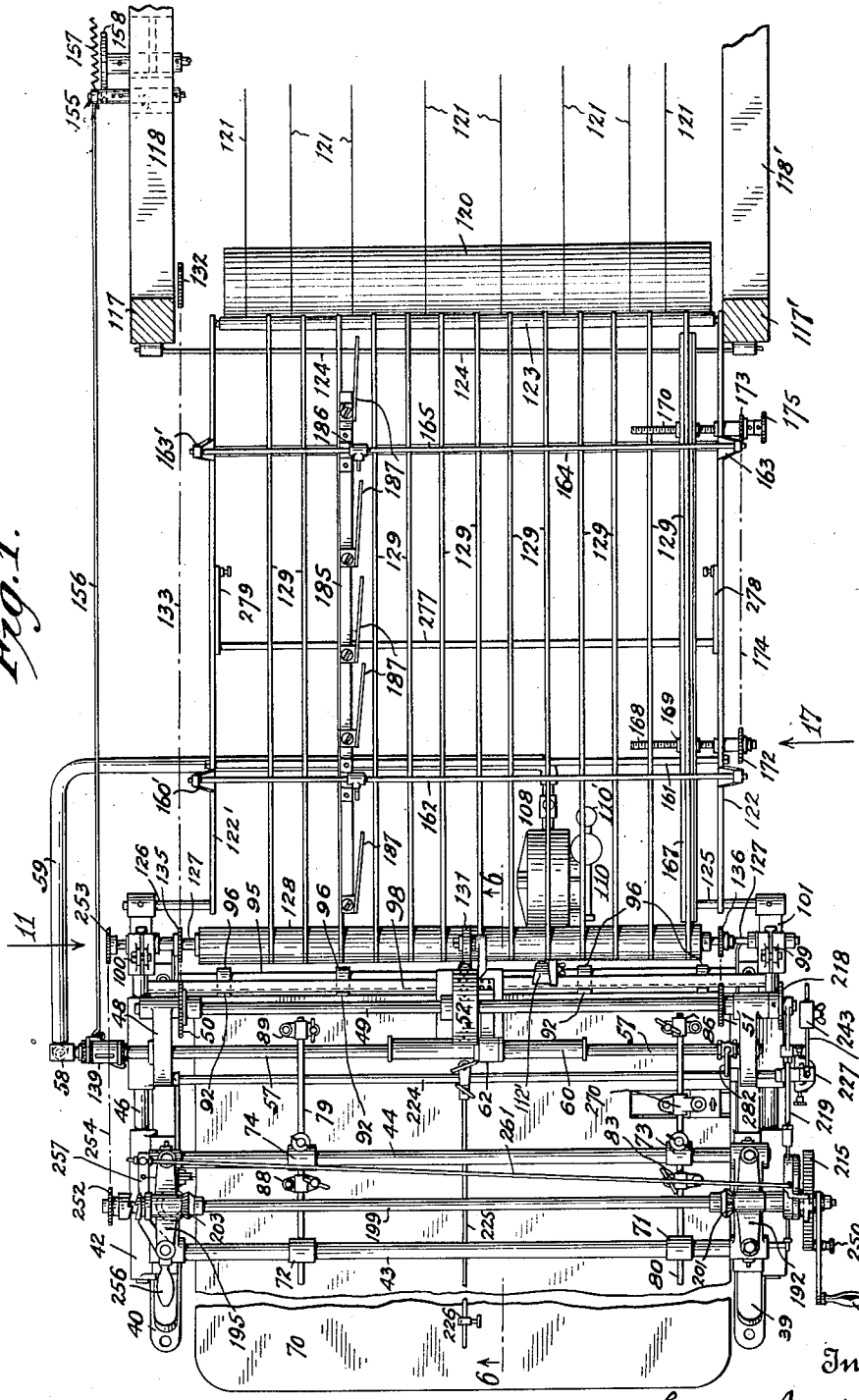
Feb. 22, 1927. 1,618,182

L. J. FROHN

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Filed Aug. 22, 1921 11 Sheets-Sheet 1

Fig. 1.



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Fig. 30.

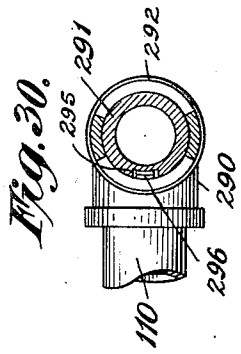


Fig. 2.

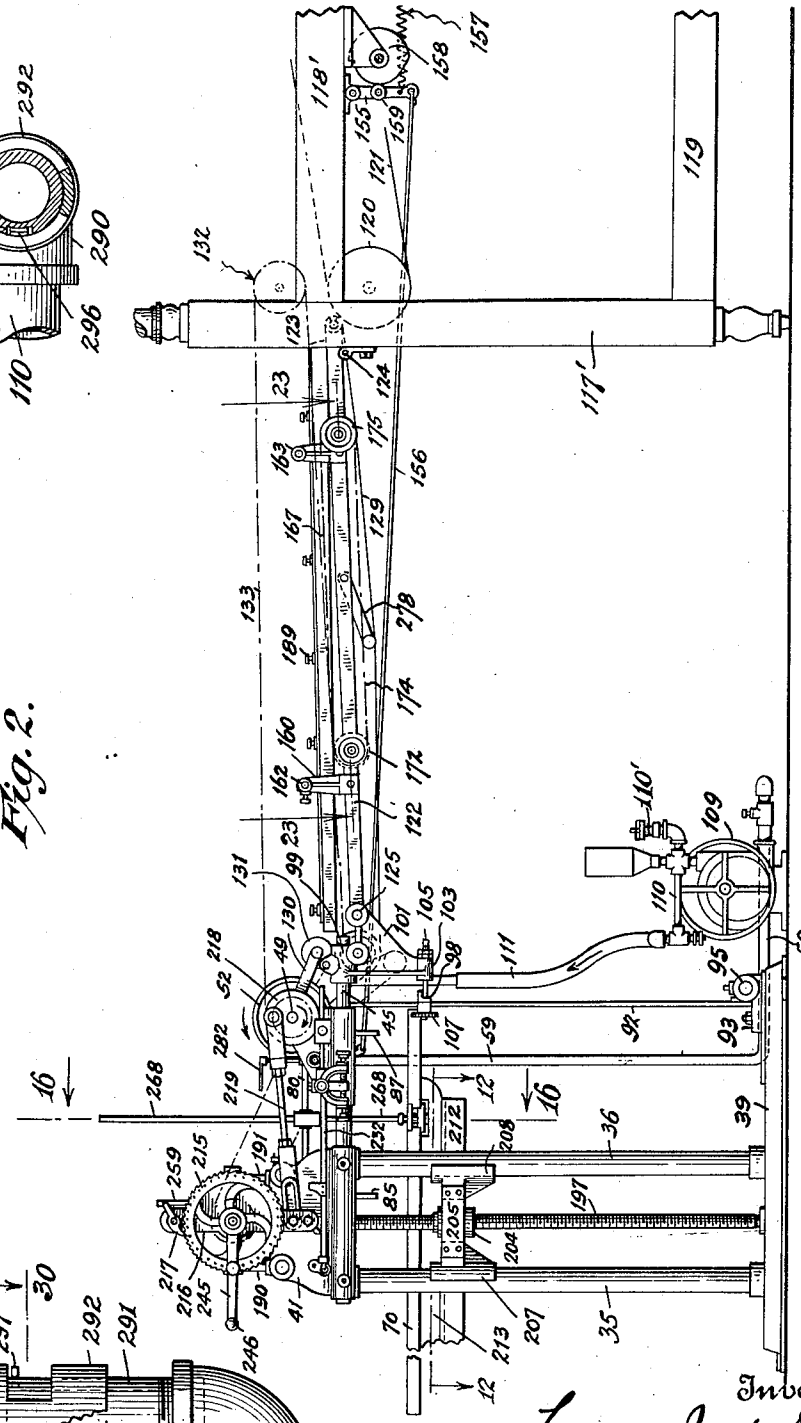
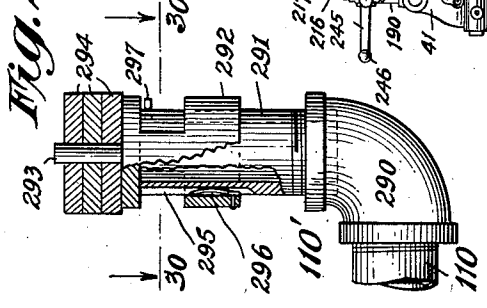


Fig. 29.



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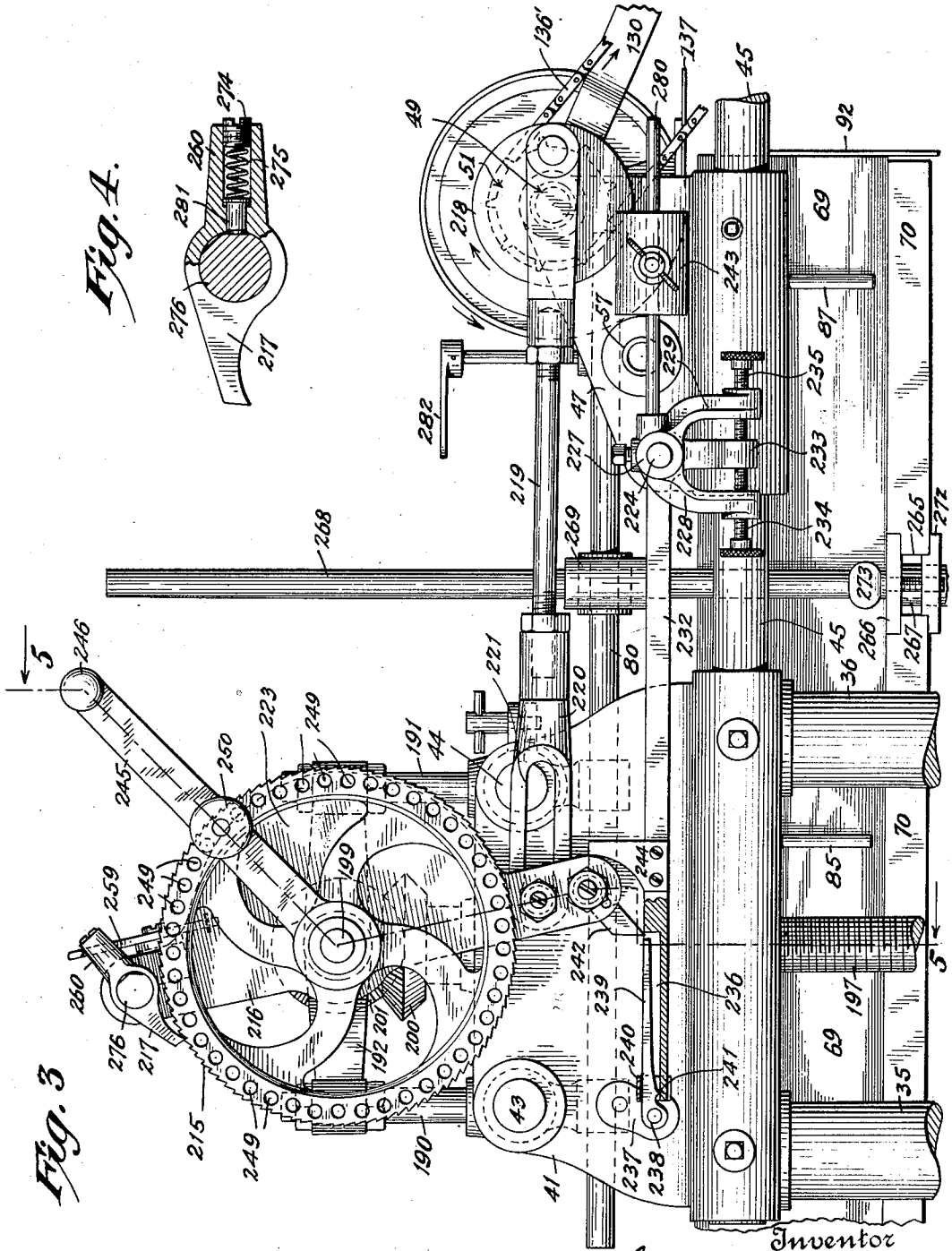


Fig. 4.

Fig. 3

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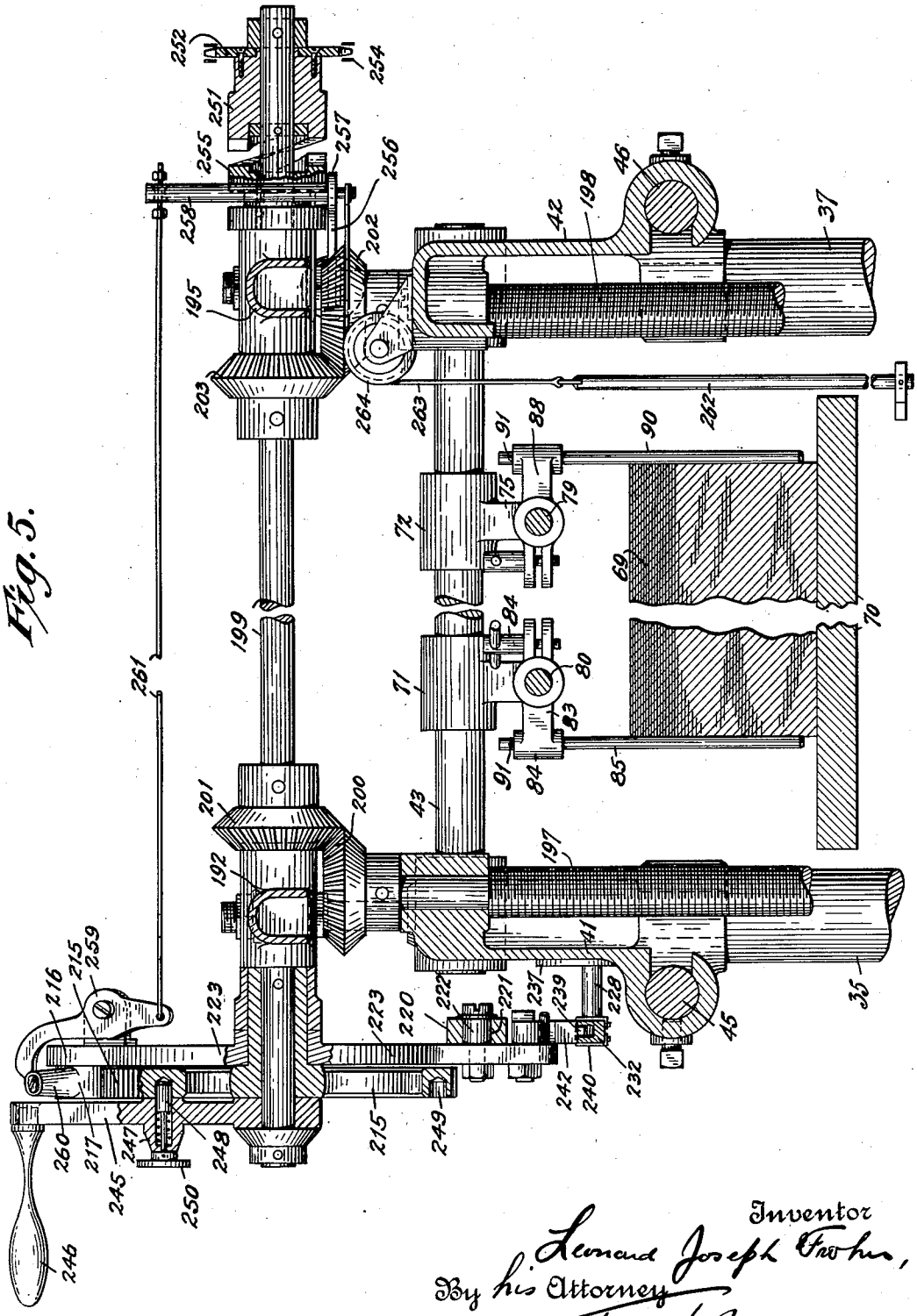


Fig. 5.

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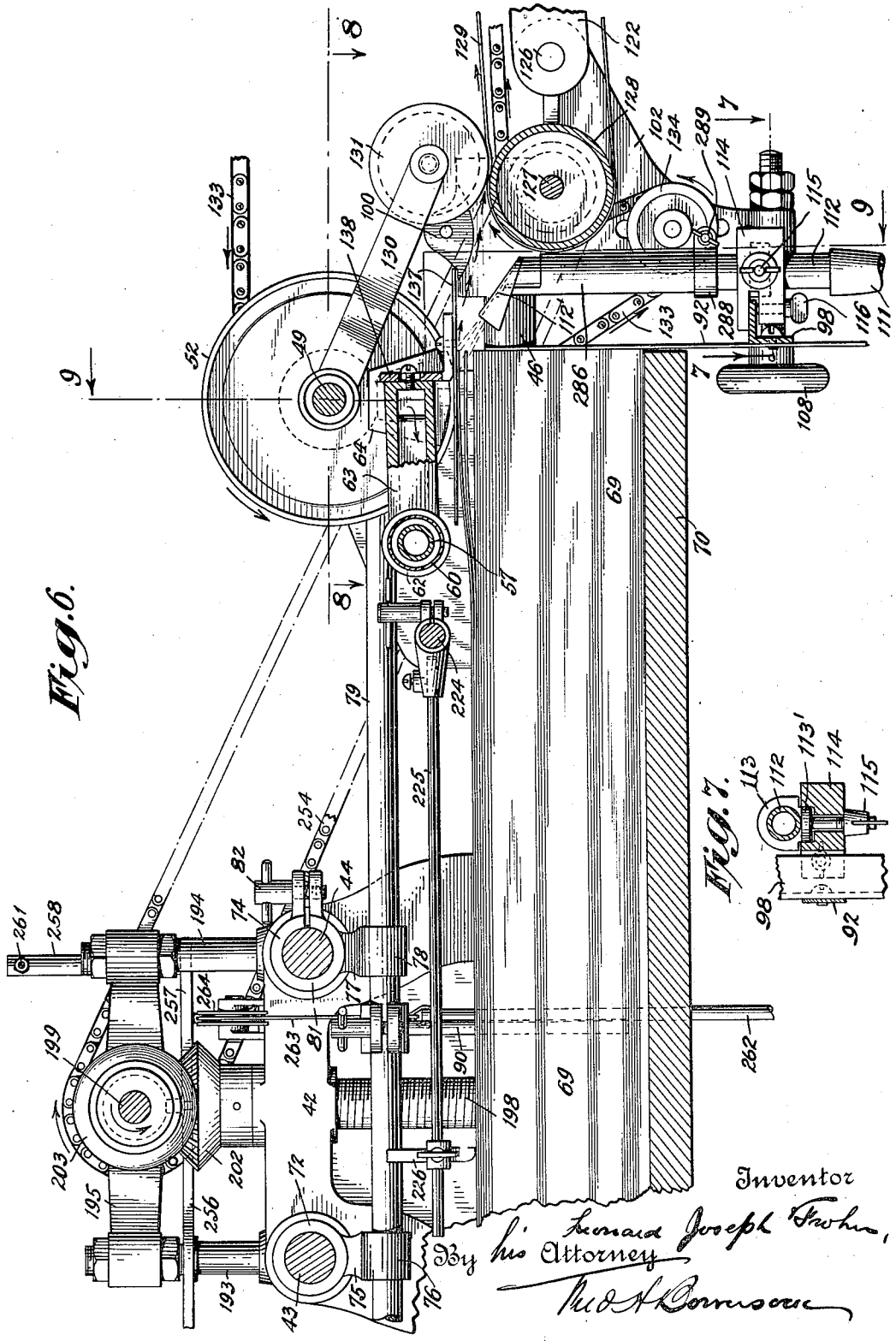


Fig. 6.

Fig. 7.

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Fig. 9.

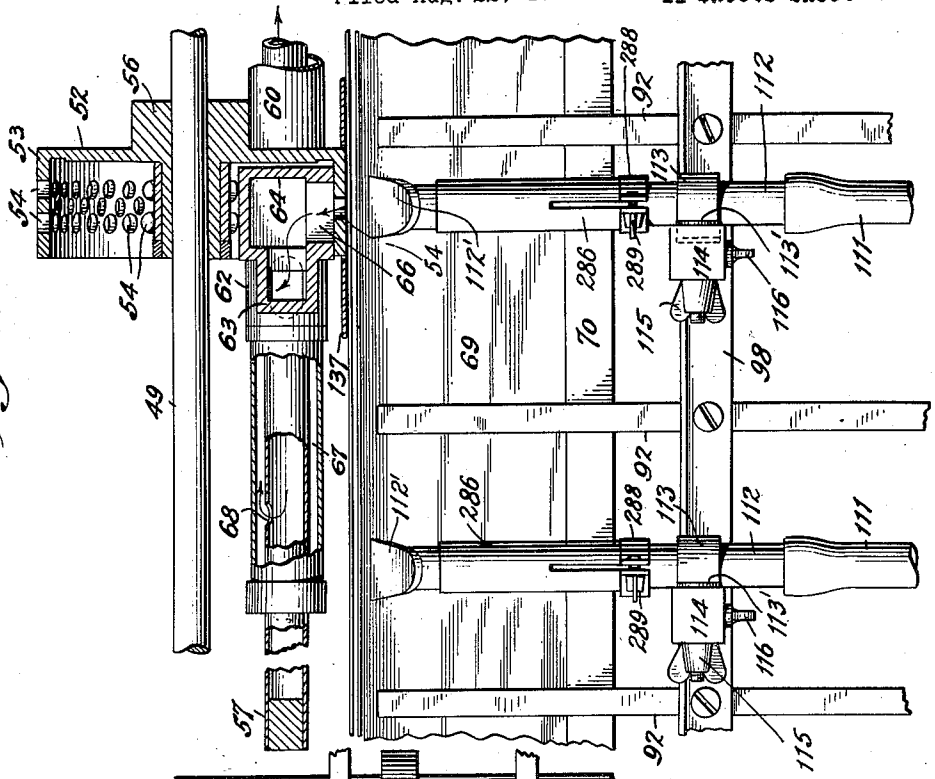


Fig. 8.

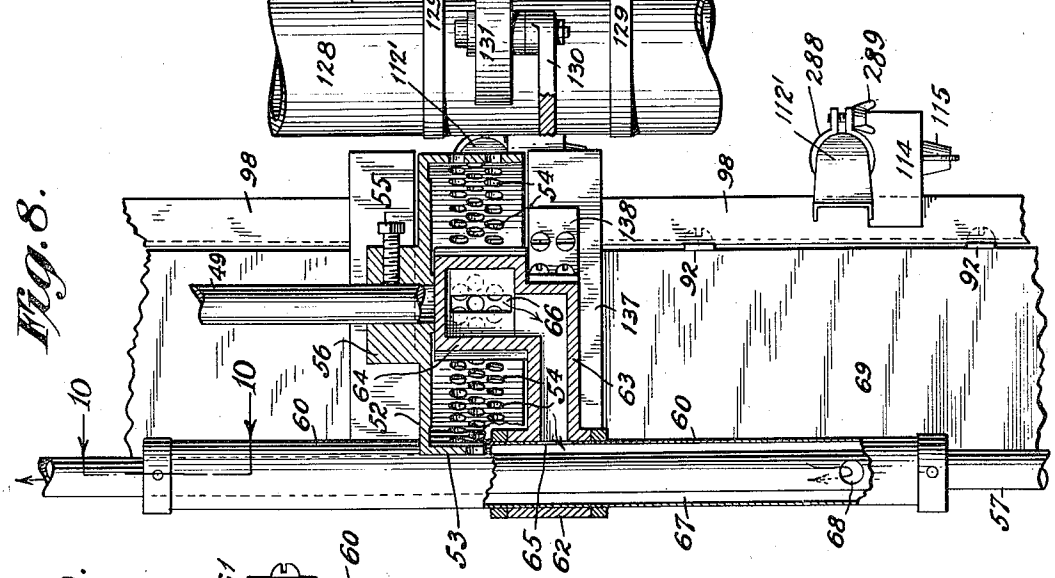
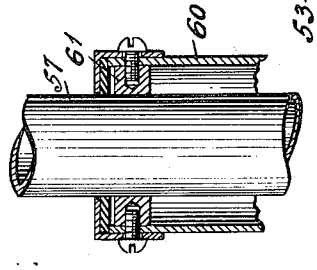


Fig. 10.



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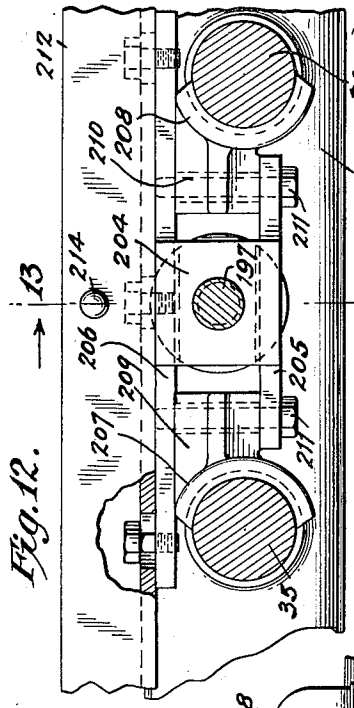


Fig. 12.

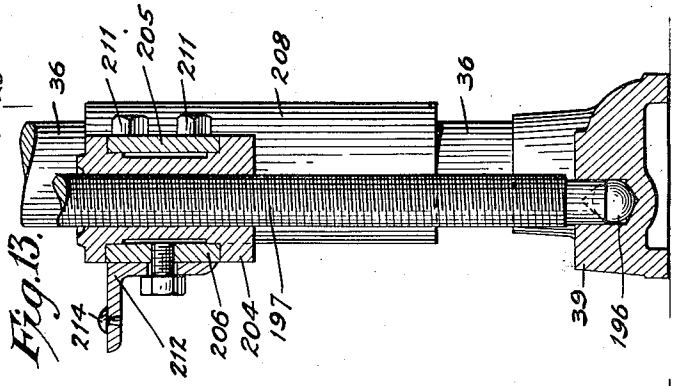


Fig. 13.

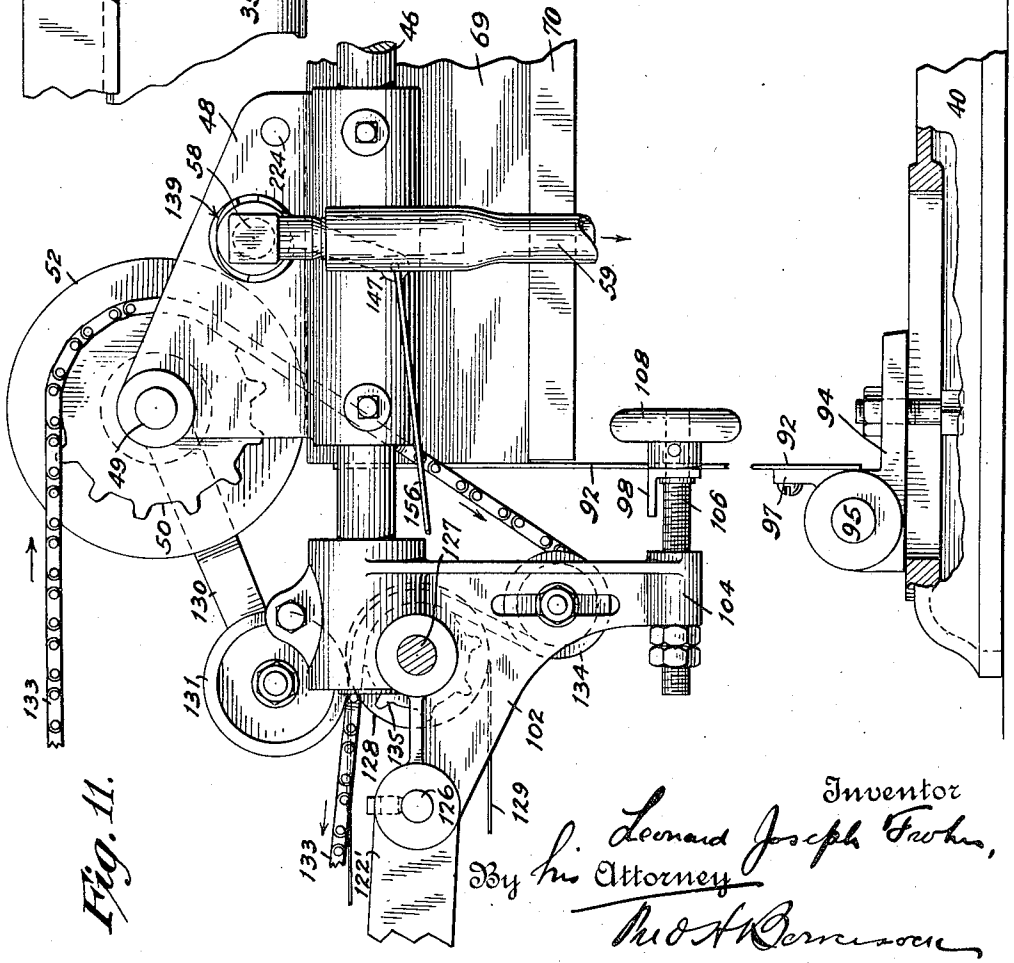


Fig. 11.

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Fig. 16.

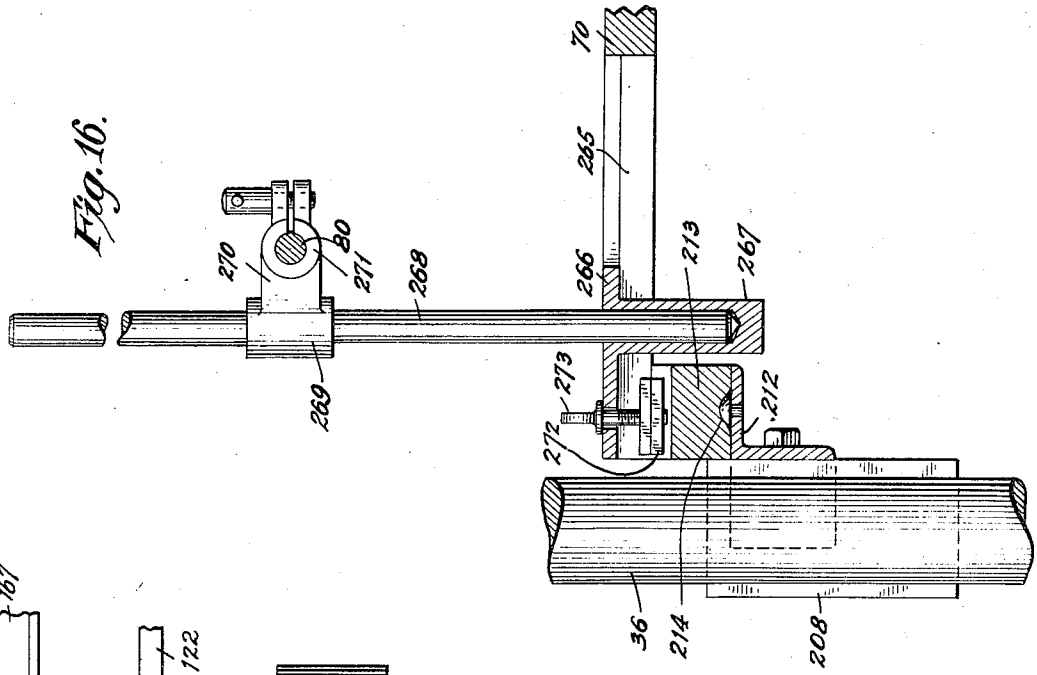


Fig. 14.

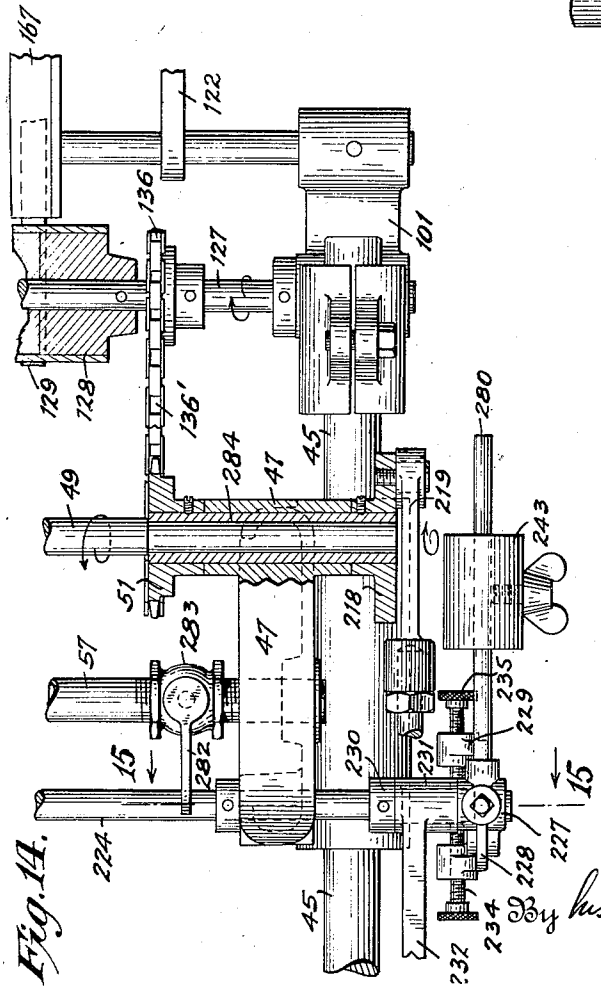
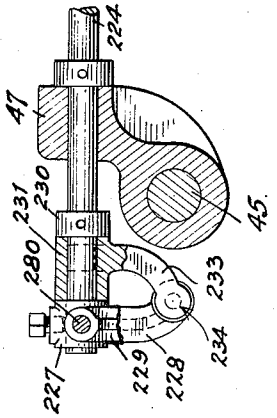


Fig. 15.



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Fig. 17.

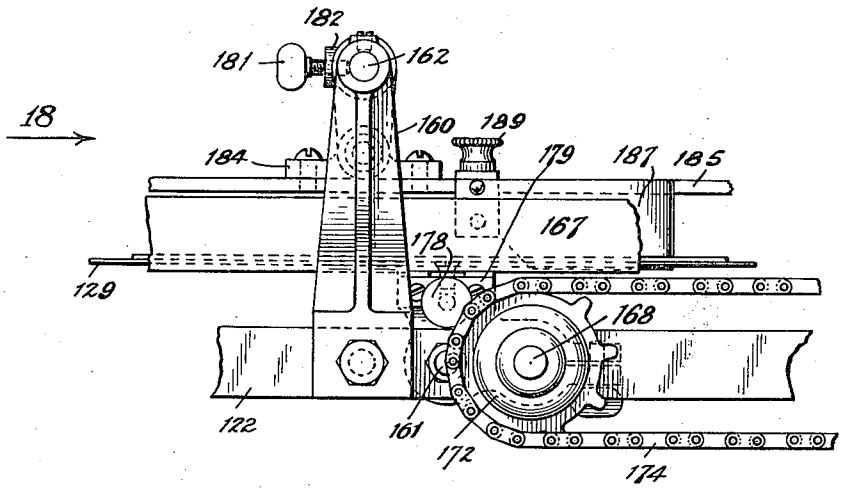
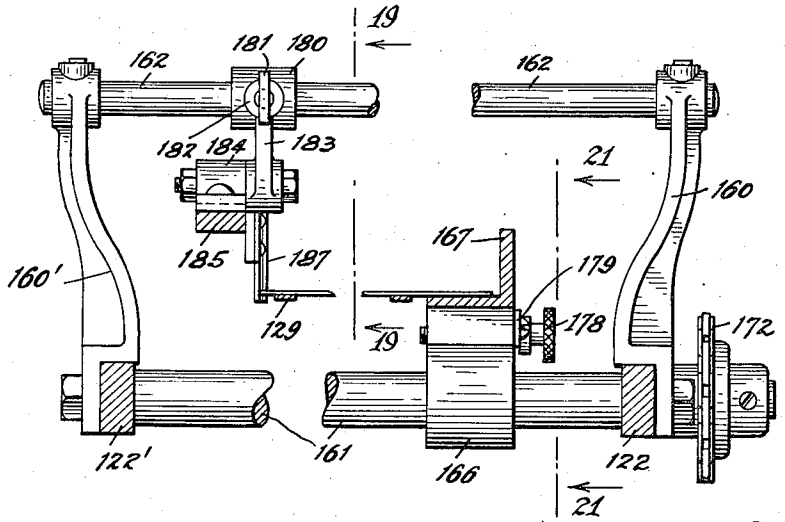


Fig. 18.



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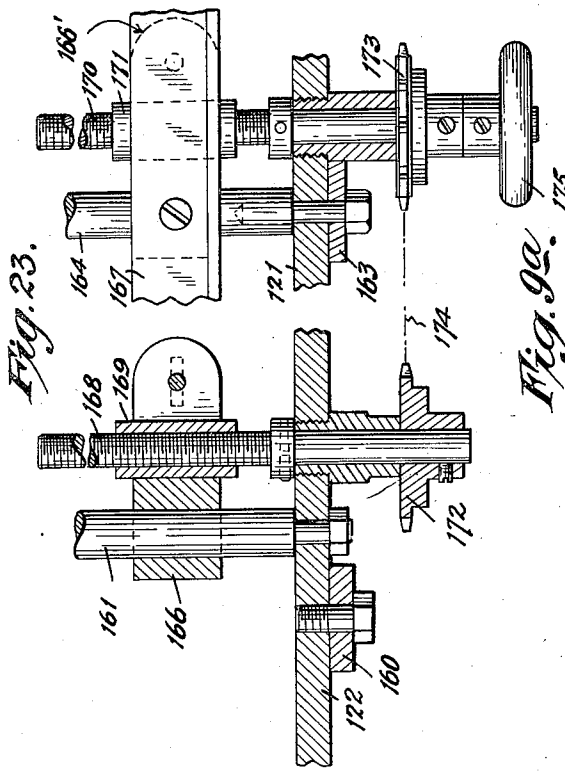


Fig. 23.

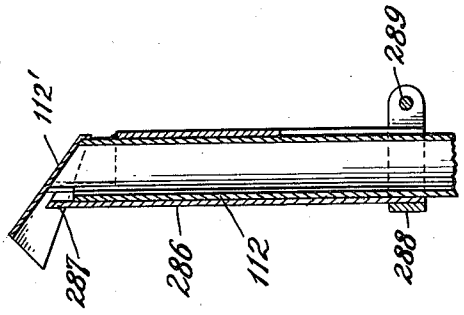


Fig. 9a.

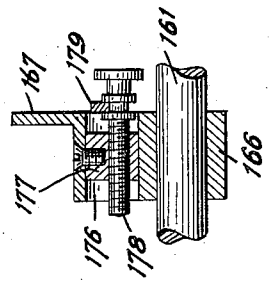


Fig. 22.

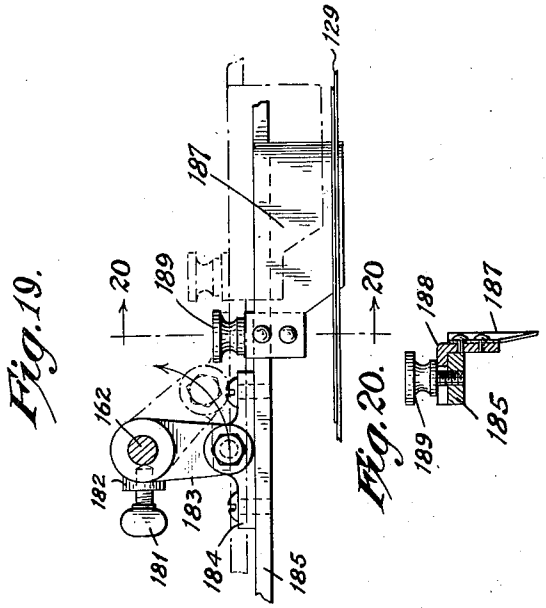


Fig. 19.

Fig. 20.

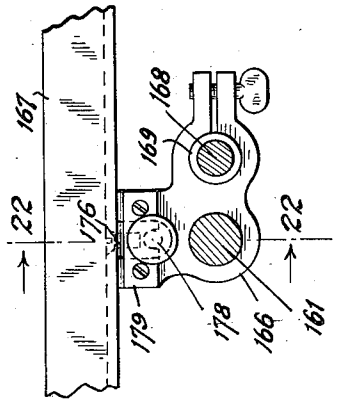


Fig. 21.

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Feb. 22, 1927. 1,618,182

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Fig.24.

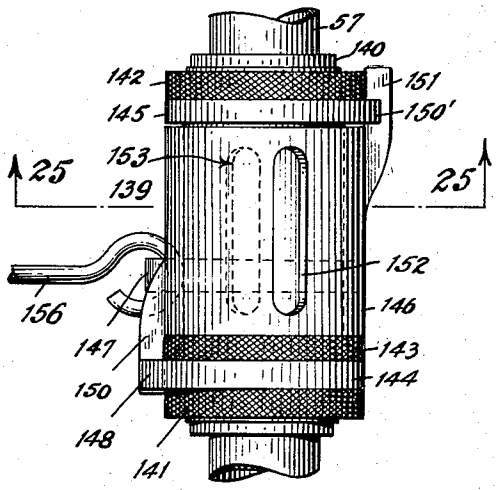


Fig.25.

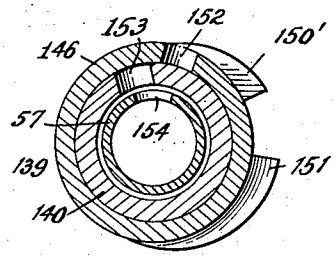


Fig.27.

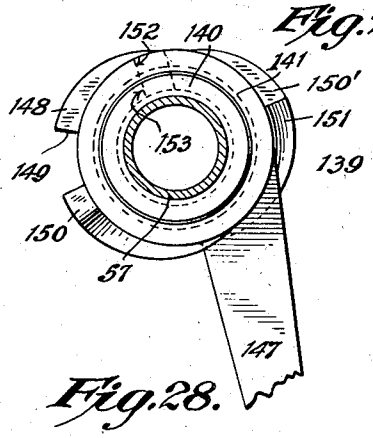


Fig.26.

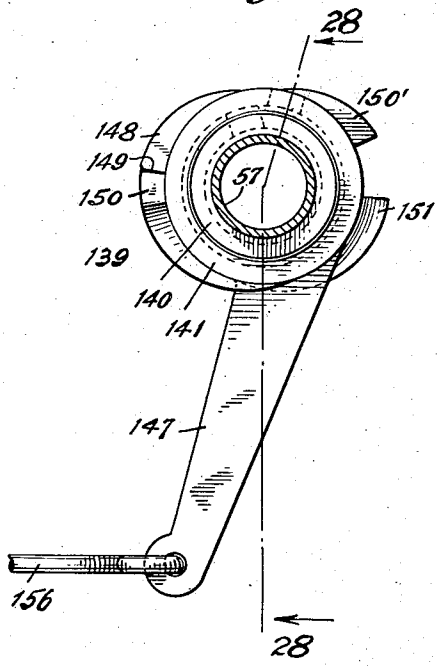
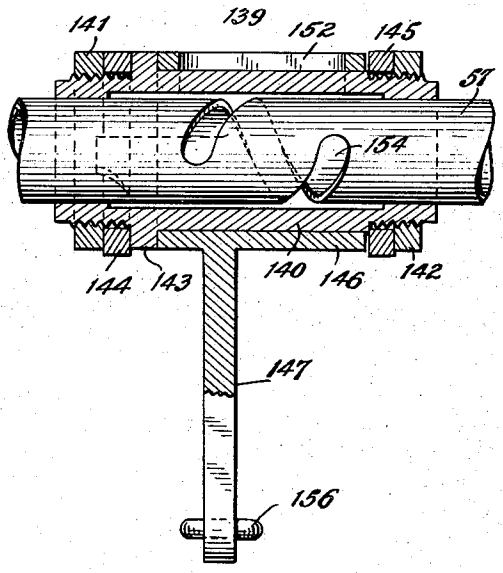


Fig.28.



Inventor

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By his Attorney

Paul H. Bonnell

Patented Feb. 22, 1927. 1,618,182

UNITED STATES PATENT OFFICE.

LEONARD JOSEPH FROHN, OF LYNBROOK, NEW YORK.

PAPER-FEEDING MACHINE.

Application filed August 22, 1921. Serial No. 494,285.

This invention relates generally to machines for withdrawing paper sheets one at a time from a stack or pile thereof and advancing the same in continuous procession and evenly spaced relationship. While subsequent handling of or operations upon the advanced or advancing sheets is immaterial, so far as the present invention is concerned, the embodiment of my invention which I have shown and which I shall proceed to describe is designed primarily for use in connection with a ruling machine, in which, as is well known, the sheets must follow each other in close succession and in practically perfect alignment.

It is not what might be called an easy matter to rapidly and accurately feed sheets by hand from a stack or pile thereof, probably for the principal reason that the friction resulting from the handling of the more or less flexible pile generates static electricity with consequent attraction, causing the sheets to "stick together" and to be separated with some difficulty. This is probably the principal obstacle to be overcome in attempting to provide an automatic feeding machine. Furthermore, the innumerable different uses to which ruled and printed paper sheets are put means an exceedingly wide variation not only in the lateral dimensions of the sheets to be handled at different times, but also in the thickness and quality of the stock. A feeding machine to be worth its installation must be capable of being quickly and readily adjusted and readjusted for any one of a wide range of sizes of sheets and for paper of any thickness and quality.

Another difficulty which presents itself grows out of the obvious fact that as the sheets are fed or withdrawn from the top of the pile the height of the latter is gradually reduced, and as the feeding or withdrawing means must be in a relatively fixed position, the pile must be gradually raised at an average speed which is the same as that of reduction of height by depletion. The slightest variation would soon or late destroy the essential positional relationship between the feeding mechanism and the top of the pile.

Speaking in the most general way, the principal object of the present invention may be said to consist in materially improving in many directions upon the machine shown and described by Joseph Hren in his patents No. 939,260, of November 9, 1909, and No. 951,074, of March 1, 1910. To this end, an important object of the invention—possibly one of the most important—may doubtless be said to be dependability of operation, by which I mean practical certainty that a single sheet will at each operation be withdrawn from the top of the pile and advanced in the wake of its predecessor in perfect alignment. A scarcely less important object of the invention is a general construction of the machine as a whole and each of the various mechanisms therein individually to permit of rapid and comparatively easy adjustment thereof for the handling of sheets of any one of a number of different sizes. I have further had particularly in mind dependable and readily and accurately adjustable connecting means between the various mechanisms to insure an interdependent relationship for the purpose of perfect timing—undoubtedly essential in a machine of this character. Possibly just as essential is the insurance of exactly proper rate of upward movement of the table which supports the stack or pile as the latter is gradually depleted, whereby the top sheet of the pile is invariably in position for engagement by the withdrawing means, and this is by no means the least important object of the invention. Incidental to the above, I have had in view general simplicity of construction and operation, minimizing so far as possible the number of parts and the amount of power required to drive the machine, and other objects which will appear from a perusal of the detailed description which follows.

However, throughout all of my efforts to provide a machine in which all of the foregoing objects will to the greatest possible extent have been attained, by no means last in my mind has been the idea of economy of manufacture through a general construction which admits of a standardization of parts. While, as hereinbefore suggested, the machine of my invention may be itself readily adjusted for the feeding of sheets of any one of a wide range of dimensions and weights, it is frequently necessary for particular purposes and special requirements to make the machines themselves of different sizes and proportions. One of the principal specific objects of the invention, therefore, is the provision of a machine which not only embodies the improvements hereinbe-

fore referred to, but one so constructed that the largest possible number of parts shall be interchangeable between machines of different sizes or proportions, wherefore the manufacturer is under the necessity of carrying in stock—or especially producing—the fewest possible number of parts.

My invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, in which I have shown a machine which I consider a practical and convenient embodiment of the invention, and in which—

Fig. 1 is a top plan view of the machine;

Fig. 2 is a side elevation thereof;

Fig. 3 is an enlarged side elevation of the upper front end of the machine, comprising the feeding and the table-controlling mechanisms, one part being shown partly in section;

Fig. 4 is an enlarged partly sectional detail view of the driving pawl of the table-controlling mechanism;

Fig. 5 is a section taken substantially on the broken line 5—5 of Fig. 3;

Fig. 6 is an enlarged longitudinal section taken substantially on the line 6—6 of Fig. 1;

Fig. 7 is a sectional detail view, taken substantially on the line 7—7 of Fig. 6;

Fig. 8 is a horizontal section taken substantially on the line 8—8 of Fig. 6;

Fig. 9 is a vertical section taken substantially on the line 9—9 of Fig. 6;

Fig. 9^a is a vertical section of the upper portion of one of the air-blast nozzles and its regulating valve, taken substantially on the line 9^a—9^a of Fig. 9;

Fig. 10 is an enlarged sectional detail view, taken substantially on the line 10—10 of Fig. 8;

Fig. 11 is an enlarged elevation of a portion of the feeding mechanism, seen from the side opposite that shown in Figs. 2 and 3, as indicated by the arrow in Fig. 1;

Fig. 12 is an enlarged horizontal section taken substantially on the line 12—12 of Fig. 2;

Fig. 13 is a vertical section taken substantially on the line 13—13 of Fig. 12;

Fig. 14 is an enlarged partly sectional plan view of a portion of the table-controlling mechanism and the means for actuating the same;

Fig. 15 is a vertical cross-section taken substantially on the line 15—15 of Fig. 14;

Fig. 16 is an enlarged vertical cross-section taken substantially on the line 16—16 of Fig. 2;

Fig. 17 is an enlarged fragmentary elevation of a portion of the sheet advancing and guiding means, as indicated by the arrow in Fig. 1;

Fig. 18 is a fragmentary and partly sectional end view of the parts shown in Fig. 17, as indicated by the arrow in Fig. 17;

Fig. 19 is a vertical section taken substantially on the line 19—19 of Fig. 18;

Fig. 20 is a sectional detail view, taken substantially on the line 20—20 of Fig. 19;

Fig. 21 is a vertical section taken substantially on the line 21—21 of Fig. 18;

Fig. 22 is a sectional detail view, taken substantially on the line 22—22 of Fig. 21;

Fig. 23 is an enlarged fragmentary horizontal section taken substantially on the line 23—23 of Fig. 2;

Fig. 24 is an enlarged detail elevation of the suction-control valve for the feeding mechanism;

Fig. 25 is a cross-section thereof taken substantially on the line 25—25 of Fig. 24;

Fig. 26 is a partly sectional end view thereof;

Fig. 27 is a similar partly sectional view of the other end thereof;

Fig. 28 is a section taken substantially on the broken line 28—28 of Fig. 26, and

Figs. 29 and 30 are enlarged detail views, in vertical and horizontal cross-section, respectively, of the relief and cut-off valve for the air-blast pipes.

Referring now to the drawings in detail, it will be seen that the main supporting frame of the machine is shown as comprising four posts or standards, 35 and 36 on one side thereof and their opposite counterparts on the other side of which one, 37, is shown in Fig. 5. These posts or standards are mounted on comparatively heavy bases 39 and 40 which for purposes of rigidity and stability I prefer to secure in any suitable manner to the floor. Removably mounted at the top of each pair of standards is a frame-plate, 41 on one side of the machine and 42 on the other. These plates 41 and 42 are preferably heavy castings and of the configuration substantially as shown for purposes which will subsequently appear. Connecting these plates 41 and 42 are the detachably mounted stay-rods 43 and 44.

Rigidly secured within sleeve-like sockets formed at the lower edges of the plates 41 and 42 and projecting forwardly therefrom are the heavy rods 45 and 46, near the forward ends of which are mounted the brackets 47 and 48. The rods 45 and 46 are detachably secured within said sleeve-like sockets and said brackets 47 and 48 are adjustably mounted on said rods for reasons which will be hereinafter explained. Journaled in bearings in these brackets is the shaft 49, mounted upon which near one end thereof is the sprocket 50. Carried by this shaft 49 is the cup-shaped wheel or flanged disk or open-ended cylinder 52, the flange or cylindrical portion 53 of which is provided with series of perforations 54 54 (Figs. 8 and 9), preferably in partly coincidental relationship. I have shown this

flanged disk or cylinder secured to the shaft 49 by means of a set-screw 55 threaded into the hub 56 of the former, whereby the same may be adjustably positioned at any desired point along substantially the entire length of said shaft.

Also mounted in and carried by the brackets 47 and 48 and paralleling the shaft 49 is the tube or hollow rod 57. One end of this rod is capped or sealed in any suitable manner, while at the other end thereof is provided a connection 58 for a pipe 59 which leads to a source of air exhaustion in a manner which will be hereinafter described. Mounted on the tube or hollow rod 57 is a sleeve 60 the interior diameter of which is appreciably greater than the exterior diameter of the tube and the ends of which are in-flanged and capped (Fig. 10) whereby, with the addition of a suitable packing ring 61, a cylindrical chamber 67 is provided around said tube 57 which is hermetically sealed although the sleeve 60 is free to slide on said tube. An aperture 68 in the tube 57 leads from the channel therein to said chamber 67.

Fixed upon the sleeve 60 at substantially the middle thereof is a collar 62 from which projects a hollow arm 63 which terminates in an offset head or mouthpiece 64 designed, when proper relative adjustment has been effected, to project into the open chamber of the wheel or cylinder 52. An aperture 65 in the sleeve 60 registers with the port of the channel provided in the arm 63, and the lower face of the head or mouthpiece 64—which is curved to correspond with the curvature of the inner face of the flange or cylindrical portion 53 of the wheel or cylinder 52 with which it is designed to be in continuous contact (Fig. 6)—is provided with a slot 66 which registers with the perforations 54 in said cylinder. Apart from the curvature of the lower face thereof, to which I have just referred, the configuration of the head or mouthpiece 64 is not material. It will be apparent that—the wheel or cylinder 52 having been first adjusted in the desired position and the sleeve 60 having been thereupon slid on the tube 57 to bring the head or mouthpiece 64 into the chamber of the former, as best shown in Figs. 8 and 9—when air is partially exhausted from the tube 57 suction will be created through the perforations 54 (or portions thereof) which at that particular moment register with the slot 66.

The stack or pile 69 of paper sheets is supported upon a table 70 carried between the standards and mounted for either automatic or manual raising and lowering in a manner which will be hereinafter described. After proper adjustment, this stack or pile is held intact against lateral fanning or distortion by means of two pairs of gauge-rods. Loose upon the rod 43 are the collars 71 and 72, and slidable (when released) upon the rod 44 are the split-collars 73 and 74. Depending from the collar 72 on the rod 43 is a short arm 75 which terminates in a transversely disposed collar 76. Depending from the split-collar 74 on the rod 44 is a corresponding short arm 77 terminating in a transversely disposed collar 78. Passing through the aligned collars 76 and 78 is a rod 79, while the parallel rod 80 is carried by the collars 71 and 73 in a precisely similar manner. The split-collar 74, as shown in detail in Fig. 6 and of which the collar 73 is a counterpart, is adapted to be clamped to the rod 44 by means of the screw 82, and in this manner the rods 79 and 80, having been relatively adjusted along the rods 43 and 44, may be locked in their adjusted positions.

A short arm 83 has a split end with a clamping screw 84, whereby said arm may be adjustably clamped on the rod 80. At the outer end of this arm 83 is provided a collar 84 through which passes loosely a rod 85. Toward the rear end of the rod 80 a corresponding arm 86 is similarly constructed and mounted, similarly carrying the vertical rod 87. On the opposite side of the machine, the rod 79 is similarly equipped with the arms 88 and 89, the former loosely carrying the rod 90 and the latter its counterpart. As the table 70 is raised, it will impinge against the lower ends of these gauge-rods 85, 87, 90 and the one carried by the arm 89 which slip through their guiding collars and rise idly with the table. When the latter is depressed or lowered beyond a certain point, these rods are held suspended in position by means of stop-pins 91 near the upper ends thereof.

It will be seen that the collars 71 and 72 being laterally adjustable on the rod 43, and the collars 73 and 74 being laterally adjustable on the rod 44, and the arms 83, 86, 88 and 89 being longitudinally adjustable on the rods 79 and 80, the gauge-rods may be set in any one of innumerable relative positions, whereby they may be readily adjusted to gauge or control a stack or pile of sheets throughout a wide range of widths and lengths.

Just beyond the rear edge of the table 70 are the end gauge or stop bars 92 92. There must be a definite—although preferably to a certain extent adjustable—positional relationship between these bars and the contiguous edge of the table, the top of the stack or pile of sheets and the wheel or disk 52. For a reason which will be hereinafter explained, these bars 92 should be capable of slight forward and rearward adjustment; maximum forward adjustment not causing engagement with the rear edge of the table and maximum rearward adjustment not re-

sulting in a space between the table-edge and the bars sufficient to permit sagging of the rear end of the pile. The upper ends of the bars 92 should approach but not reach the top of the pile to insure ample clearance for the sheet to be withdrawn and access—in a manner which will be described—to a few of the sheets just underneath the same. The sheet to be withdrawn—the top sheet of the pile—should be engaged as near as practicable to the rear edge thereof and at a certain fixed distance from said edge, varying according to the character of the operations subsequently to be performed, wherefore there must be a definite positional relationship between what may be termed the line of engagement and the common plane of said bars.

Slidably mounted on and near the end of each of the bases 39 and 40 are the blocks or brackets 93 and 94. Each of these blocks or brackets has the common and well-known pin-and-slot connection with the base upon which it rests whereby they may be clamped in various positions of longitudinal adjustment. These brackets carry the cross shaft or rod 95 upon which are mounted collars 96 96 each having an arm 97 projecting vertically therefrom to which is secured, preferably by means of a screw, as shown, one of the gauge-bars 92. Near its upper end each of the gauge-bars is secured to a transversely arranged angle-bar 98.

Near the rear ends of the rods 45 and 46 are mounted, preferably by means of the clamped split-collars 99 and 100, the downwardly projecting brackets 101 and 102 at the lower ends of which are collars 103 and 104 through which are threaded the screws 105 and 106 which pass through the vertical wing of the angle-bar 98, one near each end thereof, and being turned by means of small hand-wheels 107 and 108—a common and well-known expedient by means of which the position of the angle-bar 98 with reference to the collars 103 and 104, and therefore the position of the gauge-bars 92 with reference to the disk or wheel 52, may be adjustably varied. Obviously, in thus positionally adjusting the upper ends of the gauge-bars, the lower ends thereof must be correspondingly adjusted through the pin-and-slot connections of the brackets 94 to insure verticality and perfect rectangularity of the gauge-bar frame as a whole to the direction of travel of the sheets.

I have hereinbefore referred to the tendency of paper sheets in a compact pile to "stick together", and thus make more or less difficult the removal of the sheets one at a time. This may be due to air pressure, or it may be due to a static charge, or possibly it may be due to a combination of both. Under any circumstances, in order to remove the sheets lengthwise for horizontal feeding and insure movement of the top sheet only until after it has cleared the pile, it has been found necessary to provide means for breaking this adherence. I have found most satisfactory for this purpose the direction of one or more air currents in a slightly upward direction against the upper rear edge of the pile. I therefore employ an air-pump, preferably of the rotary type in order to secure continuous and uniform currents in both directions at the same time in the simplest possible manner, and which may be of any standard or approved make. Numeral 109 refers to a pump of this type, to the exhausting chamber of which leads the pipe 59 from connections hereinbefore described. From what may be termed the compression chamber of the pump leads a pipe 110, having a relief and cut-off valve 110′, hereinafter described, said pipe leading to upwardly-directed branches 111 at the upper ends of which are elongated nozzles 112 which are located just to the rear of the table 70 and the stack 69 of sheets thereon, and also just back of the angle-bar 98. I have shown the tips 112′ of the nozzles 112 inclined from the vertical toward the stack and flattened—to provide a comparatively wide and shallow current—as best shown in Figs. 6, 8 and 9. Probably Fig. 9 best illustrates the effect of a comparatively mild air blast directed as shown against the upper sheets of the stack.

Continued proper direction of these mild air blasts is undoubtedly of the utmost importance, and to that end the upper ends of the pipes 111 should be rigidly supported. For this purpose I mount on each of these pipes (or, preferably, on each of the nozzles 112 at the ends thereof, as shown) a collar 113 having a circular boss 113′. A block 114 is longitudinally channeled for the reception of said boss and also slotted or drilled for the reception of the shank of a set-screw 115 threaded into said boss, forming what may be termed a pin-and-slot connection for longitudinal adjustment of said block with reference to said pipe. The forward end of the block 114 is slotted for the reception of the horizontal wing of the angle-bar 98 to which the block may be clamped by means of a thumb-screw 116 (Figs 6 and 7). It will thus be seen that by loosening the screw 115 the gauge-bars 92 may be adjusted as hereinbefore referred to without disturbing the positions of the pipes 111 or their nozzles 112 which, therefore, within restricted limits, may be rigidly supported in original relative positions irrespective of positional adjustment of the gauge-bar frame.

As hereinbefore stated, the particular embodiment of my invention shown and now being described is especially adapted for use in connection with a ruling machine. As

the latter may be of any standard or approved make or type, I have only shown the forward end of the main frame thereof, comprising the standards or uprights 117 and 117′, upper side rails 118 and 118′ and the lower side rail 119′ the opposite counterpart of which does not appear. At the forward end of the ruling machine is located a driven roller 120 around which pass endless cords 121 providing a conveyor for preliminary advancement of the sheets fed in succession thereto. To deliver the sheets to the roller 120 I provide a conveyor-frame which comprises the side bars 122 and 122′ and the idler rollers 123 journaled in bearings in the ends thereof. Obviously, the positional relationship between the roller 123 and the roller 120 should be that of the closest practical proximity with highest peripheral lines of each in substantially the same horizontal plane. As the height of the roller 120 from the floor may and does differ in different types of ruling machines, and for other reasons, instead of providing a separate support for the far end of my conveyor-frame, I provide means on the ruling machine frame for such support, thus not only insuring exact relative positioning but making the machine of my invention readily adaptable to any type of ruling machine. The far end of my conveyor-frame may be supported from the frame of the ruling machine in many different ways. A simple, convenient and practical support is provided by a cross-bar 124 secured at its ends at the proper elevation to the uprights 117 and 117′, upon which the side-bars 121 and 122 rest. In order to provide for selective vertical positioning of this far end of the conveyor-frame the near end thereof, the relative vertical position of which must be permanently fixed, should be pivotally supported, wherefore I have shown a pin 125 mounted at the far end of the bracket 101 upon which the near end of the side-bar 121 is pivoted, and a pin 126 correspondingly mounted in the bracket 102 upon which the end of the side-bar 122 is pivoted.

Journaled in bearings in the brackets 101 and 102 is a shaft 127 upon which is mounted the roller 128. Upon this roller each sheet is delivered as it is slipped from the top of the pile, and as intervening parts render necessary the location of the roller at an appreciable distance from the rear end of the pile or stack and the employment of a spanning guide-plate or other suitable guiding means has been found to be impracticable, the end of the flexible sheet will sag more or less—depending upon the thickness and quality of the stock—as the sheet is advanced from the top of the pile, wherefore I locate this roller 128 in such vertical position that the plane of the top line thereof shall be appreciably below the plane of the bottom line of the feed-wheel 52, as best shown in Fig. 6. Around the roller 128 and the roller 123 passes a series of endless conveyor-tapes 129 129 which advance the sheets received upon the roller 128 successively for delivery upon the roller 120.

When the sheet throughout its entire length rests upon the tapes 129 nothing other than its own weight is required to retain it in place in transit to the roller 120, but the aforesaid necessary distance between the point or points of engagement of the sheet by the feed-wheel 52 and the top of the driven roller 128 is relatively so great that in order to insure continuous movement in perfect alignment of the sheet being fed (and for another reason which will be subsequently explained) means cooperating with the roller 128 should be provided to positively engage the sheet in process of withdrawal from the pile and retain such engagement until the sheet in its entirety has been passed to the tapes. For this purpose I pivot upon the shaft 49 an arm 130 carrying at its free end the idler roller 131 which is located just back of the wheel 52 and which rests upon the roller 128. Obviously, each sheet passes between these rollers, and the weight of the roller 131 is made sufficient to insure sufficiently positive driving engagement.

The feeding machine of my invention may, of course, be driven independently of the ruling or other machine to which the sheets are to be fed, but it will be apparent that there must be at all times a constant definite relationship between the speeds of the two machines. This can best be insured by driving one directly from the other, to say nothing of the economy resulting from the provision of a single source of power and the absence of necessity for providing and adjusting separate connections between the feeding machine and the same or another primary source of power. I have shown (more or less diagrammatically, in Figs. 1 and 2) a sprocket 132 mounted in any suitable manner in the frame of the ruling machine and driven at the desired velocity in any suitable manner from any convenient moving element of said machine. This can be done in so many different ways, common and well known, that detailed illustration and description of any one thereof is deemed to be unnecessary. Around the sprocket 132 and around the sprocket 50 on the shaft 49 passes the chain 133 whereby, through said shaft, the wheel or cylinder 52 is rotated at a peripheral velocity which, for the time being, may be said to proximate the velocity at which the sheets are advanced through the ruling machine—although, as a matter of fact, the former velocity should be slightly less than the latter for reasons

which will hereinafter be made clear. After passing around the sprocket 50, the chain 133 is not returned directly to the driving sprocket 132, but is directed around an idler roller 134—which is adjustably mounted so that it also provides a chain-tightening roller—on said bracket 102, thence around a sprocket 135 on the shaft 127 and thence back to the sprocket 132. Thus the chain 133, in addition to driving the shaft 49 and the wheel or cylinder 52 thereon, also drives the roller 128 in an opposite direction—for the direction of rotation must obviously be opposite to that of the wheel 52—and (for reasons hereinbefore referred to to be hereinafter explained) the pitch of the sprockets is so proportioned that the roller 128 is rotated at a slightly greater peripheral velocity than that of the wheel or cylinder 52.

I have not shown means for the actuation of the double-function pump 109. As there is no necessity for either the establishment or the maintenance of any inter-dependent timing relationship so far as is concerned the speed at which the pump is driven, it may be operated in any suitable manner from some driven element of either machine, or it may be operated independently, as by a small electric motor directly coupled thereto. A stack or pile of sheets having been properly positioned on the table 70, the gauge-rods and gauge-bars having been properly adjusted, and the table elevated—in a manner to be described—to bring the top of the pile to the desired degree of proximity to the bottom of the wheel 52, the pump 109 is set in operation, having the effect, first, of discharging a mild air blast from the ends of the pipes 111 against the rear end edges of the upper sheets of the pile and forcing their separation throughout at least a sufficient portion of their lengths to break any temporary adherence and permit comparatively free sliding movement of the top sheet by itself across the sheet underneath. As has been explained, the pump also operates to partially exhaust air from the chamber 67 around the pipe or hollow shaft 57, thereby creating suction through the slot 66 in the bottom of the head 64 on the arm 63. This suction is continued through the particular perforations 54 or parts thereof at that moment registering with said slot, whereby the air pressure forces the top sheet of the pile against the periphery of the wheel 52 throughout an area which approximates the dimensions of said slot. The wheel 52 being rotated in the manner described, and the area of engagement with the sheet being progressively advanced as the sheet is withdrawn—that is to say, the air pressures being equalized the instant the perforations 54 clear the slot 66—the constantly lengthening rear portion of the sheet is freed as the sheet advances and it is directed between the rollers 128 and 131. When the other end of the sheet has cleared the area of air-pressure action, the next succeeding sheet is similarly acted upon, wherefore it will be apparent that single sheets will be fed from the pile successively and at regular intervals to the conveyor-tapes 129. To assist in freeing the rear portion of the advancing top sheet from the wheel 52 after clearance of the slot 66, I provide a U-shaped plate 137 between the legs of which the periphery of the wheel 52 is located, these legs insuring proper separation of the sheet from the wheel under all ordinary conditions without in any way interfering with continuous engagement. I have shown this U-shaped plate 137 supported from the end of the arm 63 by means of an angle-iron 138, as clearly shown in Fig. 6.

Sometimes exact uniformity of spacing between the advancing sheets is not essential, and sometimes it is. For instance, when it is desired that the ruled lines extend entirely across the sheet from edge to edge, it is the general practice to permit the ruling pens to remain in depressed or operative positions, in which circumstances spacing—except to minimize ink wastage—is not a matter of importance. At other times, however, it is desired that the ruled lines extend only a portion of the distance across the sheet, in which case the pens are automatically raised and lowered at proper regular intervals, and while reciprocating stop-fingers are employed to secure exact uniformity of spacing in the ruling machine, a greater degree of exactness in uniformity of spacing all along is necessary.

It will be apparent that what may be termed the point of initial engagement of the top sheet of the pile by the wheel 52 must be some little distance in front of the rear edge of the pile. Therefore, it will also be seen that if the velocity of the advancing top sheet continues to be the same as the peripheral velocity of the wheel 52 after release therefrom, the next succeeding sheet will be drawn against the wheel and start to advance before the top sheet has cleared the pile and the edges of the advancing sheets will be overlapped. It is on this account that I provide for the rotation of the roller 128 at a peripheral velocity greater than that of the wheel 52. The moment the edge of the sheet is engaged between the rollers 128 and 131 it is drawn rearwardly at a sufficiently increased speed to insure clearance of the pile before the next succeeding sheet starts to move—or, at least, before it has been moved a distance sufficient to result in overlapping. However, while this insures spacing, it does not insure absolute uniformity in spacing, due to unequal frictional resistances at different times, and possibly for other reasons

I secure this uniformity by breaking at exceedingly well regulated intervals the partial vacuum in the head 64 and thus permitting idle rotation of the wheel 52 during such regulated intervals. As preferred means to this end, I interpose between the connection 58 at the end of the exhaust pipe 59 and the tube or hollow shaft 57 a valve 139—this particular location having been selected for no other reason than that of simplicity and convenience in the transmission of power to actuate the valve and properly timing the application of such power. This valve is shown in detail in Figs. 24 to 28, inclusive, and preferably includes a short sleeve 140 mounted on the tube 57 the interior diameter of the major middle portion of which is greater than the external diameter of said tube, whereby a shallow cylindrical chamber is provided around a portion of said tube, the ends of said sleeve snugly fitting said tube and being exteriorly screw-threaded for the reception of set-nuts 141 and 142. Near one end of the sleeve 140 I provide an annular bead or rib 143 between which and the set-nut 141 the stop-ring 144 is adjustably clamped. At the other end of said sleeve an oppositely disposed stop-ring 145 is adjustably clamped between the set-nut 142 and the end of the threaded portion of the sleeve. Snugly but rotatively mounted on the sleeve 140 between the rib 143 and the stop-ring 145 is a collar 146 from which depends an arm 147 oscillation of which is adapted to rock said collar on said sleeve.

While any form of adequate stop-lugs on the stop-rings would doubtless fulfill the strictly mechanical requirements, I prefer to form the ring 144 with an eccentric portion 148 which terminates in an abrupt shoulder 149. At this end of the collar 146 I provide a lug 150 projecting beyond the end of the collar and adapted upon rotation of said collar to impinge against the shoulder 149 of the ring 144 and thus limit the arc of rotation in that direction at a predeterminable and selective point—determined by the rotative position of the adjustable ring 144. Similarly, the stop-ring 145 is formed with an oppositely disposed shoulder stop 150′ against which the lug 151 at this end of the collar 146—similar in all respects to the lug 150 but oppositely disposed—is adapted to impinge and thus limit rotation of said collar in the other direction at a predeterminable point.

I have shown the collar 146 provided with a longitudinally elongated slot 152 and the sleeve 140 with a corresponding (see dotted lines in Fig. 24) slot 153, which slots are adapted to be brought into and out of registry with each other by rotation of the collar 146. When the various parts are in the relative positions indicated in Figs. 24, 25, 26 and 27, with the arm 147 swung to the limit of its movement toward the left (Fig. 26), the slot 153 is closed and the cylindrical chamber within the sleeve 140 sealed. When the arm 147 is swung to the limit of its movement toward the right (Fig. 27), the slots 152 and 153 are brought into registry and said chamber is opened to the atmosphere. Within the sleeve 140 I provide the tube 57 with a slot 154, which for the purpose of securing maximum area and therefore sensitiveness I have shown in helical form, wherefore the interior of the tube 57 is constantly open to the cylindrical chamber provided by the sleeve 140.

It will now be apparent that by providing means for actuating and positively and accurately timing oscillation of the arm 147 from some positively driven element of the ruling machine, I may render rotation of the wheel 52 alternately effective and ineffective at precisely regular intervals through quickly making and breaking the partial vacuum in the head 64 at exactly the proper instants. To this end, I mount in convenient location upon some part of the frame of the ruling machine—as, for instance, on the lower side of the rail 118, as shown—an oscillating arm or lever 155 the end of which is connected with the end of the valve-controlling arm 147 by a rod 156. A spring 157 in tension between the lever 155 and any suitable anchorage yieldingly retains said lever in what may be termed its most retracted position and therefore the arm 147 in the position indicated in Fig. 26, and with said arm in this position the valve 139 is closed and rotation of the wheel 52 is effective. Contiguous to the lever 155 I mount a cam 158, so positioned that the cam face impinges against a roller 159 on said lever and adapted upon each rotation thereof to oscillate said lever against the action of the spring 157.

This cam 158 may obviously be driven in any one of a number of different ways from any conveniently located and positively actuated moving element of the ruling machine, the only essential being that the speed of rotation thereof be made proportionate to the velocity at which the sheets are advanced through the ruling machine. At the proper moment, the cam 158 acts against the lever 155 and operates through the rod 156 to swing the valve-controlling arm 147 to the position indicated in Fig. 27, and with said arm in this position the valve 139 is open, as has been described, the partial vacuum in the head 64 is broken, and rotation of the wheel 52 is made instantly ineffective. The ring 144 with the shoulder stop 149 coacting with the collar lug 150, and the ring 145 with the shoulder stop 150′ coacting with the collar lug 151 may be set in any predetermined relative positions on the sleeve 140 so as to regulate and determine the arc of ro-

tation of such sleeve when the arm 147 and collar 146 are rocked by the cam 158 as has been heretofore described. The shifting of the relative positions of the stops 149 and 150′ one with the other, therefore varies the extent of the oscillating movements of the sleeve 140, and therefore determines that moment in the cycle when the ports 152 and 153 are alined to register with the slot 154 in the tube 57 to break the partial vacuum in the head 64 during the regular movement of the arm 147 to the right as shown in Figs. 26 and 27. In this manner the duration of the time interval which elapses between the instant of clearance of the slot 66 by the advancing top sheet of the pile and the instant of engagement of the next suceeeding sheet may be made for all practical purposes exactly predeterminable and uniform spacing thus insured.

In order to insure advancement of the sheets in succession in practically perfect alignment from the rollers 128 and 131 with the tapes 129 to the feed roller 120 of the ruling machine, suitable side guides should be provided, and in view of the fact that the automatic feeding machine as a whole should be adapted to feed sheets of any one of a number of different widths such side guides should obviously be made laterally adjustable. To provide these guides and for their proper support, I mount upon the side-bar 122 of the conveyor-frame, toward its forward end, a standard or bracket 160, and directly opposite, on the side-bar 122, a counterpart standard or bracket 160′. These standards are preferably bolted to said side-bars and the same bolts may be utilized to secure and support the cross-rod or shaft 161. Secured in the upper ends of these standards is another cross-rod or shaft 162. Corresponding standards 163 and 163′ are similarly mounted on said side-bars toward the rear ends thereof, and corresponding cross-rods or shafts 164 (Fig. 23) and 165 are similarly mounted and relatively positioned.

Irrespective of the lateral dimensions of the stack or pile of sheets 69, it is intended that it be positioned as far to the right as practicable on the table 70 (the right-hand side of the machine being considered as that shown in Fig. 2), wherefore it is not necessary that the right-hand guide for the advancing sheets have a wide range of adjustment. To provide this right guide, I slidably mount upon the rod or shaft 161 a block 166 and similarly upon the rod or shaft 164 a corresponding block 166′ (see dotted lines in Fig. 23). These blocks have flat upper faces upon which is mounted the angle-bar 167 the vertical wing of which is adapted to provide a guide while the horizontal wing thereof supports the extreme side-edge of the advancing paper sheet. A screw 168 passes through a threaded bushing 169 which is clamped in the block 166, and it will be apparent that if this screw is held against longitudinal movement rotation thereof will slide the block 166 on the rod or shaft 161 one way or the other, according to the direction of rotation. Similarly, a screw 170 is passed through a correspondingly threaded and clamped bushing 171 in the block 166′. It is essential, of course, in adjusting this right guide, that both ends of the angle-bar 167 be equidistantly moved. Synchronous rotation of the screws 170 and 171, and therefor synchronous movement of the blocks 166 and 166′—and, therefore, proper adjustment of the guide at one operation—is effected and insured by the sprockets 172 and 173 mounted at the ends of the screws 168 and 170, respectively, and connected by the chain 174. A single hand-wheel 175—which may obviously be mounted upon the projecting shank of either of the screws, but which is shown as mounted upon the shank of the screw 170—may thus be made to effect this entire preliminary adjusting operation. The usual set-nuts are provided, of course, to lock said screws in their adjusted positions.

I refer to the above-described adjusting operation as "preliminary" because I prefer to provide for a finer or more delicate adjustment than can be effected by the instrumentalities which I have just described. To this end, I provide a comparatively deep transverse channel or mortise 176 in the upper side of the block 166 (Fig. 22) within which the smaller block 177 is slidable. To the top of this smaller block 177 is screwed the horizontal wing of the angle-bar 167 and through the same is threaded the screw 178. A small plate 179 spans the outer end of said channel or mortise and cooperates with an annular groove in said screw to prevent axial movement of the latter upon rotation, wherefore such rotation will effect movement of the block 177 in the channel 176, in one direction or the other, according to the direction in which the screw is turned. In this manner I am able to quickly and readily compensate for any slight defect in the preliminary adjusting operation due, for instance, to lack of perfect synchronism of movements of the two blocks 166 and 166′, practically impossible to effect even through the employment of a gear-train, to say nothing of a chain-and-sprocket connection.

The left-guide must obviously be capable of a much wider range of lateral adjustment in order that the feeder may be made to accommodate sheets of any one of a number of widely varying widths. To provide this left-guide, I mount upon the rod or shaft 162 a slidable collar 180 having a boss 182 through which passes a setting thumb-screw 181. From this collar depends an arm 183 the lower end of which has pivotal connec-

tion with a bracket 184 suitably secured to the longitudinally disposed bar 185. The rear end of this bar 185 is supported in a precisely similar manner from a corresponding collar 186 on the rod or shaft 165. At intervals along the bar 185 I mount a series of vertically disposed blades 187 187 preferably—in order to effect independent adjustment and ready removal or replacement thereof—by securing the near end of each blade to the vertical wing of an angle-iron 188 (Fig. 20) the shorter horizontal wing of which is clamped against the upper face of the bar 185 by means of a set-screw 189. These blades are preferably inclined in the direction of the paper sheets advancing between them and the hereinbefore-described right-guide, whereby the extreme edges only of said blades contact with the contiguous edge of each advancing sheet.

The right-guide having been properly adjusted, the interposition of a sheet of the size of those intended to be fed enables quick, ready and accurate adjustment of the left-guide to be effected by turning the screws 181 and releasing the collars 180 and 186, then simultaneously sliding said collars on the shafts 162 and 165 until the edges of the blades 187 are to the minutest extent short of contact with the edge of the interposed sheet, and then re-setting the collars with the blades so positioned. The blades 187 are inclined to minimize friction and to obviate the possibility of an irregular or mutilated sheet-edge contacting in transit with anything in the nature of a shoulder or stop by which it might be distorted, become "jammed" on the conveyor and necessitate stopping the machine for complete readjustment.

It will be noticed that as it is necessary that the lower edge of the blades be substantially below the plane of the advancing sheets, it is also necessary that they be below the plane of the supporting tapes, wherefore, unless these blades can be raised to clear the tapes it would be impossible to secure a wider range of adjustment than would be included in the distance between two contiguous tapes. It is on this account that I pivot the bar-carrying brackets 184 at the ends of the arms 183, wherefore, when more or less extensive lateral movement of the blades 187 is necessary, before sliding the loosened collars 180 and 186 on the rods 162 and 165, the arms 183 are swung in the direction indicated by the arrow in Fig. 19, having the effect of elevating the bar 185 and therewith all of the blades 187 to vertical positions where, upon lateral movement, they will clear the tapes, as shown by the dotted lines in said figure.

I have hereinbefore referred to the fact—which will now have become obvious—that as the height of the pile or stack 69 is reduced by depletion, the supporting table 70 must be compensatingly raised in order that the top sheet of the remaining stack will always be in proper position to be acted upon by the withdrawing means. To this end, I mount in the top of the frame-plate 41 the short posts or standards 190 and 191, carrying at their upper ends the cross-arm 192, and in the top of the frame-plate 42 the posts or standards 193 and 194, carrying the cross-arm 195. To combine strength and lightness, these arms 193 and 195 are made U-shaped, as shown. Journaled in bearings in the frame-plate 41 and in the base 39 (where I prefer to interpose an anti-friction ball 196) is a shaft 197 which is screw-threaded throughout substantially its entire length. Similarly journaled in bearings in the frame-plate 42 and in the base 40 is a correspondingly threaded shaft 198. Journaled in bearings in the cross-arms 192 and 195 and located in the vertical plane of the shafts 197 and 198 is the shaft 199. At the upper end of the threaded shaft 197 is mounted a bevel-gear 200 in mesh with a similar gear 201 on the shaft 199, and at the upper end of the shaft 198 is mounted a bevel-gear 202 in mesh with a similar gear 203 on said shaft 199. The pitch of these gears is such that the threaded shafts 197 and 198 are rotated synchronously by rotation of the shaft 199.

The table 70 is identically supported at each side thereof, wherefore a detailed description of the supporting means on one side will suffice for both. Threaded on the shaft 197 is a nut or square collar 204 opposite sides of which are channeled for the reception of bars 205 and 206. Slidable on the standards 35 and 36 are the guide-shoes 207 and 208 having lugs 209 and 210 which project between the bars 205 and 206 on either side of said nut or collar 204 where they are secured by bolts 211, thus providing an essentially rigid structure. Relative positioning is such that the inner bar 206 may be elongated, as shown, and to this bar 206 is bolted or otherwise suitably secured the angle-bar 212. The table 70 is directly supported upon rails 213 secured thereto along each side edge thereof, and in the bottom faces of these rails are provided suitably located depressions or seats which receive the protuberant buttons 214 on the horizontal wing of the angle-bar 212, whereby mounting of the table—which is removable—in proper adjustment is facilitated. With identical instrumentalities employed in connection with the threaded shaft 198 on the other side of the machine, it will be apparent that upon rotation of the shaft 199 the table 70 will be uniformly raised or lowered, according to the direction of rotation of said shaft. The fact that the bars 205 and 206 are loose in the channels in the nut or collar

204 is of importance, for one reason because the weight of the pile or stack of sheets supported upon the table is often—in fact, almost invariably—unequally distributed, and if the entire supporting structure were rigid there would be a tendency for the nut or collar 204 to bind upon the threaded shaft and be raised with difficulty. Furthermore, as the parts became worn, the same undesirable result would be effected.

Mounted near the end of the shaft 199 is a ratchet-wheel 215, and loose upon said shaft adjacent to said wheel is pivoted a swinging lever 216 having pivoted at the upper end thereof a pawl 217 adapted to engage the teeth of said ratchet-wheel and rotate the latter in a counter-clockwise direction (Fig. 3) when said lever 216 is oscillated. Loose on the end of the shaft 49 is a sleeve 284 (Fig. 14) rotated from the shaft 127 by means of a chain 136′ passing around sprockets 51 and 136 on said sleeve and said shaft, respectively. To the end of said sleeve is secured a disc-wheel 218 to which is pivoted a connecting-rod 219 having a head 220 with an elongated slot 221 into which projects a pin 222 on the lower arm of the lever 216. This lever is provided with a bulge or protuberance 223 on the right-hand side thereof (Fig. 3) the weight of which tends to swing said lower arm to the left (same figure) and the upper arm to the right with the effect of re-setting the pawl 217 in a new position of engagement. The lever 216 being free to oscillate, such re-setting of the pawl would occur when the connecting-rod 219 was reciprocated to the left (same figure), and upon reciprocation to the right through engagement with the pin 222 said lever would be positively actuated in a counter-clockwise direction and the pawl 217 will effect rotation of the ratchet-wheel 215 through a comparatively small arc. As has been explained, rotation of the wheel 215 effects rotation of the shaft 199 which, in turn, effects elevation of the table 70 to a minute extent in the manner described.

It will be seen, therefore, that when the machine is in operation and the height of the pile or stack 69 is being gradually reduced by depletion, so long as the lever 216 is free to oscillate the table 70 will be gradually elevated to compensate for the depletion. No such instrumentalities as those just described, however, would be capable in themselves of such adjustment as would insure the proper rate of motion of the table under all of the varying conditions. Such rate of motion must be exactly proportionate to the rate of decrease in the height of the pile or stack and not to the velocity of any moving part of the machine. Therefore, I journal in bearings in the brackets 47 and 48 a shaft 224 upon which I mount adjustably one end of a forwardly projecting rod 225 at the free end of which is adjustably mounted a vertical gauge-pin 226 the lower end of which is at least partially rounded and is designed to rest upon the pile or stack 69 near the forward edge thereof. It will be apparent that as the height of the pile or stack is reduced by depletion, the weight of the pin 226 and the free end of the rod 225 (augmented in a manner hereinafter described) will cause them to lower, thereby rotating the shaft 224 through a minute arc-determinable, for all practical purposes, by regulating the distance at which the pin 226 is mounted from the shaft 224.

Fixed on the shaft 224 at the end thereof is a collar 227 from the sides of which project the downwardly directed arms 228 and 229—the whole having the appearance of an inverted U-shaped frame. Between this collar 227 and the fixed collar 230 is loosely mounted the collar 231 projecting forwardly from which is a bar 232 and downwardly from which projects the arm 233 which is curved to bring the end thereof between the ends of the arms 228 and 229. Through the latter are threaded the adjusting screws 234 and 235 the ends of which impinge against the end of the arm 233, wherefore it will be seen that the rotative position of the collar 231 on the shaft 224 may be adjusted with great delicacy—which is necessary in view of the fact that an exceedingly minute deflection of the bar 232 near the collar 231 is greatly multiplied at the far end thereof where delicacy of adjustment is of the utmost importance.

At the end of the bar 232 I provide an elongated longitudinal groove or channel 236. Secured to the plate 41 is a small bracket 237 carrying a pin 238 upon which is pivoted an elongated finger 239 which passes through a retaining stirrup 240 mounted at the extreme end of the bar 232 and into the channel 236, extending nearly but not quite to the end thereof (see Figs. 3 and 5). A small lug 241 on the under side of the finger 239 near the pivoted end thereof provides what may be termed a fulcrum, and it will be seen that vertical oscillation of the bar 232 will effect amplified vertical oscillation of the finger 239. Upward movement of said finger is limited by the stirrup 240 at a point where the top edge of the finger is approximately flush with the top surface of the bar 232.

Pivoted to the lower end of the lever 216 is the gravity-actuated detent 242 the point of which, when said lever has been swung to the limit of its movement to the right (as shown in Fig. 3), rests against the shoulder formed at the end of the channel 236. The pile or stack 69 having been positioned on the table, and the pin 226 on the rod 225 having been adjusted by means of the screws 234 and 235 in such manner as to swing the

finger 239 to its most raised position (as shown in said figure), in which position the end thereof is in the path of movement of the detent 242. If now the machine be started, as the connecting-rod 219 is reciprocated to the left (same figure) the detent will impinge against the end of the finger 239 and the lever 223 will be checked against movement, the pin 222 riding idly in the slot 221 in the head of said rod. Under these conditions, there will be no rotation of the wheel 215 and consequently no change in the elevation of the table.

Withdrawal of a very few sheets from the stack or pile, however, permits the pin 226 and therewith the end of the rod 225 to drop through a space which, while exceedingly slight, is still sufficient to permit the end of the bar 232 to fall and withdraw the end of the finger 239 from the path of movement of the detent 242. Now when the connecting-rod 219 is reciprocated to the left, the weighted portion 223 of the lever 216 will cause the latter to swing with said rod, thereby re-setting said pawl 217, so that when said rod is reciprocated to the right the wheel 215 will be rotated with the effect, as explained, of slightly raising the table 70. All of the various parts of the table-raising mechanism herein shown and described are readily capable of such separate and joint adjustment that they may be made to effect the raising of the table at a rate of motion which for all practical purposes exactly compensates for the exceedingly gradual reduction in the height of the pile by the successive withdrawal of a single sheet from the top thereof, and that irrespective of the initial height of the pile (within the limits of the available space), the thickness of the individual sheets of the quality of the stock.

To obviate the possibility of seriously impeding withdrawal of the top sheet of the pile by undue friction caused by the combined weight of the gauge-pin 226 and the rod 225, augmented by the weight of the bar 232, I mount in the collar 227 at the end of the shaft 224 a rearwardly directed horizontal rod 280 with a counterbalancing weight 243 adjustably mounted thereon, whereby the pressure of the pin 226 against the top of the pile or stack 69 may be made to be no more than is just sufficient to insure performance of the function for which it is designed. I have also shown mounted on the bar 232, in the path of movement of the lower end of the lever 216, a stop 244, so located as to check movement of said end rearwardly at the proper point and thus prevent any overthrow that otherwise might result from momentum.

It will be noted that the manner hereinbefore described in which the table 70 is mounted and supported, while insuring through the protuberant buttons 214 proper horizontal adjustment without difficulty, permits of ready withdrawal and replacement of the table when desired from the front of the machine between the standards of the main frame. This may be said for all practical purposes to be essential, for the stack is almost invariably initially of such height that its weight is far too great to permit of its being placed and adjusted as a unit upon a fixedly mounted table and the piece-meal building up of a stack thereon would be far too difficult to attempt with economy; wherefore it is most desirable—if it may not be said to be essential—to "load" the table while it is detached from the machine and then slide the same with its "load" into place. If desired—as it frequently is in the larger plants—two tables may be employed, one being "loaded" while the other is in use during operation of the machine, thus minimizing the time lost in the "make-ready."

In this connection, I might well call attention to the fact, as will be noted, that the entire front of the frame of the machine is "open," whereby a detached table may be placed upon a truck and there "loaded," the truck having ample clearance for movement to a position where the "loaded" table may be readily slid onto the supporting angle-bars 212 and adjusted thereon.

Of course, the stack should be properly positioned and adjusted on the table before the latter is re-placed in the machine. The rear edge of the table will serve as a gauge for what may be termed longitudinal adjustment of the stack but, obviously, some means must be provided for preliminary lateral adjustment. To this end, I provide in the right-hand edge of the table 70 a T-slot 265 within which the shoulders support a slide 266 from which depends a lug 267 in which is provided a seat or socket for the removable vertical rod or post 268. When the slide 266 has been properly positioned in the slot 265, it may be fixed in such position in a common and well-known manner by means of a clamping-plate 272 and the screw 273. The slide 266 having been "set", the rod or post 268 may be raised out of its seat or socket and the table withdrawn, as explained. A corresponding rod or post may then be inserted in the seat or socket of the detached table against which the "new" stack is adjusted. Obviously, upon removal of the auxiliary rod or post and re-placement of the newly "loaded" table, the stack thereon will be in proper lateral adjustment against the replaced rod or post 268.

I have shown clamped on the rod 80 a split-collar 271 from which projects a lug or arm 270 having at its end the sleeve 269 within which the rod or post 268 is slid-

able. It will thus be seen that the rod or post 268 having been properly positioned for lateral adjustment of the stack, the rod 80—having been first released—will have been moved therewith to automatically properly position the gauge-rods 85 and 87 with which the rod or post 268 is aligned.

When a newly "loaded" table is slid onto its supports, its relative vertical position is generally a little too low to establish the necessary positional relationship between the wheel or cylinder 52 and the top of the stack, wherefore careful initial adjustment is required. For this purpose, I have shown loosely mounted at the end of the shaft 199, adjacent to the ratchet-wheel 215, a crank-arm 245 provided with a handle 246. I have further shown this crank-arm 245 provided with a boss 247 having a bore within which a lock-pin 248 is spring-pressed to projecting position. This pin 248 registers with a circularly arranged series of holes 249 near the periphery of the wheel, and when in any one thereof the wheel and crank are connected and the former may be rotated by turning the latter. The purpose of this construction, among others, is that of making the initial location of the handle 246 selective, as a matter of convenience. When it is desired to change the relative position of the crank, the pin 248 is withdrawn against the action of its spring by means of a head 250 secured at the end thereof. It will be seen that by turning the crank 245 in the proper direction the table 70 may be raised and initial adjustment thereof readily effected.

When a "job" has been finished, however, the stock exhausted and the table in its highest position, the matter of lowering for removal and replacement is quite a different proposition. Action of the screws 197 and 198 is so slow that by far too much time and effort would be consumed if the table were lowered by hand through the instrumentality of the crank 245. I therefore mount loose upon the shaft 199, between fixed collars thereon and at the end thereof, the clutch-member 251 which carries the sprocket 252 driven from a sprocket 253 mounted at the end of the shaft 127 by means of the chain 254. During normal operation of the machine, of course, the clutch-member 251 runs idly on the shaft 199. The other clutch-member 255 is feathered on said shaft and is provided with the usual annular groove in which is located the roller mounted on the clutch-operating lever 256, whereby the clutch may be "thrown in" when desired in a common and well-known manner and the shaft 199 rapidly and continuously rotated in a direction which effects the lowering of the table 70. Of course, to permit of such continuous rotation, the pawl 217 must be held out of engagement with the teeth of the ratchet-wheel 215, and to effect this automatically I have shown the clutch-operating lever 256 extended to provide an arm 257 at the end of which is mounted the upwardly-directed pin or post 258. Secured to the lever 216 near the upper end thereof is a small bracket to which is pivoted a lever 259 the operative end of which is so shaped, and said lever otherwise so located and disposed, that when said end is swung to the left (Fig. 5) it will engage a lug 260 on the pawl 217 and swing the latter upwardly, clear of the teeth of the ratchet-wheel. A rod 261 connects the other or operating end of the lever 259 with the top of the pin or post 258, wherefore it will be seen that when the clutch is "thrown in" by the lever 256, the pawl 217 is at the same time automatically disengaged from the teeth of the ratchet-wheel and the shaft 199 will be rapidly rotated to lower the table.

Obviously, during normal operation of the machine, the clutch-member 255 should be yieldingly retained in disengaged position with the lever 259 similarly in a position of disengagement. On account of the relative association and arrangement of parts, I have found impracticable the employment of a spring heavy enough for this purpose, and prefer to employ a weight 262 suspended by a cord 263 which passes over an idler pulley 264 and has the end thereof secured to the arm 257 of the lever 256, wherefore both the clutch and the lever 258 are normally yieldingly held in disengaged positions and automatically returned to such positions upon release of the lever 256 after a table-lowering operation.

I have shown the lug 260 on the pawl 217 provided with a bore in which is mounted a little plunger 281, interposed between which and a screw-plug 274 is a spring 275, whereby the end of said plunger is spring-pressed against a flattened face on the pivot 276. As shown in Fig. 4, another flattened face adjoins the one first mentioned, whereby, when it is desired to turn the wheel 215 back and forth in making careful final adjustment of the table 70, the pawl 217 may be turned until the end of the plunger 273 impinges against the last-mentioned flattened face and thus yieldingly retain said pawl in a position of disengagement.

The sheets of the pile or stack 69 should of course be successively engaged by the wheel or cylinder 52 at points substantially midway between the side edges thereof, and as the stack is always positioned as far to the right as possible on the table 70, there is never any occasion for fixing said wheel or cylinder on the shaft 49 any farther to the left than the middle of said shaft. Most often, the wheel or cylinder is adjusted at a point much farther to the right than the

middle of the shaft 49, and the reason for the employment of the comparatively long sleeve 60 to form the cylindrical chamber 67, and for the location of the aperture 68 in the hollow shaft 57 near the left-hand end of said chamber, is to permit of the obviously necessary adjustment of the arm 63 to the left with the wheel or cylinder 52.

The reason for making the gauge-bars 92 forwardly and rearwardly adjustable through a slight distance is because the location of the end of the stack with reference to the point of engagement of the top sheet thereof to be fed determines—to a much greater degree of exactitude than the difference in the peripheral velocities of the wheel or cylinder 52 and the roller 128—the distance or extent of the space between the advancing sheets after having been fed to the conveyor. This spacing, therefore, within certain limits, is adjustable to a high degree of exactitude without varying the ratio of peripheral velocities between the wheel or cylinder 52 and the roller 128.

I have hereinbefore referred to the desirability of standardization of parts for machines of different sizes and for different purposes, with economy of manufacture in view. It will be noted that if a wider machine is required, it is only necessary to substitute longer stay-rods for the rods 43 and 44, or shorter stay-rods for a narrower machine. If it is desired to support all of the inter-related mechanisms at a higher elevation, it is only necessary to substitute longer or taller standards for the standards 35 and 36 and their opposite counterparts, or shorter standards if a reduction in height is desired. If increased distance between the table-controlling mechanism and the paper engaging and withdrawing mechanism is required, it is only necessary to adjust the brackets 47 and 48 on the rods 45 and 46, respectively, and either longer or shorter rods may be readily substituted if necessary or desirable. The desirability of thus being able to easily detach, remove, substitute and interchange parts of the supporting frame is thought to be too apparent to require comment.

The air currents, both from the compression and the exhaustion sides of the pump must be controlled and regulated to a certain degree of nicety and frequently independently of each other. This cannot well be done—if at all—through varying the speed of operation of the pump. It is therefore most desirable, particularly if the pump is directly driven from an electric motor, the normal speed of which is more or less variable on account of variations from time to time in the intensity of the electric current supplied, that means independent of the pump be provided for separately controlling and regulating the degree of the partial vacuum in the head or mouthpiece 64 and the intensity of the air blast from the nozzles 112. To control the degree of suction, I provide at the right-hand end of the tube or hollow shaft 57 (although a similar instrumentality located at any point along the entire length of the suction conduit would obviously serve the same purpose) an ordinary regulator-cock 282 by means of which the interior of said tube may be to a greater or lesser extent opened to the atmosphere. To control the intensity of the air blast, I slidably mount upon each of the nozzles 112 (Fig. 9[a]) a sleeve 286 having a lip or tongue 287 at its upper end which upon sliding said sleeve upon said nozzle may be made to vary the area of the opening from the nozzle 112 to the tip 112′ thereof and thus correspondingly vary the intensity of the air current delivered against the upper end of the stack. To fix said sleeve in any one of its various positions of adjustment, the lower end thereof may be slotted and a split-collar 288 with its clamping screw 289 provided to clamp said sleeve to said tube.

After adjustment of the sleeve 286 on each of the nozzles 112, the intensity of the air blast is automatically regulated and substantial uniformity of current insured by means of the valve 110′ located in the pipe 110 and preferably at the end thereof, as shown, where I provide an elbow 290 carrying a comparatively short pipe 291 (Fig. 29). Over this pipe 291 I fit a sleeve 292 the top of which is closed and from which projects the vertical pin or post 293. Near the upper end of said sleeve I provide lateral openings which are closed by the pipe 291 when said sleeve is in its lowermost position, as shown in Fig. 29, and more or less opened to the atmosphere when said sleeve is raised. Upon the pin or post 293 may be removably mounted in a common and well known manner a plurality of weights 294 whereby the pressure tending to depress said sleeve may be varied through the removal or addition of a weight or weights. It will be apparent that, the valve being closed, the weight on said sleeve may be so regulated that an undesirable excess of air pressure in the pipe 110 will raise said sleeve proportionately to the degree of such excess and permit the escape of air from said pipe until such excess pressure has been relieved. I have shown the pipe 291 provided with a longitudinal channel 295 within which is located a spring 296 secured to the sleeve 292 to frictionally retard movement of said sleeve on said pipe and tend to yieldingly retain the former wherever positioned on the latter. A stop-pin 297 mounted near the upper end of said pipe 291 and located within one of the lateral openings of the sleeve 292 serves to prevent complete dislodgement of said sleeve from said pipe.

The partial vacuum in the head or mouth-

piece 64 may be substantially entirely broken by completely opening the cock 282, and the air blast from the nozzles 112 may be checked (or, at least, made negligible) by removing all of the weights from the top of the sleeve 292.

I have shown a smooth round rod 277 mounted in the free ends of arms 278 and 279 pivoted to the bars 122 and 122′, respectively, of the conveyor-frame and resting upon the lower legs of the tapes 129 to retain the latter in the necessary taut condition.

Throughout this specification I have frequently made use of the words "forward", "rear", "right" and "left". In using these words or their derivatives or equivalents in connection with the entire machine or any of the parts thereof, I have considered the "forward" end of the machine as being the left-hand end as shown in Figs. 1 and 2, and the "right" side of the machine as the side shown in Fig. 2.

Many modifications of any number of minor details of my improved paper feeding machine will doubtless readily suggest themselves to those skilled in the art to which it appertains, and I therefore do not desire to limit my invention to the specific construction herein shown and described.

I claim:—

1. In a paper-feeder, means for supporting a pile of paper, a continuously rotating, open-ended cylinder having a plurality of peripheral perforations arranged along the front margin of the pile, a stationary hollow suction head in said cylinder having interior sliding contact therewith and also having a slot registering progressively with said perforations upon rotation of said cylinder, an air-exhausting means connected with said head, cooperating feed-rollers for seizing each sheet as withdrawn from the pile by said cylinder, and means for rotating said rollers at a higher peripheral velocity than said cylinder.

2. In a paper-feeder, means for supporting a pile of paper a continuously rotating, open-ended cylinder having a plurality of peripheral perforations arranged along the front margin of the pile, a stationary hollow suction head in said cylinder having interior sliding contact therewith and also having a slot registering progressively with said perforations upon rotation of said cylinder, an air-exhausting means connected with said head, means for making and breaking the suction at regular intervals, cooperating feed-rollers for seizing each sheet as withdrawn from the pile by said cylinder, and means for rotating said rollers at a higher peripheral velocity than said cylinder.

3. In a paper-feeder, means for supporting a pile of paper, a continuously rotating, open-ended cylinder having a plurality of peripheral perforations arranged along the front margin of the pile, a stationary hollow suction head in said cylinder having interior sliding contact therewith and also having a slot registering progressively with said perforations upon rotation of said cylinder, an air-exhausting means connected with said head, means for making and breaking the suction at variably timed intervals, cooperating feed-rollers for seizing each sheet as withdrawn from the pile by said cylinder, and means for rotating said rollers at a higher peripheral velocity than said cylinder.

4. In a paper-feeder, a rotary suction cylinder arranged above a pile of sheets to feed off same successively from the pile having perforations in its periphery, a hollow head in said cylinder contacting therewith and registering with said perforations during the rotations of said cylinder, suction means connected with said head, an oscillatable valve for opening and closing said head to atmosphere, and means for actuating said valve a predetermined distance in either direction at regular intervals.

5. In a paper-feeder, a rotary suction cylinder arranged above a pile of sheets to feed off same successively from the pile having perforations in its periphery, a hollow head in said cylinder contacting therewith and registering with said perforations during the rotations of said cylinder, suction means connected with said head, an oscillatable valve for opening and closing said head to atmosphere, and means for variably adjusting the arc of rotation of said valve.

6. In a paper-feeder, a rotary suction cylinder arranged above a pile of sheets to feed off same successively from the pile having perforations in its periphery, a hollow head in said cylinder contacting therewith and registering with said perforations during the rotations of said cylinder, suction means connected with said head, an oscillatable valve for opening and closing said head to atmosphere, and means for variably adjusting the arc of rotation of said valve.

7. In a paper-feeder, a rotary suction cylinder arranged above a pile of sheets to feed off same successively from the pile having perforations in its periphery, a hollow head in said cylinder contacting therewith and registering with said perforations during the rotations of said cylinder, suction means connected with said head, an oscillatable valve for opening and closing said head to atmosphere, means for variably adjusting the arc of rotation of said valve, and means for automatically opening and closing said valve.

8. In a paper-feeder, pneumatic suction means for forwarding a sheet, an oscillatable

valve for opening and closing said suction means to atmosphere, and means for variably adjusting the arc of rotation of said valve.

9. In a paper-feeder, pneumatic suction means for forwarding a sheet, an oscillatable valve for opening and closing said suction means to atmosphere automatically actuated in timed relation with the feeding of successive sheets, and means for variably adjusting the arc of rotation of said valve.

10. In a paper-feeder, pneumatic suction means for forwarding a sheet, an oscillatable valve for opening and closing said suction means to atmosphere, and means for variably adjusting the arc of rotation of said valve predeterminedly to variably determine the timing of said valve actuation.

11. In a paper-feeder, pneumatic suction means for forwarding a sheet, a rotary slide valve for opening and closing said suction means to atmosphere, and means to limit the movements of said valve in either direction.

12. In a paper-feeder, pneumatic suction means for forwarding a sheet, a rotary slide valve for opening and closing said suction means to atmosphere, and means to variably limit the movements of said valve in either direction.

13. In a paper-feeder, a pneumatic suction means for forwarding a sheet, a rotary slide valve for opening and closing said suction means to atmosphere, and manually-operated means to variably limit the movement of said valve in either direction.

In testimony of the foregoing, I have hereunto set my hand.

LEONARD JOSEPH FROHN.