Aug. 23, 1938. J. F. JIROUSEK 2,127,736

SHEET FEED MECHANISM

Filed May 3, 1935 5 Sheets-Sheet 1

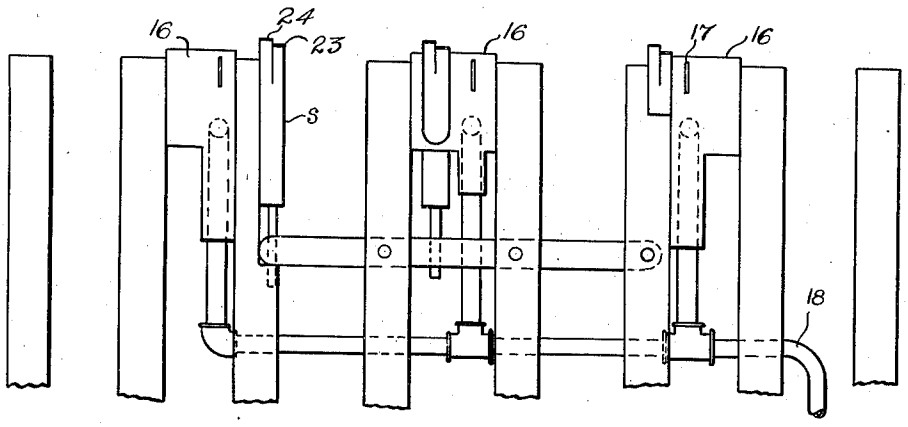


Fig. 2

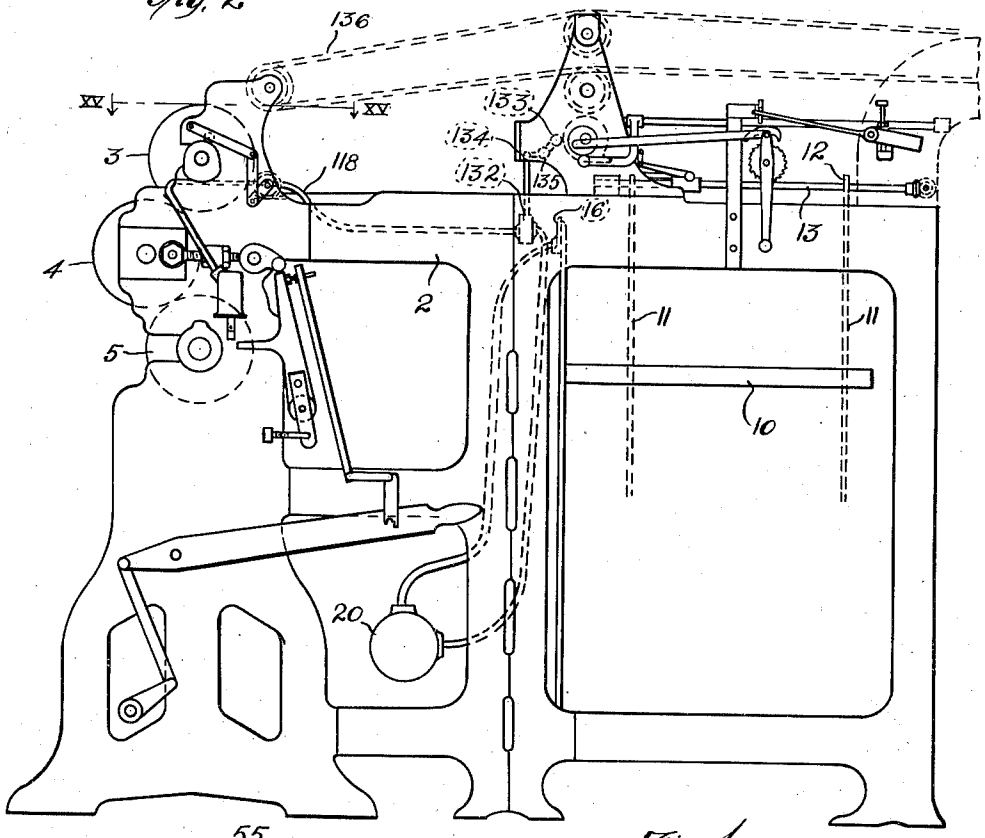


Fig. 1

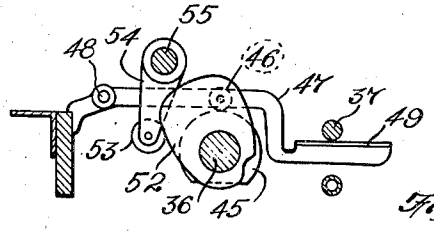


Fig. 4a

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SHEET FEED MECHANISM

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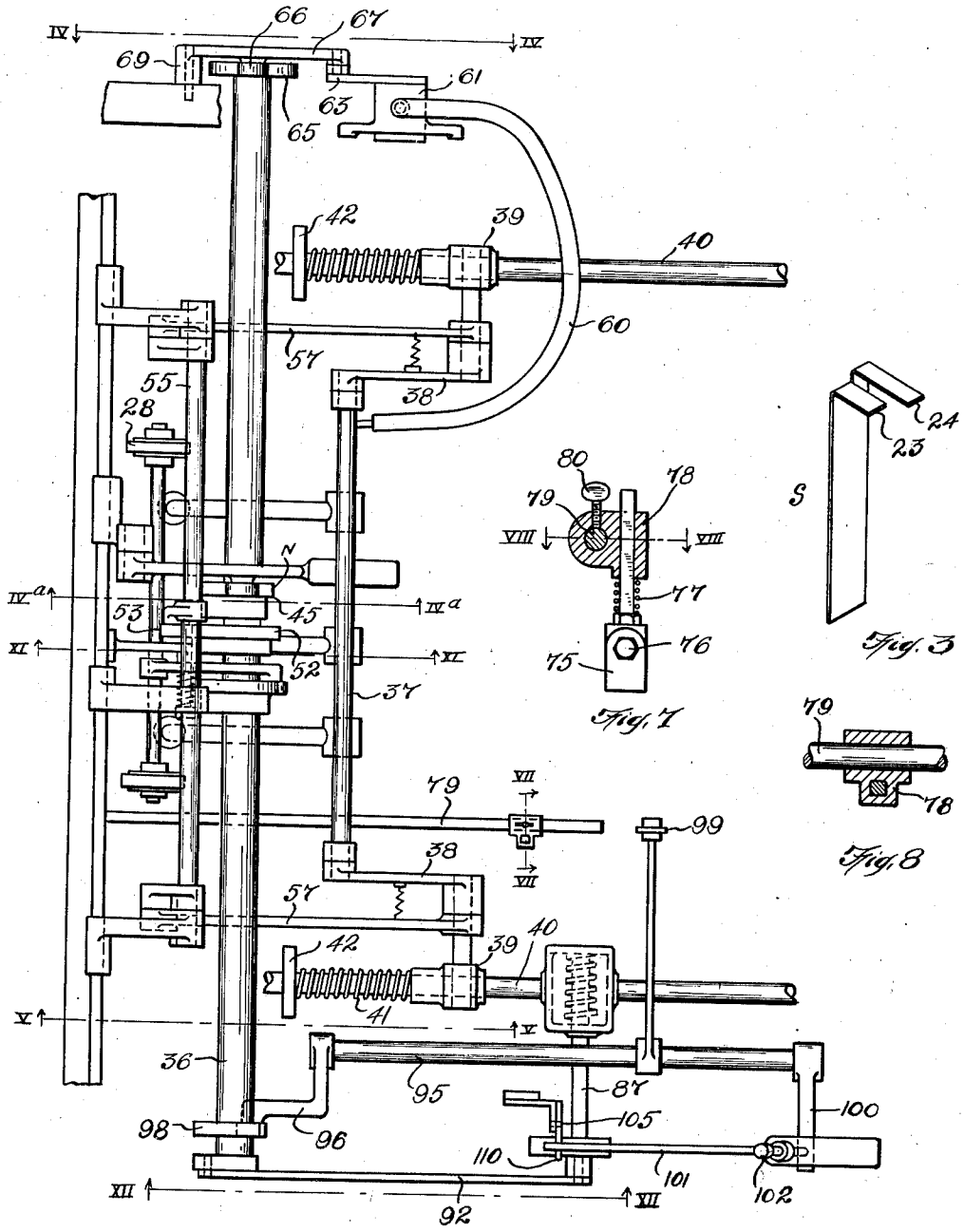


Fig. 4

Fig. 7

Fig. 3

Fig. 8

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SHEET FEED MECHANISM

Filed May 3, 1935 5 Sheets-Sheet 3

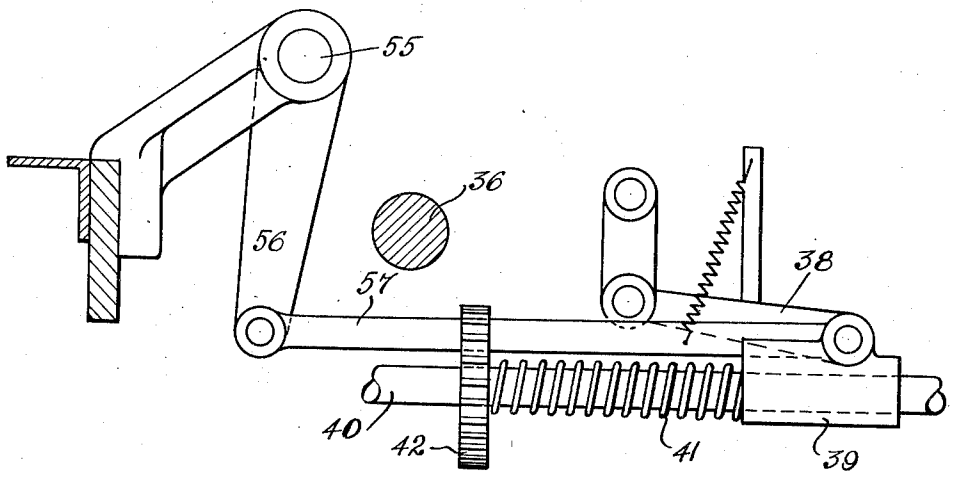


Fig. 5

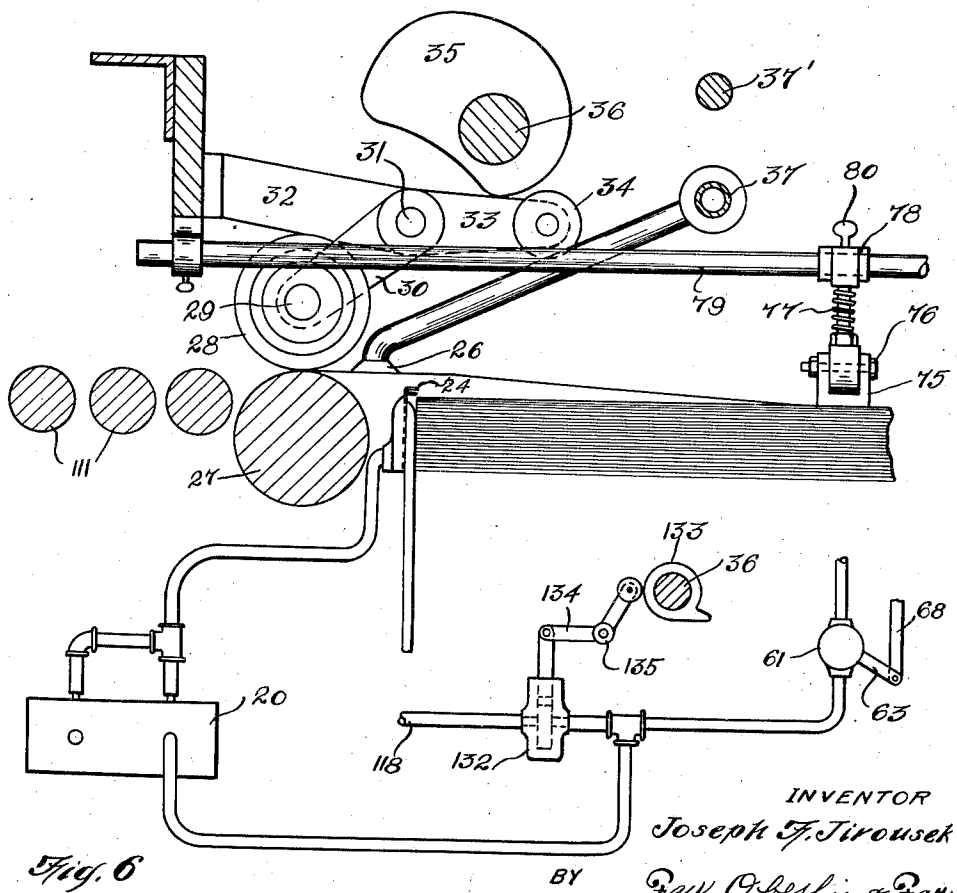


Fig. 6

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SHEET FEED MECHANISM

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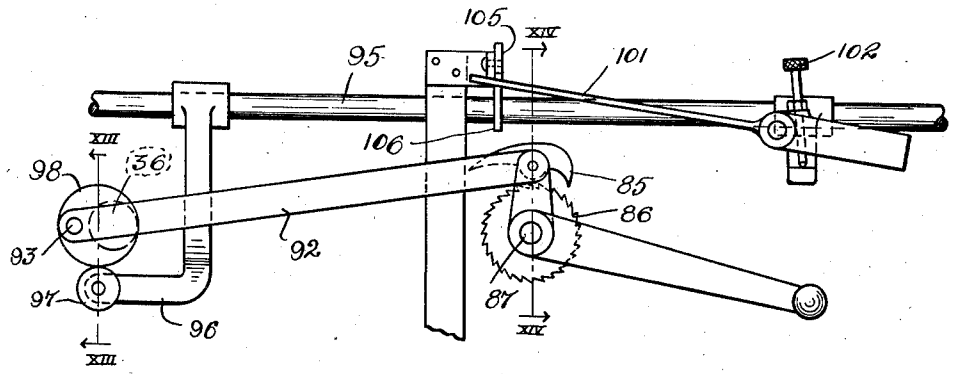


Fig. 12

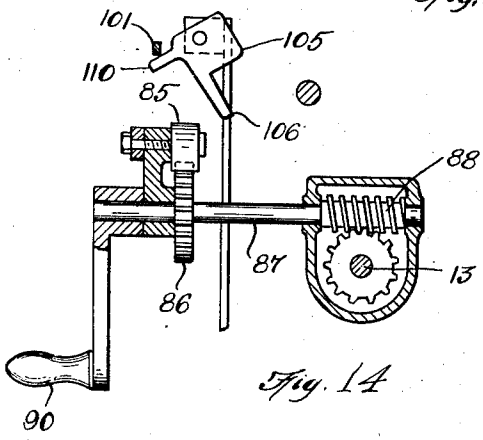


Fig. 14

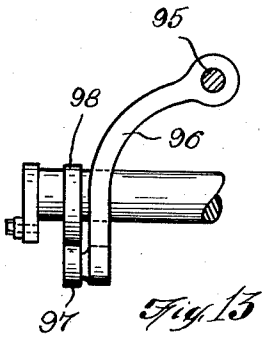


Fig. 15

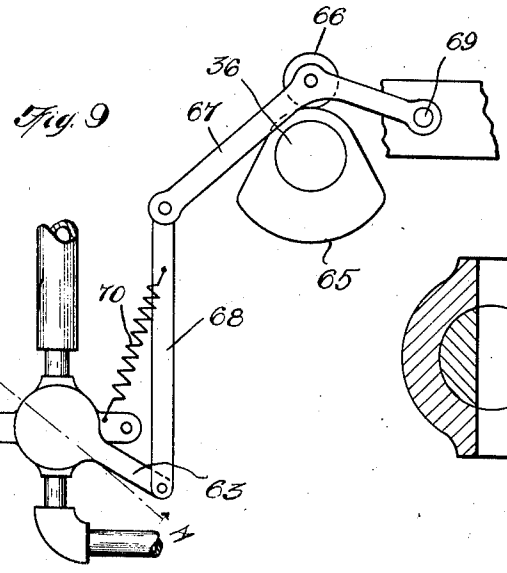


Fig. 9

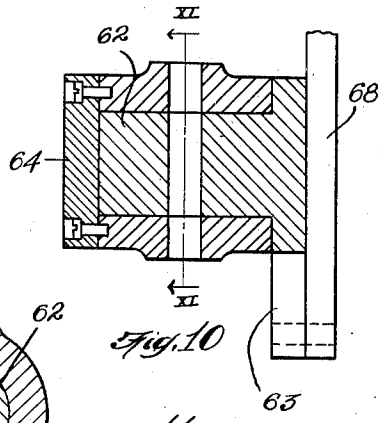


Fig. 10

Fig. 11

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SHEET FEED MECHANISM

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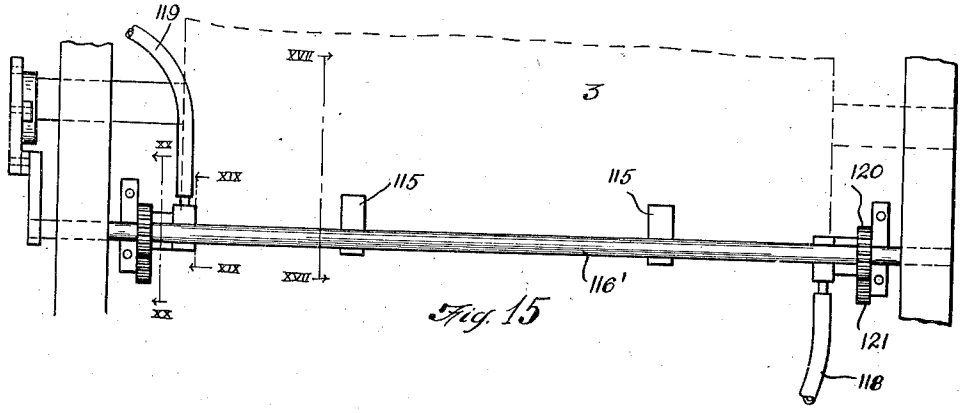


Fig. 15

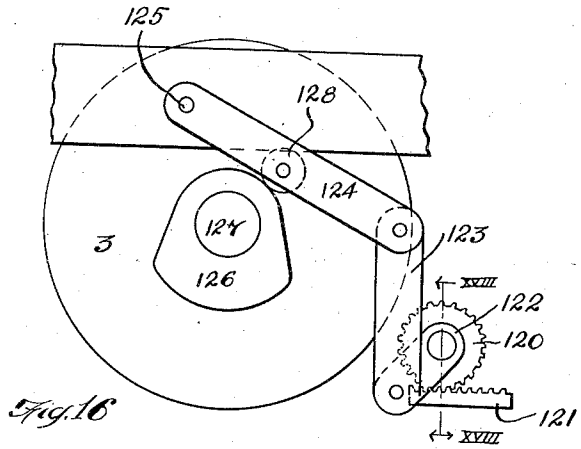


Fig. 16

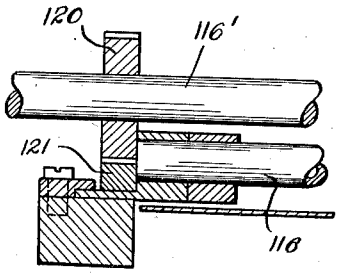


Fig. 18

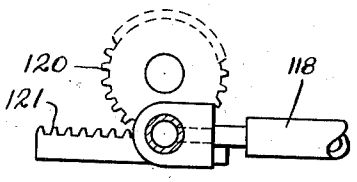


Fig. 19

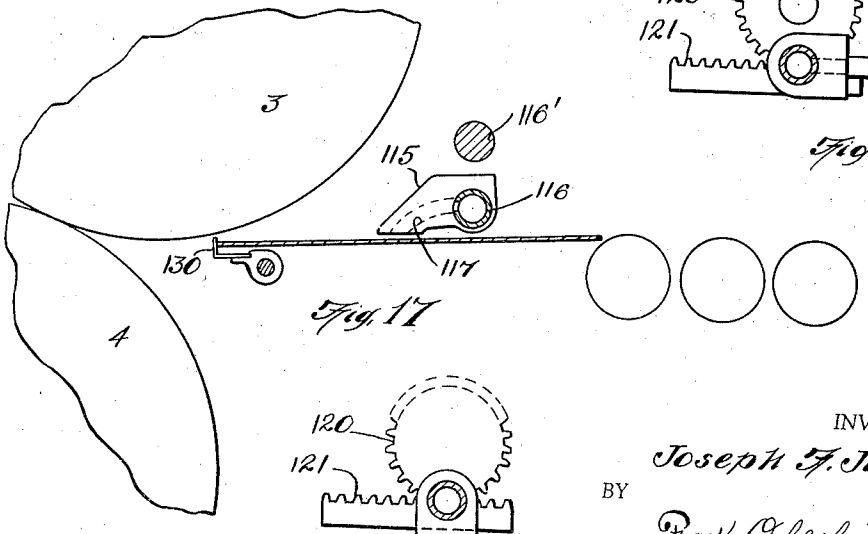


Fig. 17

Fig. 20

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Patented Aug. 23, 1938 2,127,736

UNITED STATES PATENT OFFICE

2,127,736

SHEET FEED MECHANISM

Joseph F. Jirousek, Cleveland, Ohio, assignor to The Chandler & Price Company, Cleveland, Ohio, a corporation of Ohio

Application May 3, 1935, Serial No. 19,688

12 Claims. (Cl. 271—31)

In the feed of sheets in printing machinery and the like, if quite high speed operation be attempted trouble is encountered from sheets failing to separate properly or from too easily slipping into inaccurate positions, etc. A construction which will accurately control sheet movement and allow a consistent high throughput is accordingly an important desideratum, and fundamentally desirable.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings—

Fig. 1 is a side elevational view of a portion of printing machinery including a sheet feed mechanism in accordance with the invention; Fig. 2 is an enlarged elevational detail of sheet-separating means; Fig. 3 is a further enlarged perspective detail of structure therein; Fig. 4 is a fragmentary plan view of the sheet advancing means assembly; Fig. 4*a* is a sectional detail taken on a plane indicated substantially by line IV*a*, Fig. 4; Fig. 5 is a sectional view taken on a plane substantially indicated by the line V, Fig. 4; Fig. 6 is a sectional view taken substantially on the line VI, Fig. 4, somewhat conventionalized to include further associated structure; Fig. 7 is an enlarged sectional detail taken on a plane substantially indicated by line VII, Fig. 4; Fig. 8 is a sectional detail taken on a plane substantially indicated by line VIII, Fig. 7; Fig. 9 is a slightly enlarged sectional detail taken on a plane substantially indicated by line IX, Fig. 4; Fig. 10 is a further enlarged sectional detail taken on a plane substantially indicated by line X, Fig. 9; Fig. 11 is a sectional detail taken on a plane substantially indicated by line XI, Fig. 10; Fig. 12 is a sectional detail taken on a plane substantially indicated by line XII, Fig. 4; Figs. 13 and 14 are sectional details taken on planes substantially indicated by lines XIII and XIV respectively, Fig. 12; Fig. 15 is an enlarged sectional view taken on a plane substantially indicated by line XV, Fig. 1; Fig. 16 is an end elevational view of the structure shown in Fig. 15; Fig. 17 is a further enlarged sectional detail taken on a plane substantially indicated by line XVII, Fig. 15; Fig. 18 is a further enlarged sectional detail taken on a plane substantially indicated by line XVIII, Fig. 16; and Figs. 19 and 20 are further enlarged sectional details taken on planes substantially indicated by lines XIX and XX respectively, Fig. 15.

Referring more particularly to the drawings, there is shown in Fig. 1 printing press machinery including framing 2, and cylinders for printing or lithographing, etc., such as cylinders 3, 4, 5, and means for controlling the same, as need not be further detailed here, and in association therewith a feed table 10 for carrying a stack of sheets to be fed, and intervening mechanism for forwarding the sheets from the feed table to the cylinders as will now be more particularly described.

The feed table 10 is arranged for movement in vertical plane, being progressively raised with its load as the sheets are taken off from the top, mechanism for such movement including chains 11 running over sprockets 12 on a shaft 13 which is turned in relation with the press mechanism generally by detail means which need not here be described. At the front top edge of the stack of sheets as it rests on the elevating feed table 10 is sheet separating means, including blast-heads 16 (Figs. 2 and 6) having air blast openings 17 in communication with blast-piping 18 which connects with the discharge side of air pump 20. With a plurality of such blast-heads in spaced relation across the upper edge of the stack service area, sheets of greater or less dimension may be taken care of equally well. Associated with the blast-heads are separator fingers S mounted so as to present staggered finger-members 23, 24, at slightly different levels at the upper edge of the stack of sheets, such that as a sheet is raised from the stack its forward edge drags successively from under one finger and then under the other. Above the delivery table and mechanism just described, is a sheet picker including sucker heads 26 (see Fig. 6 particularly), these being mounted to take a position over the stack to seize the topmost sheet and then carry the sheet upwardly and forwardly to the bite of feed rolls 27, 28. The former roll extends across substantially full length, while the latter rolls may be short-spaced sections mounted for timed raising, for instance being mounted on a cross shaft 29 of sufficient length, and the latter being carried in turn by lever-arms 30 secured to a rock shaft 31 mounted on brackets 32, while arm 33 extending from the rock shaft carries a roller 34 to coact with a cam 35 on shaft 36. The sucker heads 26 are carried in common by a hollow shaft or pipe 37, and this in turn is supported by arms 38 on slides 39, the assembly forming a sort of carriage which

rides to and fro on the shafts 13. The pipe 37 supports a cross-bar 37', the function of which will hereinafter appear. Springs 41 interposed between sprockets 12 and the slides 39 serve to normally urge the slides into rearward position, while the cam effects forward movement of the slides and sucker heads carried thereby. Movement of the sucker head carriage is accomplished in detail by one cam 45 on shaft 36 which serves to raise the sucker head carriage by operating upon a cam roller 46 (see Fig. 4a) carried by an arm 47 which is pivoted at 48 to a stationary bracket, and which at its free end extends by a flattened extension 49 to engage under the cross-bar 37', allowing sliding movement thereof relative to the extension 49 as required in the further stage of the operation. The forward movement of the sucker head carriage is effected by a cam 52 on shaft 36, cooperating with a cam roller 53 on an arm 54 extending from rock shaft 55 which has arms 56 (see Figs. 4a and 5 particularly) carrying links 57 to attach to the slides 39, respectively, such that as the cam 52 thrusts against the cam roller 53 it rocks the shaft 55 and correspondingly the arms 56 to draw the slides 39 and sucker head assembly forwardly. The sucker head assembly pipe 37 has a connection 60 to the air pump 20 through a timing valve 61. The latter is of quick cut-off type, conveniently for instance an oscillable plug 62 (see Figs. 9–11 particularly) having an operating arm 63 secured thereto, and an end closure 64 for the valve casing. The valve-arm 63 is operated from a cam 65 on shaft 36 with the intermediary of a cam roller 66 on lever 67, and link 68. The lever 67 is pivoted at 69 to a stationary part of the frame. A spring 70 serves to return the valve lever during the interval of cam-movement thereof. Thus, the communication of suction or vacuum to the sucker heads 26 is accurately timed with the cycle of movement of the sucker heads, such that the vacuum is applied for the seizing of the sheet when the sucker head is brought into contact and performs its movement, and is then released appropriately for the seizing of the sheet by the rollers 27, 28. For holding the sheets against accidental displacement, there is arranged a presser-shoe 75 (see Figs. 6–8 particularly). This comprises a foot plate having preferably a rubber facing, and a pivoted mounting at 76 to allow slight adjustment compensative to leveling on contact, and a pressure spring 77 serves to hold the sheet down with sufficient positiveness. The presser as a whole is carried in a bracket 78 which is slideably adjustable on a bar 79, a set screw 80 serving to maintain the desired adjusted position. The rod 79 projects from a convenient point on the frame. The pressure of the shoe 75 is just sufficient to prevent accidental displacement of the sheet, but when the sheet is seized by the sucker head, the presser yields sufficiently to allow the sheet to be withdrawn.

The feed table 10 is raised progressively by the intermediary of a pawl and ratchet 85, 86 (see Figs. 12 and 14 particularly) operating the shafts 13 which carry the sprockets 12 for the draw-up chains 11. The ratchet 86 is carried by a shaft 87 which by a worm gear drive 88 turns the shaft 13. A hand-crank 90 on the shaft 87 allows such manual adjustment as is desirable in connection with changing the table, etc., the pawl 85 being manually raised to allow such movements. The pawl 85 is of such forward weight as to normally engage the teeth of the ratchet 86, and to and fro movement is maintained by a link 92 which is reciprocated by a crank 93 on shaft 36. This constant drive movement tending to elevate the feed table through the pawl and ratchet intermediary, is controlled however, in accordance with the needs of feed at any given instant, by auxiliary control mechanism. This includes a rock shaft 95 having an offset arm 96 which carries a cam roller 97 to be operated by a cam 98 (Fig. 13). The rock shaft 95 also carries a contactor 99 (Fig. 4) which is thus caused to intermittently contact with the top of the stack at each swing of the rock shaft. Carried also on the rock shaft 95 is an arm 100 with an angularly-extending member 101, whose position is adjustable by regulating screw 102. The member 101 extends into proximity with a detent 105 which is so hung that normally its lower projection 106 tends to swing onto the top of the tail of the pawl 85 and thereby hold it out of engagement with the ratchet 86. However, when the member 101 is in a sufficiently low position, as determined by the position of the contactor 99 in following the top of the stack, the member 101 depresses side projection 110 of the detent 105, thereby swinging it such that the lower projection 106 is cleared from the pawl 85 and the latter operates fully for raising the feed table. Thus, in accordance with the position of control member 101, as determined by the height of the top of the stack contacting the member 99, the pawl and ratchet raising mechanism operates sufficiently at each moment to compensate the feed-height of the stack.

The sheets as fed from the stack through the feed rollers 27, 28, pass over rollers 111 to the stop guides ready for the grippers of cylinder 3. In order to further insure accuracy of positioning here also, the sheet as it approaches the cylinder is taken into charge by a mechanism including feeder heads 115 (see Figs. 15–17 particularly). These feeder-heads are carried by a hollow shaft or pipe 116 which extends across the machine, the feeder-heads having openings 117, and the hollow shaft 116 being connected in the vacuum circuit including the pump 20 aforementioned, suitable connections 118, 119, being provided. The hollow shaft 116 has a slight to and fro movement, permitted by the mounting of the shaft with a rack and pinion arrangement, the pinions 120 being on the shaft, and the racks 121 being stationarily carried by the framing. The shaft 116 is moved by arms 122 connected through links 123 with lever 124 which is pivoted at 125 to the framing. A cam 126 on the cylinder shaft 127 serves to operate the lever 124 through the intermediary of a cam roller 128, the cam 126 being timed consistently with the position of the cylinder-grippers such that the latter may seize the sheet as presented by the feeder-heads 115.

The operation of the mechanism as a whole will be clear from the foregoing. With the entire machine set in motion, and a stack of sheets on the feed table 10, the sucker-heads 26 are moved back into a position over the stack, are lowered to the slight extent necessary, and simultaneously the vacuum is applied through the timing valve mechanism 63—65. The sucker heads 26 are then slightly raised and carried forwardly with the topmost sheet of the stack attached, and its forward edge is thrust into the bite of feed rollers 27, 28, the sheet being slid along from under the control shoe 75, and being forwarded by the feed rollers 27, 28, the former being positively driven. The forward edge of the sheet now approaches the cylinder 3, and coming under the

feeder-heads 115 proceeds to the stop gauge 130 (Fig. 17) under the cylinder. The vacuum is now switched onto the feeder-heads 115 by timing valve 132 which is operated off of the shaft 36 in synchronism through a cam 133 and lever 134 pivoted at 135 on the frame. With the application of vacuum, the feeder-heads 115 and their shaft 116 are carried forwardly through the operation of the cam 126 on the cylinder shaft and the associated lever and linkage. As the forward edge of the sheet is thrust into the cylinder grippers, the vacuum is released by the valve 132, and the cylinder grippers carry the sheet thence on through the operation of printing, and it is taken off in turn by carrier mechanism including chains 136, as need not be further detailed. The pawl and ratchet mechanism 85, 86, is meantime operating, the pawl link 92 being thrown to and fro by the crank 93, but whether the pawl 85 engages the ratchet 86 at any given moment is determined by the position of the control member 101 with respect to the detent 105, and this in turn is determined by the height of the contactor 99 as it finds the top of the stack. With the top of the stack sufficiently high to obviate necessity for immediate further raising, the contactor 99 sets the control member 101 sufficiently high to allow the detent 105 to swing its projection 106 on top of the pawl 85, and the latter simply rides above the ratchet 86 in its swing, without turning the ratchet. When the contactor 99 finds its level lower down, it causes a positioning of the control member 101 such as to depress the projection 110 of the detent 105, and the detent projection 106 then swings into position off from the pawl 85, and the latter takes hold of the ratchet 86 with movement. Step by step compensation is thus had at all stages of stack raising.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In apparatus of the character described, suction-means for lifting and forwarding a sheet from a stack, blast-heads adjacent the upper edge of the stack, blast-openings in said heads directed against the edge of the sheet, valve-means for controlling a blast through said blast-heads in timed relation with the operation of the suction-means, and suction-means for further handling the forwarded sheet.

2. In apparatus of the character described having a feed table for carrying a stack of sheets and means for progressively elevating said table; suction means for lifting and forwarding a sheet from the stack on said table, blast heads at the upper forward edge of the stack, blast openings in said heads directed toward the edge of the sheets, valve-means for controlling blasts thereto; and stationary successive separator fingers adjacent the blast-heads.

3. In apparatus of the character described, a sucker-head for engaging a sheet from a stack, cam-means for raising said sucker-head and moving it forwardly, including a cam-operated arm on which the sucker-head may slide, feed-rolls for seizing the sheet as presented by the sucker-head, and suction means for further handling the forwarded sheet.

4. In apparatus of the character described, sucker-means for engaging a sheet from a stack, and a holding means disposed rearwardly of said sucker-means for pressing the sheet until ready to move, including a spring-urged shoe and a bracket adjustably carrying said shoe.

5. In apparatus of the character described having a feed table for carrying a stack of sheets and means for progressively elevating said table; suction means for removing a sheet from the stack, additional suction-means for forwarding the sheet into relation with printing cylinders, and rollers disposed between said suction means for transferring said sheet to said last-named suction means after it has been removed from the stack by said first-named suction means.

6. In apparatus of the character described, means for picking a sheet from a stack, means for passing the sheet into relation with printing cylinders, including a feeder-head, a vacuum connection to said feeder-head, valve-means for timing suction to said head, means for reciprocably moving said head relative to the cylinders, said reciprocating movement being unaccompanied by rotation of said head, and rollers disposed between said first and second named means for transferring said sheet to said last-named means after it has been picked from the stack by said first-named means.

7. In apparatus of the character described, means for picking a sheet from a stack, means for seizing such sheet and forwarding it into relation with printing cylinders, including a hollow shaft reciprocably movable adjacent the cylinders, a feeder-head carried by said shaft, vacuum-connections to said shaft and head, valve-means for timing vacuum-application to said head, and rack and pinion means for mounting said shaft.

8. In apparatus of the character described, a feed table for a stack of sheets, suction-means for picking a sheet from the stack, feeder-heads for seizing such sheet and forwarding it into relation with printing cylinders, a hollow non-rotating shaft carrying said feeder-heads and being reciprocable adjacent the cylinders, a vacuum-producing pump connected to said suction-means and said feeder-heads, and rollers disposed between said suction-means and feeder-heads for transferring a sheet into proximity with said feeder-heads after it has been picked from the stack by said suction-means.

9. In apparatus of the character described, a feed table for a stack of sheets, suction-means for picking a sheet from the stack, blast-means for promoting separation of such sheet in the stack, a feeder-head for seizing the sheet and passing it into relation with printing cylinders, and a pump having its intake connected to said suction-means and said feeder-head and its discharge connected to said blast-means.

10. In apparatus of the character described, a feed table for a stack of sheets, a sucker-head for picking a sheet from the stack, cam-means for raising and advancing said sucker-head, a blast-head for promoting separation of the sheet, separator fingers adjacent the blast-head, a feeder-head for seizing the sheet and passing it into relation with printing cylinders, means for reciprocating said feeder-head, and a pump having its intake connected with said sucker-head and said feeder-head and its discharge connected with said blast-head.

11. In apparatus of the character described having means including a pawl and ratchet for raising a stack of sheets, means for controlling the rate of raise, including a contactor on top

of the stack, a rock-shaft carrying said contactor, a cam for operating said rock-shaft, means for operating the pawl, a detent swingable into and out of position against the pawl, and an arm controlled by the stack-conductor for positioning said detent relative to the pawl; means for picking and forwarding a sheet from the stack, and suction means movable independently of said sheet picking means for further handling the forwarded sheet.

12. In apparatus of the character described having a feed table for a stack of sheets, means for raising said feed table progressively and means including feed-ratchet means for controlling the rate of movement of said feed table in accordance with the advance sheet of the stack; a sucker-head for picking a sheet from the stack, cam-means for raising and forwarding said sucker head, a feeder head for passing the sheet into relation with printing cylinders, and a shaft in common for controlling said feed-ratchet means and timing said sucker-head and said feeder-head.

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