 87a, forming the ends of the cylinder. A helical spring 120 is mounted about each of the shaft portions 118, and is secured at one end 121 to the shaft portion 118 as by entry into a shallow bore therein, and at the other end to one of the flanged end plates 87 and 87a. It is the function of the springs 120 to rotate the shaft portion 118 and the square block 116 so as to exert constant tension on the tympan 111 tending to maintain it taut relatively to the flexible backing 109 and the cylinder C, and without undue strain. Moreover, contraction of the tympan merely reacts against the springs and does not crack the tympan.

Those skilled in the art will readily appreciate that the tympan in my machine may also be very easily removed by merely relieving the tension on the square block 116 and releasing the right angular member 117. This facilitates the procedure known as "make-ready" to a great degree. Those skilled in the art will also appreciate the value of the flexible backing 109 for the tympan and its extreme utility during the printing process, and in facilitating the "make-ready" procedure.

The gripper and stripper assembly which I utilize in connection with my cylinder C comprises a square gripper shaft 122 (Figs. 18 and 21a) mounted for rotation through cylindrical extensions 123 thereon relatively to the bearing lugs 90 and 90a previously described by me as secured to the flanged end plates 87 and 87a of the cylinder C. A pin 124 extends from each end of the gripper shaft 122, and has secured at one end thereto a spring 125 whereby the gripper shaft 122 is rotated in a clockwise direction, looking at Figs. 20, 21 and 21a. This rotation tends, of course, to rotate the gripper shaft to bring its several gripper plates 126 into gripping relation relatively to the register bar 113. Each of the gripper plates 126 is formed as best shown in Fig. 21a, and is cut away as at 127 for positioning relatively to necked pins 128 extending from the gripper shaft 122. A bowed leaf spring 129 has its central bowed portion fitting within a slot 130 formed in each gripper plate 126, and has its opposite ends fitting within necked portions of two adjacent pins 128. It is obvious that the several bowed springs 129 will function to maintain the gripper plates 126 yieldingly in position against the gripper shaft 122, and that the necked pins 128 will have the dual function of locating the gripper plates 126 relatively to the shaft 122, while cooperating with the ends of the bowed springs to maintain them in position. Through the particular assembly, it is possible to mount my gripper plates 126 so that they require no adjustment whatsoever, it being obvious that any irregularities which may occur in the paper, or in the movement of the mechanism and the variation of the springs, and the construction of the gripper shaft and plates, will be absorbed by the resilience of the bowed springs 129.

The register bar 113, it should be pointed out, has a series of register lugs 131, for which the gripper plates 126 are cut out as at 132 for proper meshing, all as will be appreciated. In addition, the register bar 113 has slots 113a formed therein for guiding stripper fingers 133 formed on a single metal stripper plate 134. This stripper plate 134 is pivoted centrally thereof at 135 to a hinged member 136, which in turn is hinged through pin 137 to the hinge plate 115, previously pointed out as supported relatively to the turned up flange 108 of the peripheral metal member 90 of the cylinder. A spring 134a operates between the stripper plate 134 and the hinged member 136, urging the stripper plate in a direction to hold its fingers 133 within the slots 113a of the register bar. A further hinge plate 138 is secured as through screws 139 to the gripper shaft 122, and is hinged at 140 to a plate 141, which in turn is pivoted at 142 to the hinged member 136. It is now quite apparent, with reference to Figs. 20, 21 and 21a, that clockwise rotation of the gripper shaft 122 to bring the gripper plates 126 into gripping position relatively to the register bar 113, will move the stripper fingers 133 out of the stripping position of Figs. 21 and 21a. It is further obvious that when the gripper plates 126 are moved out of gripping position, as to the position of Figs. 21 and 21a, the stripper fingers are moved toward stripping position.

For moving the gripper shaft and its gripper plates 126 out of gripping position and the stripping fingers into stripping position against the resistance of the springs 125, I utilize an arm 142 having a cam roller 143, and fixed to the right hand end of the shaft 123 extending from the gripper shaft 122, all as is shown in Figs. 18 and 20. The roller 143 of the arm 142 cooperates with suitable means, to be described hereinafter, for moving the gripper plates out of gripping position in certain positions of the cylinder.

Referring now once again more particularly to

Figs. 18 and 19, there is secured to the shaft 86 as by a pin or a key, what I choose to call an actuator 144. This actuator is in the form of a plate having a circular rim 144a, and on part of this circular rim there are formed a series of teeth constituting a gear 145. This gear is used to drive the inking rollers of my printing press, as will hereinafter be set forth. Part of the rim of the actuator is cut away as at 146 and 146a whereby to form an opening for the entry of a portion of a cable 147 which is to be anchored to the actuator. This cable 147 is wound about the actuator 144, as may best be seen from Fig. 35 taken in connection with Figs. 18 and 19, and is adapted to ride in grooves 148 formed on the outer periphery of the circular rim 144a of the actuator.

A portion of the cable, as previously described generally, is wound about a snubber post 149 which extends from the plate portion of the actuator 144, while part of the cable traverses the loop of a clip 150. The clip 150 is in turn slotted as at 151 for cooperation with pins 152 carried by a plate 153. The plate 153 is slotted at 154 for pivotal and sliding movement about the screw bolt 155 secured to the plate portion of the actuator 144, its other end being adapted for pivotal adjusting movement relatively to the bolt 155 through means of the bracket 156, in which is housed the screw threaded stud 157.

At each end of the cable 147, there is secured a metal clip 158 having an offset ear 159, which is pierced as at 160 whereby the clip may be pivotally secured through the pin 161 relatively to a lever 162, which is shown in Fig. 33 as pivoted at 163 to a bracket 164 fixed to the bed B. Each of the levers 162 is limited in its movement relatively to the bed B, and is guided in that movement by a stud 165 extending upwardly from the bed B. It may be well at this point to indicate that the cable 147 is secured to the clips 156 in any one of several ways which are well understood by those skilled in the particular art.

From the description of the actuator 144 and the cable which has so far been given, it can readily be appreciated that as the bed B reciprocates, it winds and unwinds portions of the cable about the actuator 144, through cooperation of the cable with the grooves 148 of the actuator, to rotate the actuator clockwise and counterclockwise. The length of the cable 147 is so calibrated relatively to the bed and the movement of the bed, that there will be a completely 360° rotation of the actuator in one direction as the bed moves through its forward stroke, while there will be a complete reverse rotation of the actuator when the bed moves through a reverse stroke. For convenience, the forward stroke of the bed will be termed its printing stroke hereinafter, while its reverse stroke will be called the feed stroke.

It will also be appreciated that the effective length of the cable may be readily adjusted by operation of the adjusting means described particularly with regard to Fig. 19, and including the adjusting stud 157 and the pivoting and sliding plate 153 cooperating with the clip 150. Functionally, it is entirely possible for me to utilize two independent cables, each of which may be secured to the actuator. For the purpose of economy in manufacture, I have shown but one cable and actually use but such a single cable.

The cable is secured through the clips 158 relatively to the pivoted levers 162 in order to allow for upward and downward movement of the actuator relatively to the bed, which movement takes place during the operation of the machine, as will be hereinafter set forth. Through the utilization of the cable, I obtain an inexpensive, flexible and efficient drive for the actuator, while facilitating the upward and downward movement of the actuator, which in said upward and downward movement is never separated from the cable.

The offset ears 159 on each of the clips 158 are of prime importance, since those ears allow for an alignment of the cable tangential to the cylinder in every position of the cylinder, as, for example, in Fig. 19. In Fig. 19, the cylinder is shown in approximately its raised position and about to move into its lower position in the printing plane. There it will be noted that the lever 162 has been moved about its pivot at 163, the cylinder being in a partially elevated position, as was indicated. It will be noted that that portion of the cable which is within the clip 158 is tangential to the grooves 148 of the actuator 144, and forms a continuous extension of that portion of the cable within the said grooves 148. There is therefore no bending or twisting of the cable at the point where it enters the clips 158, a feature of considerable desirability. Due, moreover, to the fact that the cable within the clips 158 is maintained tangential to the actuator at all times, there is no undue stretching of the cable at any particular position of the cylinder, all as will be appreciated by those skilled in the art.

As has already been indicated generally, the actuator 144 and the cylinder C are movable vertically to bring the cylinder within the printing plane of the bed B during the printing stroke of the bed. To accomplish this, there is mounted on each end of the cylinder shaft 86 a bushing 166. Each of the bushings 166 is slidably mounted in a groove 167 formed in the upper main side plates 168 of the machine. It should at this point be indicated that there are two of these upper main side plates 168, and that they are mounted on the upper rim 13 of the machine, as is probably best shown in Fig. 18, being secured to that rim by suitable means, such as bolts, rivets or welding, all as will be quite apparent to those skilled in the art. If desired, the weight of the shaft 86 and the cylinder and actuator thereon may be counter balanced by suitable springs operating against the ends of the shaft 86, as will be readily understood.

There is pivoted on each of the upper main side plates 168 through a screw threaded stud 169, a cylinder positioning cam 170, probably best illustrated in Figs. 19 and 22. Each of the cams is formed with a cam slot 171 which cooperates with one of the bushings 166. The cam slots 171 are so calculated that when the bushings 166 are at the inward end of the slots, indicated by reference numeral 171a, the cylinder will be positioned in the printing plane of the bed B. On the other hand, when the bushings 166 are at the outer ends of the cam slots 171, as within the depressions 171b, the cylinder and its actuator will be positioned out of the printing plane. It will be appreciated that in Figs. 19 and 22, with the cams 171 positioned as shown, the cylinder will be approximately midway between its position out of the printing plane and its position in the printing plane.

For moving the cams 170 to move the cylinder into the printing plane, the printing bed B carries rollers 172 which strike the lower ends of the cams 170, as best illustrated in Fig. 22. Obviously, as can be appreciated also from Fig. 19, this is accomplished toward the end of the feed

or return stroke of the bed, and just prior to the beginning of the printing stroke. Rollers 173 at the other end of the bed are adapted to contact the cams 170 at the very end of the printing stroke for moving the cams to position the cylinder out of the printing plane.

As those skilled in the art will appreciate, it is necessary to stop the operation of the printing press, should no paper be present for application between the cylinder and the bed. I have, for this purpose, arranged suitable side latches carried by the bed, these side latches being adapted to move the cylinder out of the printing plane in the event that there is not present a sheet of paper for feeding, as just set forth, or in case a sheet of paper is not accurately and properly accepted by the cylinder. At this point, I shall describe the side latches, but I shall not describe the control or detector mechanism for positioning the side latches. Referring to Fig. 22, I shall merely point out that there is mounted on each side of the bed a side latch 174, pivoted as at 175 to a bracket 176 adjustably secured by a screw 177 to the side of the bed. This side latch 174 is normally pressed by a spring 178 (Figs. 28 and 30) secured thereto at 179, so that the roller 180 on the end of the latch will be maintained out of the plane of the lower end of the cam 170. In certain conditions of operation, the side latches 174 will be moved outwardly into the position of Fig. 30 from the position of Fig. 28, and against the pressure of springs 178. In such event, the rollers 180 will be in the plane of the lower ends of the cams 170, so as to move those cams in a counter clockwise direction in Figs. 19 and 22, whereby to move the cylinder C out of the printing plane.

It may be well at this time to point out that when this is done, a second roller 181 on one of the side latches 174 will contact the end of a lever 182 fixed on a short shaft 183, and will rotate the shaft 183 clockwise in Fig. 19. The spring 184 mounted on the shaft 183 merely presses the shaft 183 into its position of Fig. 30 so that the lever 182 will lie in the path of the roller 181. When shaft 183 is so rotated, it rotates the lever 183*a* which is slidable on the shaft 183 but is adjusted for rotation therewith. This movement of the lever 183*a* effects movement of levers 185 and 186 for operating a switch contained within a casing 187, for shutting off the power to the printing press motor 33. At the same time, a bell hammer 188 secured through a wire 189 to the lever 183*a* strikes the bell 190 to signal the shutting off of the power, all as will be readily appreciated by those skilled in the art. To start the machine, the operator rotates the shaft 183 through the knob 190*a*, back to its position of Figs. 19 and 30, as will be understood. It is sometimes required to maintain the machine running even when no paper is being fed to the cylinder. In such an event, the operator pulls on knob 190*a* to move shaft 183 endwise to withdraw lever 182 from the plane of roller 181. This will naturally prevent the shutting off of the power, but will still allow the raising of the cylinder by rollers 180. As I have already stated, further features of the particular construction and its method of control will be described hereinafter in considerable detail.

At this point, I should like to clarify the relationship between the gripping and stripping mechanism, and the operation of the clutch between the actuator 144 and the cylinder, whereby to clarify the operation of the several parts. It will first be well to point out that the cylinder C is freely rotatable on the shaft 86, and is driven by the shaft 86 through the clutch plunger 98 as the shaft is rotated by the actuator 144 fixed thereon. Starting now with the parts in the position of Fig. 16, it will be well to note that in this position, the bed has completed its return or feed stroke, as I choose to call it. The roller 172 has contacted the lower end of the cam 170, moving the actuator 144 and shaft 86 so as to position the cylinder in the printing plane.

Prior to reaching the position of the parts in Fig. 16, the parts were positioned as shown in Fig. 19, and before that they were in the position of Fig. 20. In Fig. 20, the actuator is being rotated by the cable 147 in a clockwise direction incidental to the completion of its feed stroke. The clutch plate 96, which it will be remembered is secured to the shaft 86, will of course rotate in the same clockwise direction, which is illustrated by the arrow R in Fig. 20. During this rotation of the actuator shaft 86 and the clutch plate 96, the cylinder C is positioned out of the printing plane and is locked against rotation by a plunger 191 which is mounted in an abutment 192 extending from one of the upper main side plates 168, and pressed by a spring 193 against the cylinder. A cap 194 is pinned to the plunger 191, and contains therein anti-friction balls 195 to facilitate the rotation of the cylinder relatively to the plunger as the plunger rides on the cylinder periphery during rotation of the cylinder. In the position of Fig. 20, the plunger cap 194 is of course in alignment with the bores 95*b* formed in the peripheral metal member 90 of the cylinder, the bore 95*a* in the rim 89*a*, and the bore 95 of the clutch block 94, and maintains the cylinder against any rotation whatsoever. Thus, it will be appreciated that during the feed stroke of the bed B and the return stroke of the actuator 144, and the clutch plate 96, there is no movement whatsoever of the cylinder. It will therefore be appreciated that during the feed or return stroke, the cylinder does not move and is available for the feeding of paper thereto. This makes it possible to utilize the very simple and effective type of grippers already described, and whose operation will be more fully indicated hereinafter.

Suffice it to say that when the parts are in the position of Fig. 20, with the cylinder out of the printing plane, the roller 143, which it will be recalled is secured to the lever 142 pinned to the shaft portions 123 extending from the gripper shaft 122, is in contact with a cam 143*a* fixed to one of the upper main side plates 168 of the machine. This contact is sufficient to rotate the gripper shaft counterclockwise in Fig. 20 against the force of its springs 125, so as to hold the gripper plates 126 out of registry with the register bar 113, exposing the register lugs 131. The paper sheet, which is designated by the letter S in Fig. 20 and is shown in dash and dot lines, may then be fed by suitable means against the register lugs 131, and is actually maintained by suitable means pressed against the several lugs 131 so as to obtain effective register. It will be noted that in Fig. 20, the gripper shaft 122 is not rotated sufficiently to move the stripper fingers 133 into stripping position. As a matter of fact, the grippers require an opening of but a few degrees.

Viewing now the gripper parts of Fig. 20, it will be appreciated that when the roller 172 strikes the bottom of the cam 170 in Figs. 19 and 22, it will move the shaft 86 downwardly to bring

the cylinder into the printing plane, and into the position of the parts in Fig. 16. This movement will bring the cam roller 143 of the gripper mechanism away from the surface of the cam 143a, so as to allow the springs 125 to move the gripper plates 126 to grip the paper S, all as is well seen in Fig. 16. At the same time, the clutch plunger 98 carried by the clutch plate 96 has moved into alignment with the bore 95 of the clutch block 94, but is held out of bore 95 through the coaction of its roller 102 with cam surface 201 of cam 197 fixed to the plate 168 (Fig. 18). The downward movement of the cylinder, as already indicated, effects the release of the plunger for movement into the bore 95, whereupon the actuator 144, the shaft 86 and the cylinder C are united for movement as a unit for the printing stroke of the bed. This movement is a counterclockwise movement in the direction of the arrow P in Figs. 16 and 21. It will also be appreciated that the downward movement of the cylinder releases it from the plunger 191 which previously was holding the cylinder against rotation.

When the parts rotate counterclockwise from the positon of Fig. 16 during the printing stroke, the paper will be carried by the grippers between the bed and cylinder until the grippers reach the position of Fig. 21. The cam roller 143 has then contacted in succession the surface 196 of the cam 197, and the surface 198 of the same cam. This rotates the gripper plates 126 together with the gripper shaft 122 into release position, as illustrated in Fig. 21. At the same time, the stripper fingers 133 move the sheet S out of contact with the register bar 113, thereby releasing the end of the sheet from the cylinder. Actually, the end of the sheet is thereupon deposited upon the upper surface of a guide plate 199 for feeding to the delivery rack of the machine, all as will be hereinafter set forth.

The grippers may be allowed to remain partially open from the position of Fig. 21 through a lengthening of the cam surface 198, or may be allowed to close and thereafter to open when the cam roller 143 is moved into its position of Fig. 20 until the end of the printing stroke, and when the actuator together with the shaft 86 and the clutch plate 96 are raised incidental to the return stroke of the bed.

Reviewing now the operation just described and returning first to Fig. 20, it is seen that with the parts in the particular position therein shown, the clutch plate 96 will rotate with the actuator 144 to bring the plunger 98 into its clutching position of Fig. 16, the cylinder then moving into the printing plane through the action of cams 170 operated by the bed. The grippers grip the paper and the printing stroke begins. Upon completion of part of the printing stroke, the grippers release the end of the sheet of paper. At the end of the printing stroke, the roller 102 of the plunger 98 carried by the clutch plate 96, will move into juxtaposed relation to the lower surface 201 of the cam 197. With the cylinder in its lowered position in the printing plane, the plunger will be maintained within the bore 95 of the clutch block 94 to drive the cylinder. However, when the rollers 173 on the end of the bed strike the lower ends of the cams 170, the cylinder will be moved upwardly and out of the printing plane while still rotating somewhat. Incidental to this movement, the lower surface 201 of the cam 197 will actuate roller 102 to move the clutch plunger out of the bore 95 of clutch block 94, and will release the cylinder from the actuator 144. The cylinder, at the end of its upward movement, will effect the entry of the cap 194 of the positioning plunger 191 into the bores 95a and 95b of the cylinder, locking the cylinder against rotation. It will be appreciated that under some conditions, the clutch plunger 98 will be withdrawn from clutching engagement by the upward movement of the cylinder and actuator, and just before the cylinder completes its stroke and is properly aligned relatively to positioning plunger 191. To complete the stroke of the cylinder, the bed B carries a bracket 100a which strikes against the end surface 100b of an opening 100c in the cylinder C to impart the last increment of rotation to the cylinder C, all as is quite apparent.

The return stroke of the printing bed of course rotates the actuator 144 and clutch plate 96 in the direction of the arrow R in Fig. 20 to complete the return or feed stroke, during which a sheet of paper is fed to the cylinder. After that, there is a lowering movement of the cylinder once again, an engagement of the clutch, a gripping of the sheet of paper by the grippers, and the beginning of the printing stroke, all as has been described.

I shall now describe the means utilized for feeding the sheets of paper to the cylinder for acceptance by the grippers. For this purpose, reference will first be made back to Fig. 5, where it will be remembered the sprocket 69 is indicated as driving the sprocket chain 75 under the control of the clutch rod 74. It is understood that when the clutch rod is moved to the left from its position of Fig. 5, the sprocket 69 will drive the chain 75, which in turn will drive a sprocket 205, thereby rotating a shaft 206, mounted for rotation on the upper main side plates 168. A further sprocket 208 is mounted on the shaft 206, and through a chain 209, drives a sprocket 210 on a shaft 211, which shaft is parallel to the shaft 206 and is similarly mounted in the side plates 168.

The chain 209, as may be best seen in Fig. 8, drives also a sprocket 212 on a shaft 213 mounted in the upper main side plates 168. On the shaft 213 is mounted a cylindrical pulley 214 for actuating a flat belt 215, preferably made of canvas, and best illustrated in plan view in Figs. 5 and 17. This flat belt extends from the pulley 214 downwardly towards the cylinder C, as best seen in Fig. 2, passing around the relatively small idler pulley 216 and up to the upper side of the pulley 214, and then down about the idler roller 217 toward the pulley 214, all as will be readily seen.

Cooperating with this flat, and preferably canvas belt 215, there are a pair of small circular belts 218 mounted in grooves on a pulley 219 mounted on the shaft 211 (Fig. 5). With the pulley 215 rotating in the direction of the arrow 214a in Fig. 8 to move the upper stretch of the belt 215 towards the cylinder C, the pulley 219 will rotate in the direction of the arrow 219a, moving its two belts 218 so that those portions of the belts juxtaposed to the canvas belt 215 will move in the same direction as the canvas belt, that is, toward the cylinder. Belts 218 are guided in suitable grooves 220 in an idler pulley 221 (Fig. 16) and then extend upwardly into grooves 222 of an idler pulley 223. Pulley 223 is fixed on a shaft 223a (Figs. 17 and 18) for driving that shaft when it is itself driven by belts 218. Formed on the shaft 223a on each side of the pulley 223 are rollers 224, which are preferably of some resilient material, such as rubber, it being the function of the rollers 224 to move the

printed sheets, all as will presently be indicated. The upper reaches of the belts 218 extend rearwardly from the pulley 223 and back to the pulley 219 on the shaft 211. The further function of the belts 218 to assist in carrying the paper from the cylinder to the delivery rack, will be indicated later in the specification.

The chain 209, already described as driving the pulleys 214 and 219 and therefore the flat canvas belt 215 and the small circular belts 218, is in further engagement with a sprocket 225a mounted on the shaft 225, as is best seen in Figs. 8 and 9. The shaft 225 is mounted in the end side plates 207 which are suitably secured as extensions of the upper main side plates 168. Actually, the plates 207 might be made integral with plates 168, as will be appreciated. The shaft 225 has mounted thereon a rather unusually shaped sprocket 226 utilized for driving a rather unusual belt, indicated generally by the reference numeral 227.

The construction of this belt is best illustrated in Figs. 5a and 5b, taken together with such a figure as Fig. 7. In those figures, it will be noted that the belt has a plurality of metal sections 228 formed with hinge portions 229 which are so related that when they are joined together by hinge pins 230, a continuous metal surface is presented at one side of the belt. This continuous metal surface is best seen in Fig. 7. At the same time, the hinge portions 229 will fit within the depressions of the sprocket 226 so as to be readily driven by rotation of that sprocket (Fig. 9). While the belt 227 is adapted to rotate continuously, only certain portions thereof are intended to be utilized for feeding the paper, it being further intended that by changing the positions of those portions which feed the paper, and predetermining their number, varying controls of my printing machine may be obtained, as may be desired.

On those sections 228 of the belt which are to be utilized for feeding the sheets of paper to my printing cylinder, I weld or otherwise secure metal channel members 231, preferably of the shape shown in cross section in Fig. 5b. Within these channel members I insert resilient strips, designated by reference numerals 232 and 233. These resilient strips are preferably made of rubber, and are formed with channels, or with vacuum cups, as shown in the drawings, for coaction with the paper sheets. The resilient strips are inserted into the channels 231 by first stretching the strips, whereupon they become considerably narrower than the channels so as to be readily inserted into those channels either endwise or vertically. Thereafter, tension is taken off the strips, and they are allowed to contract in length, whereupon they broaden and fill out the channels, to be retained therein thereafter as shown. I have found through actual experience that a belt as shown and described operates with extreme efficiency for the feeding of paper in my machine.

Referring now back again to such figures as 2, 7, 8 and especially 9, it will be noted that my belt 227 extends from its sprocket 226 forwardly of the machine and about a spacer sleeve 234 on the idler pulley 219 and between the belts 218 actuated by said pulley. On the other side of the sprocket 226, my belt 227 extends downwardly and under an idler pulley 235 mounted for free rotation on a shaft 236 which is pivotally supported in the auxiliary side plates 207 (Fig. 10).

The shaft 236 is pinned as at 237 to the abutments 238 of the side plates 239a of a belt guiding bracket 239. The parallel side plates 239a of the bracket 239 are slotted as at 240, and mounted for sliding movement within the slots 240 is a shaft 241 whose ends are squared for that purpose. Extending between this shaft 241 and a rod 242 carried at the end of the bracket 239, are springs 243 tending to move the shaft 241 downwardly towards the end of the bracket, and towards the ends of the slots 240, all as will be appreciated. Idler spacer disks 244 are mounted at each end of the shaft 241 and about the anti-friction bushing 245 on said shaft. An idler pulley 246 is mounted between the idler disks 244, and over this idler pulley 246 there passes the belt 227. From under the idler pulley 246, the belt extends upwardly towards the spacer sleeve 234 on the idler pulley 219, and in juxtaposed relation to the flat canvas belt 215, all as is best shown in Fig. 9. It will now be understood that it is the function of the springs 243, cooperating with the shaft 241 on which the idler pulley 246 is mounted, to maintain under predetermined tension the belt 227. It is the function of the idler disks 244 to maintain the metal hinged portions 228 of the belt spaced from the sheets of paper S shown in Fig. 9, except when the feed portions 232 and 233 of the belt come opposite the paper, whereupon those portions will contact the paper sheets, as shown in Fig. 9, moving vertically the belt 227, the disks 244, and the bracket 239, all as will be understood.

It is apparent that the metal belt 227 and the friction paper moving elements 232 and 233 thereon weigh considerably, and that if allowed to bear on the sheets of paper, will exert considerably more pressure thereon than may be desirable. I therefore employ suitable means for counter-balancing the weight of the belt through controlling the bracket 239 on which the lower portion of the belt is mounted. For this purpose, I have extending from the left hand auxiliary side plate 207, in Fig. 10, a stud 247, and cooperating with this stud is one end 248 of a coil spring 249 which is secured at its other end to a collar 250 which is loose on shaft 236. The collar 250 in turn is serrated as at 251 for locking coaction with the collar 252 pinned to the shaft 236 on which the bracket 239 is pinned. A series of holes 253 are formed in the collar 250, whereby through the insertion of a proper tool the collar may be withdrawn relatively to the collar 252 and rotated to place the spring 249 under any tension which is desirable. Endwise movement of the collar thereafter will connect it to the collar 252 so that they form, in effect, a single unit. In this way, the tension in the spring 249 may be adjusted to any degree desired so as to counterbalance to any particular degree the weight of the bracket 239 and the belt 227.

There is pinned to the shaft 236 on which the bracket 239 is supported, a further arm 254, best illustrated in Figs. 7 and 8, through the intermediary of a pin 255. This arm extends rearwardly of the machine for controlling the paper feed mechanism in a manner which will be described hereinafter. The counterbalancing spring 249 functions, therefore, to counterbalance the arm 254 and therefore exerts considerable influence also on the paper feed mechanism, as will appear hereinafter.

It may be well at this point to indicate that the paper sheets, as best shown in Fig. 9, are fed upwardly from a stack by the belt 227 and over a feed plate 256 into contact with the flat canvas belt 215 which traverses an opening 257 in the said plate, and thereafter rides over the feed plate towards its actuating pulley 214. Further in this specification I shall describe the caliper gap and

paper separating means which cooperate with the said feed plate and belt for controlling the feeding of the sheets of paper. I shall now describe the paper feed rack from which sheets are moved by the belt 227, together with the paper delivery rack to which the sheets are feed after they are printed.

Referring now to Figs. 2–4, it will be noted that secured to the rear or feed end of the machine and below the auxiliary side plates 207, there are a pair of lower side plates 260 suitably secured in any conventional and desirable way, to the main frame. It is thought that the several figures amply illustrate how these plates may be secured relatively to the frame, and it is not thought necessary to complicate the specification further by describing the several nuts, bolts and angles in detail. As a matter of fact, the lower side plates 260 may conceivably be part of the base of the frame if desired.

Extending transversely between the upper auxiliary side plates 207, there is a bracket 261 secured as by bolts 262 to each of the plates, as best shown in Figs. 8 and 9. Centrally of this bracket 261, which is midway between the side plates 207, there is a bearing for the upper end of a screw feed shaft 263. This shaft extends downwardly, and has a suitable ball thrust bearing for its lower end in an abutment 264 (Fig. 4) carried by the transverse bracket 265 supported by the lower side plates 260. For cooperation with the threads of the feed shaft 263, I utilize a block 266, best shown in Figs. 2, 3 and 6, this block having a bore 267 therein which is of such size relatively to the threads of the shaft 263 as to slide freely on the said shaft. For cooperation with the threads of the shaft, there is pivoted to the block 266 as at 268 a lever 269 having teeth 270 formed thereon. In one position of the lever, the teeth 270 will engage with the threads of the shaft 263, and in the upper release position illustrated in Fig. 3, the teeth will be out of engagement with the said threads. It is obvious that with the teeth in engagement with the threads, rotation of the feed shaft 263 will effect movement of the block 266. Actually, the shaft 263 is adapted for rotation in a direction which will carry the block upward, it being necessary when it is desired to adjust the block downwardly, to rotate the lever 269 on its pivot 268 to withdraw its teeth 270 from the threads of the shaft 263, all as will be appreciated. Also, this method of adjustment is utilized whenever it is desired to move the block upwardly a considerable distance relatively to the shaft.

The block 266 cooperating with the shaft 263 is used as the actuating element for the paper feed rack. This paper feed rack comprises opposite main vertical arms 271 connected to the block, and each carrying upper and lower rollers 272 which ride in suitable guide grooves 273 formed in vertical standards 274 extending between the lower side plates 260 and the upper side plates 207, all as is probably best shown in Figs. 2 and 6, as well as in Fig. 3.

Suitably secured to the vertical arms 271 of the feed rack are horizontal arms 275, and extending between the horizontal arms 275 and the vertical arms 271 is the angular support plate 276. This support plate 276 has a central slot 277 formed therein, as is best shown in Figs. 6*a* and 6, as well as relatively large spaced rectangular openings 278. It will be appreciated that it is necessary, in order to maintain the paper in the angular position required by the support plate 276, to have an end support for the lower ends of the paper, which end support is adjustable relatively to slot 277 in accordance with the length of the sheets to be printed upon. For this purpose, I utilize the end support 279, probably best shown in its entirety in Fig. 2. This end support is in the form of a vertical channel member, to the lower end of which there is secured a lug portion 280 part of which extends downwardly into the slot 277 for threaded cooperation at the underside thereof with a turn-piece 281 having a series of turn pins 282, whereby it may be readily manually rotated to clamp the end support 279 in proper relation to the plate support 276. Any other suitable means for clamping the end support 279 in adjusted relation to the slot 277 of support plate 276 would be quite as effective.

The end support 279 is adapted also for cooperation with a delivery rack 283, which is mounted parallel to the angular support plate 276, and is best shown in Figs. 3 and 6*a*. The delivery rack 283 has side flanges 284 which rest by gravity on ledges 285 extending outwardly from the upper side plates 207, as is best illustrated in Figs. 3 and 7, whereby the central portion of the receiving rack 283 is supported. The upper ends of the side flanges 284 of the receiving rack are formed with hook portions 285 (Figs. 8 and 9) which are slotted as at 286, whereby to be slipped over the studs 247, the slots 286 cooperating with necked portions 247*a* of the studs 247. It will be remembered that the studs 247, as snown in Fig. 10, extend from the upper auxiliary side plates 207 and that one stud cooperates with the counterbalancing spring for the belt supporting bracket 239. It will now be appreciated that I thus obtain a very simple assembly of the paper delivery rack 283.

The end support 279 extends through a slot 288 formed in the delivery rack 283 as the feed rack moves vertically. For bracing the end support 279 as it moves upwardly relatively to the delivery rack with the feed rack, I utilize a guide bracket 289 adapted to telescope the member 279. This bracket is secured to the receiving rack through the utilization of a hand screw 281*a*, similar to the screw 281 used in securing the member 279 to the feed rack. The bracket 289 carries thereon a roller 289*a* which cooperates further with the end support 279 for guiding it in its vertical movement relatively to the telescoping guide bracket 289. It is now readily seen that as the screw 263 is rotated, it moves the paper feed rack vertically whereby to supply paper to the feed belt 227 for feeding to the machine. It is also appreciated that at the same time, the paper will be deposited on the delivery rack 283 where it will be supported against endwise movement by the guide bracket 289, the end support 279 being vertically movable relatively to the delivery rack 283 and guide bracket 289 as the feed rack moves upwardly.

At this point, I should like to indicate that the sheets of paper must be guided at their opposite longitudinal edges relatively to the feed rack, the delivery rack, and throughout the machine. For this purpose, I use a series of guides, all of which are simultaneously adjustable. For convenience, I prefer to describe these guides later.

I have found it desirable to maintain the paper at a level relatively to the machine which is shown best in Fig. 9, in which one sheet of paper is shown actually being fed by the friction elements 232 and 233 of the feed belt 227. In order

to maintain the paper at this level, I control the means whereby the feed shaft 263 is rotated, all in a manner which will be better understood with reference to Figs. 3, 8 and 10. Considering those figures, it will be noted that the upper end of the feed shaft 263 carries a bevel gear 290, which is in mesh with a bevel gear 291. This bevel gear 291 is in turn fixed to a shaft 292, on one end of which is secured a ratchet 293. Suffice it to say, the shaft 292 is suitably mounted in brackets, as is shown in the several figures, so that as the ratchet 293 is rotated, the shaft 292 and the bevel gear 291 rotate, and through the intermediary of the bevel gear 290, rotate the feed shaft 263. For cooperation with the ratchet 293, I utilize the gravity pawl 294 pivoted at 295 on a plunger 296 which is mounted for sliding movement at 297 on the main frame of the machine, and preferably in a portion of the bed support casting. The plunger 292 is maintained spring pressed by a spring 298 towards the right, or the forward end of the machine, as seen in Fig. 8, the spring 298 cooperating with a suitably mounted pin 299 whereby it is constantly maintained in compression. The end surface 300 of the bed B is adapted, each time that the bed completes its return or feed stroke, to contact the end of the plunger 296, as shown in Fig. 8, moving the plunger against the pressure of the spring 298. This actuates the pawl 294 to rotate the ratchet 293, thereby advancing the feed shaft 263, as will be appreciated.

A collar 301 limits the movement of the plunger 296 to the right, and its movement is silenced by a suitable resilient material, shown in section in Fig. 8 at 302. If desired, suitable means may be provided for adjusting the forward movement of the plunger by its spring 298, and thereby limiting the reverse amount of movement which will be imparted to the plunger by the bed. Such means are not herein shown, but may be readily incorporated if found desirable. It is necessary to stop the feeding of the paper when it reaches a predetermined level, which predetermined level I have found, as I have already indicated, to be the level illustrated in Fig. 9 and also illustrated in Fig. 8. For this purpose, as I have already indicated earlier in the specification, I utilize the belt supporting bracket 239, and the arm 254 movable integrally therewith. Referring now again to the lever 254, it will be noted that it is pivoted at 303 to a collar 304 maintained in position, through suitable adjustable means which are shown but need not be described, on a rod 305. The rod 305 is slotted as at 306 for cooperation with a pin 307 extending from a lever 308 pivotally mounted on a pin 309 extending from one of the upper side plates 207. The right hand end of the lever 308 has a lug 310 cooperable with a lug 311 extending upwardly from the feed plunger 296.

It will now be seen that when the level of the stack of paper is that illustrated in Figs. 8 and 9, the belt 227, and therefore the bracket 239, pivot about the axis of the shaft 236 to which the bracket is pinned, to hold the rod 305 as shown, so that the lever 308 may move by gravity. This allows its lug 310 to fall in front of a lug 311 of the feed plunger 296. In the position of the parts, should the bed B move to the right in Fig. 8, that is, through its printing stroke, it will not, on its reverse movement, find the plunger 296 extended sufficiently so as to move the plunger. Since the plunger will not be moved, the feed pawl 294 will obviously not move the ratchet 293. Thus, so long as the paper level is maintained as shown in Fig. 8, there will be no movement of the paper feed rack upwardly. Should the paper level fall, however, the bracket 239 will rotate with its shaft 236 in a counter clockwise direction so that the rod 305 will be caused to move downwardly, rotating the lever 308 counter clockwise about the pin 309. This will move the lug 310 upwardly relatively to the lug 311, allowing the plunger 296 to move forward into a position in which it may be contacted by the bed on its return or feed stroke. There will thereafter be a movement of the paper feed rack upwardly until the proper level of the upper paper sheets is reached.

As I indicated previously, suitable side guides must be provided for the use of the paper sheets as they are fed through the machine, and as they are supported relatively to the feed and delivery racks. As has already been indicated, the angular support plate 276 of the feed rack has two spaced rectangular openings 278. The delivery rack 283 has similar openings, designated by reference numeral 312 in Fig. 6a. Side guide plates 313 extend through the openings 312 and 278, and are utilized for the side edges of the paper sheets, both on the plate 276 and delivery rack 283. The side plates 313 have suitable collars 314 thereon which are threaded for engagement with the oppositely threaded ends of an upper shaft 315 and a lower shaft 316, mounted in the upper auxiliary side plates 207 and the lower side plates 260 respectively. Moreover, through a vertical rotating shaft 316a having a bevel gear 317 at its upper end, and a bevel gear 318 at its lower end, in mesh respectively with a bevel gear 319 on the end of the shaft 315 and the bevel gear 320 on the end of the shaft 316, the two shafts 315 and 316 are rotated together at identically the same speed through manipulation of a crank 322 on shaft 315. It is thus seen that by merely rotating the crank 322, the side plates 313 are moved toward one another, or away from one another, depending on the width of the sheet of paper to be guided. Moreover, the two plates 313 are moved simultaneously relatively to the center line of the machine, all as will be readily appreciated.

It will be well at this point to indicate that broadly, the adjusting of side guides for sheets of paper traversing a printing machine is shown, discussed and claimed in my application, Serial No. 164,726. In this application, I have conceived a new adaptation for the sheet adjusting means which is extremely novel and desirable in the type of machine shown by me.

It will be remembered that a canvas belt 215 is utilized for feeding the paper towards the cylinder, and that a pair of relatively small circular belts 218 are utilized with the belt 215 for assisting it in feeding the paper sheets to the machine and for feeding the paper from the machine toward the delivery rack. Cooperating with this canvas belt, and with the pair of belts 218, are a pair of opposite duplex guide assemblies 325, only one of which need be described since the two are complementary in form.

Each duplex guide has a downwardly curved apron portion 326 terminating at 327, as best shown in Figs. 6a, 7 and 8. The apron 326 is used to absorb some of the sag in the paper, but actually, a horizontal flange 328 extending inwardly from the side plate 324 of each of the duplex guides, supports one edge of the paper, as that paper is fed toward the cylinder by the canvas belt 215. An upper horizontally extending flange

329 is supported from each of the duplex guides, and is utilized for supporting an edge of the paper as the paper is being fed from the impression cylinder by the pair of belts 218. It will be noted that the duplex guides are utilized, therefore, for supporting the paper as it travels to the cylinder and as it travels from the cylinder, and it is for that reason that I have termed them duplex.

Each of the duplex guides 325 has forward and rearward internally threaded collars 330 for cooperation with shafts 331 which are oppositely threaded at their ends similarly to the shafts 315 and 316 already described. Moreover, these shafts 331, through suitable bevel gears 332 on the ends thereof, are connected through the intermediary of rods 333 and 334, also having bevel gears thereon, with the shaft 315, through the bevel gear 319 of the said shaft. In this way, the duplex guides 325 move together with the side plates 313 in accordance with the width of the sheet to be fed through the machine. It is thus seen that the side guides for the paper in its traversal through the machine, are all controlled together by the simple operation of the crank 322. In addition, it will later be appreciated that certain additional paper feed and control means are movable with the duplex guides for further assisting in the feed of the paper.

At this point, it will be well to indicate that it is many times necessary to vary the pressure between the belts 218 and the canvas feed belt 215. It will be appreciated that by varying the pressure between the two belts, the force with which the paper will be fed against the cylinder and against the register lugs 131 of the register bar 113 of the cylinder C will be varied. For a very light paper, such as tissue paper, a very light pressure will be required. On the other hand, where heavy paper is to be utilized, considerably greater pressure is necessary. For the purpose of varying the pressure between the belts 218 and the canvas feed belt 215 to obtain the results indicated, I utilize a construction best illustrated in Figs. 19 and 24 taken in conjunction with Fig. 16. Before proceeding with a description of this construction, I should like to add that part of the means shown in these figures is utilized for moving the idler pulley 216 laterally relatively to the belt actuating pulley 214, whereby the axis of travel of the moving belt 215 will be positioned angularly relatively to the machine. This means that while a sheet of paper is moving downwardly towards the cylinder on the horizontal flanges 328 of the duplex guides 325, through the force imparted thereto by the belt 215 in conjunction with the belts 218, the sheet is actually moved angularly relatively to the duplex guides 325 so that one of its side edges will be brought with some force against the vertical side plates 324 of the particular duplex guide against which it is being moved. The degree of force with which it is brought against the side plate 324 of the duplex guide will, of course, depend on the angularity which the belts 218 and the canvas belt 215 assume. In this way, very effective side register of the sheets is obtained, all as will be well appreciated. It is well to point out also, that a similar angular alignment of the lower stretches of belts 218 is simultaneously obtained.

I shall now refer to the figures previously indicated for a description of the means whereby the canvas belt 215 and the belts 218 are positioned for angular alignment relatively to the machine. Referring now especially to Fig. 24, the shaft 216a of the idler pulley 216 on which the belt 215 moves, is shown as adapted for axial as well as rotary movement relatively to the upper main plate 168 of the machine. The other end of the shaft 216a is not shown, but it of course is similarly mounted. A stud 335 is secured on the main frame plate 168 for rotation relatively thereto and against endwise movement, through the means clearly shown in the drawings. Mounted on the threads of this stud is a plate 336 which is screw threaded relatively to the stud 335 so that rotation of the stud 335 will move the plate laterally relatively to the main plate 168. The plate 336 is slotted as at 337 so that it may be slipped over a necked portion 338 of the shaft 216a. Because of this relationship between the shaft 216a and the plate 236, it is obvious that lateral movement of the plate will move the shaft 216a laterally, thereby adjusting the pulley 216 and consequently the belt 215 as required. The plate 336 is further slotted as at 339 whereby it may be slipped over the necked portion 340 of the shaft 341 on which is mounted the idler pulley 221 for the belts 218, it being remembered that the belts 218 pass about the idler pulley 221 in their movement towards the upper idler pulley 223. This arrangement of the belts 218 is best appreciated by viewing Figs. 16, 17 and 18. It will now be appreciated that by the lateral movement of the plate 336 through the rotation of stud 335, the shaft 341 will also be moved laterally, together with the shaft 216a, so as to adjust the guide pulley 221 of the belts 218. In this way the belts 218, together with the canvas belt 215, are set at an angle for directing the paper sheets towards one of the side plates 324 of the duplex guides 325.

For applying tension to the shaft 341 to press the pulley 221 downwardly to bring the belts 218 with greater force against the paper sheets, I utilize the knob 343 which is adapted for sliding movement on the square end 346 of a shaft 347, while rotatable with the shaft. A plate 345 is mounted on the main side plate 168 of the machine, and has a pin 348 extending therefrom in a suitable slot of the main side plate 168 so as to prevent rotation of the plate 345. The plate has an internally serrated bore for cooperation with the serrated surface 344 on the shaft 347 whereby to lock the shaft in any particular rotated position when the shaft is in the position of Fig. 24. It will be noted that the shaft 347 has a collar 349, to which is secured one end of a coil spring 350, the other end of which bears on a square block 351 secured to the shaft 341 and slidable in an opening 352 of the main plate 168. If now it is desired to increase the pressure of the belts 218 by downward movement of their pulley 221, viewing Figs. 19 and 24, the knob 343 is pressed to the right in Fig. 24, moving the plate 345 toward the main plate 168 against the pressure of a compression spring 353. This releases the serrated portion 344 of the shaft 347 from the plate 345, so that the shaft 347 may be rotated by the knob 343. When this is done, the tension on the spring 350 may be increased or decreased. When the tension on the spring 350 reaches a desired degree, the knob 343 together with plate 345 are allowed to move to the left under the influence of the coil spring 353, whereby to engage the serrated surface of the plate 345 with the serrated surface of the shaft 347, locking the shaft in its particular adjusted position.

It is now apparent from the description which has been given that the angular alignment of

the canvas feed belt 215 may be readily changed for obtaining proper side register of the sheets of paper, and that the pressure against the sheets of paper moving them towards the cylinder C may also be readily increased through the simple means I have shown and described.

I have found that a variation in the alignment of the canvas belt 215 is relatively difficult to obtain where the belt is of more than a particular width. On the other hand, I have found that a shifting of the small circular belts 218 is easily obtained through the means just described. In a modification of my invention illustrated in Fig. 39, I substitute for the belt 215 a pair of leather belts 215*a* mounted in exactly the same relation to the machine that the single canvas belt 215 is mounted. The driving pulley for the canvas belt 214 requires modification, and is designated in Fig. 39 by the reference numeral 214*b*, and is shown formed with suitable grooves 214*c* for the belts 215*a*. The pulley 217 has been modified, and is now designated by reference numeral 217*a* in Fig. 39, and is formed with grooves 217*b* for cooperation with the belts. Similarly, the idler pulley 216 has been modified, and is designated by reference numeral 216*a*, and is equipped with grooves 216*b* for the belts 215*a*, all as will be quite apparent.

I have devised a further modification for utilization in connection with the belt 215, which is best illustrated in Figs. 36, 37 and 38. In those figures, it will be noted that I do not utilize the small circular belts 218, although I do retain the driving pulley 219 and the forward and upper idler pulley 223 on which belts 218 are mounted. About the pulleys 219 and 223 I mount a pair of small, round leather belts 355, on which are secured metal frictional elements 356 for moving the sheets of paper in the direction of the arrow 257 from the printing cylinder, all as will be hereinafter described.

For applying pressure to the sheets of paper moving downwardly towards the cylinder on the flat and relatively wide canvas belt 215, I utilize instead of the belts 218 of the first form of invention described, a caster roller 358 pivotally supported on a bracket 359 pivoted at 360*a* to a plate 360 fixed to a cross shaft 360*b* supported by the main side plates 168 of the machine. A guide plate 359*a* extends from the bracket 359 on which the roller is mounted, and assists in guiding the paper sheets toward the roller 358. A spring 361 is secured to an ear on the bracket 359, and tends to maintain the roller against the belt 215, and against the paper sheets moving on the belt. The tension on the spring 361 is adjustable by a thumb turn 362 mounted on plate 360 in a manner which is quite apparent. In this way, the pressure on the paper sheets relatively to the feed belt may be increased or decreased, thereby varying the force with which the paper sheets are fed towards the impression cylinder.

In the modifications illustrated in Figs. 36–38, side register is obtained without lateral shifting of the canvas belt 215 through means of a spring pressed finger 363, which is pivoted through its portion 364 relatively to a shaft 366 mounted in ears 365 extending from the side plate 324 of one of the duplex guides 325. The shaft 366 has fixed thereon a knurled thumb piece 367 which is ratcheted at 368 for cooperation with a small plate 369 also extending from the side plate 324. A spring 370 is secured at one end to a collar 371 on the shaft 366, and at its other end bears against the arm of the finger 363, so as to move the finger into the position of Fig. 38. It is obvious that by moving the shaft 366 upwardly from its position of Fig. 37, its ratcheted portion 368 is released relatively to the plate 369 and the shaft may be rotated to increase or decrease the tension in the spring 370, after which the shaft may be moved vertically downwardly to lock it in adjusted position. In this way, tension on the spring 370 may be readily adjusted and side register pressure on the finger 363 increased or decreased, all as will be quite apparent.

Fig. 37 is an interesting view in that it shows more clearly than the remaining views the relationship between the rotating shafts 331, the bevel gears 332 and 334, and the threaded collars 330, whereby side adjustment of the duplex guides 325 may be obtained. Fig. 37 shows also the horizontally extending upper supports 329 of the duplex guides, and the lower supporting flanges 328 on which the paper moves toward the cylinder. In Fig. 37, there is also rather well shown the extreme forward idler pulley 216 on which the canvas belt 215 is mounted, together with a base plate 372 formed integral with the main side plates 168 of the machine and relatively to which the duplex guides move. Suitable openings in this base plate 372 are bridged by longitudinally extending rods 373 supported by the base plate 372.

It will now be recalled, especially with reference to Fig. 21, that during part of the printing stroke of the machine, and the printing rotation of the impression cylinder C, the sheet of paper S is released from the grippers and is moved toward the belts 218 which will carry it to the delivery rack or receiving rack 286. I shall now describe the means whereby the paper is fed towards the belts 218 after being released by the gripper plates 126.

Referring now to Figs. 6*a*, 16 and 17, it will be noted that the forward end of each duplex guide 325 has secured thereto a box-like structure 375 in which lie a pair of anti-friction balls 376, the lower one of which is adapted to protrude from the box to bear on the resilient surface of the roller 224. It will be remembered that the roller 224 is integral with the pulley 223, and is rotated with the pulley by the belts 218. It will therefore be appreciated that should a sheet of paper enter between the lowermost ball 376 and the surface of the roller 224, it will be fed rearward and toward the upper flanges 329 of the duplex guides. Naturally, when deposited on those duplex guides, it will be available for actuation by the belt 218 for movement toward the delivery rack 283.

Each of the boxes 375 has a transverse pin 377 extending thereacross, and mounted on this pin for pivotal movement is a substantially right angular lever 378 having a horizontally extending arm 379 which terminates at 380. Near the terminal point 380 of the arm 379, there is secured the bracket 381 of a caster roller 382. Springs 383 are secured at 384 to the arm 379 and at 385 to the box 375, rotating the lever 378 about pin 377 so that in the position of the parts in Fig. 16, the caster roller 382 will be maintained against the periphery of the impression cylinder C and against a sheet of paper which may be lying on the cylinder. The same is true, of course, in the position of the parts in Fig. 21 wherein the grippers have released the paper, but where the pressure between the rollers 382 and the cylinder C serves to feed the paper rearwardly, as has already been indicated.

As can best be seen from Figs. 16 and 17, the shaft 223a on which the pulley 223 and the rollers 224 are secured, supports for free rotation at each end thereof a sleeve 386, and to each sleeve is integrally secured an arm 387, on the end of which is mounted a caster roller 388 in a manner similar to that in which the caster roller 382 is mounted on the end 380 of the arm 379 of lever 378. The movement of each arm 387 in a clockwise direction relatively to the shaft 223a is limited by a pin 389. A rod 390 is secured at its ends to each of the opposite arms 387, and rests against the arms 379 under small brackets 391 secured to the arms 379. The relationship of the rod 390 to the brackets 391 is such, that when the arms 387 are raised, through the raising of the rollers 388, shaft 390 will encounter the brackets 391 to raise the arms 379, and thereby move rollers 382 from contact with the sheet of paper and the cylinder. This movement actually takes place when the cylinder C and its actuator 144 move vertically upwardly at the end of the printing stroke. At that time, the rollers 388, which ride on the outer flange of the cylinder C, as best seen in Figs. 17 and 18, move upwardly with the cylinder, thereby withdrawing the rollers 382 from driving relation to the sheet of paper.

It will now be understood that when a sheet of paper is released by its grippers, as in Fig. 21, the rollers 382 will still remain in contact with the sheet so that the rotation of the cylinder will continue to move the sheet towards the rear of the machine, and towards the delivery rack. The sheet is so moved over the guide support 199 until it enters between the bottom anti-friction balls 376 and the rollers 224, whereupon it is fed by the rollers and the balls to the upper guide flanges 329 of the duplex guides 325. At the end of the printing stroke, the cylinder C moves upwardly, contacting the rollers 388, as best shown in Fig. 20, whereby to remove the rollers 382 from contact with the sheet so that the sheet may be moved entirely by the belts 218 with which it is in contact at the time. The belts 218 are driven at a faster speed than the sheets are moved by the cylinder, so that the sheets are rapidly withdrawn from the cylinder, all as will be well appreciated by those skilled in this art.

I shall now describe the means whereby the sheets of paper are separated as they are fed from the feed rack by the belt 227 toward the canvas belt 215 for movement to the impression cylinder. As is probably best seen from Figs. 8 and 9, the sheets of paper first encounter the curved end 395 of what I have heretofore termed the feed plate 256. If more than one sheet of paper encounters the curved surface 395, it is the function of the curved surface to fan the sheets relatively to one another so that the topmost sheet will be extended upward further than the remaining sheets, all as is probably best illustrated in Fig. 9a. Actually, the position the sheets assume on the feed rack is helpful also in effecting a separation of the sheets, since gravity will assist in holding the lower sheets back of the first sheet being fed by belt 227.

In my earlier application, Serial No. 164,726, I show a rubber separator roller with which I apply tension to the lowermost sheets of several sheets being fed forward by the feed belt so that only the upper sheet will be moved by the feed belt. I have found that by the utilization of the curved surface 395 of the feed plate 256, and a caliper gap separator, which I shall hereinafter describe, it is generally not necessary to use the rubber separator of my earlier application. However, I show that separator in the several drawings of this application in that position in which it would be utilized by me, if required for particular types of paper.

Thus, referring to Figs. 8, 9, 11, 14 and 15, it will be noted that secured to the under side of the feed plate 256 is a plate 396, to which is pivoted at 397 a plate 398. The plate 398 is cut away to form bifurcated end portions 399 supporting a shaft 400 on which is mounted the roller 401, to which is secured as by cementing, a semi-circular rubber or other friction element 402 which is the actual separator element. A spring 403 passes at one end into a slot 404 of the roller 401, and at its other end is secured within a slot 405 of one end of the shaft 400. It is obvious, therefore, that the spring 403 urges the roller 401 and its friction separator element 402 in a counterclockwise direction in Figs. 8 and 14, which is the equivalent of rotation in a clockwise direction in Fig. 15. This rotation is limited by a finger extension 401a of the roller 401 making contact against bearing 399 (Figs. 11 and 15). It may be well at this point to indicate that when the separator 402 is utilized, the feed plate 256 is cut away to make room therefor, as best shown in Figs. 10 and 11.

I come now to the description of the caliper gap separator which prevents the movement by the belt of more than one sheet at a time upwardly on the feed plate 256. As seen in Fig. 10, there is secured to the feed plate 256 at each side thereof a bracket 406, as through screws 407. A shaft 408 having reduced ends 409 eccentrically located relatively to the axis of the shaft 408 is mounted through said ends 409 in bearings 410 of the brackets 406. A pair of spaced disks 411 are formed on the shaft 408, and are adapted to move into juxtaposed relation to the feed plate 256, being located just over relatively narrow openings 412 in the said feed plate 256. The upper caliper edge 413 defining each of the openings 412, illustrated in Fig. 14, cooperates with the disks 411 to determine the caliper gap through which but a single sheet of paper, designated by the reference letter S^1, may pass, while a second sheet S^2 is obviously incapable of passing. For determining the space between the disk 411 and the caliper edge 413 of each opening 412, the eccentrically mounted shaft 408 has secured thereto one end of a spring 414, the other end 415 of which bears against the feed plate 256 whereby to rotate the shaft 408 to bring the disks 411 against the plate 256 to decrease the width of the gap. Fixed to the shaft 408 is a bracket 416, which is screw threaded for a threaded stud 417 which bears against the feed plate 256. By rotating the stud 417, the rotation of the shaft 408 by the spring 415 may be limited to an extent which, through the eccentricity of the shaft ends 409, will vary the distance between the disks 411 and the caliper edges 413 in accordance with the thickness of the sheets of paper to be fed.

I appreciate that caliper gaps are old and well known in the art, but all such gaps operate under the principle that if more than a single sheet is jammed between the parts thereof, there will be no paper fed to the machine and the machine will, of course, stop. The caliper gap separator of my invention, as its name implies, not only prevents the movement of more than a single sheet through the caliper gap, but also separates the lower sheets from the upper sheets, as I shall now indicate. Thus, a small bracket member 418 ex-

tends from the plate 256, as best seen in Fig. 14, and has mounted thereon two springs 419 about small pin shafts 419a, with each spring maintaining upwardly a rounded lug 420 of substantially the same width as the openings 412 of the feed plate 256. The construction of the rounded lug 420 is such that its upper edge 420a lies substantially in alignment with the caliper edge 413 of the opening 412. Of course, there is a lug 420 for each opening 412. In Fig. 12, a single sheet S^1 is shown being fed through the caliper gap, and between the feed plate 256, the caliper edge 413, and the disks 411. Should more than one sheet be guided toward the caliper gap, as shown in Figs. 13 and 14, it will be noted that the lowermost sheet will press downwardly the rounded lugs 420, at those points where the two sheets contact the disks 411 and overlie the openings 412 of the feed plate 256. This means, of course, that the lower sheet, designated by reference letter S^2, will be held by the caliper edge 413 against movement, while the upper sheet S^1 will be fed forwardly by the belt 227. In addition, where the friction separator member 402 is utilized, it will exert further separating influence, moving the lower sheet S^2 downwardly. I have found in actual operation, without employing the separator 402, I can separate a considerable number of sheets, as many as five or six, through utilization of the caliper gap separator which I have now described, whereby but one sheet at a time will be fed upwardly on the feed plate by the belt 227.

As I have hereinbefore indicated, where no sheet of paper is present for feeding by the grippers of the cylinder between the cylinder and the bed, certain side latches 174 on the bed, best indicated in Figs. 19 and 22, will move the cylinder upwardly and out of the printing plane, through cooperation with the cylinder positioning cams 170. I should now like to describe those means whereby the latches are moved relatively to the bed of the machine for actuating the cylinder positioning cam 170 when no paper is present to be fed by the grippers of the cylinder, or is improperly fed.

For this purpose, I shall refer more particularly to Figs. 16, 19, 22 and 25–31, inclusive. As is probably best seen in Figs. 16 and 19, taken in connection with Fig. 22, guides 421 are formed on each of the upper main side plates 168 of the machine, and slidable vertically on these guides are cam slides 422, each of which has a horizontal flange 423, upstanding from which is a pin 424 cooperable, as will hereinafter be set forth, with a cam slot 425 on the side latches 174. It may be well at this point to indicate that a pin 426 extends from each of the side plates 168 into suitable guide slots in the cam slides 422 for further guiding those cam slides, as is probably best shown in Fig. 22. Since the cam slides on both sides of the machine are the same in construction and operation, only one will be described hereinafter.

A block 427 is secured on one cam slide 422, and cooperating with this block is a control slide 428 suitably guided as by pins 429 relatively to the upper side plate 168 of the machine. A detent lever 430 is pivoted at 431 on the upper side main plates 168 for cooperation with a notch 432 in the control slide 428 under certain conditions. A spring 433 is secured at its opposite ends to the control slide 428 and the detent 430, as is probably best indicated in Figs. 26, 27 and 29, whereby to urge the detent 430 in a clockwise direction relatively to its pivot at 431. Spring means tending to position the control slide 428 relatively to the cam slide 422, will be hereinafter set forth.

A feeler shaft 435 is supported by the upper side main plates 168 for rotation relatively thereto, and has secured at each end thereof a cam 436, each cooperable with an upper flange 437 on the cam slides 422 and a lower flange 438 on the cam slides, whereby rotation of the shaft 435 will, through the cams 436, position the cam slides 422, all as will be readily appreciated from Figs. 25a, 26a, and 27a. The shaft 435 carries at its outer end a disk 439 having a hub 440, and secured to the hub is one end of a spring 441, the other end of which is suitably secured to the upper main side plate 168 by a clip 442 having an end portion 443 insertible through an opening 444 in the plate 168, as shown in Figs. 31 and 32. Through the means indicated, it is readily appreciated that the spring may be readily secured in place without the addition of any complicated means. It is a feature of the disk 439 that it is utilized not only as a mounting for the spring 441, but to operate a counting mechanism through a lever 446 secured to the shaft 448 of a suitable commercial type of counter 445 through a coupling 449.

Incidentally, in Fig. 32, it is noted that at 450 on the main frame there is secured a screw, relatively to which there is secured one end of a coil spring 451, the other end of which is secured to the head 452 of one of the studs 429 extending from the control slide 428. The spring 451 assists the spring 433 heretofore described in moving the control slide 428 to the right in Figs. 22, 29, and 32.

Secured centrally of the feeler shaft 435 there is a spool 453 having flanges 454 between which extends a shaft 455 (Fig. 31) on which is mounted a bracket 456 terminating in a support 457 for a feeler 458. Feeler 458, which is fixed to the bracket 456, is preferably cylindrical in shape, as shown in such figures as 22 and 26, and is made of some material such as rubber. A spring 459 operates between the bracket 456 and the body of the spool 453, maintaining the bracket pressed in a clockwise direction on the shaft 455 when the parts are positioned as in Figs. 25 and 26. An end portion 460 of the bracket 456 limits its clockwise rotation so that the normal relationship of the feeler 458 and its bracket 456 to the body of the spool 453 is that illustrated in Figs. 22 and 26. Before describing further the operation of the feeler 458, it will be well to indicate that when it is in contact with a sheet of paper, such as the sheet S in Fig. 26, it operates against a friction roll 461 carried on the shaft 462 mounted in brackets carried on the under side of a support plate 464 (Fig. 31) down which the sheets are fed after leaving the flat canvas belt 215.

It will be appreciated now that in the position of the parts in Figs. 19, 22, 25 and 25a, the spring 441 tends to rotate the feeler shaft 435 in the counter clockwise direction of the arrow 465, which rotation would bring the feeler 458 into the position of Fig. 26, where it would contact the sheet of paper. This movement is prevented, however, by the control slide 428 which is imposed over the block 427 on the cam slide 422, whereby to prevent upward movement of the cam slide 422. Such upward movement of the cam slide 422 is absolutely essential in order to allow rotation of the shaft 435, since the upper flange 437 of the cam slide 422, through contact with the cam 436 on the shaft 435, prevents

rotation of that shaft from the position of Fig. 25*a* to Fig. 26*a*.

It will, of course, be remembered that in the position of the parts indicated, a sheet of paper has been fed towards the open grippers of the impression cylinder C, and that but a slight movement to the left of the bed in Figs. 19 and 22, will cause the positioning cam 170 to lower the cylinder into the printing position and effect a closing of the grippers. This movement of the cylinder into the printing plane by the cams 170, through the rollers 172 on the bed B, will effect the movement of the two control slides 428 to the left from the positions of Figs. 19, 22 and 25, since the slides will be struck by the cams 170 in their clockwise rotation. As soon as the control slides 428 move to the left, they are locked in the particular position by the detent levers 430 pivoted at 431 to the main frame. Since the movement of the slides 428 to the left in Fig. 19 withdraws their end portions 428*a* from over the blocks 427 on the cam slides 422, as is best illustrated in Fig. 26, the cam slides 422 will be released for upward movement. This upward movement is imparted to the cam slides 422 by the cams 436, as illustrated in Figs. 26 and 26*a*, such movement allowing the rotation of the shaft 435 into the position of Figs. 26 and 26*a*, and a movement of the feeler 458 directly against the roller 461, with the paper sheet between the feeler 458 and the roller 461. Further rotation of the feeler shaft 435 will be impossible because the feeler 458 and its bracket 456 are now in dead center relation to the body of the spool 453. Therefore, the parts are halted in the particular position.

It will be noted that in this position of the cam slides 422, the pins 424 thereof are positioned in the cam slots 425 of the side latches 174. Unless the cam slides 422 are moved downwardly so as to move the pins 424 out of the position of Fig. 26, further movement of the bed B with the side latches 174 will cause the pin 424 to cooperate with the cam slots 425 of the side latches, urging them outwardly into the position of Figs. 29 and 30 for actuating the cams 170 to move the cylinder out of the printing plane, to stop the machine, as well as to ring the bell. This is exactly what happens if there is no sheet of paper between the feeler 458 and roller 461, as shown in Fig. 29, or if there is a sheet of paper and it is not properly fed forward from the position of Fig. 26. If, with the parts in the position of Fig. 26, the paper is actually properly gripped and pulled, it will first break the toggle or dead center relationship between the bracket 456 of the feeler 458 and the body 453 of the spool, all as illustrated in Fig. 27, whereupon the spring 441 will rotate the shaft 435 further in a clockwise direction. This rotation of the shaft 435 will cause a rotation of the cams 436 so as to bring the cam slides 422 into their position of Figs. 27, 27*a*, and 28. It will be noted that the pin 424 of each cam slide is now out of the cam slot 425 in the side latch 174 so that as the side latches move together with the bed, the rollers 180 pass to one side of the ends of the cylinder positioning cam 170, whereby not to actuate the same. The cylinder then remains in the printing plane.

It will now be readily appreciated that it is necessary to reestablish the feeler parts and the cam slides 422 in their relationship of Fig. 25, so that the feeler 458 may be moved into a position wherein it is adapted to contact the next sheet of paper to be fed to the impression cylinder.

With the parts in the position of Figs. 27 and 27*a*, and the bed moving towards the right, a cam strap 466 secured to a bracket 24*a* extending from the under side of the bed (Fig. 22), contacts a roller 468 extending from a lever 469 secured to a shaft 470 suitably pivoted on the right hand side of the machine. A lever 471 extends from the shaft 470 and is bifurcated to form a pair of arms 472 between which extends a pin 473. A sheet metal strip 474 is slotted as at 475 for mounting about the pin 473. A pin 476 (Fig. 19) is secured to the sheet metal strip 474, and operating against this pin is a small plate 477. A spring 478 lies between the bifurcated arms 472 of the lever 471 and the plate 477, so that clockwise rotation of the shaft 470 and upward movement of the lever 471 will effect a compression of the spring 475 and an upward movement of the plate 477, the pin 476, and the sheet metal strip 474 under the influence of the said spring 475. This upward movement of the sheet metal strip 474, as best illustrated in Fig. 31, will rotate the lever 479 mounted about the reduced end portion 480 of the feeler shaft 435. It will in this rotation contact the abutment 481 secured at 482 to the shaft 435, whereby to rotate the shaft from its position of Fig. 27 to its position of Figs. 19, 22, 25 and 25*a*.

Reviewing the operation of the parts thus described, it will be remembered that as the bed moves to the right to complete its printing stroke, the cam strip 466 carried on the under side thereof will contact the roller 468 of the lever 469, rotating the shaft 470 and the arm 471 thereon to compress the spring 475, and thereby operate the strip 474. The strip 474 through its pivotal relationship to the lever 479 mounted about the reduced end 480 of the shaft 435 will operate the abutment 481 of the feeler shaft to bring the feeler shaft and its several associated parts to the position indicated.

Rotation of the feeler shaft from the position of Fig. 27 to the position of Fig. 25 as just reviewed, will first move the cam slide 422 upwardly to the position of Figs. 26 and 26*a*, and then downwardly to the position of Figs. 25 and 25*a*. As soon as the cam slide 422 moves upwardly from its position of Fig. 27 towards its position of Figs. 26 and 26*a*, a cam lug 483 on the end of the bed strikes the detent lever 430 whereby to move it out of the position of Fig. 27, and therefore out of the notch 432 in the control slide 428 so as to allow the control slide 428 to move to the right to the position of Figs. 22 and 25. It will so move as soon as the cam slide 422 moves downwardly once again to the position of Figs. 25 and 25*a*, whereby to lock the cam slide and feeler shaft in that position, until the impression cylinder is once again moved into the printing plane through its positioning cams 170. This brings us back to the beginning of the feeler cycle and to the point where the feeler is to move against a sheet of paper as in Fig. 26, which it does as the control slide 428 moves to the left once again from Fig. 22, and is locked in its said left position by the detent 430 as in Fig. 26.

At this point, it may be well to indicate certain features of the machine which have not as yet been discussed, and which are of considerable importance. Thus, referring first to Fig. 22, it will be noted that the rear end of the bed is equipped with a bracket 485 having a flange 486

which is adapted to cooperate with the chase of the machine, best shown in end view in Fig. 18 where it is designated by the reference numeral 487, and in which the type held therein is indicated by reference numeral 488.

It will readily be appreciated that the chase 487 is moved endwise on the bed B until its rear end portion lies under the flange 486 of the bracket 485, as is probably best shown in Fig. 8. For holding assembled to the bed the front end of the chase, I use a hook 489 secured to a pin 490 rotatable on the bed. A suitable spring 491 (Fig. 19) is secured at one end to the shaft 490, and at the other end to the bed so as to maintain the hook 489 normally spring pressed in a counterclockwise direction looking at Fig. 18, and against the stop pin 492. The front end of the chase has a pin 493 which is adapted to ride under the hook 489 for securing the front end of the chase to the bed, all as will be readily appreciated.

Referring back again to Fig. 8, it will be noted that there is a spring guide member 494 for guiding the sheets of paper as they fall on the receiving rack 283. These spring members may be secured in any desired location, and may conceivably form part of the duplex guides. Incidentally, it will be well to emphasize at this time that because the boxes 375 are movable with the duplex guides, and because the arms 379 on which are mounted the rollers 382, are also movable with the duplex guides, it is very simple to effect adjustment of the rollers 382 and the boxes 375 relatively to the paper as the width of the paper moving from the machine varies.

For guiding the rear end of the paper sheets as they leave the printing surface, and for protecting them from the inking rolls, I use an arcuate barrier plate 495 (Fig. 16) which is secured at one end at 496 to a shaft 497 carried by small removable brackets 498 mounted on the upper main side plates 168 of the machine. The lower end of the barrier plate 495 is equipped with hook portions 499 adapted to slip over a small rod 500 extending between the side plates 168, all as will be readily appreciated from Fig. 16. The brackets 498 are readily removable by rotating the thumb screws 501, which are best shown in Fig. 17.

The inking roller assembly per se does not form a part of the invention intended to be covered in this application. However, the driving connection between the inking rollers and the actuator 144 of the impression cylinder is of extreme importance, it being a feature of my invention that the inking rollers are rotated by the actuator 144 through the gear teeth 145 of that actuator. The inking assembly itself comprises a pair of main plates 502 (Figs. 2 and 16) each notched as at 503 whereby to be slipped over fixed pins 504 extending from the upper main side plates 168 of the machine. In this way, the entire inking assembly may be moved into place relatively to the printing machine by the mere application of the notched portions 503 to the fixed pins 504. Extending between the main side plates 502 of the machine there is an upper cross plate 505, best illustrated in Fig. 17, and pivoted to this upper cross plate 505 about a sleeve 506 is a latch handle 507 connected through wires 508 with right and left hand spring bolts 509 which extend through openings 510 in the upper main side plates 168, being spring pressed toward the said openings by springs 511. It will now be readily appreciated that by simple rotation of the latch handle 507, the bolts 509 are readily retracted so as to permit the removal of the entire inking assembly from the machine.

Juxtaposed, and inwardly of the main plates 502 of the inking assembly, there are mounted for vertical movement, inner plates 511, controlled for said vertical movement by a handle 512 through a suitable threaded shaft 513, it being the function of the side plates 511 to move the various inking rollers of my assembly so as to separate them from one another, all as is clearly shown and described in my application Serial No. 164,726, filed September 20, 1937. The threaded shaft 513 is within the sleeve 506 on which latch handle 507 is rotatably mounted. Instead of mounting the various inking rollers for vertical sliding movement relatively to the main side plates 502 as in my said application, they are mounted for movement in arcuate paths, as determined by slots 514 and 515, best illustrated in Fig. 2, and in which slots the bearing lugs 516 on the ends of the shafts 517, 517a, and 517b of the inking, driving and spreading rollers are mounted. The purpose of this arrangement is to maintain in driving relationship the teeth 145 formed on the outer periphery of the actuator 144, certain gear connected with the rollers, so that the actuator 144 may drive the inking rollers.

Referring now more especially to Figs. 16 and 40, it will be noted that I employ steel driving and spreading rollers 518 mounted for rotation about the shafts 517a, these shafts 517a being mounted similarly for sliding relatively to the arcuate grooves 514 in the main plates 502. At one side of the assembly there is a gear plate 519 traversed by each of the shafts 517a and slidable with those shafts relatively to the main plates 502 and somewhat inwardly of the inner plates 511 (Fig. 40). The gear plate 519 is slotted as at 520 so that it may slide vertically relatively to the spreading roller shaft 517b, this relationship being utilized so that the gear plate 519 may be properly supported and yet not interfere with the vertical sliding movement of the particular shaft 517b. Mounted on the gear plate 519 through a suitable sleeve 521 flanged at 521a, and for rotation relatively to the gear plate, gears 522 and 523. The sleeve 521 is of sufficient diameter to allow vertical sliding of the shaft 517b of the other of the spreading rollers relatively thereto. An intermediary gear 524 is secured on the gear plate 519, and is in driven relation to the gear 523, while itself in driving relation to gears 525 secured to the shafts 517a for rotation integrally with those shafts. The gear 522 is of course in driven relationship with the teeth 145 of the actuator 144, as best shown in Fig. 40. A plate 519a similar to plate 519 is secured to the right hand ends of the shafts 527 and is mounted for movement together with those shafts. Naturally, plate 519a does not carry gears as does plate 519.

It will now be appreciated that as the actuator 144 is rotated, its teeth 145 will rotate the gear 522, which in turn will effect the rotation of the gear 523, which through the intermediate gear 524, drives the gears 525, and therefore the drive steel rollers 518. These steel rollers, as is definitely seen from Fig. 16, are in physical contact with the upper spreading rollers and the lower form rollers for actuating those rollers in a manner which is apparent to those skilled in the art.

As will be noted also from Fig. 16, I employ an idler oscillator roller 526, the construction of which forms no part of this invention, it being shown merely to illustrate the relationship of the various parts. It will be appreciated also from

viewing the several figures, that the lower inking rolls have flanges 527 which are adapted to ride on cam surfaces of the chase assembly, so that the inking rollers may be elevated relatively to the chase assembly in certain positions thereof, whereby to allow for the use of mimeograph or ribbon inking portions, if desired.

I have shown also in Fig. 16 my ink fountain F, which does not form a part of this invention, it being thought well, however, to incorporate it herein so that its relationship to the remainder of the inking assembly may be made clear. As shown, a series of three vertical rollers, designated together by the reference numeral 528, are vertically movable to operate the feed for the fountain F in a manner which will be set forth in a separate application.

From the description of the inking assembly which has been given, it will now be appreciated that that assembly is mounted on a pair of main side plates, whereby to be readily secured in proper operating position on the upper main side plates 168 of the machine. It will further be understood that the inking rollers are adapted for free up and down movement through contact with the chase of the bed B during the printing operation for the several purposes indicated, and that the rollers are also movable freely upwardly and downwardly, as is required in order to separate them when no printing is being done, all for purposes which are understood by those skilled in the art. It has also been made clear that the actuator drives the inking rollers through suitable gearing, and that this gearing permits the upward and downward movement of the rollers, since this upward and downward movement is guided by certain arcuate guides so as not to interfere with the gear connection between the actuator and the gear drive for the inking rolls.

Referring now back to Fig. 1, I show there upper cover plates 529 and 530 which are used to cover the mechanism of my machine, while not interfering with its operation. Fig. 1 is useful for noting the position of the speed adjusting knob 85, clutch knob 74b, manual feed crank 66, and the inking assembly handle 512.

Having now described the various parts of my invention in rather considerable detail, I believe it will be helpful to a fuller appreciation thereof, if I describe one complete operation of the machine, including the feeding of the paper, its acceptance by the grippers of the cylinder, its movement through the printing operation, and its feeding back to the delivery rack.

Referring first to Fig. 2, it will be remembered that the power mechanism comprises the motor 33, which through the belt 37 and suitable gearing operates the lever 45, reciprocating that lever on its pivot shaft at 44 so as to move the bed B back and forth on its bed mounting and relatively to the rails 12a and 12b. This reciprocating movement of the bed, through operation of the plunger 296 best illustrated in Fig. 8, actuates the pawl 294 which, through the intermediary of the ratchet 293 and suitable gearing, rotates the screw shaft 263. This screw shaft 263, through its contact with the block 266 (Fig. 2) of the feed rack, moves the feed rack and its plate 276 upwardly so as to bring the paper thereon into proper operating relationship to the feed belt 227. The paper feed belt 227 is driven through suitable chains and sprockets from the power assembly shown in Fig. 2, and the end thereof which overlies the paper, as best shown in Figs. 8 and 9, is mounted on a bracket 239, which is best shown in Fig. 10, and which is counterbalanced by a suitable spring 249. It is the function of this counterbalancing mechanism of the bracket to maintain the belt in proper operating contact with the paper. It is also the function of the bracket 239 and the spring 249 to counterbalance the arm 254, best shown in Fig. 8, which through a further arm 308 and a lug 310 coacting with the lug 311 on the plunger 296, controls the paper feed so that when the level of the paper reaches a certain plane, there will be no further feeding of the paper feed rack. To adjust the feed rack manually, resort may be had to the hand crank 292 for rotating the shaft 292a for rotating the shaft 292, as is apparent.

The operation of the paper feed belt 227 is adapted to move the paper over the skirt 395 of the feed plate 256, so that the various sheets may be fanned out, as shown in Fig. 9a. The friction roller 401, best shown in Figs. 14 and 15, may or may not cooperate with the sheets so as to retract the lower sheets so that only the upper sheet will be submitted to a caliper gap separator, whose operation is best shown in Figs. 12, 13 and 14. As was explained earlier, the caliper gap separator functions to guide the paper between the disks 411 and caliper edges 413, it being understood that only one sheet of paper may pass between the caliper edges 413 and the disks 411. If there is more than one sheet, as best shown in Fig. 14, the lower sheet will depress the lugs 420 which assist in guiding the paper towards the caliper edge 413. In this way, the caliper gap serves not only to prevent the passage of more than one sheet therethrough, but acts to separate the sheets, all as has already been set forth.

When the paper sheet passes the caliper gap, it is fed by the belt 215 in the particular modification illustrated in Figs. 36–38, inclusive, with side register being exerted thereon by the finger 363, and with the feed pressure regulated by the roller 358, it being understood that while the paper is being fed down the incline belt 215 and against the register lugs 131, the cylinder C is stationary, and the grippers are open so that the paper sheets have ready access to the said register lugs. The paper is thus being fed downwardly to the cylinder as the bed B is on its feed stroke, it being remembered that during the feed stroke, the cylinder is in its upper position and out of the printing plane, and that in this upper position the cam 143a cooperates with the roller 143 associated with the grippers to maintain the grippers open. When the bed B reaches the end of its feed stroke, its rollers 172, best shown in Fig. 22, contact the positioning cams 170 to move the cylinder downwardly into the printing plane, whereupon the grippers are released from control of cam 143a so that the springs 125 may move them to grip the paper. Simultaneously, the plunger 98 carried by the clutch plate 96 is released from cam surface 201 to move into clutching engagement with the cylinder clutch block 94, as shown in Fig. 16, so that upon the beginning of the printing stroke of the bed, the cylinder is rotated and the grippers carry the sheet thereabout until they are released.

Just prior to the movement of the positioning cams into the position of Fig. 16 from their position in Fig. 22, the feeler 458 is in its position of Fig. 25, being maintained in that position and against rotation by spring 441 with the feeler shaft 435, through the locking of the cam slides 422 by the control slides 428. As the positioning cams 170 are moved to the position of Fig. 16, they

act to move the control slides 428 to release the cam slides 422, whereupon the feeler shaft 435 rotates with its cams 436 to the position of Fig. 26a, with the cam slides 422 moving into the position of Fig. 26, with the pins 424 thereon in the cam slots 425 of the side latches 174.

A pull on the paper sheet thereafter by the grippers incidental to the rotation of the cylinder will break the toggle between the feeler 458 and the feeler shaft 435, so that the feeler shaft may rotate to the position of Fig. 27, effecting the movement of the cam slides 422 to the position of Figs. 27 and 27a. In this position of the parts, the control pins 424 do not interfere with the side latches 174, and the side latches move as in Fig. 28 with the bed, so that the rollers 180 escape the bottoms of the cams 170, leaving the cylinder in the printing plane.

The printing operation takes place due to the continued movement of the bed, and the grippers carry the paper until they reach the position of Fig. 21, where they release the paper, and the strippers 133 force the paper sheet upwardly so that it will gradually move over the support 199. While this is going on, the rollers 382 are in contact with the paper, and through contact with the paper and cylinder, act to feed the paper rearwardly of the machine through the continued rotation of the cylinder. When the cylinder completes its printing movement, the positioning cams 170 are contacted by the rollers 173 to move the cylinder upwardly and out of the printing plane. This movement opens the grippers so that they are ready to receive a second sheet of paper. At the same time, the clutch plunger 98 is moved out of clutch position due to the contact of its roller 102 with the cam surface 201, and the cylinder is locked against rotation by positioning plunger 191. Should the cylinder fail to reach the end of its 360° rotation because of too early a withdrawal of plunger 98, the lug 100a on the bed B will contact the edge 100b of the opening 100c in the cylinder to complete its rotation. The cams 483 at the rear end of the bed, as best shown in Fig. 22, contact the pivoted detent levers 430 to release the control slides 428, which have heretofore been locked in their position of Fig. 29, so that the control slides move back to the position of Fig. 22. This does not, however, take place until the cam strip 466 carried on block 467 on the under side of the bed actuates the roller 468 for restoring the feeler shaft 435 to its position of Fig. 22, whereupon the control slides 428 in their movement to the right to the position of Fig. 22, coact with the blocks 467 for holding them and the cam slides 422 in the position of Fig. 22, in which position they are capable of maintaining the feeler shaft 435 and the feeler 458 ready for movement against a second sheet of paper when the positioning cams 170 are once more rotated from the position of Fig. 22 to the position of Fig. 16 incidental to the moving of the cylinder back into the printing plane.

If, in the position of the feeler in Fig. 26, there is no paper present, as shown in Fig. 29, it is obvious that the toggle between the feeler 458 and the feeler shaft 435 will not be broken, and that the feeler will remain in its position of Fig. 29. If this is the case, the pins 424 on the cam slides 422 will remain within the cam slots 425 of the side latches 174 so that the side latches will be caused to move to the position of Fig. 30 as the bed continues its movement. The rollers 180, in such an event, will contact the lower ends of the positioning cams 170 moving the positioning cams to raise the printing cylinder out of the printing plane. At the same time, a switch 187 will be moved to shut off the flow of electricity to the power unit, while the bell 190 will be rung to warn the operator.

The cylinder is driven through the operation of the cable wound thereabout, and properly secured to its snubber post 149, and with its ends secured through the clips 158 and the levers 162 relatively to the brackets 164 on the bed so as to allow for a proper alignment of the cable as the bed moves back and forth.

As was indicated previously, the sheets are fed by cooperation of the rollers 382 with the cylinder after they are released by the grippers. When the cylinder is raised to its upper position out of the printing plane, as has been discussed, the rollers 388 carried on the ends of the arms 387 are raised upwardly, thereby raising also the rolls 382 and releasing the paper so that the paper may be fed toward the belts 355 and by those belts to the delivery rack in the modification of Fig. 36. In this movement, they are fed also by the cooperation of the lower ball bearings 376 carried by the boxes 375 secured to what I term duplex guides with the rollers 224, as best shown in Fig. 16. Referring to Fig. 6a, it will be noted that the feed rack and the delivery rack 283, together with the duplex guides and the boxes 375, the arms 378, and the feed rollers 382, are all adapted for movement towards and away from one another by the simple operation of the crank 322. In this way, I can readily adjust the effective width of the guides and other parts for any width of paper which is to be fed thereby.

The inking rolls, as brought out clearly in the specification, are adapted for driving by the gear teeth of the actuator, thereby forming an effective brake for the cylinder drive, thereby contributing a number of important results. Of course, all movement of the cylinder when out of the printing plane is prevented by the positioning plunger 191, this plunger being released from the cylinder as the cylinder moves down into the printing plane.

A further feature of my invention which was emphasized and set forth clearly, was the utilization of the disk 439 rotatable with the feeler shaft 435 for operating the counting mechanism, all as is clearly shown in Figs. 31 and 32. Through this feature, not only is there obtained an efficient operating assembly for the counting mechanism, but it is also seen that the counting mechanism functions only as the feeler mechanism operates, so that a true count is obtained.

A further feature of the invention which has been set forth in considerable detail, is the utilization of means for directing the feed belts at an angle, whereby to exert side pressure on the sheets of paper urging them against one of the side plates 324 of the duplex guides 325 whereby to obtain side register. I do not believe it necessary to review a number of other parts of my machine which I have already described, since I believe their operation is rather clearly set forth.

While I have now described in detail the parts of my machine and have briefly outlined the coaction of the several parts, it should be understood that there are a considerable number of parts which I have not reviewed in too great detail because they will form parts of other applications. Also, while I have shown particular operating combinations and parts adapted for obtaining those combinations, it should be understood that the basic contribution which my ma-

chine makes to the printing art may readily be incorporated in other mechanical embodiments. I therefore do not wish to be limited in the patent monopoly granted me, in order that my monopoly shall extend to equivalent parts which may be conceived by those skilled in the art to utilize my contribution.

I now claim:

1. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counterclockwise as said bed reciprocates, a clutch between said impression cylinder and said actuator whereby during movement of said bed in a printing direction said actuator rotates said impression cylinder while leaving said impression cylinder stationary when said bed moves through its return stroke, a series of inking rollers for such type forms as may be carried by said bed, and means whereby said actuator rotates said rollers for inking said type.

2. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, a rotating actuator mounted coaxially with said impression cylinder and having a gear formed on its outer periphery, means whereby said reciprocating bed rotates said actuator clockwise and counterclockwise as said bed reciprocates, a clutch between said impression cylinder and said actuator whereby during movement of said bed in a printing direction said actuator rotates said impression cylinder while leaving said impression cylinder stationary when said bed moves through its return stroke, a series of inking rollers for such type forms as may be carried by said bed, and at least one gear carried by said inking rollers in mesh with the gear on said actuator whereby said actuator rotates said rollers for inking said type.

3. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, an actuator, means whereby said reciprocating bed rotates said actuator clockwise and counterclockwise as said bed moves through its printing and return strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for vertical movement to bring the impression cylinder into and out of the printing plane, and means whereby said clutch is engaged when said impression cylinder is in the printing plane and is disengaged when the impression cylinder is out of the printing plane.

4. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, an actuator, means whereby said reciprocating bed rotates said actuator clockwise and counterclockwise as said bed moves through its printing and return strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for vertical movement to bring the impression cylinder into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch is engaged when said impression cylinder is in the printing plane and is disengaged when said impression cylinder is out of the printing plane, and means on said bed for moving the positioning means to position said cylinder into and out of the printing plane.

5. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for vertical movement into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch engages when said impression cylinder is in the printing plane and disengages when the impression cylinder is out of the printing plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, whereupon the clutch is disengaged and said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke.

6. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said rotating member and impression cylinder for vertical movement to bring the impression cylinder into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch engages when said impression cylinder is in the printing plane and disengages when the impression cylinder is out of the printing plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, whereupon the clutch is disengaged and said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke, said bed and actuator being so related in their movements that a stroke of said bed is accompanied by a full rotation of said actuator.

7. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for movement into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch engages when said impression cylinder is in the printing plane and disengages when the impression cylin-

der is out of the printing plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, whereupon the clutch is disengaged and said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke, said bed and actuator being so related in their movements that a stroke of said bed is accompanied by a full rotation of said rotating member, paper grippers carried by said cylinder, and means whereby said grippers are held in released position when said cylinder is out of the printing plane and move into paper gripping position when the cylinder is lowered to begin its printing stroke.

8. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for movement into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch engages when said impression cylinder is in the printing plane and disengages when the impression cylinder is out of the printing plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, whereupon the clutch is disengaged and said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, a locater adapted to hold said cylinder against movement when the clutch is disengaged and said cylinder is out of the printing plane, means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke, said bed and actuator being so related in their movements that a stroke of said bed is accompanied by a full rotation of said rotating member, paper grippers carried by said cylinder, and means whereby said grippers are held in release position when said cylinder is out of the printing plane and move into paper gripping position when the cylinder is lowered to begin its printing stroke.

9. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for movement into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, a cam for moving said clutch out of engagement as said cylinder moves out of said printing plane whereupon said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, and means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke.

10. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed reciprocates, a clutch between said impression cylinder and said actuator engaged during movement of said bed in a printing direction and through its printing stroke whereby said actuator rotates said impression cylinder through one complete revolution, means for disengaging the clutch at the end of said printing stroke for allowing a return rotation of said actuator incidental to the return stroke of said bed, and means on said bed engaging with said cylinder near the end of the printing stroke for imparting movement to said cylinder to insure its full movement by said bed.

11. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said impression cylinder for vertical movement to bring the impression cylinder into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch engages when said impression cylinder is in the printing plane and disengages when the impression cylinder is out of the printing plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, whereupon the clutch is disengaged and said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke, said bed and actuator being so related in their movements that a stroke of said bed is accompanied by a full rotation of said actuator, and means on said bed for engaging the cylinder near the end of the printing stroke for insuring the moving of the cylinder to complete its rotation.

12. In a printing machine of the class described, a main frame, a reciprocating bed mounted on said main frame, transversely spaced side plates forming part of said main frame, a cam pivotally supported on each of said side plates, an impression cylinder, a shaft for said cylinder and about the axis of which said cylinder rotates, guide means whereby said shaft is guided for vertical sliding movement relatively to said side plates, cam surfaces formed on said cams and cooperable with portions of said shaft for moving said shaft vertically relatively to said guide means

as said cams are rotated, and means on said reciprocating bed adapted to contact the said cams physically as said bed reciprocates whereby to rotate said cams on their pivots.

13. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, means whereby said impression cylinder is mounted for vertical movement into and out of the plane of the type carried by said reciprocating bed, means actuated at the ends of the printing and return strokes of said bed for moving said cylinder into and out of said plane, and additional means for effecting the movement of said cylinder out of said plane after said bed has begun its printing stroke.

14. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, a cam for moving said impression cylinder into and out of the plane of the type carried by said reciprocating bed, means operating at the ends of the printing and return strokes of said bed for actuating said cam to move said cylinder into and out of said plane, and additional means for actuating said cam to move said cylinder out of said plane after said bed has begun its printing stroke.

15. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, a positioning cam for positioning said cylinder in the plane of type carried by said bed or out of the said plane, means on said bed for moving said cam to move the cylinder out of said plane as said bed completes its printing stroke, means on said bed for moving the positioning cam to move the cylinder into said plane at the completion of the feed stroke of said bed, and additional means carried by said bed for moving the positioning cam to move the cylinder out of said plane just after the beginning of the printing stroke.

16. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, means whereby said impression cylinder is mounted for vertical movement into and out of the plane of the type carried by said reciprocating bed, means actuated at predetermined points of the printing and return strokes of said bed for moving said cylinder into and out of said plane, paper grippers carried by said cylinder, means controlled by the downward movement of said cylinder for moving said grippers into gripping position as said cylinder moves downwardly into the printing plane, and for moving said grippers thereafter to release the paper in a predetermined point of the printing cycle.

17. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, means whereby said impression cylinder is mounted for vertical movement into and out of the plane of the type carried by said reciprocating bed, means actuated at predetermined points of the printing and return strokes of said bed for moving said cylinder into and out of said plane, paper grippers carried by said cylinder, and means controlled by the downward movement of said cylinder for moving said grippers into gripping position as said cylinder moves downwardly into the printing plane.

18. In a printing machine of the class described, a reciprocating bed, an impression cylinder mounted for rotation relatively to said bed, a positioning cam for positioning said cylinder in the plane of type carried by said bed or out of the said plane, means on said bed for moving said cam to move the cylinder out of said plane as said bed completes its printing stroke, means on said bed for moving the positioning cam to move the cylinder into said plane at the completion of the return stroke, paper gripping means carried by said cylinder, means controlled by the downward movement of said cylinder for moving said gripping means into paper gripping position when said cylinder moves downwardly into the printing plane, and means for thereafter moving said grippers to release the paper during rotation of said cylinder.

19. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves in a reverse or feed direction, means for feeding a sheet of paper to said cylinder as said cylinder is stationary, grippers on said cylinder, means actuated by said bed when moving in said feed direction for effecting the movement of said grippers to grip the end of said paper sheet, after which said grippers carry said sheet about said cylinder as said cylinder rotates relatively to said bed, and means actuating said grippers to release the end of said paper sheet thereafter.

20. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves in a reverse or feed direction, means for feeding a sheet of paper to said cylinder, grippers on said cylinder, means maintaining said grippers open as said cylinder is stationary, register stop surfaces formed on said cylinder, means whereby said paper feeding means brings said paper against said register stop surfaces while said cylinder is stationary and thereafter presses said paper against said register stop surfaces until said cylinder begins to rotate, and means for effecting the movement of said grippers to grip the paper for the beginning of the printing rotation of said cylinder.

21. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves through its reverse or feed stroke, means for feeding a sheet of paper to said cylinder as said cylinder is stationary during the feed stroke of said bed, grippers on said cylinder, means maintaining said grippers open as said cylinder is stationary, register stop surfaces on said cylinder, said paper feeding means maintaining the paper pressed against said register stop surfaces as said cylinder is stationary, means actuated by said bed for effecting the movement of said grippers to grip the end of said paper sheet just prior to the beginning of the printing rotation of said cylinder, after which said grippers carry the paper about said cylinder as said cylinder rotates relatively to said bed, and means whereby said grippers thereafter release the end of said paper sheet.

22. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves in a reverse direction, grippers carried by

said cylinder, means whereby said grippers are open when said cylinder is maintained stationary, register stop surfaces on said grippers, paper feeding means for feeding sheets of paper, and means whereby said paper feeding means brings said paper against said register stop surfaces while said cylinder is stationary and thereafter presses said paper against said register stop surfaces until said cylinder begins to rotate.

23. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves through its reverse or feed stroke, positioning means for said cylinder operated by said bed for maintaining said cylinder upwardly and out of the printing plane of said bed when the bed moves through its feed stroke, and for positioning said cylinder in the printing plane for the printing stroke, means for feeding a sheet of paper to said cylinder during the said feed stroke, grippers on said cylinder, means maintaining said grippers open when said cylinder is held out of the printing plane during the feed stroke, register stop surfaces formed on said cylinder, and means whereby said paper feeding means maintains the paper pressed against said register stop surfaces during part of the said feed stroke.

24. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves in a reverse direction, means for feeding a sheet of paper to said cylinder as said cylinder is stationary, grippers on said cylinder, means for moving said grippers to grip the end of said paper sheet prior to rotation of said cylinder, after which said grippers carry said sheet about said cylinder as said cylinder rotates relatively to said bed, means whereby said grippers release the end of said paper sheet at a point in the rotation of said cylinder during which said cylinder is rotating to complete its printing rotation, rollers bearing against the cylinder and adapted therefore to bear against the paper and cylinder whereby to continue the movement of the paper together with the cylinder after the grippers have released the end of the paper, and means for moving said rolls to release the paper upon completion of the printing stroke.

25. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves through its reverse or feed stroke, means for maintaining said cylinder upwardly and out of the printing plane of said bed when the bed moves through its feed stroke, and for lowering said cylinder into the printing plane of said bed for the printing stroke, means for feeding a sheet of paper to said cylinder as said cylinder is stationary during the feed stroke of said bed, grippers on said cylinder, means maintaining said grippers open as said cylinder is held out of the printing plane, register stop surfaces formed on said cylinder, said paper feeding means maintaining the paper pressed against said register stop surfaces, means for effecting the movement of said grippers to grip the end of said paper sheet upon a lowering of the cylinder into the printing plane, after which said grippers carry said paper about said cylinder as said cylinder rotates relatively to said bed during the printing stroke, and means actuating said grippers to release the end of said paper sheet at a predetermined point in the rotation of said cylinder.

26. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves through its reverse or feed stroke, positioning means for said cylinder operated by said bed for maintaining said cylinder upwardly and out of the printing plane of said bed when the bed moves through its feed stroke, and for positioning said cylinder in the printing plane for the printing stroke, means for feeding a sheet of paper to said cylinder as said cylinder is stationary and out of the printing plane, grippers on said cylinder, means maintaining said grippers open as said cylinder is held out of the printing plane, register stop surfaces formed on said cylinder, said paper feeding means maintaining the paper pressed against said register stop surfaces, means for effecting the movement of said grippers to grip the end of said paper sheet operative upon lowering of the cylinder by the bed for the printing stroke of said bed, after which said grippers carry said paper about said cylinder as said cylinder rotates relatively to said bed, means whereby said grippers release the end of said paper sheet at a point in the rotation of said cylinder during which said cylinder is rotating to complete its printing rotation, rollers bearing against the cylinder and adapted therefore to bear against the paper and cylinder whereby to continue the movement of the paper together with the cylinder after the grippers have released the end of the paper, and means for moving said rollers to release the paper from said cylinder when said cylinder is moved upwardly and out of the printing plane for the feed stroke of said bed.

27. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves through its reverse or feed stroke, positioning means for said cylinder operated by said bed for maintaining said cylinder upwardly and out of the printing plane of said bed when the bed moves through its feed stroke, and for positioning said cylinder in the printing plane for the printing stroke, means for feeding a sheet of paper to said cylinder as said cylinder is stationary and out of the printing plane, grippers on said cylinder normally spring pressed toward closing position, means maintaining said grippers open as said cylinder is held out of the printing plane, register stop surfaces formed on said cylinder, said paper feeding means maintaining the paper pressed against said register stop surfaces, said grippers moving under their spring pressure to grip the end of said paper sheet when said grippers are released from said maintaining means upon lowering of the cylinder by the bed for the printing stroke of said bed, after which said grippers carry said paper about said cylinder as said cylinder rotates relatively to said bed, and means for moving said grippers to release the end of said paper sheet at a predetermined point in the rotation of said cylinder.

28. In a machine of the class described, having a rotary impression cylinder, means supporting a stack of sheets, a moving belt for feeding said

sheets from said stack towards said cylinder, means supporting said belt in juxtaposed relation to said sheets, and adjustable spring means acting on said belt supporting means to vary the degree of pressure of said feed belt against said paper.

29. In a machine of the class described having a rotary impression cylinder, means supporting a stack of sheets, a moving belt for feeding said sheets from said stack towards said cylinder, a bracket pivoted about a horizontal axis, a pulley supported on said bracket, said belt passing around said pulley, the weight of said belt and bracket moving said bracket on its pivot to carry the belt toward surface contact with said paper for feeding the paper as said belt moves, and adjustable spring means acting to counterbalance the weight of said belt and bracket to vary the degree of pressure of said feed belt against said paper.

30. In a machine of the class described having a rotary impression cylinder, means supporting a stack of sheets, a moving belt for feeding said sheets from said stack towards said cylinder, a bracket pivoted about a horizontal axis, a pulley supported on said bracket for sliding and rotary movement, said belt passing around said pulley, the weight of said belt and bracket moving said bracket on its pivot to carry the belt toward surface contact with said paper for feeding the paper as said belt moves, and spring means pulling said pulley relatively to said bracket whereby to maintain said belt in predetermined tension.

31. In a printing machine of the class described, a main frame, a reciprocating bed mounted on said main frame, an impression cylinder mounted for rotation and cooperation with said bed, a feed shaft mounted for rotation on said main frame, means whereby reciprocation of said bed rotates said shaft, a paper feed rack, means guiding said rack for movement on said main frame, and means whereby said movement is imparted to said rack by said shaft.

32. In a printing machine of the class described, a main frame, a reciprocating horizontal bed mounted on said main frame, an impression cylinder mounted for rotation on said main frame for cooperation with said bed, a vertically positioned worm shaft mounted for rotation at one end of said main frame, means whereby reciprocation of said bed rotates said worm shaft, a paper feed rack, means guiding said rack for vertical movement at the said end of said main frame, and means whereby said movement is imparted to said rack by said worm.

33. In a printing machine of the class described, a main frame, a reciprocating horizontal bed mounted on said main frame, an impression cylinder mounted for rotation on said main frame and for cooperation with said bed, a vertically positioned worm shaft mounted for rotation at one end of said main frame, means whereby reciprocation of said bed rotates said worm shaft, a paper feed rack, means guiding said rack for vertical movement at the said end of said main frame, means whereby said movement is imparted to said rack by said worm, a belt overhanging the paper stacked on said rack and movable to carry the paper off said stack toward said impression cylinder, a supporting bracket for said belt movably mounted on said main frame and movable with said belt to follow the level of the topmost sheet of paper on the stack as said stack is depleted, and means whereby the movement of said bracket with said belt controls the rotation of said worm by said reciprocating bed.

34. In a machine of the class described, having a rotary impression cylinder, a paper feed rack from which paper is fed to said impression cylinder, a belt adapted to brush against said paper and to feed it to said cylinder, supporting means for said belt movable vertically with said belt as the paper on said rack is depleted through feeding by said belt, means for raising said rack in small increments to maintain the uppermost paper sheet on said rack at a predetermined level, and means whereby said means supporting said belt controls the operation of said rack raising means.

35. In a machine of the class described having a rotary impression cylinder, a paper feed rack from which paper is fed to said impression cylinder, a belt adapted to brush against said paper and to feed it to said cylinder, means supporting said belt relatively to said paper and movable vertically with said belt to follow the paper as the paper on said rack is depleted, means for raising said rack in small increments to maintain the uppermost paper sheet of said rack at a predetermined level, and means whereby said means supporting said belt controls the operation of said rack raising means to halt its operation when the said belt supporting means is at a predetermined position.

36. In a machine of the class described having a rotary impression cylinder, a paper feed rack from which paper is fed to said impression cylinder, a belt adapted to brush against said paper and to feed it to said cylinder, a bracket having a pulley thereon for supporting and guiding the belt relatively to said paper, said bracket and belt bearing by gravity against said paper and movable to follow the level of the paper as it is depleted, means for raising said rack in small increments to maintain the uppermost paper sheet of said rack at a predetermined level, and means whereby said bracket controls the operation of said rack raising means to halt its operation when the uppermost paper sheet reaches said predetermined level.

37. In a machine of the class described having a rotary impression cylinder, a paper feed rack from which paper is fed to said impression cylinder, a belt adapted to brush against said paper and to feed it to said cylinder, a bracket having a pulley thereon for supporting and guiding the belt relatively to said paper, said bracket and belt bearing by gravity against said paper and movable to follow the level of the paper as it is depleted, adjustable spring means acting on said bracket to counterbalance its weight and the weight of said belt whereby to vary the degree of pressure of said feed belt against said paper, means for raising said rack in small increments to maintain the uppermost paper sheet of said rack at a predetermined level, and means whereby said bracket controls the operation of said rack raising means to halt its operation when the uppermost paper sheet reaches said predetermined level.

38. In a machine of the class described having a rotary impression cylinder, means supporting a stack of paper sheets, a moving belt for feeding said sheets from said stock towards said cylinder, a pivoted bracket having guides thereon for said belt, said belt passing about said guides and thereby supported in juxtaposed relation to said paper sheets, the weight of said belt and said bracket acting to press the belt toward surface contact

with said paper sheets for feeding the paper sheets as said belt moves, and adjustable spring means acting on said bracket to counter balance its weight and the weight of said belt whereby to vary the degree of pressure of said feed belt against said paper sheets.

39. In a printing machine of the class described, a main frame, a reciprocating horizontal bed mounted on said main frame, an impression cylinder mounted for rotation on said main frame in the path of reciprocation of said bed, a paper feed rack assembly having a paper supporting plate, means guiding said rack for vertical feed movement relatively to said main frame, means for moving said rack vertically whereby the paper thereon is maintained at a predetermined level, a delivery rack mounted in fixed relation to said main frame and over said feed rack and having a paper supporting plate maintained substantially aligned and superimposed relatively to the plate of said feed rack, vertical spaced side guide plates supported on said main frame and extending through aligned openings in both said plates, and means for moving said side plates simultaneously and in opposed directions laterally of said openings for adjustment to the width of the paper on said plates.

40. In a printing machine of the class described, a main frame, a reciprocating horizontal bed mounted on said main frame, an impression cylinder mounted for rotation on said main frame in the path of reciprocation of said bed, a paper feed rack assembly having a paper supporting plate, means guiding said rack for vertical feed movement relatively to said main frame, a delivery rack mounted over said feed rack and having a paper supporting plate maintained substantially aligned and superimposed relatively to the plate of said feed rack, vertical spaced side guide plates supported on said main frame and extending through aligned openings in both said plates, and means for moving said side plates laterally of said openings for adjustment to the width of the paper on said plates.

41. In a printing machine of the class described, a reciprocating bed, a rotary impression cylinder rotatable relatively to the printing plane of said bed, a paper feed rack at one end of said machine, an inclined plane extending upwardly from said rack and terminating in an inclined plane extending downwardly to the cylinder near the printing plane, means for feeding paper sheets from a stack of paper on said rack upwardly on said upwardly extending inclined plane and down said downwardly extending inclined plane to the cylinder at a point near the printing plane, grippers on said cylinder for gripping the paper fed thereto from said downwardly extending inclined plane and for carrying it through the printing operation, means actuating the grippers to release the paper at a point above the point where said paper is gripped, paper supporting means parallel to said inclined planes and on which said paper is then deposited, a paper delivery rack vertically superimposed relatively to said paper feed rack, and means for feeding the paper from said paper supporting means to said paper feed rack, vertical side guides for said racks, inclined planes, and paper supporting means, and means for adjusting all of said side guides simultaneously.

42. In a printing machine of the class described, an impression cylinder, a shaft on which said cylinder is rotatably mounted, side plates on which said shaft is mounted, means for moving said shaft vertically relatively to said side plates, an actuator fixed to said shaft, means for rotating said actuator and therefore said shaft, means between said actuator and shaft, and said cylinder, forming a clutch, said means including a plunger movable to secure said actuator, shaft and cylinder for rotation together, a cam on one of said plates, and means whereby said cam moves said plunger out of clutching position to release the cylinder from said actuator and shaft when said shaft is moved into a predetermined position relatively to said plates.

43. In a printing machine of the class described, an impression cylinder, a pair of opposed guide members for guiding and supporting sheets of paper fed forwardly to said cylinder and then rearwardly from said cylinder, each of said guide members having lower flanges on which the paper moves to said cylinder, and upper flanges on which the paper moves from said cylinder, and flexible belts movable between said guides for moving the paper sheets relatively to said guides.

44. In a printing machine of the class described, an impression cylinder having grippers for moving a sheet of paper through the printing stroke and then releasing it, a rotating roller juxtaposed to said cylinder for feeding the paper sheets when released from said cylinder grippers, a pair of opposed guide members having flanges to which said paper sheets are fed by said roller, means for moving said guide members to adjust them to the width of the paper sheets, and rotatable rolls carried by and movable with said opposed guides and resting against said roller to assist the roller in feeding said paper sheets.

45. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, an actuator for said impression cylinder, means for operating said actuator, a clutch between said impression cylinder and said actuator, means mounting said impression cylinder for vertical movement to bring the impression cylinder into and out of the printing plane, and means whereby said clutch is engaged when said impression cylinder is in the printing plane and is disengaged when the impression cylinder is out of the printing plane.

46. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, a rotating actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and feed strokes, a clutch between said impression cylinder and said actuator, means mounting said actuator and impression cylinder for movement into and out of the printing plane, positioning means for positioning said cylinder in or out of said plane, means whereby said clutch engages when said impression cylinder is in the printing plane and disengages when the impression cylinder is out of the printing plane, means on said bed for actuating said positioning means to move the impression cylinder out of the printing plane at the end of the printing stroke, whereupon the clutch is disengaged and said actuator rotates relatively to said cylinder as said bed moves through its feed stroke, a locator adapted to hold said cylinder against movement when the clutch is disengaged and said cylinder is out of the printing plane, and means on said bed for actuating the positioning means to move the impression cylinder into the printing plane at the end

of the feed stroke, whereupon the clutch is engaged and said actuator rotates the cylinder as said bed moves through its printing stroke, said bed and actuator being so related in their movements that a stroke of said bed is accompanied by a full rotation of said rotating member.

47. In a printing machine of the class described, a reciprocating type carrying bed, an impression cylinder mounted for rotation as said bed moves through its printing stroke, an actuator, means whereby said reciprocating bed rotates said actuator clockwise and counter clockwise as said bed moves through its printing and return strokes, a clutch between said impression cylinder and said actuator, means mounting said impression cylinder for vertical movement to bring the impression cylinder into and out of the printing plane, and means whereby said clutch is engaged when said impression cylinder is in the printing plane and is disengaged when the impression cylinder is out of the printing plane.

48. In a machine of the class described, a reciprocating bed, a rotary impression cylinder, means whereby said cylinder rotates as said bed moves in a direction corresponding to its printing stroke while remaining stationary as said bed moves in a reverse or feed direction, moving frictional means for feeding a sheet of paper to said cylinder, grippers on said cylinder, means maintaining said grippers open as said cylinder is stationary, register stop surfaces formed on said cylinder, means whereby said paper feeding means brings said paper against said register stop surfaces while said cylinder is stationary and thereafter frictionally urges said paper against said register stop surfaces until said cylinder begins to rotate, and means for effecting the movement of said grippers to grip the paper for the beginning of the printing rotation of said cylinder.

49. In a printing machine of the class described, a main frame, a reciprocating bed mounted on said main frame, an impression cylinder mounted for rotation on said main frame and for cooperation with said bed, a paper feeding rack, means mounting said rack for movement relatively to said main frame, and means whereby said reciprocating bed imparts step by step movement to said rack.

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