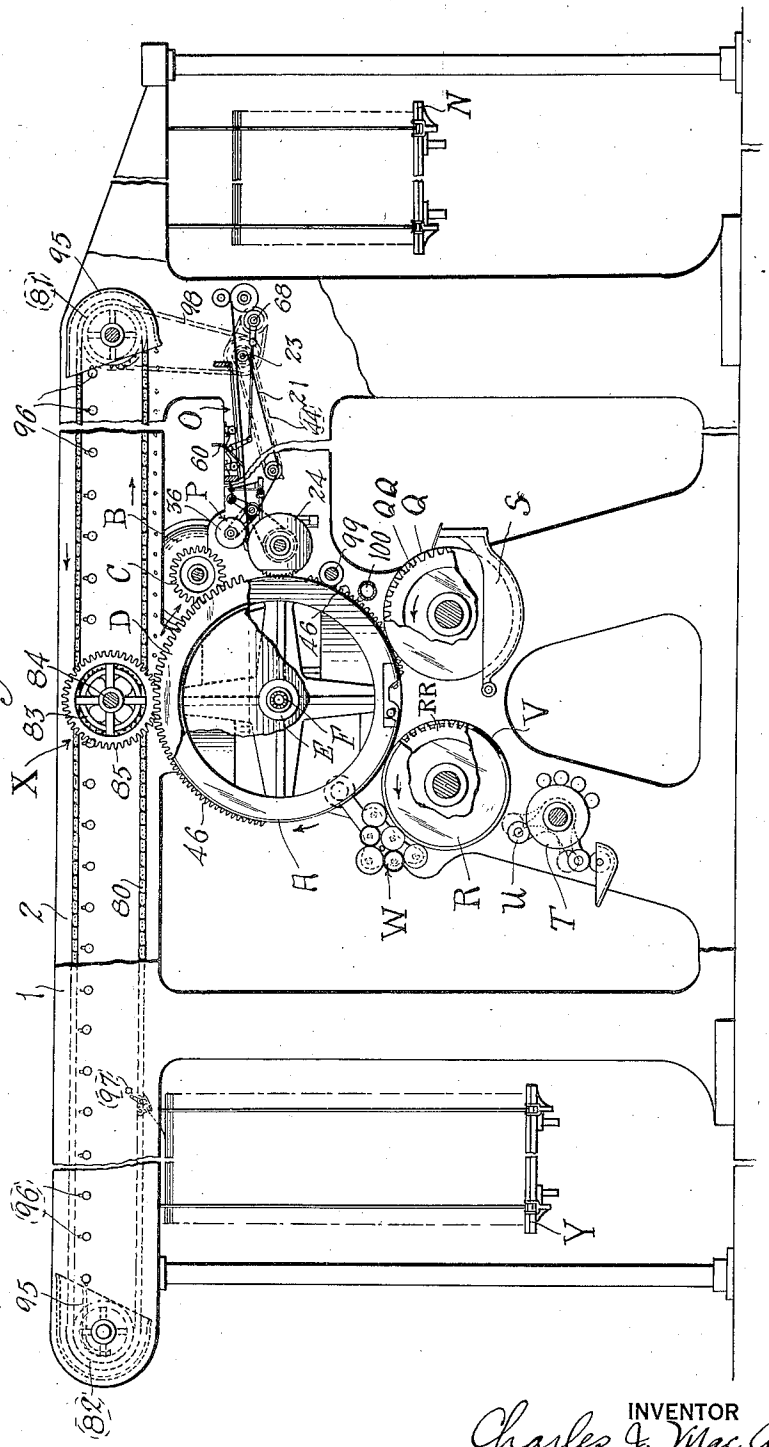
Jan. 24, 1933. C. J. MacARTHUR 1,895,080

SHEET FED RELIEF INTAGLIO ROTARY PRINTING PRESS

Filed Nov. 7, 1929 6 Sheets-Sheet 1

Fig. 1



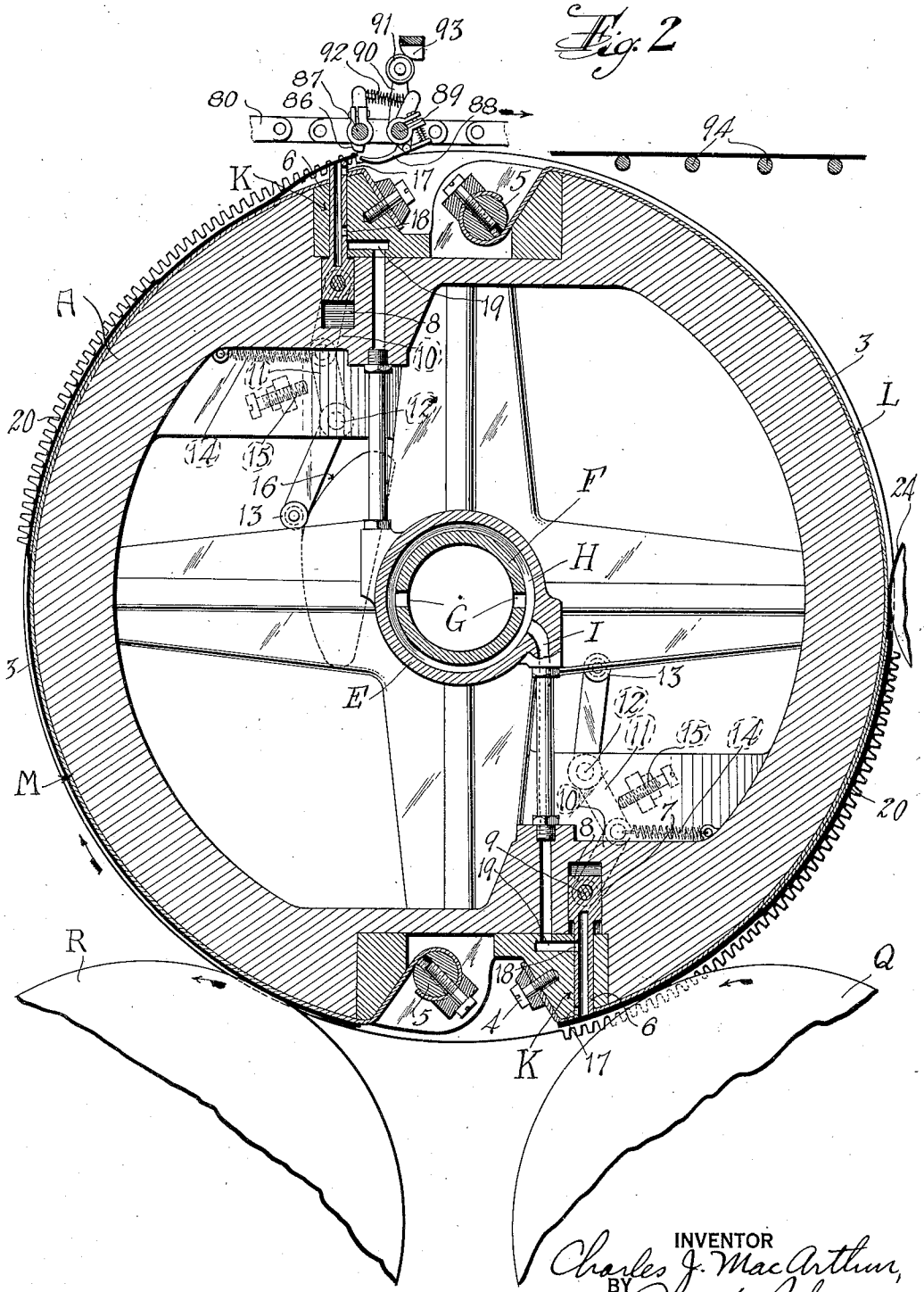
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SHEET FED RELIEF INTAGLIO ROTARY PRINTING PRESS

Filed Nov. 7, 1929 6 Sheets-Sheet 2

Fig. 2



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SHEET FED RELIEF INTAGLIO ROTARY PRINTING PRESS

Filed Nov. 7, 1929 6 Sheets-Sheet 3

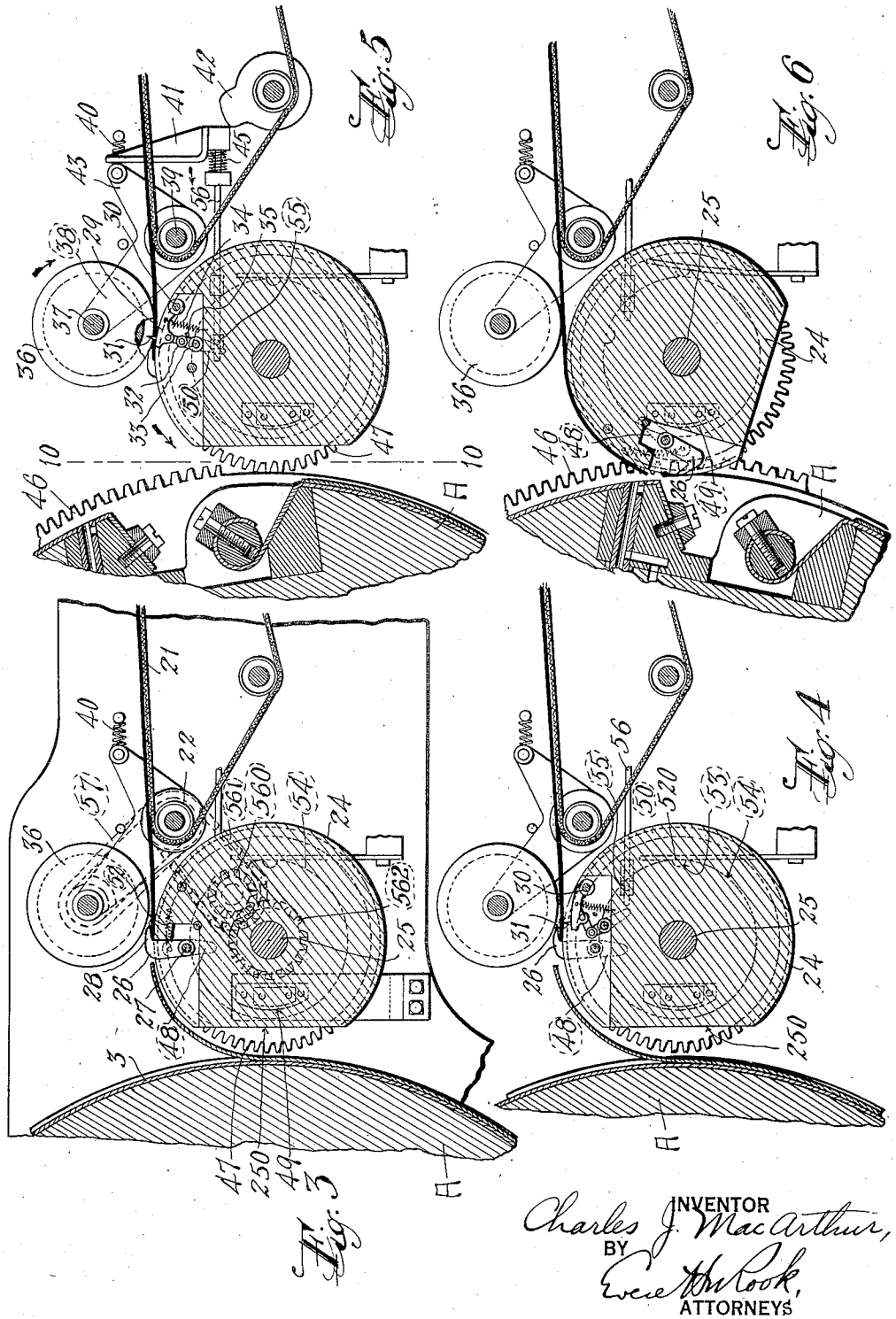


Fig. 5

Fig. 6

Fig. 3

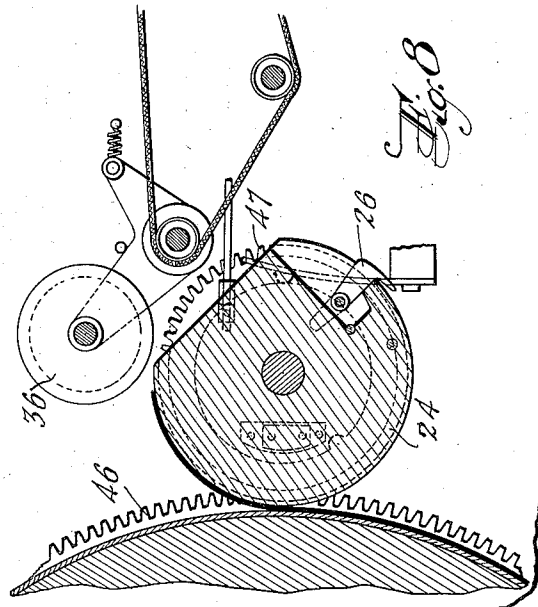
Fig. 4

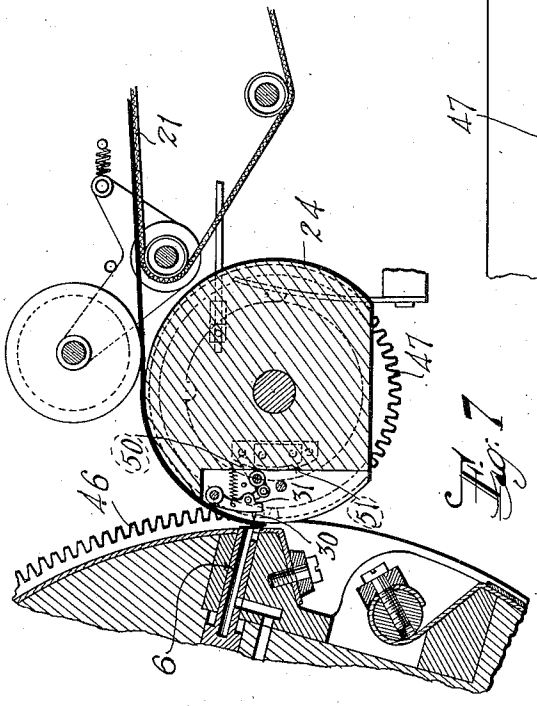
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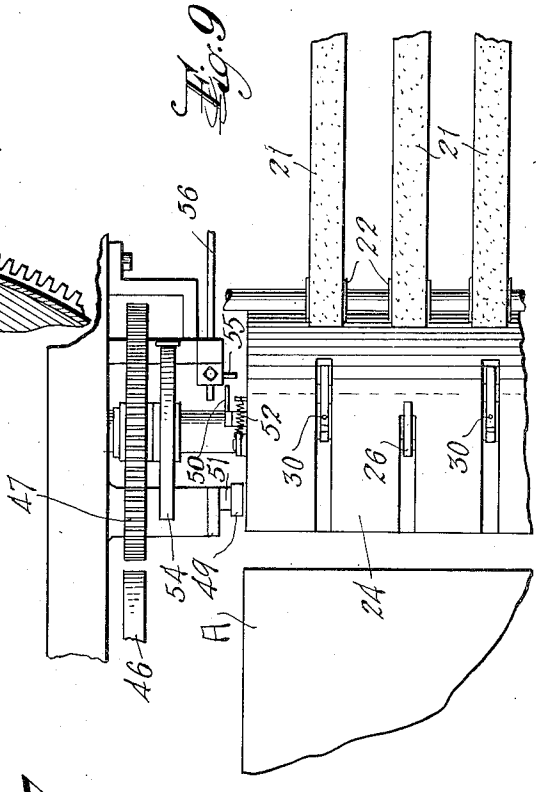
Jan. 24, 1933. C. J. MacARTHUR 1,895,080

SHEET FED RELIEF INTAGLIO ROTARY PRINTING PRESS

Filed Nov. 7, 1929 6 Sheets-Sheet 4





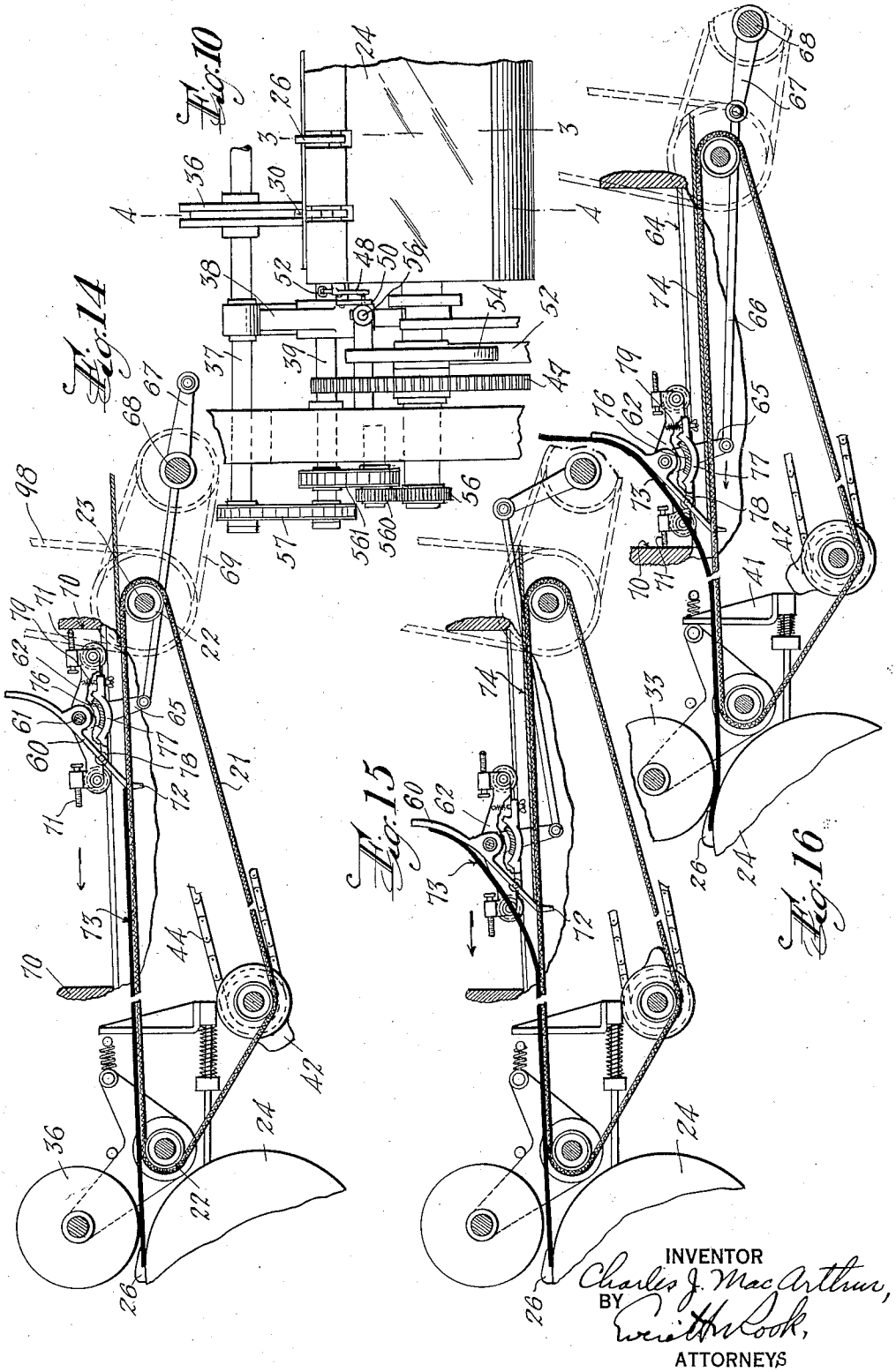


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SHEET FED RELIEF INTAGLIO ROTARY PRINTING PRESS

Filed Nov. 7, 1929 6 Sheets-Sheet 5



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SHEET FED RELIEF INTAGLIO ROTARY PRINTING PRESS

Filed Nov. 7, 1929 6 Sheets-Sheet 6

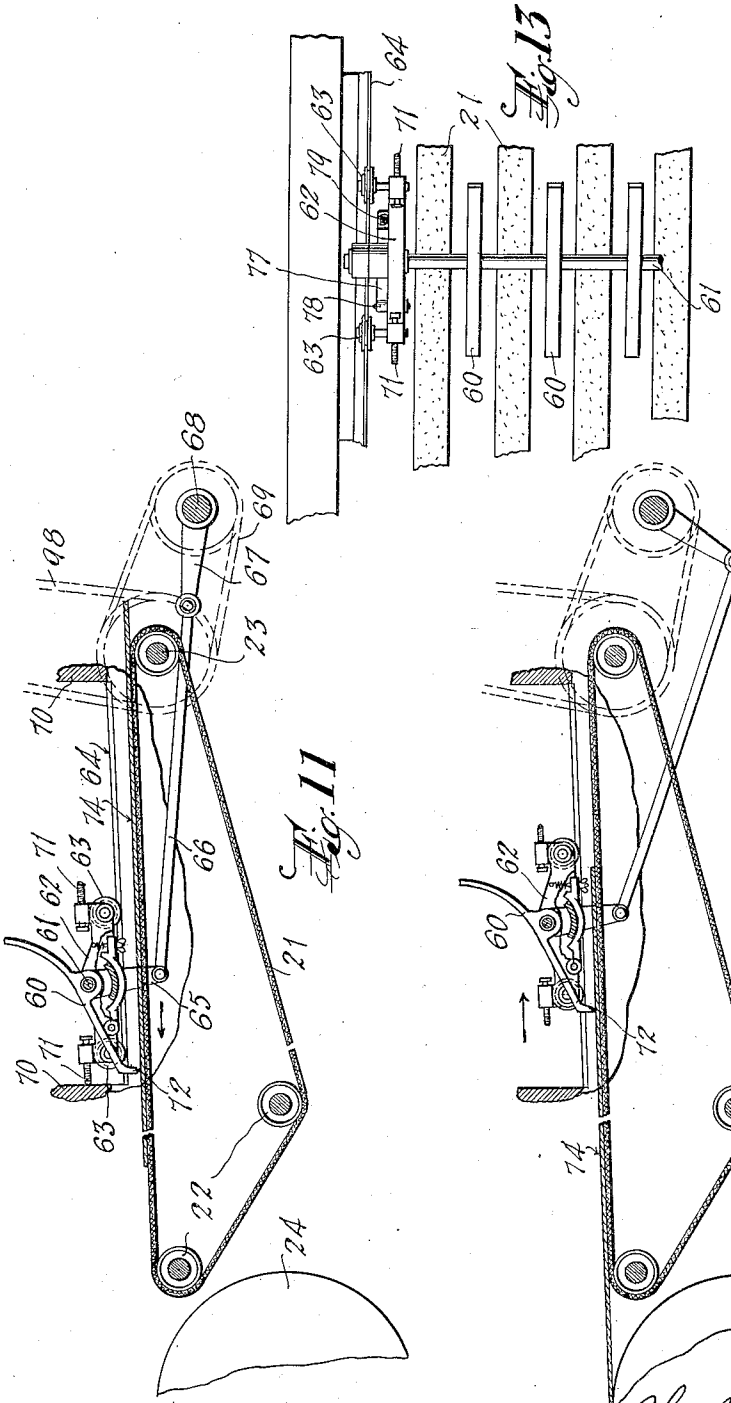


Fig. 13

Fig. 11

Fig. 12

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Patented Jan. 24, 1933 1,895,080

UNITED STATES PATENT OFFICE

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SHEET-FED RELIEF-INTAGLIO ROTARY PRINTING PRESS

Application filed November 7, 1929. Serial No. 406,732.

This invention relates particularly to sheet-fed rotary printing presses and has for its main object to provide a sheet-fed intaglio printing press which shall overcome the disadvantages incident to known sheet-fed intaglio presses and obtain as nearly as possible the advantages of the known web-fed intaglio presses.

Accordingly I contemplate the provision of a sheet-fed press embodying novel and improved features of construction whereby a single sheet feed mechanism may be utilized in combination with an impression cylinder, an intaglio or relief printing cylinder having a smaller circumference than said impression cylinder, and a delivery mechanism, so as to completely print a sheet upon each revolution of said printing cylinder and deliver said sheet with the freshly printed side facing upwardly.

Another object of the invention is to provide a combined intaglio and relief sheet-fed press with a single sheet feed-mechanism wherein an intaglio printing cylinder and a relief printing cylinder, each less in circumference than an impression cylinder, shall completely print a sheet in both intaglio and relief upon each of their revolutions and upon the same packing of the impression cylinder, and wherein said sheet shall be taken from the impression cylinder by delivery grippers with the freshly printed side up.

Another object of my invention is to provide in a printing press of the character described an impression cylinder the periphery of which is divided into two impressional sections each having a sheet gripping mechanism and adapted to support a sheet of paper or the like to receive impressional contact thereon from the intaglio and/or relief printing cylinders, hold said sheets in said sheet gripping mechanism until the maximum area of impressional section is printed thereon, and release said sheets to the delivery mechanism freshly printed side up.

The invention also contemplates the provision of novel and improved means for gripping the leading edge of the sheet of paper upon the impression cylinder as the sheet is fed thereto, which permits printing of the intaglio form close to the edge of the sheet, and raises the leading edge of the sheet from the impression cylinder into engagement with the take-off mechanism after the printing operation, said means constituting in effect a combined sheet gripper and shoe-fly.

Further objects are to provide in such a press a novel construction and combination of a sheet feeding mechanism, an intaglio printing cylinder, and an impression cylinder whereby to ensure a minimum peripheral distance of travel of the impression and printing cylinder, to print and deliver face up a sheet of a given size, and thereby approximate in the intaglio printing cylinder the ideal ink wiping conditions and durable printing qualities that prevail on known web-fed rotary photogravure printing cylinders; to this end to provide in such a combination an impression cylinder having two circumferentially spaced sheet-receiving sections on its periphery, and a novel and improved intake and stop cylinder of a diameter substantially less than said printing cylinder which shall have guides to stop and adjust each incoming sheet, and means for rotating said intake cylinder so that a sheet shall be fed to each section of the impression cylinder upon each revolution of the latter; and to provide a novel and improved means for feeding sheets to said intake cylinder so that a sheet shall be presented to the intake cylinder at the end of each revolution thereof.

Other objects are to provide a composite packing or tympan for the impression cylinder, mainly composed of semi-hard materials, to receive impressional contact from the relief printing cylinder, which has thereon sectional layers of a plastic substance, such as gutta percha which forms a matrix for receiving impressional contact from the intaglio printing cylinders, without producing visible embossing effects on sheets therefrom, said sectional layers being secured upon the impression cylinder in relative positions corresponding with the engraved subjects on the intaglio cylinder when the intaglio cylinder and impression cylinder are brought into impressional contact, whereby it is rendered practicable to make-ready and print in one

operation or simultaneously the same sheet by intaglio and relief principles; and to provide a novel construction and combination of an impression cylinder and take-off or delivery mechanism so that the sheets may be rapidly and accurately removed from the impression cylinder and delivered face up so that smearing of the ink is prevented and inspection of the printing is facilitated.

For the purpose of illustrating the principles of my invention, I have illustrated the preferred embodiment thereof in the accompanying drawings schematically, and omitted all parts which are unnecessary to a complete understanding of the invention and known to those skilled in the art.

Referring to said drawings in which corresponding and like parts are designated throughout the several views by the same reference character.

Figure 1 is a side elevation of a printing press embodying my invention, showing portions of the near side of the frame broken away for clearness in illustration.

Figure 2 is an enlarged transverse vertical sectional view through the impression cylinder.

Figures 3 and 4 are transverse vertical sectional views through the intake or transfer cylinder taken on the lines 3—3 and 4—4 respectively of Figure 10, showing the sheet guides and sheet gripper pins, respectively in corresponding positions.

Figure 5 is a view similar to Figure 4 showing the portions of the parts as the gripper pins are forced through the sheet of paper.

Figure 6 is a view similar to Figure 3 showing the intake cylinder rotated into the positions to apply the sheet to the impression cylinder.

Figure 7 is a view similar to Figure 4 showing the gripper pins retracted from the sheet as the latter is applied to the impression cylinder.

Figure 8 is a view similar to Figure 6 showing the intake cylinder approaching its initial position shown in Figure 3, as the sheet leaves said cylinder.

Figure 9 is a fragmentary top plan view of one end of the intake cylinder, impression cylinder and sheet feeding tapes.

Figure 10 is a fragmentary side elevation of the intake cylinder and its associated parts taken on the line 10—10 of Figure 5.

Figure 11 is a longitudinal vertical sectional view through the sheet feeding mechanism showing the sheet lifter at the limit of its movement toward the intake cylinder.

Figure 12 is a similar view showing the sheet lifter intermediate the limits of its movement and moving toward its starting position.

Figure 13 is a fragmentary plan view of one end of the sheet lifting mechanism, and

Figures 14, 15 and 16 are similar views showing various positions of the sheet lifting mechanism.

Specifically describing the illustrated embodiment of the invention the machine comprises generally a frame including two side pieces 1 and 2 between which is journaled an impression cylinder A driven by an electric motor B through a pinion C on the motor shaft meshing with a gear D connected to the hub E of the cylinder A. The hub E of the cylinder revolves about a tubular shaft F which is connected to any suitable vacuum producing means and has a plurality of lateral ports G opening into annular grooves H with each of which communicates a pair of ducts I, one for each of a plurality of vacuum sheet grippers K, a number of which are provided spaced longitudinally of the impression cylinder to grip a sheet applied to each of two sheet receiving sections L and M.

At one end of the frame of the press is a table N of known construction for receiving a pile of sheets to be printed and from which the sheets are supplied by suitable known means, or manually, to a sheet feeding mechanism O from which the sheets are successively transferred to the impression cylinder by a transfer mechanism P.

Each section L and M of the impression cylinder periphery receives a sheet to be printed, has a circumferential length substantially equal to that of the largest sheet to be printed, and carries the sheets successively into contact with an intaglio engraved printing cylinder Q and a relief plate printing cylinder R. Each of the sheet-receiving sections L and M of the impression cylinder is of a peripheral length substantially equal to the circumference of the printing cylinders Q and R, so that a sheet may be completely printed upon one revolution of the printing cylinders. Ink is supplied to the cylinder Q by the usual fountain S, and ink is supplied to the plate cylinder R by a known type of inking mechanism T including a roller U which intermittently contacts with an ink plate V on the cylinder to apply ink thereto. The ink is distributed and deposited over the ink plate and type by the usual series of rollers W which are pivoted on the frame to swing away from the cylinder R to permit access thereto.

The two printing cylinders Q and R may be directly driven from the gear D by gears QQ and RR meshing with the gear D and mounted on the shafts of the respective rollers Q and R.

The sheets after being printed are removed from the impression cylinder by a take-off mechanism X upon which the sheets are dried, conveyed and piled upon a delivery table Y of known construction at the end of the frame opposite the supply table N.

As shown on the drawings each section L

and M of the impression cylinder occupies substantially one-half the circumference thereof and at the leading end of each section, which may be determined by the direction of rotation of the cylinder as shown by the arrow on Figures 1 and 2, a tympan or packing sheet 3 is secured by cap screws or the like 4. This packing is preferably formed of semi-hard material to receive the impressional contact from the relief printing cylinder R, and its other end is secured to a rod 5 rotatively mounted in the periphery of the cylinder whereby the packing may be tightly drawn over the surface of the cylinder. Spaced longitudinally of the leading edge of each of the sections L and M are a plurality of nozzles 6 slidably mounted to move in and out of the cylinder so as to be flush with the periphery thereof or project therefrom, as shown at the lower and upper portions of Figure 2 of the drawings. Each nozzle of each group has a base 7 slidably mounted in a recess 8 in the cylinder, and all of the nozzles of each group are connected to a rod 9 which extends longitudinally of the cylinder and is connected at each end to one end of a toggle link 10, the other end of which is connected to one arm of a bell crank 11 pivoted at 12 on the corresponding end of the cylinder and carrying a roller 13 at its other end. A spring 14 is provided for each bell crank to normally actuate the same and draw the corresponding nozzles inwardly of the impression cylinder against an adjustable stop screw 15. Both bell cranks at each end of the impression cylinder cooperate with a cam 16 fixed upon the frame of the press so that upon rotation of the impression cylinder the nozzles are moved outwardly from the cylinder to release the sheet therefrom, as shown at the upper side of Figure 2 of the drawings.

Each nozzle has adjacent its outer end a port 17 which is exposed to the atmosphere when the nozzle is pushed outwardly, and at its inner end each nozzle has another port 18 which when the nozzle is at its innermost position communicates with a passage 19 which in turn communicates with one of the ducts I. When the nozzle is moved outwardly of the cylinder the port 18 is moved out of communication with the passage 19.

In the operation of the press so far described, the nozzles 6 are normally drawn inwardly of the impression cylinder and as they approach the intake or transfer mechanism, the sheet is pressed against the periphery of the impression cylinder so that the vacuum in the nozzles draws the edge of the sheet into tight contact with the impression cylinder. After the sheet has been brought into impressional contact with each of the printing cylinders Q and R by rotation of the impression cylinder, and when the nozzles reach the upper side of the cylinder, the bell cranks engage the cams 16 to actuate the nozzles so as to cut off the vacuum therefrom and admit air through the ports 17 beneath the sheet, whereby the sheet is released from the nozzles. The sheet is then picked up by the take-off mechanism X, which is spaced along the periphery of the impression cylinder in the direction of movement thereof from the printing cylinder R a distance greater than the length of the sheet-receiving portions L and M of the impression cylinder.

To permit both relief and intaglio printing on the impression cylinder, sectional overlays or layers 20 are secured to the packing 3 at various points corresponding to the positions of the intaglio subjects to be printed from the cylinder Q when the latter is in impressional contact with the impression cylinder. The layers 20 are of matrix forming materials, such as gutta percha, to permit an embossed impression being made by the intaglio cylinder. This substance is such that under pressure from the intaglio engraved subjects the material is squeezed into the depressions or cells in the engraving on the intaglio cylinder and remains set so as to form in effect a matrix which later during actual printing, forces the paper into the cells on the cylinder somewhat as in an embossing operation. This permits the use of a layer 20 of several thousandths of an inch in thickness, and avoids the necessity of great printing pressure as is common in intaglio printing where the impression cylinder surface is composed of resilient material such as rubber. It will be understood that with such an arrangement it is possible to print sheets, for example, pages of printed matter which include both type or relief printing, and intaglio printing such as illustrated.

Where two sheets are to be printed upon each complete revolution of the impression cylinder as above described, it is necessary to provide special sheet feeding means which will place a sheet in proper relation to the impression cylinder at each half revolution of said cylinder. Such feeding means is shown as comprising the usual tapes 21 mounted upon rollers 22 and driven from a shaft 23 which may be driven in any suitable manner to be hereinafter described. The tapes move in the direction of the arrows in Figures 11 to 16 inclusive, and at one end receive the sheets from the supply table N. Each sheet is moved by the tapes toward the impression cylinder and into contact with guides on the intake or transfer cylinder 24 which is journaled on a shaft 25 and has a diameter substantially less than the diameter of the printing cylinders Q and R. There are a plurality of these guides spaced longitudinally of the intake cylinder 24 and normally projecting beyond the periphery thereof as shown in Figure 3. Each guide is shown as comprising an L-shaped member 26 mounted at one end

upon a shaft 27 extending longitudinally of the intake cylinder and common to all of the guides. The other end 28 of each guide normally extends beyond the periphery of the intake cylinder and partially overlies it so as to receive the leading edge of the sheet between it and the periphery of the intake cylinder.

For securing the sheet to the intake cylinder so that the latter may carry the sheet to the impression cylinder, a plurality of gripper pins are provided, each consisting of an arm 29 pivoted on a shaft 30 common to all of the arms 29, and having at one end a sharp pin 31 capable of penetrating the sheet. The swinging end of each arm 29 is connected to a toggle 32 actuated by a shaft 33 common to all of the toggles. When the toggles are contracted, the pins 31 are retracted beneath the periphery of the intake cylinder, as shown in Figure 4, while when the toggles are extended the pins project above the periphery of the intake cylinder as shown in Figure 5 of the drawings. A tension spring 34 is provided for holding each toggle in retracted position, and a stop pin 35 limits extending movement of each toggle.

For causing the pins 31 to penetrate the sheet, I provide a plurality of rollers 36 having grooved peripheries, one roller for each pin. The rollers are mounted on a common shaft 37 supported on arms 38 of bell crank levers in substantially parallel relation to the intake cylinder. Each bell crank 38 is pivoted on a shaft 39 and the other arm is normally influenced by a spring 40 to hold the rollers 36 out of contact with the intake cylinder, as shown in Figure 6 of the drawings. For forcing the rollers against the intake cylinder, a reciprocating arm 41 is actuated in opposite directions respectively by a cam 42 and a compression spring 45 into and out of engagement with the second-mentioned arm 43 of the bell crank 38. The cam 42 may be driven by chain and sprocket mechanism 44 connected to a sprocket on the shaft 23. The rollers 36 are forced into contact with the intake cylinder each time a sheet contacts with the guides 28 so that the sheet is connected to the intake cylinder, the grooves permitting the pins to penetrate the sheet.

As the leading edge of each of the sections L and M of the impression cylinder approaches the intake cylinder, a mutilated gear 46 engages a gear 47 on the shaft 25 of the intake cylinder so as to rotate the intake cylinder in the direction of the arrow on Figure 3. This pulls the sheets toward the impression cylinder, and as the leading edge of the sheet reaches the impression cylinder, an arm 48 at one end of the shaft 27 of the guides 26 engages a cam 49 on the frame of the press so as to retract all of the guides inwardly away from the periphery of the intake cylinder as shown in Figure 6 of the drawings. When the leading edge of the sheet has been gripped by the nozzles 6, the pins 31 are withdrawn from the sheet by engagement of an arm 50 at one end of the shaft 33 with a cam 51 on the press frame, as shown in Figure 7 of the drawings. The mutilated gear 46 rotates the intake cylinder one complete revolution, and as the arm 48 clears the cam 49 a spring 52 throws all of the guides back into their normal positions. When the intake cylinder has been rotated to its starting position it is stopped by a spring detent 520 which engages a notch 53 in a disc 54 on the shaft 25. The intake cylinder has a cut-away portion 250 which provides a clearance between it and the impression cylinder. After the intake cylinder has been returned to its initial position, a pin 55 is moved into engagement with the arm 50 by reciprocation of a rod 56, so as to return the pins 31 to their sheet penetrating positions. The rod 56 may be actuated by the cam 42, as shown in Figure 5 of the drawings. It will be observed that as the diameter of the intake cylinder is less than that of the printing cylinders, the distance of travel of the guides 26 and gripper pins 21 during each revolution of the intake cylinder is less than that of a given point on the periphery of the printing cylinder or the impression cylinder during a complete printing cycle, i. e. from the beginning to the end of each revolution of the printing cylinder, and is less than the length of either sheet receiving section L or M of the impression cylinder.

It should be understood that any other suitable mechanism for actuating the intake cylinder may be provided, and in practice a starting and stopping gear, known to those skilled in the art, would be utilized to initiate movement of the gear 47 before meshing thereof with the gear 46, and to gradually slow down the rotation of the gear 47 after disengagement thereof from the mutilated gear.

The rollers 36 are rotated in unison or simultaneously with the intake cylinder. For this purpose the rollers may be driven by a gear 562 on the shaft 25 meshing with an idler 560 which in turn drives a chain and sprocket gear 561 which connects with other chain and sprocket gearing 57 connected to the shaft 37.

It should further be understood that the gearing and actuating mechanism for the various parts must be properly timed to cause the necessary sequence and speeds of movement. The gearing shown is in general conventional for clearness, and other suitable mechanism may be readily adapted by those skilled in the art.

While one sheet is being adjusted and perforated at the guides 26, a second sheet is on its way toward the intake cylinder so as to be in proper relation to the impression

cylinder as the section L or M of said cylinder to receive the second sheet, approaches the intake cylinder. To accomplish this result I have provided special means for lifting the tail end of the leading sheet and permitting the leading edge of the second sheet to pass beneath the first sheet, while the latter is being adjusted to the guides 26. As shown on the drawings, this sheet-lifting means includes a plurality of plows 60 all mounted on a shaft 61 and each arranged between two adjacent tapes 21. The shaft 61 is mounted in a carriage 62 having a pair of rollers 63 at each side of the press running on a track 64. An arm 65 is connected to one end of the shaft 61 and also by a link 66 to an arm 67 on a shaft 68 driven from the shaft 23 by chain and sprocket gearing 69. With this construction the carriage 62 is moved back and forth on the tracks 64 between abutments 70 which are engaged by adjustable set screws 71 on the carriage 62. On movement of the carriage 62 toward the intake cylinder the plows 60 are lowered with their leading ends 72 beneath the planes of the tapes 21 so as to slip under the tail end of the leading sheet 73, which permits the second sheet 74 to be fed under the first sheet 73 as shown on Figure 15. The depending end 72 of the plows 60 serve as a control and slow-down for the second sheet 74 to insure accurate travel to its destined position at the guides. When the carriage strikes the abutment 70 nearest the intake cylinder, the plows are raised to permit the second sheet to pass beneath them as shown in Figures 11 and 12; and in the meantime the leading sheet has been withdrawn from the plows by the intake cylinder. For raising and lowering the plows, a brake segment 76 is mounted on the shaft 61 and cooperates with a brake shoe 77 pivoted at one end 78 to the carriage and connected to the carriage at its other end by a tension spring 79 which draws the brake shoe into tight engagement with the brake segment. The friction between the brake segment and the brake shoe is sufficient to permit the carriage to be moved back and forth by rotation of the arm 67, and when such movement is limited in either direction by the abutments 70, relative movement between the brake shoe and the brake segment takes place, which relative movement rotates the shaft 61 and moves the plows 60 in one direction or the other.

With this construction it will be observed that it is possible to have the second sheet at the guides 26 by the time said guides have returned to starting position after transfer of the leading sheet to the impression cylinder, and as the intake cylinder rotates rapidly it is possible to apply the sheets in rapid succession to both of the sections L and M of the impression cylinder.

It will be obvious to those skilled in the art that the action of the plows 60 gently pushing the sheets to the front guides 26 is a highly desirable feature. Furthermore, the plow being curved as illustrated, imparts to the sheet a curved or concave condition which stiffens the sheet laterally and strengthens or smooths out all wrinkles and irregularities in the sheet so as to insure perfect contact with the front guides 26 and the side guide and absolute uniformity in laying of the sheets in take-off position.

As heretofore indicated the sheets are carried by the impression cylinder into impressional contact with the intaglio and relief printing cylinders Q and R. After the printing of each sheet is completed its leading edge is disposed at the upperside of the impression cylinder where it is released by the suction nozzles 6, as shown in Figure 2. At this point the leading edge of the sheet is gripped by grippers of known construction carried between chains 80 one at each side of the press which pass over sprockets 81 and 82 at opposite ends of the frame. The chains 80 are driven by sprockets 83 on a shaft 84 which also has connected thereto a gear 85 meshing with the driving gear D on the impression cylinder. Each gripper comprises a fixed member 86 fast on a rod 87 connected to the opposite chains, which member cooperates with a yielding finger 88 mounted on another rod 89 which is rotatable by an arm 90 carrying a roller 91. The yielding member 88 is normally influenced toward the fixed member 86 by a compression spring 92, but as the grippers reach the leading edge of the sheet the rollers 91 engage a fixed cam 93 so as to separate the gripper members 86 and 88. Continued rotation of the impression cylinders moves the leading edge of the sheet between the gripping members and as the roller 91 passes the cam 93 the spring 92 forces the gripping members together with the sheet between them. It will be understood that there are several of the grippers arranged between the chains 80 on the rods 87 and 89, and that the grippers are spaced along the chains 80 according to the size of the sheets and the speed of travel of the impression cylinder. The sheets are drawn by the grippers from the impression cylinder over rods 94 with the inked side uppermost. At one end of the chains, is a guide 95 for guiding the sheet from the lower reach of the chains to the upper reach. Beneath the upper reaches of the chains are a plurality of nozzles 96 connected to a source of compressed air so that the air jets from the nozzles are directed upwardly against the sheets to dry the ink thereon which now faces downwardly. The air jets may be used to support the sheets, or any other suitable guide means such as rods like the rods 94 may be utilized. The sheets are conveyed to the opposite end of the frame and deposited upon

the table Y by tripping of the grippers by a cam 97 similar to the cam 93.

It will be noted that the movement of the grippers is away from the outer side of the pile so that an operator may easily inspect the top sheets on the pile without danger of injury from the grippers. Ordinarily the sheets are deposited on the pile with the conveyors moving toward the end of the machine instead of toward the center of the machine as here shown.

Take-off mechanism X can be connected to a feeding mechanism for another press so that the sheets would be conveyed directly to the second press or to a folding device instead of to the delivery table Y.

As shown on the drawings the shaft 23 may be driven by chain and sprocket connection 98 from the shaft of one of the sprockets 81 of the take-off mechanism X.

It is also desirable, in order to provide a more perfect application of the sheets to the impression cylinder and to remove wrinkles therefrom, to utilize a compression roller 99 between which and the periphery of the impression cylinder the sheet passes, said roller expelling the air and effectuating a vacuum between the sheet and impression cylinder. Also, it may be found desirable to use air blasts from nozzles 100 to further force the sheet into contact with the impression cylinder. The roller 99 and the air blasts 100 also serve to prevent the tail end of the sheet from becoming disengaged from the impression cylinder.

From the foregoing it will be observed that two distinct types of printing are produced in one operation with accurate register of the printed matter ensured; that is, the sheet is successively subjected to the two printing cylinders while the sheet is held in the same position on the impression cylinder, which avoids the difficulty in obtaining register where the sheet is removed from one impression cylinder after one printing and subsequently placed upon another cylinder for a second printing, which difficulties arise from feeding of the paper and expansion and contraction of the paper between removal thereof from one impression cylinder and application to another. Furthermore, the invention enables the printing of double the quantity of sheets possible with known presses without increasing the surface speed of the printing and impression cylinders beyond the speed of known sheet feed presses producing gravure or intaglio printing, because on presses of the last-mentioned type it is necessary for the intaglio engraved cylinder to make two revolutions for each sheet printed. This reduction in the number of revolutions of the engraved cylinder required, results in an additional economy in engraving costs from the reduction of scraping and wearing away of the intaglio engravings by contact thereof with the wiping or doctor blade in removing ink from the cylinder; in accordance with the invention the doctor blade scrapes the intaglio cylinder only once for each printing instead of twice as in the presses of known type.

Other advantages arising from the invention are that the vacuum sheet gripping and releasing means avoids the necessity of metal grippers heretofore used and saves a considerable portion of the sheet at the edge which is now wasted by the gripping mechanism used on gravure or intaglio sheet fed presses, and that the inks will be thoroughly set before the sheets are stacked, and by mechanism which requires a small amount of space due to the particular arrangement thereof with respect to the main frame of the press.

As above indicated, the specific details of construction herein shown and described are primarily for the purpose of illustrating the principles of the invention, and the invention may be embodied in various other apparatus without departing from the spirit or scope of the invention.

Having thus described my invention, what I claim is:

1. In a printing press, the combination of a relief printing cylinder, an intaglio printing cylinder, means for inking said printing cylinders, a single impression cylinder cooperating with both of said printing cylinders, a semi-hard packing on said impression cylinder to cooperate with said relief printing cylinder in making an impression on a sheet to be printed, an overlay of matrix forming material secured upon the first-mentioned packing to cooperate with the intaglio printing cylinder in making an impression upon said sheet.

2. The steps in a method of printing consisting in forming a matrix on a portion of the tympan of an impression member to cooperate with the etching on a photogravure printing member, and bringing a sheet on said impression member into printing contact successively with a photogravure printing member and a relief printing member.

3. The steps in a method of printing consisting in applying a matrix forming material to a portion of the relief printing tympan of an impression member, making a matrix by bringing said material into contact under pressure with the etching on a photogravure printing member, and bringing a sheet on said impression member into printing contact under uniform pressure successively with a relief printing member and said photogravure printing member, whereby the sheet is dual printed in one operation.

4. The steps in a method of printing consisting in applying a matrix-forming material to an impression member, making a matrix by bringing said material into contact under pressure with the etching on a

photogravure printing member, and bringing a sheet on said impression member into printing contact with said photogravure printing member.

5. In a printing press, the combination of a printing cylinder, means for inking said printing cylinder, a single impression cylinder cooperating with said printing cylinder and having its periphery divided into a plurality of sheet receiving sections said printing cylinder and each of said sheet-receiving sections having a circumferential length substantially equal to that of the largest sheet to be printed, means rotating said impression cylinder and said printing cylinder, and means for feeding and applying a sheet to each of said sheet receiving sections of the impression cylinder during each complete revolution of said impression cylinder including a rotatable intake cylinder having guides to temporarily stop advancement of said sheet and position it with respect to said impression cylinder, said intake cylinder being of a diameter substantially less than said printing cylinder and having means for gripping the leading edge of the sheet after it has been adjusted to said guides, means for actuating said intake cylinder so as to successively stop the latter to present said guides to an incoming sheet as the leading edge of each section of the impression cylinder approaches the intake cylinder and then rotate said intake cylinder at the same peripheral speed as said impression cylinder to apply said sheet to said section of the impression cylinder, and means for advancing a sheet to said guides of the intake cylinder upon each stopping of the latter.

6. In a printing press, the combination of a printing cylinder, means for inking said printing cylinder, a single impression cylinder cooperating with said printing cylinder and having its periphery divided into a plurality of sheet receiving sections, said printing cylinder and each of said sheet-receiving sections having a circumferential length substantially equal to that of the largest sheet to be printed, means rotating said impression cylinder and said printing cylinder, and means for feeding and applying a sheet to each of said sheet receiving sections of the impression cylinder during each complete revolution of said impression cylinder including a rotatable intake cylinder having guides to temporarily stop advancement of said sheet and position it with respect to said impression cylinder, said intake cylinder being of a diameter substantially less than said printing cylinder and having means for gripping the leading edge of the sheet after it has been adjusted to said guides, means for actuating said intake cylinder so as to successively stop the latter to present said guides to an incoming sheet as the leading edge of each section of the impression cylinder approaches the intake cylinder and then rotate said intake cylinder at the same peripheral speed as the impression cylinder to apply said sheet to said section of the impression cylinder, means for advancing a sheet to said guides of the intake cylinder upon each stopping of the latter including means for moving sheets successively into partially overlying relation to each other, and a device for raising the tail end of each sheet as said sheet reaches said guides on the intake cylinder to permit the leading edge of the next adjacent sheet to advance beneath the first sheet.

7. In a printing press, the combination of a printing cylinder, means for inking said printing cylinder, a single impression cylinder cooperating with said printing cylinder and having its periphery divided into a plurality of sheet receiving sections, said printing cylinder and each of said sheet-receiving sections having a circumferential length substantially equal to that of the largest sheet to be printed, means rotating said impression cylinder and said printing cylinder, and means for feeding and applying a sheet to each of said sheet receiving sections of the impression cylinder during each complete revolution of said impression cylinder including a rotatable intake cylinder having guides to temporarily stop advancement of said sheet and position it with respect to said impression cylinder, said intake cylinder being of a diameter substantially less than said printing cylinder and having means for gripping the leading edge of the sheet after it has been adjusted to said guides, means for actuating said intake cylinder so as to successively stop the latter to present said guides to an incoming sheet as the leading edge of each section of the impression cylinder approaches the intake cylinder and then rotate said intake cylinder at the same peripheral speed as said impression cylinder to apply said sheet to said section of the impression cylinder, and means for advancing a sheet to said guides of the intake cylinder upon each stopping of the latter including means for moving sheets successively into partially overlying relation to each other, means for raising the tail end of each sheet as the sheet reaches said guides on the intake cylinder to permit the next succeeding sheet to advance beneath the first-mentioned sheet comprising a device reciprocable toward and from said impression cylinder, means reciprocating said device, and means for lowering it at the limit of its movement away from said impression cylinder to travel beneath said sheet as the device moves toward said impression cylinder and for raising said device at the other limit of its movement to clear the second-mentioned sheet as the device moves away from said impression cylinder.

8. In a sheet-fed printing machine, the

combination of a printing member, means for inking said printing member, an impression cylinder having sheet grippers, means for operating said printing member and said impression cylinder, a rotatable sheet-intake device including guide members to slow down an incoming sheet to a temporarily stopped position to permit registering of said sheet and means for gripping said sheet after it has been registered to convey and transfer it to the said grippers of said impression cylinder, the distance of travel of said guide members and said gripping means during each revolution of said intake device being substantially less than that of a given point on the periphery of the printing member and/or the impression cylinder during a complete printing cycle, and means for actuating said intake device to successively slow down and stop the same so that said guide members slow down a sheet advancing to said stopped position to be registered and permit said sheet to be gripped by said gripping means while rotation of said gripping means is stopped, and then rotate said gripping means at the same peripheral speed as the impression cylinder whereby to convey and transfer said registered sheet to the said sheet grippers of the said impression cylinder, and means for feeding and advancing a sheet to said intake device upon each slowing down and stopping thereof.

9. In a sheet-fed printing machine, the combination of a printing cylinder to print during each revolution thereof, means for inking said printing cylinder, a single impression cylinder cooperating with said printing cylinder and having two sets of sheet grippers and two sheet-receiving sections each of such length that the leading edge of one sheet is located closely to the tail end of the next preceding sheet, means for operating said printing cylinder and said impression cylinder, a rotatable sheet-intake device including guide members to slow down an incoming sheet to a temporarily stopped position to permit said sheet to be registered and means for gripping said registered sheet to convey and transfer it to said sheet grippers of said impression cylinder, the distance of travel of said guide members and said gripping means during each revolution of said intake device being substantially less than the circumferential length of the printing cylinder and/or each sheet receiving section of the impression cylinder and less than the length of the largest sheet that the machine is capable of printing, means to actuate said intake device to successively slow-down and stop the same so that said guide members slow down said advancing sheet to said stopped position to be registered and permit said registered sheet to be gripped by said gripping means while rotation of said gripping means is interrupted, and then rotate said gripping means at the same peripheral speed as the impression cylinder, whereby to convey and transfer a registered sheet to said sheet grippers in each of said sheet receiving sections of said impression cylinder during each revolution of the impression cylinder, and means for advancing a sheet to said intake device upon each slowing down and stopping thereof including a sheet-plow device for raising the tail end of each sheet to allow the succeeding sheet to advance to said registering position before the normal peripheral movement of said impression cylinder can remove the entire preceding sheet from said sheet registering position.

10. The sheet-fed printing machine set forth in claim 9 with the addition of means for causing said sheet grippers of said sheet receiving sections of said impression cylinder to retain their grip on each sheet until the sheet has been completely printed and then release each of said sheets, and delivery mechanism to grip the leading edges of said sheets after they have been so released and remove them from said impression cylinder with the freshly printed side of each sheet facing upwardly.

11. The sheet-fed printing machine set forth in claim 9 with the addition of means for causing said sheet grippers of said sheet receiving sections of said impression cylinder to retain their hold on each sheet until the sheet has been completely printed and then release each of said sheets, and delivery mechanism to grip the leading edges of said sheets after they have been so released and remove them from said impression cylinder with the freshly printed side of each sheet facing upwardly, and wherein said printing cylinder is disposed beneath the impression cylinder, said sheet intake device is disposed at one side of said impression cylinder, and said sheet delivery mechanism is disposed at the top of said impression cylinder and movable in the direction of rotation of said impression cylinder to grip said sheets as the impression cylinder revolves and the leading edge of each sheet receiving section reaches the top of the impression cylinder.

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