April 10, 1928. 1,666,004

M. A. DROITCOUR

SHEET PRINTING PRESS

Filed Aug. 29, 1923 6 Sheets-Sheet 1

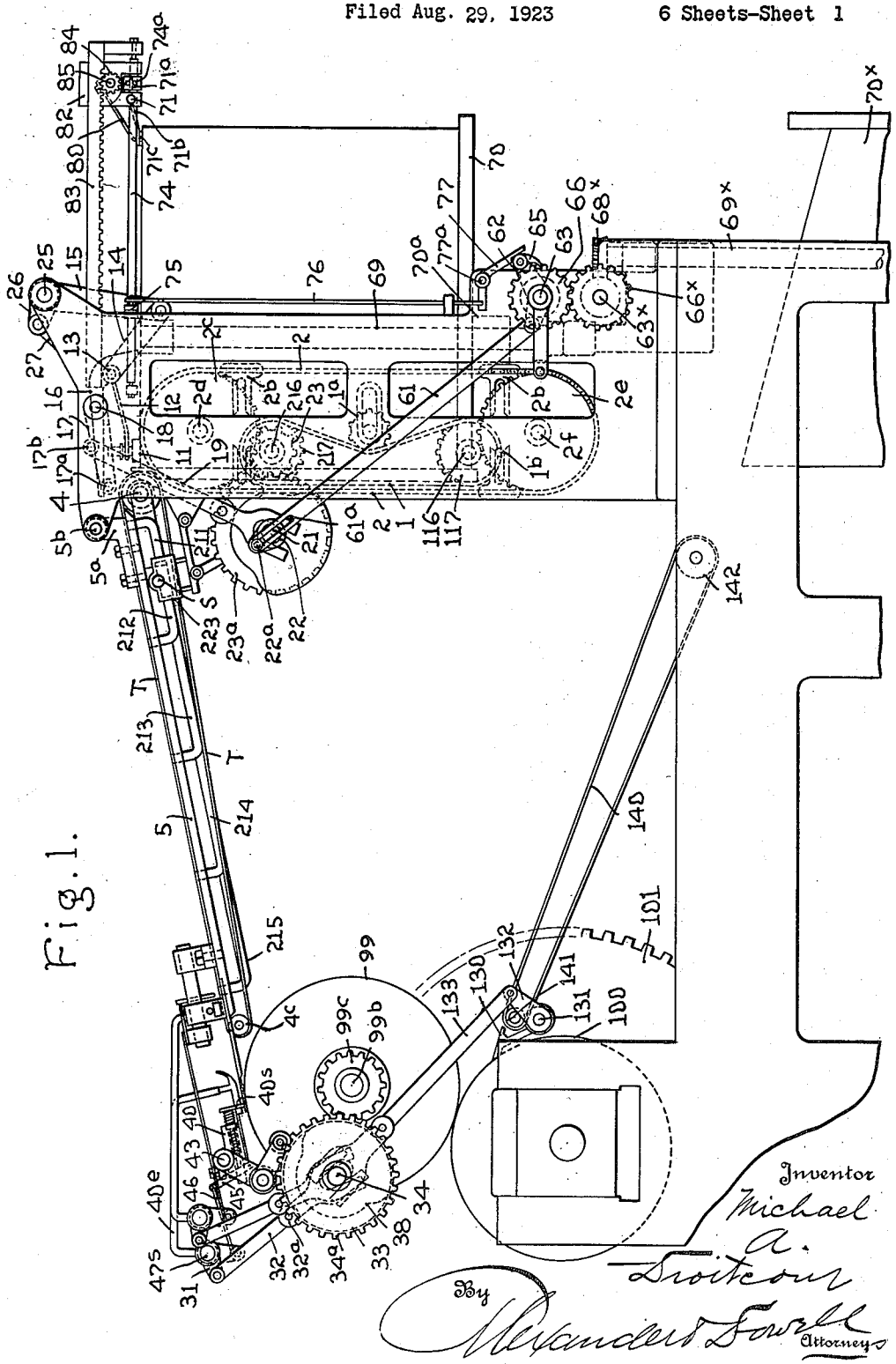


Fig. 1.

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SHEET PRINTING PRESS

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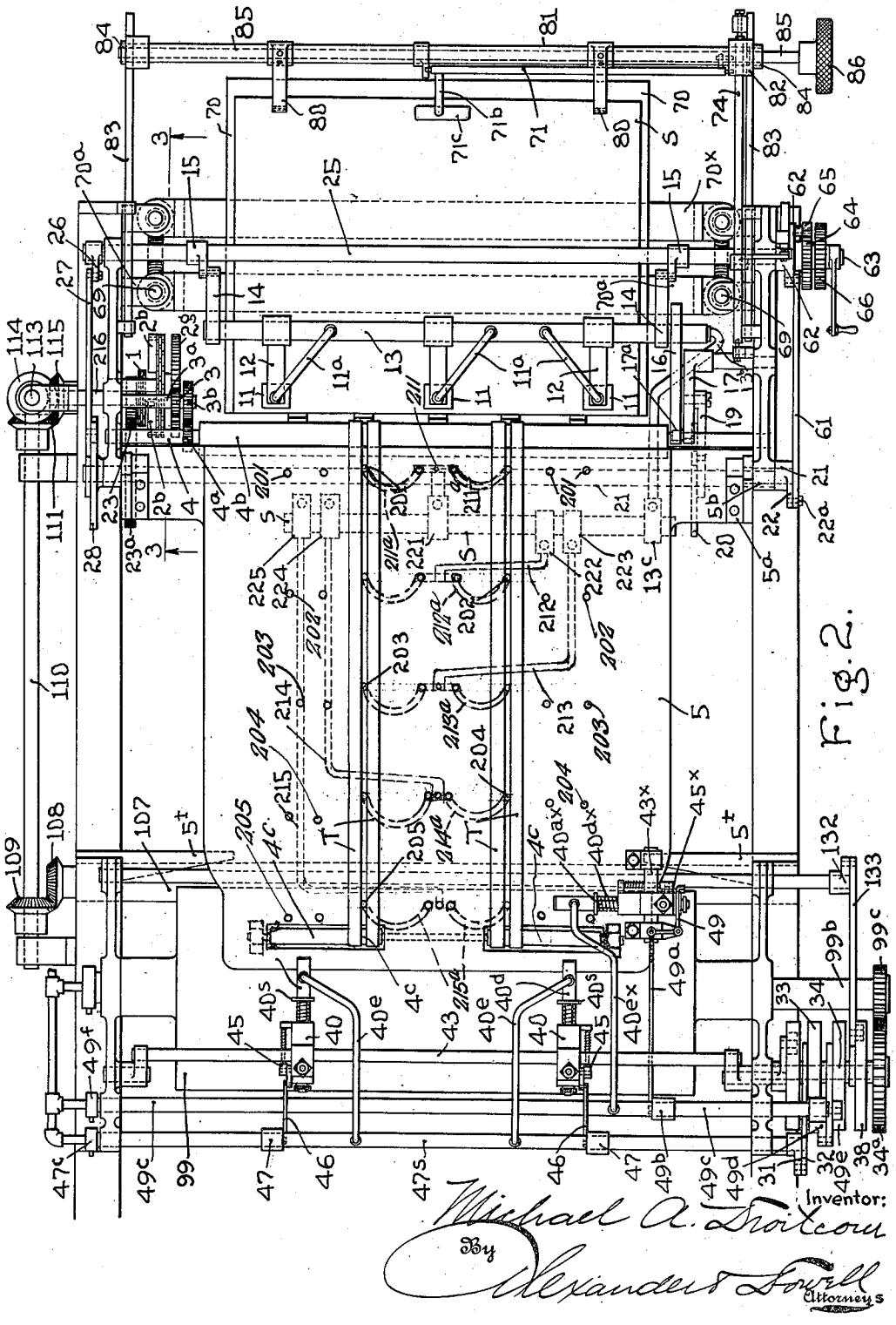


Fig. 2.

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SHEET PRINTING PRESS

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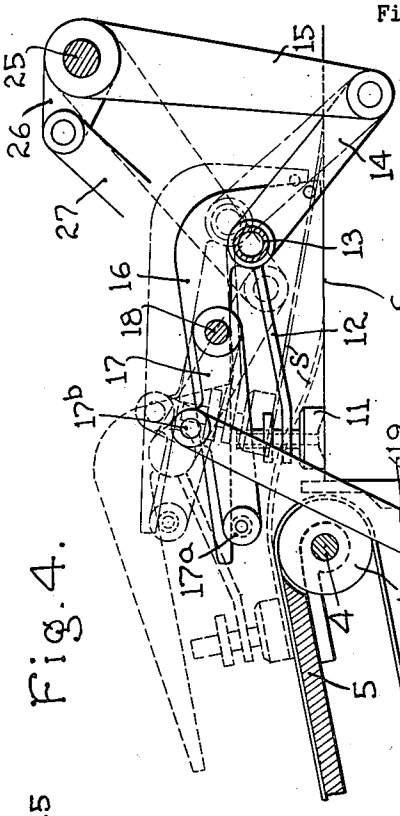


Fig. 4.

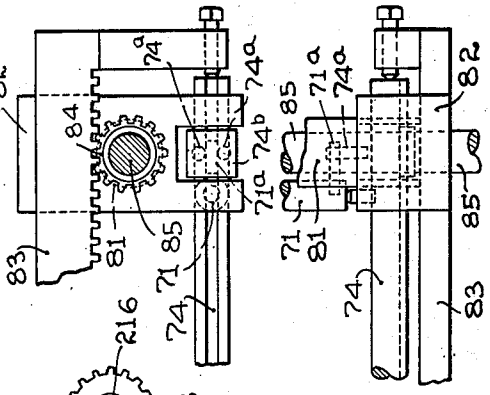


Fig. 21.

Fig. 22.

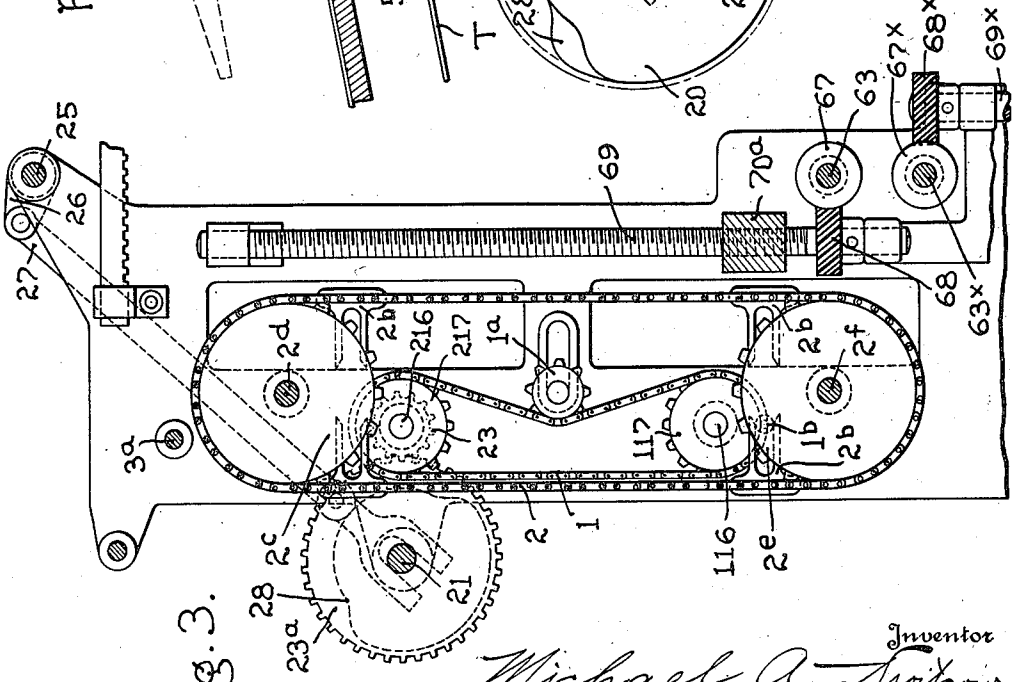


Fig. 3.

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SHEET PRINTING PRESS

Filed Aug. 29, 1923 6 Sheets-Sheet 4

Fig. 5.

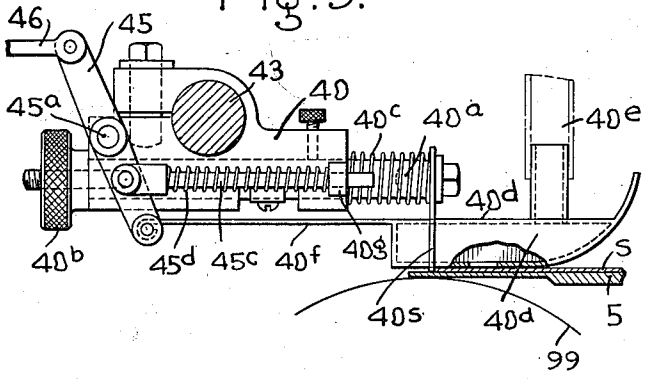


Fig. 6.

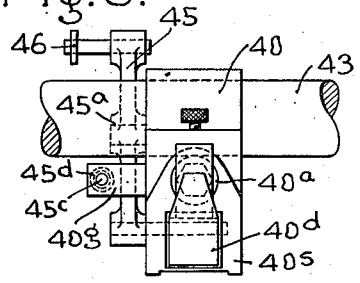


Fig. 7.

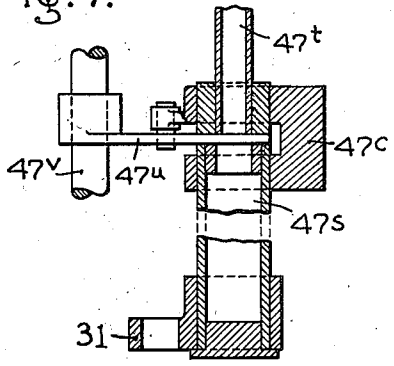


Fig. 8.

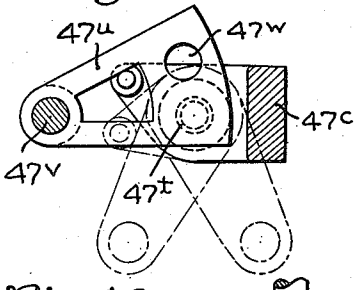


Fig. 10.

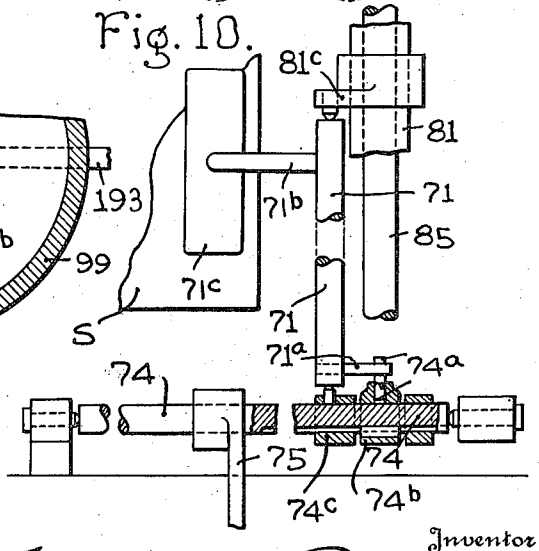


Fig. 9.

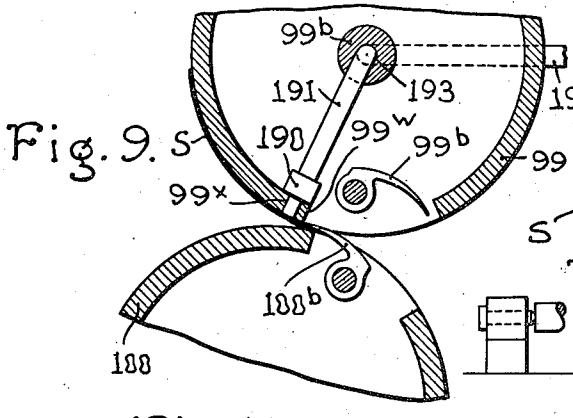
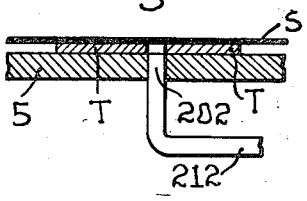


Fig. 11.



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April 10, 1928. 1,666,004

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SHEET PRINTING PRESS

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Fig. 12.

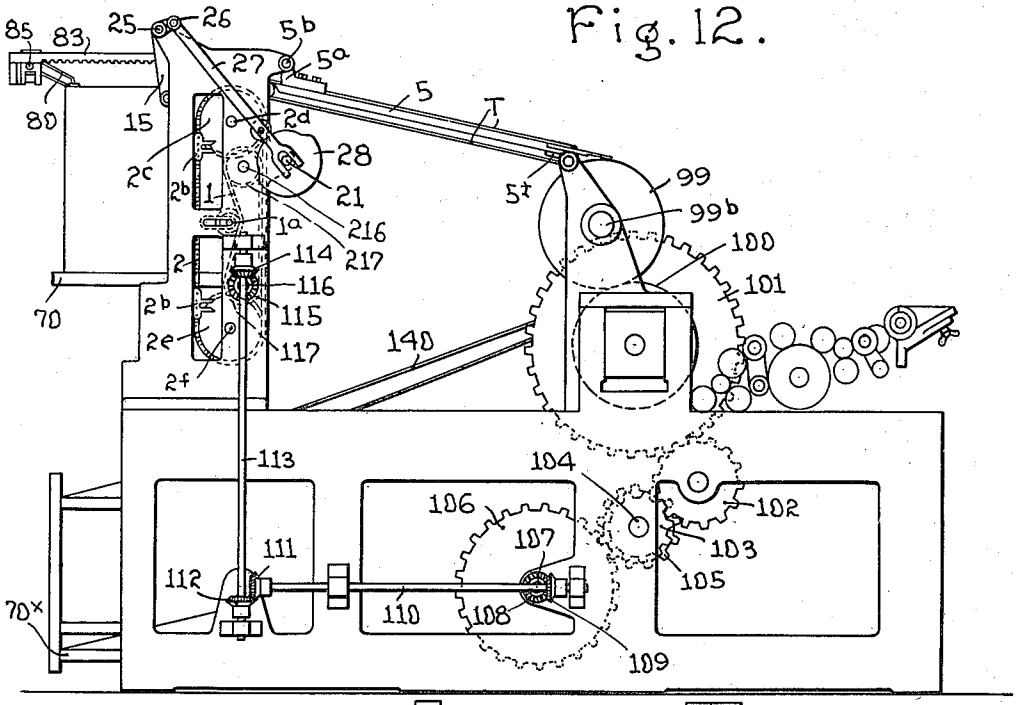
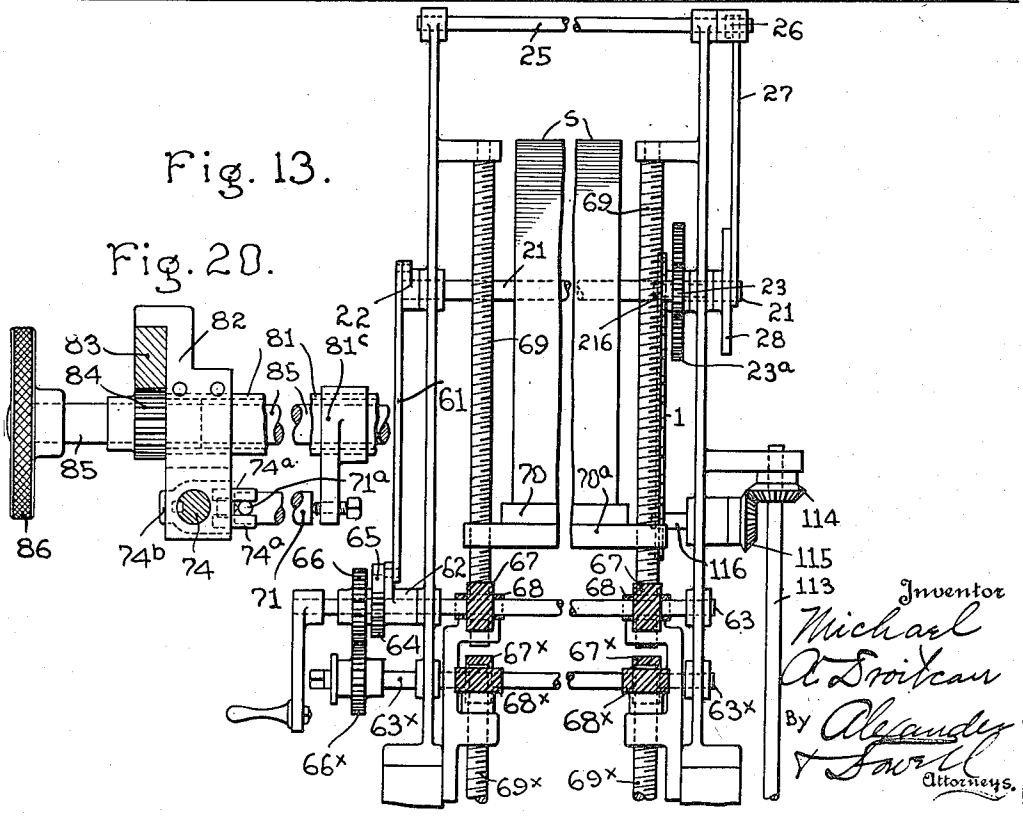


Fig. 13.

Fig. 20.



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SHEET PRINTING PRESS

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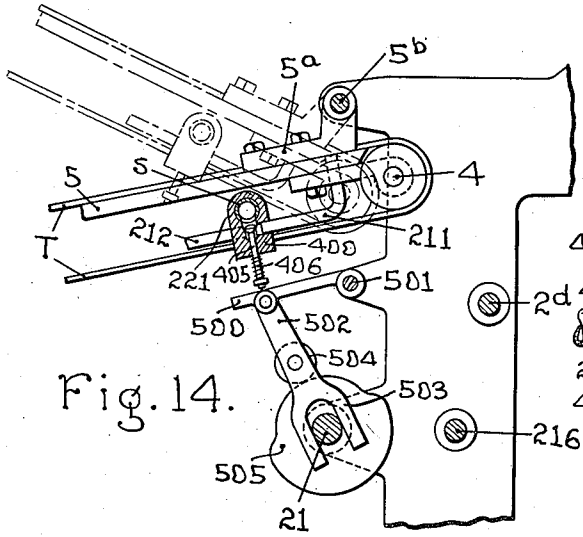


Fig. 14.

Fig. 15.

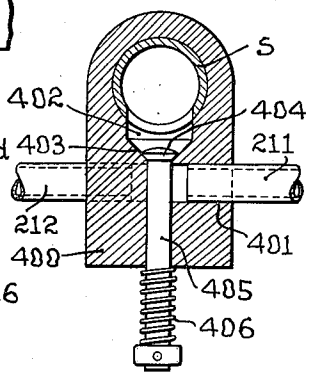


Fig. 16.

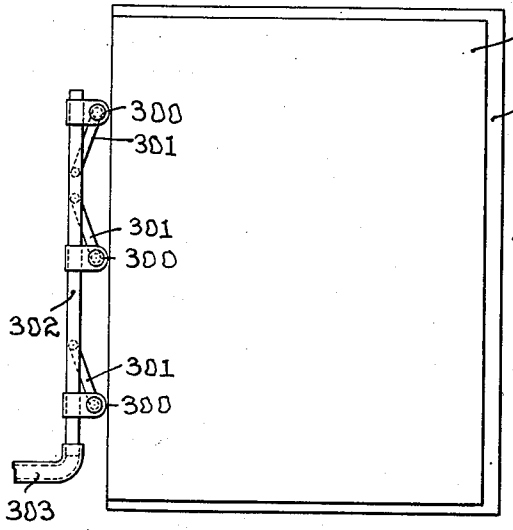


Fig. 19.

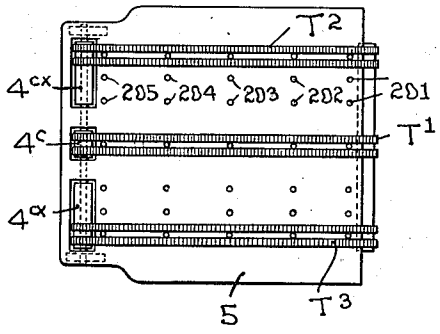


Fig. 17.

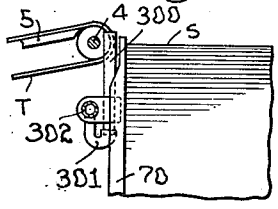
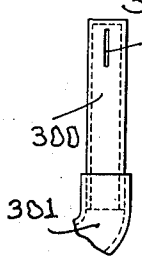


Fig. 18.



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Patented Apr. 10, 1928. 1,666,004

UNITED STATES PATENT OFFICE

MICHAEL ANDREW DROITCOUR, OF PROVIDENCE, RHODE ISLAND.

SHEET-PRINTING PRESS.

Application filed August 29, 1923. Serial No. 659,937.

This invention is a novel improvement in sheet printing presses, and has particular reference to the various means for advancing the sheet from the feed table through the press to the delivery table.

The objects of the invention are; to have the delivery table and the feed table at the same end of the press, and the delivery table preferably below the feed table; so that both will be conveniently under the observation of the pressman; to provide novel means for simultaneously operating the feed and delivery tables in opposite directions; to provide novel pneumatic suction means for feeding the sheets from the table onto the feed board; to provide novel pneumatic suction means for advancing the sheets from the feed table over the feed board to the sheet taking position; to provide a novel pneumatic suction means for front registering and side registering the sheets; to provide novel means for transferring the sheets from the sheet taking position on the feed board to the impression cylinder so that the sheets may be delivered directly from the impression cylinder, printed side up toward the delivery table at the feed end of the press; to provide novel means for forwarding the printed sheets from the impression cylinder to the delivery table; to provide a transfer cylinder between the feed board and the delivery board to enable the sheet to be delivered without having its printed side touched; to provide pneumatic means for holding the sheet on a cylinder after the cylinder grippers have released the sheet; to provide means whereby grippers on the cylinders can be arranged in alignment and posts in the cylinders to co-operate with the grippers dispensed with; to separate the top sheet from the feed pile without the necessity of using drop rollers closing tapes, or like mechanical devices such as are now commonly employed in separating sheets and feeding them from the pile to the feed board; to provide the feed board and parts thereon so that same may be raised when it is desired to get access to the underlying parts of the press; to provide novel means for timing the suction action of the sheet advancing means on the feed board, so that the sheet will be properly handled; to employ the feed tapes as part of the suction channels by which the sheets are advanced over the feed and also delivery if desired.

I will explain the invention with reference to the accompanying drawings to enable others to adopt and use same, and set forth in the claims the essentials of the invention, and the novel features of construction, and novel combinations of parts, for all of which protection is desired.

Fig. 1 is a partial side elevation of a sheet printing press equipped with my novel sheet handling mechanism.

Fig. 2 is a top plan view of Fig. 1.

Fig. 3 is an enlarged sectional view on the line 3—3, Fig. 1.

Fig. 4 is an enlarged diagrammatical view illustrating the operation of the devices for transferring the sheets from the pile to the feed board.

Figs. 5 and 6 are enlarged side and end views of one of the sheet registering boxes.

Figs. 7 and 8 are detail sectional views of one of the suction valves.

Fig. 9 is a detail sectional view of the transfer and impression cylinders showing the suction sheet holding devices of the transfer cylinder.

Fig. 10 is a detail view of the pile feed controlling devices.

Fig. 11 is a detail sectional view illustrating the air suction passage formed by the feed board and sheet feed tapes.

Fig. 12 is a reduced side elevation of the press looking at the side opposite to Fig. 1.

Fig. 13 is a detail end elevation, partly broken of the device for operating the feeding pile, and the sheet delivery pile.

Fig. 14 is a detail view of means of operating one of the air valves.

Fig. 15 is an enlarged sectional view of one of the suction valves for the feed board.

Figs. 16, 17, 18 are detail views illustrating the means for "fluffing" the sheets on the feed pile.

Fig. 19 is a detail top plan view of a feed board with adjustable sets of tapes.

Figs. 20, 21, 22 are detail views of the feed pile controlling devices.

In the accompanying drawings the invention as shown is applied to a flat bed and cylinder press preferably of the type in which the cylinder makes two revolutions for each reciprocation of the bed, but is adaptable to other types of presses.

As shown the impression cylinder 100 is driven by a gear 101 which is driven by intermediate 102 from a gear 103 on the driving fly wheel shaft 104; and gear 105 on intermediate 102 meshes with a gear 106 on a

shaft 107 which makes three revolutions in unison with the cylinder for each reciprocation of the bed.

On the shaft 107 is a beveled gear 108 which meshes with a beveled gear 109 on a counter shaft 110 that extends toward the feed end of the press and carries a beveled gear 111 which meshes with a beveled gear 112 on a vertical shaft 113 carrying a beveled gear 114 which meshes with a beveled gear 115 on a short stub shaft 116 suitably mounted in the feeder framing; and on the inner end of this shaft 116 is a sprocket 117. Mounted on the frame above the sprocket 117 is a similar sprocket 217 mounted on a stub shaft 216; over sprockets 117 and 217 runs a sprocket chain 1 which chain is continuously driven by the means described in unison with the movement of the impression cylinder. The chain 1 may be provided with an adjustable slack taking up or tensioning means, such as indicated at 1^a in the drawings, to maintain proper tension thereon.

The chain 1 carries a pin 1^b which is adapted to engage with any one of the slotted yokes 2^b attached to an endless chain 2 which runs over upper and lower sprockets 2^c and 2^e mounted on stud shafts 2^d and 2^f attached to suitable framing mounted on the press.

The sprocket 2^c is attached to a pinion 2^g which meshes with a pinion 3 on a stud shaft 3^a, and the pinion 3 is connected to a stud pinion 3^b which meshes with pinion 4^a on the end of a shaft or tape roller 4 which is journaled in suitable bearings in the frame adjacent the outer end of the feed board 5, the outer end of which feed board is provided with hinge yokes 5^a, by which the feed board is pivotally supported on pintles 5^b on the main frame so that the feed board can be raised; the inner end of the feed board when lowered is supported on brackets 5^t on the framing adjacent the transfer cylinder. This feed board is hereinafter referred to.

The paper feed pile.

In construction shown the pile of paper to be printed is mounted on a table 70 which is arranged at and above one end of the press, and is supported on a bar 70^a the ends of which are screw threaded to engage vertically disposed screw rods 69 which are rotatably mounted in suitable bearings or brackets attached to the framing; the lower end of each of the rods 69 is provided with a spiral gear 68 meshing with a spiral gear 67 on a shaft 63 suitably journaled in the framing, and on one end of this shaft is a ratchet 64, adapted to be engaged by a pawl 65 on an oscillatory arm 62, pivotally mounted on the shaft 63, and one end of said arm 62 is pivoted to a link bar 61, the other end of which link bar has a vertical slot 61^a engaging a pin 22^a on the face of a crank 22 which is mounted on a shaft 21 adjacent the sprocket gear 217, and is driven from the sprocket gear 217 by means of a pinion 23 fastened on sprocket 217 meshing with a pinion 23^a on shaft 21.

Pinion 23^a rotates continuously during the operation of the machine, and consequently would tend to impart oscillatory movement to the pawl 65 at all times, but to prevent this oscillation, except at the proper time, I provide a trip lever 77 which is pivoted on a stud 77^a adjacent the pawl 65 and normally depends in position to engage the arm 62 when in its depressed condition and to hold it in this position so that the rod 61 is held elevated and the pin 22^a works idly in a slot in the link 61. If the trip is disengaged from the pawl 62 then the link 61 drops and causes the arm 62 to oscillate and the pawl 65 to raise and the pin 22^a engaging the upper end of the slot in the link 61 will draw the link forward and thus depress the pawl and impart motion to the shaft 63 through the ratchet 64.

The engagement of the pawl is determined by the height of the pile of paper on the table and a detector (described separate).

As shown the short arm of the trip lever 77 is engaged by a rod 76 the upper end of which is attached to an arm 75 on a rock shaft 74 to which is attached an arm 71^b which carries a feeler plate 71^c adapted to rest upon the top of the pile of paper on the table 70. On this shaft 74 is splined a block 74^b carrying two projecting pins 74^a which are engaged by a pin 71^a on the shaft 71 which is pivotally mounted at one end on a block 82 which is fastened to the tube 81 adjacent the shaft 74. The other end of the shaft 71 is pivoted on the block 81^c also hung from the sleeve 81. The block 82 is bifurcated at its lower end to loosely embrace the block 74^b on shaft 74 and this permits the block 81^c and shaft 71 to be adjusted with the sleeve 81 to stand various sizes of sheets of paper in the pile and the shaft 74 is turned to adjust the plate 70 of the feeder. When the pile of paper is at the proper height the plate 71^c will be elevated sufficiently to hold rock shaft 71 so that the arm 71^a engaging pins 74^a will hold shaft 74 in such position that rod 76 will be elevated permitting the trip 77 to engage the arm 62 and hold the pawl 65 inactive. But as the pile is lowered by the feeding of the sheets plate 71^c lowers and permits shaft 71 to turn and permit the lowering of rod 76 until it disengages the trip 77 from the ratchet; whereupon the lever 62 is oscillated by the means described and imparts rotary motion to the shaft 63; which in turn causes the screws 69 to elevate to the table 70 until the top of the pile is raised sufficiently to cause plate 71^c, through

the described connections, to raise rod 76 and permit the trip 77 to again engage the lever 62 and hold the pile elevating device inoperative.

The delivery table.

The sheets are fed from the pile onto the table 5 as hereinafter described. In the construction shown a receiving or delivery table 70^x is arranged at the end of the press directly below the feed table 70. For every sheet fed from the top table 70, a sheet will be deposited upon the pile on the delivery table 70^x. At the beginning of the operations when table 70 is in its lowest position the table 70^x would be in its highest position. The table 70^x is constructed and operated substantially like the table 70 but is preferably inclined as shown, so that the sheets can slide readily thereonto; as shown table 70^x is provided with a bar 70^{ax} having its ends threaded to engage threaded rods 69^x which are suitably journaled in the frame; and these rods 69^x have spiral gears 68^x on their upper ends meshing with spiral gears 67^x on the shaft 63^x, (Fig. 3) and shaft 63^x has a gear 66^x meshing with the gear 66 on the shaft 63. The construction is such that each time the table 70 is elevated (or lowered) the table 70^x will be lowered (or elevated) a corresponding extent; and the elevating and lowering of both tables 70 and 70^x is governed by the above described trip mechanism, by which the operation of the shaft 63 is controlled as above described.

The sheets are fed successively from the pile on table 70 onto the feed board, by means hereinafter described, and are carried down the feed board and registered both longitudinally and laterally against the sheet stops by means hereinafter described.

It will be seen that the unprinted sheets are fed from the pile mounted on the feed table at the same end of the press when the sheets are delivered; and the sheets are delivered on the receiving table arranged beneath the feeder table. This produces a very compact press and enables the operator to easily control the feed and the delivery at the same end of the press, and this is a great practical advantage particularly on presses of the smaller size.

The sheet stops or front guides 40^s in the press shown co-operate with a transfer cylinder 99 which is practically the same size of the impression cylinder 100 and is suitably journaled above the same and is provid- with grippers 99^b which operate in the usual manner and are adapted to take a sheet from the feed board and transfer it to the grippers 100^b of the impression cylinder in the usual manner. After the sheet has been printed it is released by the cylinder grippers and stripped from the impression cylinder by strippers 130 attached to a rock shaft 131 supplied with an arm 132 which is pivoted to a link 133 which is operated in the proper time by a cam 38 on a stud shaft 34 and which shaft is provided with a gear 34^a meshing with a pinion 99^c on the shaft 99^b of the transfer cylinder 99, the gearing being so proportioned that the strippers 130 will be moved in and out and held in and out of operative position at the proper time during the rotation of the press. The printed sheet is directed by the strippers 130 onto a set of delivery tapes 140 running over guide rollers 141 and 142 suitably mounted in the machine; the sheets passing over the roller 142 onto the delivery pile on table 70^x as indicated in the drawing.

The means for feeding the sheets.

The sheets are successively fed from the pile on table 70 onto the feed board 5 by suction devices which comprise suction boxes 11 mounted on arm 12 attached to a hollow shaft 13 which is in turn attached to links 14 pivoted or suitably connected to arms 15 mounted on a rock shaft 25 which is suitably journaled in suitable framing on the press above the feed table.

To one of the links 14 is attached an arm 16 which is slidably supported on a pin 17^a attached to the free end of a lifting lever 17 which is pivoted on a stud 18, attached to a suitable part of the framing, see Figs. 2 and 4; link 17 is pivotally connected at 17^b to one end of a link 19, the other end of which is bifurcated or slotted to embrace the shaft 21 and be guided thereby and link 19 is actuated by a cam 20 attached to the shaft 21, see Fig. 4.

As shown in Fig. 4 the suction boxes 11 may be of any suitable construction and are connected by hose section 11^a to the pipe 13; and said pipe 13 may be connected to a suction apparatus of any suitable kind, not shown, by which suction is produced in the pipe and in the boxes 11.

The shaft 25 has an arm 26 on one end connected to one end of a link 27 which is operatively engaged by a cam disk 28 on a shaft 21 journaled in the framing and having a gear 23^a on its inner end meshing with a pinion 23 on the shaft 216 (see Figs. 2 and 4). The cam 28 is operated in such time and manner that when a sheet is to be fed from the pile to the feed board the suction boxes 11 are first raised from the position shown in full lines in Fig. 4, to the position indicated in dotted lines x in Fig. 4 by the action of the cam 20 link 19 and arm 17; then, while the link 17 is held in this raised position, the cam 28 through link 27 and arm 26 rocks shaft 25 and moves the elevated suction boxes 11 from the position shown in dotted lines x (Fig. 4) to the position shown in dotted lines y in (Fig. 4). Then after the sheet has been

thus moved to the feed board the suction in boxes 11 is cut off, and the sheet left partly on the board while the boxes are returned to the position as shown in full lines in Fig. 4 ready to lift another sheet. The boxes 11 have sufficient vertical play to enable them to pick sheets from a pile slightly varying in height; and each sheet will be lifted in a straight curved line and will have a natural curve, according to its own tension or spring, and will be passed to the feed board with almost the same movement used in manually handling the sheet; the boxes moving as described imparting a wave or winding motion to the sheet so as to get air under the whole sheet as is done in hand feeding, thus facilitating the separation of the top sheet from the pile.

In order to facilitate the removal of the top sheet from the pile I provide means for fluffing the top sheets by air. For this purpose a plurality of air jet heads 300 are arranged adjacent the top of the pile, below and between the shaft 4 and the top of the pile S (see Figs 16, 17, 18) and are connected by flexible sections 301 to air pipe 302 which can be connected by a hose 303 to an air blower not shown. These heads have slits 304 in their sides adjacent the upper end of the pile through which jets of air are directed against the adjacent edges of the top sheets to cause the top sheet in the pile to fluff up, so that when the top sheet is lifted by means of the suction boxes 11, as above described, it is immediately seperated from the other sheets by the air blown between the sheets, which prevents the raising of more than one sheet at a time from the pile by the suction boxes.

Advancing sheets.

The sheet is advanced to the feed board by the suction boxes 11 so that the forward edge of the sheet lies beyond the roller 4^b and lies upon the sets of tapes T; which tapes extend from roller 4^b at the outer end of the feed board to and over rollers 4^c suitably mounted at the adjacent end of the feed board as indicated so the upper runs of the tapes T lie upon and close to the upper surface of the feed board, or in slight recesses in the feed board if desired, while the return run of the tapes pass back under the feed board.

As shown these tapes T are arranged in pairs, two pairs being shown; the tapes in each pair being parallel and near together the slight space between adjacent edges of the tapes in each pair forming an air suction channel (see Fig. 11) which is normally open but is closed by the sheet lying on the tapes, and I have found that when a sheet is laid upon these tapes and a suction is created in the space between the tapes and overlying sheet, the sheet will be held to the tapes and caused to travel therewith by the suction.

To facilitate the advance of the sheet on the table the suction is created progressively along the length of the spaces between the pairs of tapes between the rollers 4^b and 4^c, by means of suitable suction openings indicated at 201, 202, 203, 204, 205, in Fig. 2; which openings are respectively connected by pipes 211, 212, 213, 214, 215 to suction valves 221, 222, 223, 224, 225, respectively; and said suction valves are all connected with a common suction pipe S which is connected by a hose S′ to the air pump, not shown. As indicated in Figure 2 the several pipes 221 to 215 may be provided with flexible or adjustable sections 211^a, 212^a, 213^a, 214^a, 215^a, respectively, the free ends of which may be plugged into any one of the related series of openings 201 to 205 according to the position in which the sets of belts T are adjusted. The belts can be adjusted laterally on the feed table to suit different widths of paper; and the free ends of the sections 211^a to 215^a can be plugged into the proper opening between the belts of each pair.

The air valves 221 may be of any suitable construction, and I do not deem is necessary to show all of them in detail as they all may be operated alike. One of these valves is shown in section in Figs. 14, 15. Each of these valves preferably comprises a body 400 having an outlet opening 401 to which a pipe 211 (212–3–4–5, etc.) is connected. It has a bore 402 communicating with the pipe S and the outlet opening, and provided with a valve seat 403 closed by a valve 404^d. The stem 405 of this valve projects below the body, and the valve is normally pressed by a spring 406 on the projecting end of the valve. These valves raise and lower with the feed board. When the board is lowered the stem 405 of each valve lies above a related lever 500 which is pivotally mounted on a rod 501 attached to an adjacent part of the framing (see Fig. 14) above the shaft 21. This lever 500 is connected to the upper end of a link 502, the lower end of which is bifurcated or slotted as at 503 to embrace the shaft 21; and on this link 502 is a roller 504 which engages a related cam 505 fixed to the shaft 21. The cams 505 are so formed and relatively adjusted that at the proper times the several levers 500 will be raised to contact with the related valve stem, and open the valve whereupon suction will be created through the related openings in the feed board in the manner and for the purpose described.

The pipe 13 is connected by a hose 13^b to a suction box 13^c on pipe S. The suction valves 13^e and 211 to 215 respectively may be operated by any suitable means in the well known manner so as to be opened and

closed at the proper time to receive pipes to which they are connected or prevent the same as required. Thus the suction would be created in the pipe 13 just before the boxes 11 are raised to lift a sheet on the feed board and suction will be maintained in the boxes 11 until they have passed the sheet onto the feed board at the position indicated in dotted lines *y* in Fig. 4 at which time the tapes T are stationary and when the suction boxes 11 place the sheet upon the tapes as indicated in dotted lines *x* in Fig. 4 then the suction is created in the pipes 201 and this creates a suction in the space between the tapes T and holds the sheet thereto. Then the suction is released from the boxes 11 and the latter raised while the sheet is held to the tapes by the suction in pipes 201, and then as the tapes begin to move the sheet down the feed board suction is successively created in the pipes 212, 213, 214, 215 until the sheet is brought close to position near the front sheet stops 40^s. The cams may be so arranged that as the sheet is advanced suction is created successively in the pipes and successively cut off in the pipes.

The front register.

The front register devices are preferably constructed as shown in Fig. 5 and comprise stops 40^s, each of which is fastened to a rod 40^a which is slidably mounted in a casting 40 attached to a rod 43 mounted in the bearings in the framing above the transfer cylinder 99. The rod 40^a is provided on its rear end with an adjusting nut 40^b and is normally projected outwardly, as far as permitted by the nut, by means of a spring 40^c interposed between the plate 40^s and the casting 40. Projecting through an opening in the stop 40^s is a suction box 40^d which has an aperture 4 in its under side and is movable longitudinally and at right angles to the shaft 43.

Each suction box 40^d is connected by a hose 40^e to a suction pipe 47^s, journaled in the framing in rear of shaft 43, provided with a suitable suction valve and operating connections.

The box 40^d is connected by a link 40^f to one end of a lever 45 which is pivoted at 45^a on the casting 40; and to this lever, below its pivot, is pivotally connected a rod 45^c which passes through a guide 40^g on the casting 40, and a spring 45^d is strung on the rod 45^c between the lug 40^g and the lever 45 and normally tends to rock the lever to draw the suction box inward toward shaft 43.

The other end of lever 45 is connected by a link 46 to an arm 47 on the shaft 47^s and on shaft 47^s is an arm 31 which is pivotally connected to a link 32, the other end of which is slotted to embrace the shaft 34 and be guided thereby. This lever 32 carries a roller 32^a engaging a cam 33 on the shaft 34. By this means the shaft 47^s will be rocked at the proper time to shift the boxes 40^d.

One end of the shaft 47^s is connected with an air valve box 47^c and which in turn is connected by the suction apparatus (not shown) and suitable means are provided (not shown) whereby the valve 47^c could be opened or closed at the proper time to produce suction in the pipe 47^s and boxes 40^d and relieve the suction therein at the proper time.

The parts are so arranged that as or before the leading edge of the sheet leaves the lower end of the feed board 5 the shaft 43 is rocked to lower the front stops 40^s into the path of the sheet and the sheet is released from the suction on the tapes T just as or before its leaving edge reaches the stops 40^s. Then the valve on hollow shaft 47^s is actuated so as to create suction in the boxes 40^d and take hold of the sheet nearest the leading edge, and then hollow shaft 47^s is rocked so as to oscillate levers 45 in a direction to permit spring 45^c to move the suction boxes 40^d slightly rearward so that they will register the front edge of the sheet against the stop 40^s before suction is cut off in said boxes.

The side register.

After the sheet is properly forwarded against stops 40^s it is wide registered by means of a suction box 40^{dx}, similar to the box 40^d, mounted on a rod 40^{ax}, similar to rod 40^a, carried by a casting 40^x supported on a rod 43^x detachably mounted on the end of the feed board 5. The lever 45^x of this device is connected to one arm of a bell crank lever 49 the other arm of which is connected by a rod 49^a to an arm 49^b on a hollow shaft 49^c which is journaled in the frame and has a crank arm 49^d on its outer end which engages a race cam 49^e on the shaft 34.

The shaft 49^c is hollow and is connected by a pipe 40^{ex} to the box 40^{dx} and on the outer end of the shaft is an air valve box 40^f (similar to valve 47^c) connected to the suction apparatus (not shown) and suitable means are provided (not shown) whereby the valve 49^f may be opened or closed at the proper time to produce suction in the box 40^{dx}.

The cams and suction boxes are so arranged that at the proper time the side register box 40^{dx} will be engaged with the sheet of paper and then be moved laterally so as to register the sheet of paper sidewise. The registering movement of the box 40^{dx} is so timed as not to interfere with the registering movement of the front registering boxes 40.

The suction valves 47^c and 49^f may be made as shown in detail Figs. 7 and 8. As shown the valve body 47^c is attached at one side to the end of the shaft 47^s and has an air suc-

tion pipe 47^t connected to its opposite side opposite the end of the pipe 47^s. The valve member 47^u is normally held in the position shown in Fig. 8 where it presents an imperforate surface between the adjacent ends of pipe 47^s and pipe 47^t. The valve member 47^u is pivoted on a rock shaft 47^x which may be rocked by a suitable cam at the proper time so as to raise or lower the valve 47^u. This valve member has a hole 47^w in it and when the valve member is lowered the hole 47^w establishes direct communication between pipes 47^s and 47^t, and then suction is produced in pipe 47^s, and this suction continues until it is cut off by valve member 47^u.

Upon the sheets on the feed pile yieldingly rest spring finger 80 which are connected to a tube or a hollow shaft 81 which is fast in boxes 82 which slide on rack bars 83 mounted on the sides of the frame. These rack bars 83 are engaged by pinions 84 attached to a rod 85 which extends through the hollow shaft 81 and is provided with a hand wheel 86 by which the rod 85 may be turned manually, thus the hollow shaft 81 with fingers 80 may be advanced inwardly or outwardly according to the lengths of the sheets on the pile.

The transfer cylinder 99 is provided with gripper fingers 99^b which may be operated to open and close in the usual manner, and the sheets are so fed that they overlap the edge 99^w of the transfer cylinder, as shown in Fig. 9, when the grippers 99^b are closed thereon. A suction box 190 is arranged inside the surface of the cylinder 99 and is provided with apertures 99^x opening through the outer face of the cylinder. The box 190 is connected by a pipe 191 to a bore 192 in the shaft 99^b of the transfer cylinder; and this bore is connected by suitable means with a suction pipe 193 which leads to the vacuum pump, and a suitable suction valve (not shown) is provided and operated by a cam (not shown) so that after the grippers 99^b have taken the sheet from the feed board and before they release the sheet the suction is created in box 190 sufficient to hold the sheet to the transfer cylinder with its edge projecting beyond the face of the bar 99^w as shown in Fig. 9 giving the impression cylinder grippers 100^b room to fully engage the sheet as indicated in Fig. 9 after the grippers 99^b have been opened. This does away with any interference of the grippers at the transfer point, as the suction holds the sheet to the transfer cylinder after the grippers 99^b are opened and suction is cut off to release the sheet just as the fingers 100^b of the impression cylinder 100 take the sheet. This does away with the necessity for "posts" under the grippers on other cylinders, and enables impressions to be made very close to the edge of the sheet.

By holding the sheet to transfer cylinder by suction as above described the grippers on both cylinders 99 and 100 can be in alignment, and there will be no interference between them. This will dispense with the necessity of providing "posts" usually employed on the cylinders for the grippers to engage, to permit clearance of the grippers. In ordinary construction if the grippers were in alignment, or directly opposite on the two cylinders they could not pass between the cylinders, but in my construction by using the air suction I can have the grippers on the respective cylinders directly opposite or in alignment. I also do not have to provide any means for adjusting the "posts" for height. Whereas in ordinary construction (where "posts" are required to co-operate with the grippers) if a card say .025 thick was being printed then the "posts" would have to be lowered .022 to bring top of sheet on pitch line; obviously when a heavy sheet is to be printed the packing on impression cylinder must be reduced as otherwise there would be too much impression and smash type etc. In my press the grippers on transfer cylinder 99 open before there can be any interference with the closing of the grippers on the impression cylinders and when they are open the suction holds the sheet to cylinder 99 until the grippers on the cylinder 100 close on sheet.

If desired while I have described the suction tapes as used only on the feed board suction might also be used in connection with the delivery tapes 140. These could be arranged in pairs between the rollers 141 and 142 and operated as described to transfer the sheet positively from the impression cylinder 100 to the delivery table 70^x.

In presses adapted to handle sheets of large size, I may provide more sets of air suction tapes. In Fig. 19 I show three sets of such tapes: One set T′ being at the center of the feed board, and sets of tapes T^2 and T^3 are arranged parallel with but on opposite sides of the central set of tapes. All of these tapes may be driven from the shaft 4^b, as above described; but the tapes T^2 and T^3 run over elongated rollers 4^{ex}; a plurality of parallel sets of apertures 201–2–3–4–5 etc., are provided in the feed board, and the sets of tapes T^2 and T^3 may be adjusted toward or from the tapes T′ to suit the size of sheets, and the preferably related sets of said apertures.

On a small press say handling sheets of 22 inches, it is not necessary to use the adjustable tapes; but for larger presses three or more sets of tapes are preferable, the outer tapes being movable as described, so they can be adjusted to suit the width of the sheets being printed.

Operation.

Power is transmitted from the three revo-

lution shaft 107 through miter bevel gears to twenty tooth sprocket 117 which operates the 60 link chain one revolution to each impression. The chain 1 has a pin which engages a yoke 2^b on driven chain 2 and operates the tapes T on feed board intermittently. The suction pipes under feed board are connected through valves to vacuum pump. Valves are operated by cams on shaft which is driven one revolution to each impression of press.

The pile of paper to be fed is supported on board 70 and the pile is kept at normal height by the devices controlled by the plate 71^c resting on top of pile. When pile is reduced the trip 77 releases bell crank 62, and crank pile is forced to normal height by the spiral gears 67—68 and screws 69.

The top sheet is engaged by the suction boxes 11 (preferably three as shown) which are swung (Fig. 4) to lift the forward end or edge of sheet. Then the suction boxes advances the sheet over (to left) and holds leading part of sheet in practical contact with upper face of feed board over tapes T. (The tapes are not travelling at this time). Then the suction goes on first set of holes 201 between each set of tapes holding sheet to tapes. Suction boxes 11 then releases sheet. Then the pin 1^b on power chain 1 engages a yoke 2^b and travels tapes T and sheet toward transfer cylinder; when the pin leaves the yoke the tapes are stopped, and sheet is then in position to be registered to gauges by the register mechanisms. The sheet is controlled in its movement toward the cylinder by progressively applying the suction as lead end of sheet gets to openings 202, 205 and closes vacuum as tail of sheet passes these openings. By this means the vacuum is not lost or overly weakened.

The sheet is then registered by action of suction boxes 40^d and 40^{dx} as described.

The grippers on transfer cylinder take the sheet from the feed board (after register) and suction holds the sheet to cylinder as grippers are opened so as not to interfere at transfer point to impression cylinder. From the impression cylinder 100 the sheet is directed by strippers 13^v onto the delivery tapes 140 and by them delivered onto the delivery tables 70^x.

The feeder pile being over the delivery pile effects a saving of space and overcomes the long travel of sheet from pile to cylinder also from cylinder to delivery. The twin tapes with suction applied between them handle the sheet very effectively and with very little suction.

By employing the transfer cylinder 99 to transfer sheets from the feed board to the impression cylinder I am enabled to deliver the sheets printed side up without having the printed side touched by the delivery. By employing a guide with the register devices the sheet will be brought into contact with the whole face of the guide and I do not have to employ posts on either side of the registering member as heretofore necessary, and the registering means can be lifted with the guide.

The novel features of my invention are the employment of side by side tapes with suction between them for advancing (feeding or delivering) the sheets, without having to employ any co-operating devices on the top of the sheet when advancing same. This is especially useful in the delivery of sheets, as the top of the sheets have a freshly printed surface and it is highly desirable that nothing shall come in contact with the freshly printed surface. Arranging the feed pile above the delivery pile gives the operator better control as both feed and delivery are at same end of press. By using the transfer cylinder before sheet is printed there will be no smutting of printed sheets or offset caused by the freshly printed surfaces coming in contact with the transfer surface, such as the reels used in drum cylinder presses and on two revolution rear delivery presses. Heretofore in both one revolution or two revolution presses the only delivery used was a fly, delivering printed side up but by using the transfer cylinder in advance of printing I can use a tape delivery and deliver sheets printed side up without touching the printed side of sheet.

Another desirable feature is having the register devices as parts of guides and having the sheets brought into contact with whole faces of guide at either side of registering member. Also having registering means lift with guide. By holding sheet by suction to transfer cylinder (after grippers are tripped) I can have grippers, on in same path on both transfer and impression cylinders in line without interference, whereas in other makes of presses the grippers cannot be in line, and the cylinders are provided with posts to permit clearance between the grippers and in other presses these posts must be adjustable for height or thickness of paper.

Another feature of the invention is using same member as 11 to separate the top sheet and place sheet onto feed board without the use of drop rollers, or closing tapes. I use suction throughout. The advancing member or feed board 5 is hinged to allow access to parts underneath. My design allows access to impression cylinder for putting on makeready etc. without having to lift the advancing mechanism or feed board, which cannot be done on any other machine (of the two revolution flat bed type). I also propose to mount my rollers, vibrators, and ink

fountain so that they can be moved laterally around a post out of the way in making ready the forms if desired.

Another advantage is having the timing device (pipes 212—213, etc., and opening between tapes) stationary and the advancing tapes not having to be timed; as such tapes can move or slip without causing any damage, as the travel of tapes is governed by the yokes and the suction opening between tapes cannot be thrown out of time.

In compliance with the requirement of the office for division I do not herein claim that arrangement of feeding and delivery mechanisms set forth in original claims 1 to 16 inclusive; nor that arrangement of sheet stop and suction presses set forth in original claims 24 to 32; nor that arrangement of impression and transfer cylinders set forth in original claims 37 and 38; nor that particular arrangement of feed and delivery tables set forth in original claims 41 to 45 inclusive, nor the particular suction sheet device set forth in original claims 17, 18 and 22; and reserve my right to file divisional applications on the subject matter of such claims.

What I claim is:

1. In a printing press of the character specified, sheet advancing means comprising a support, adjacent endless tapes having runs lying on the surface of said support, said tapes being arranged close together, the space between the tapes the support and a sheet laid on the tapes forming an air channel; and means for creating suction in said channel, whereby the sheet is held to the tapes by suction and is moved forward by the tapes when the latter are travelled.

2. In sheet advancing mechanism as set forth in claim 1, means whereby the channel and suction in the channel is progressively advanced as the sheet is progressively advanced by the tapes substantially as described.

3. In a printing press, having a feed table, and a feed board, and means for feeding sheets from the table to the feed board; means for advancing sheets on the feed board, comprising adjacent endless parallel tapes having runs lying on the surface of said board, said tapes being arranged close together; the space between the tapes, board, and a sheet laid on the tapes forming an air channel, and means for creating suction in said channel through the feed board when the sheet is laid upon the tapes whereby the sheet is held to the tapes by suction, and is moved forward on the board by the tapes when the latter are travelled.

4. In sheet advancing mechanism as set forth in claim 3 means whereby the suction in the channel between the tapes is progressively created as the sheet is advanced by the tapes, substantially as described.

5. In a printing press as set forth in claim 1, means for operating the tapes intermittently, comprising an endless chain, means for operating the tapes from said chain; a second endless chain adjacent the first chain; means for continuously driving the second chain; and interengaging pins and yokes on the chains whereby the first chain is intermittently driven from and by the second chain.

6. In combination with mechanism as set forth in claim 1, means for intermittently operating the tapes synchronously with the printing mechanism and once for each printing operation of said mechanism.

7. In combination with a support adjacent, side by side tapes for advancing sheets over the support, and means for applying suction to the under side of the sheet in the channel formed by the space between said tapes the sheet and the feed board.

8. In combination with a support, sets of side by side tapes for advancing sheets over the support, said sets of tapes being relatively adjustable to suit different sizes of sheets, and means for applying suction to the under side of the sheet in the channel formed by the space between said tapes the sheet and the feed board.

9. In combination with a support, sets of side by side tapes for advancing sheets over the support, said sets of tapes being relatively adjustable to suit different sizes of sheets, and means for creating suction through the support in the channel formed by the space between the tapes in each set the sheet and the feed board to hold the sheet to the tapes.

10. In combination with a feed board, sets of side by side tapes for advancing sheets over the feed board, and means for applying suction to the bottom side of the sheet in the channels formed by the spaces between the tapes of each set on the runs thereof contacting the feed board the sheets and the feed board.

11. In combination a feed board, sets of side by side tapes for advancing sheets over the feed board, said sets of tapes being relatively adjustable to suit different sizes of sheets, and means for applying suction to the bottom side of the sheet through the feed board in the channels formed by the spaces between the adjacent tapes of each set the sheets and the feed board.

In testimony that I claim the foregoing as my own, I affx my signature.

MICHAEL ANDREW DROITCOUR.