

June 6, 1933.

L. R. JOHNSON

1,912,941

SHEET STACK HANDLING MECHANISM

Filed July 25, 1931

5 Sheets-Sheet 1

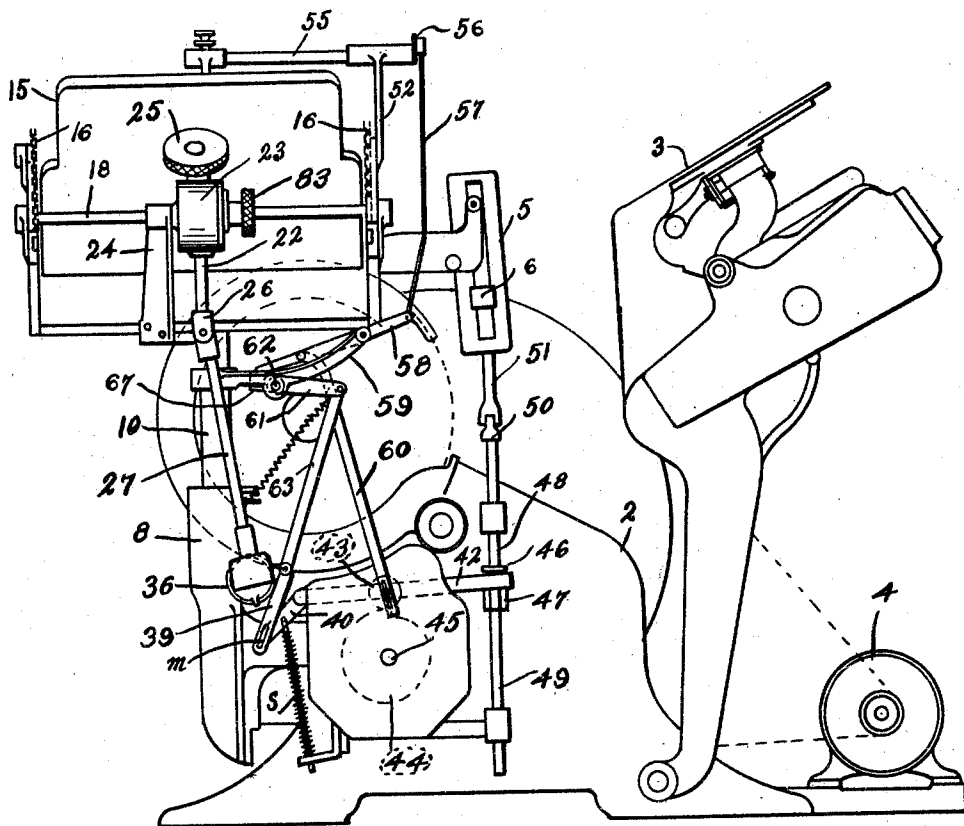


Fig. 1

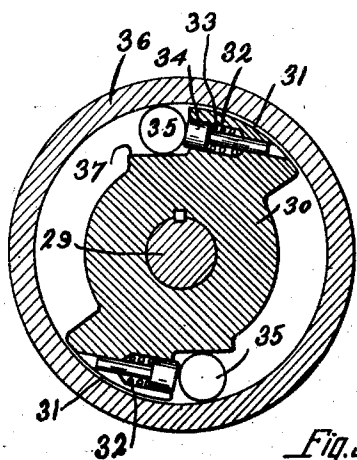


Fig. 5

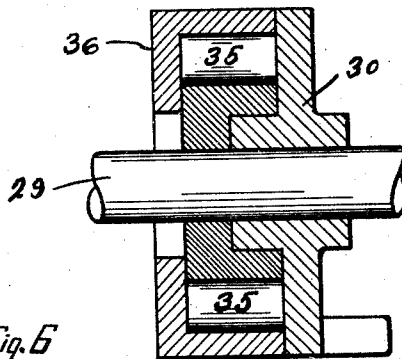


Fig. 6

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5 Sheets-Sheet 2

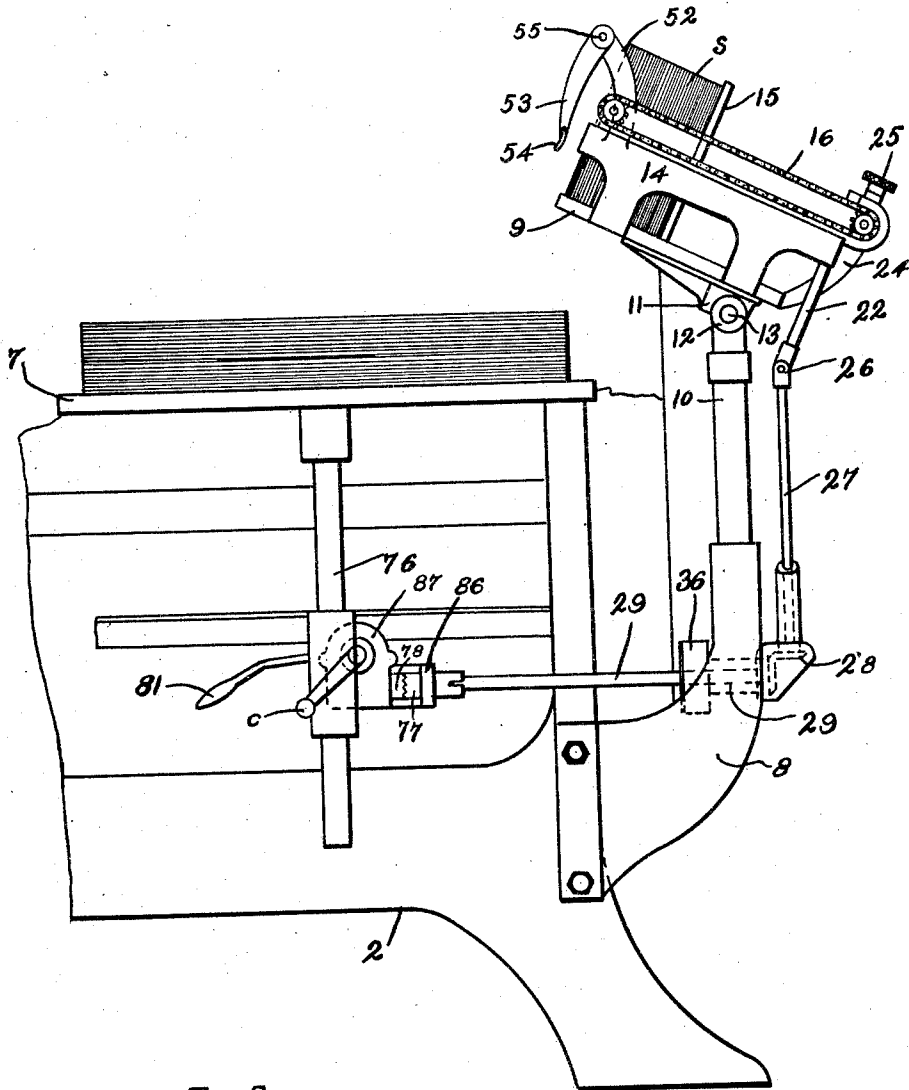


Fig. 2

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5 Sheets-Sheet 3

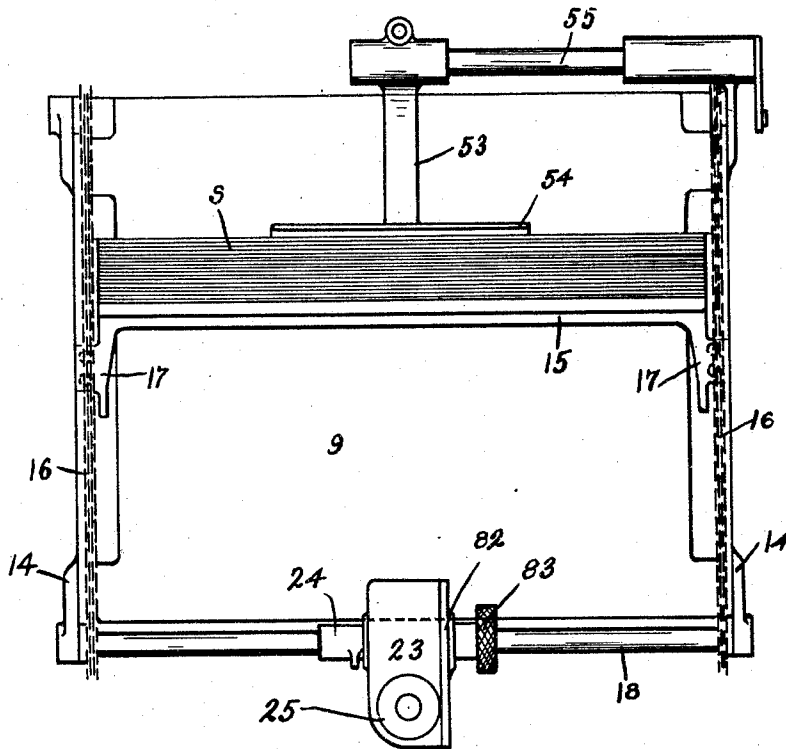


Fig. 3

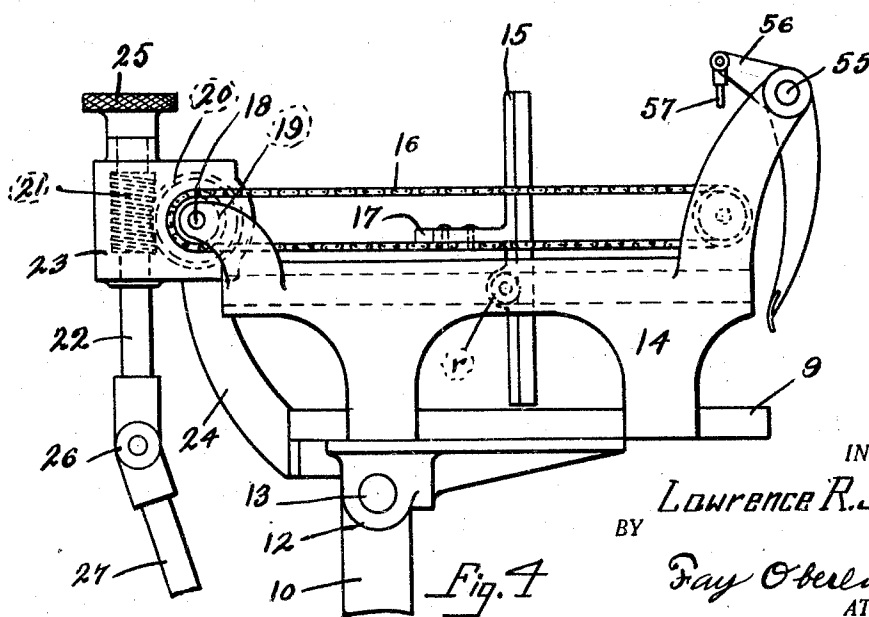


Fig. 4

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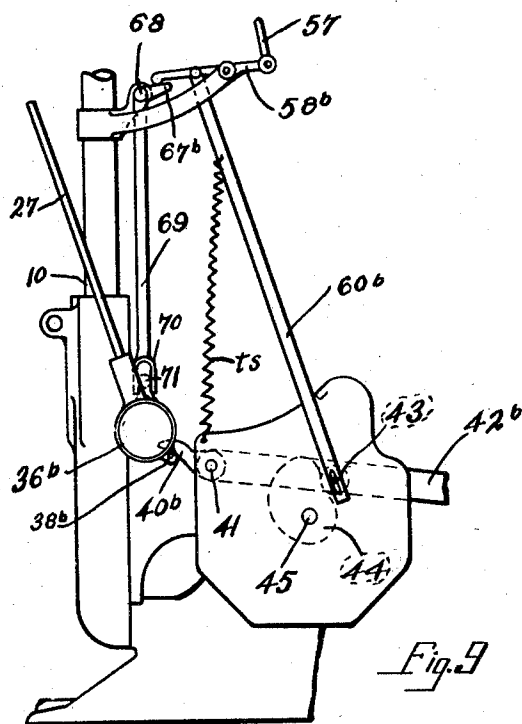
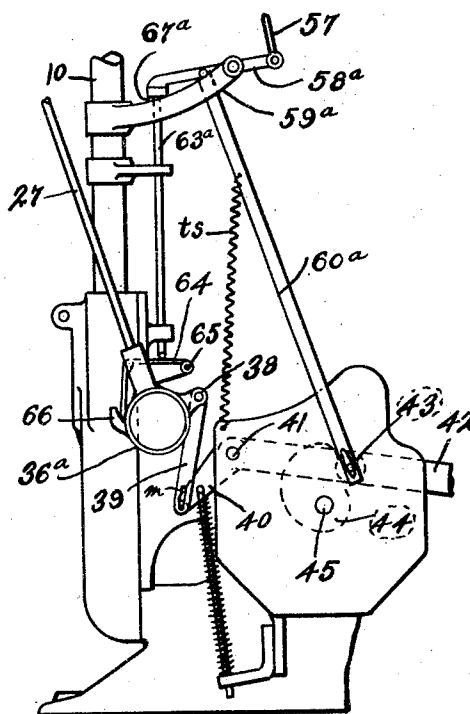
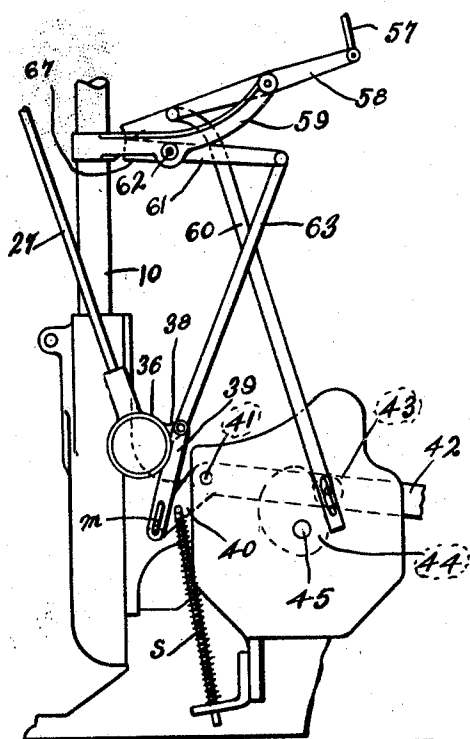
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SHEET STACK HANDLING MECHANISM

Filed July 25, 1931

5 Sheets-Sheet 4



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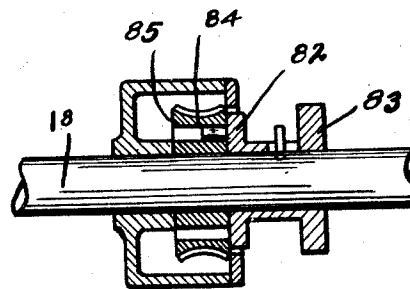
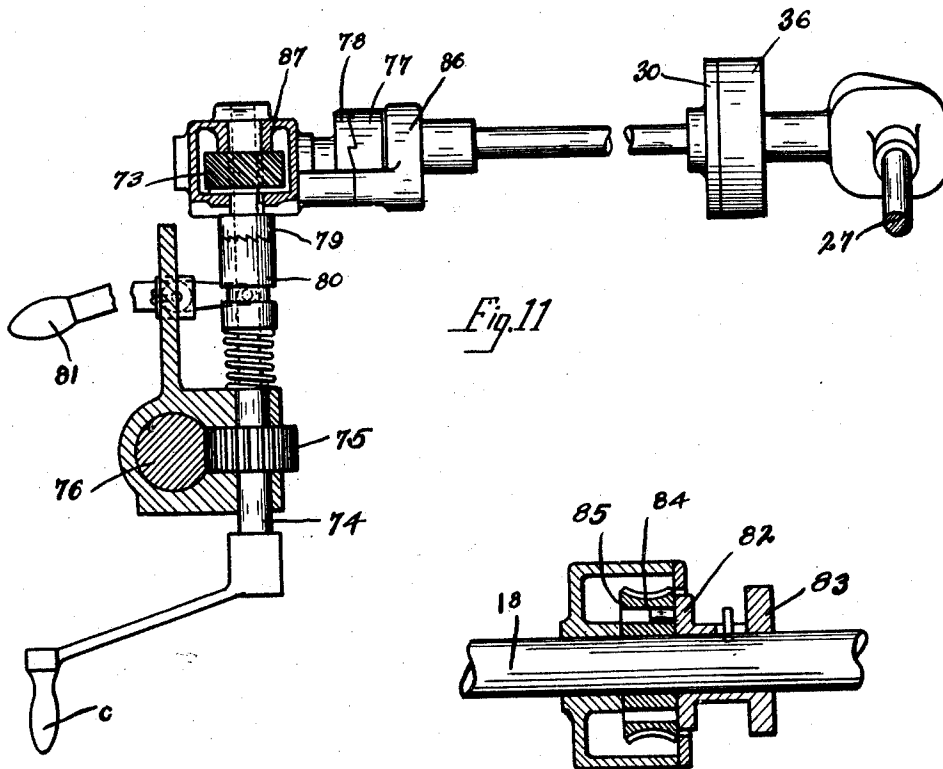
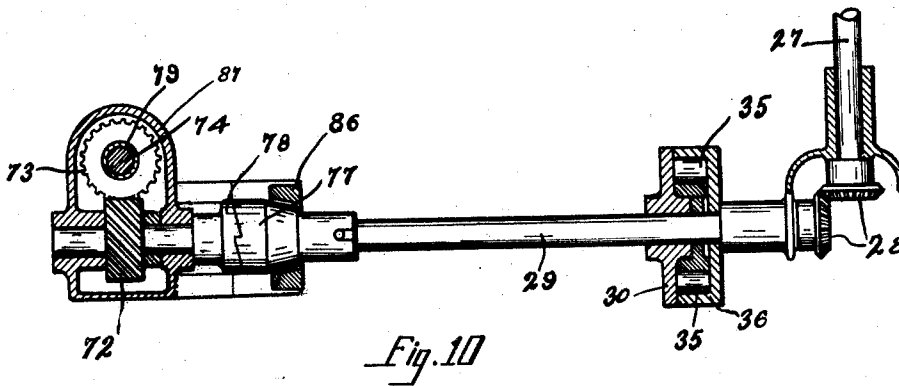
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SHEET STACK HANDLING MECHANISM

Filed July 25, 1931

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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SHEET-STACK HANDLING MECHANISM

Application filed July 25, 1931. Serial No. 553,092.

This invention relates to sheet-handling mechanism, and more particularly such mechanism as adapted for association with printing presses; and it is among the objects of the invention to provide improved construction affording controlled movement of sheet-stacks in relation to means for handling individual sheets. Another object of the invention is the provision of construction making possible accurate regulation and correlation of respective working elements. Other objects and advantages will appear as the description proceeds.

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 mechanism in accordance with the invention as associated with a printing press; Fig. 2 is a front elevational view of the same; Figs. 3 and 4 are detail plan and side elevational views respectively of the feed table and associated elements on slightly larger scale; Figs. 5 and 6 are enlarged sectional details, taken on planes substantially at right angles to each other; Fig. 7 is a slightly enlarged detail of table-operating mechanism shown in Fig. 1; Figs. 8 and 9 are similar views of modifications; and Figs. 10, 11 and 12 are sectional details of drive connections, the first-named figures being taken on sectional planes substantially at right angles to each other.

Referring more particularly to the drawings, there is shown in Fig. 1 the frame 2 of a printing press of platen or Gordon type. Inking mechanism 3 of conventional type, and a drive motor 4 are shown, as in customary practice. The further details of the printing press being immaterial to the present invention, reference thereto is further unnecessary. Mounted in relation with the

printing press is sheet-feed means, for instance of pneumatic type, the guide 5 and reciprocating cross-head 6 thereof being indicated as in conventional relation, and sheet-delivery means, for instance also of pneumatic type, is likewise arranged to pick up the printed sheet from the press and deposit such sheets in succession upon a delivery table 7 at the front of the press. The detail of the individual sheet feed and sheet delivery means being well known, and forming no part of the present invention, further consideration thereof may be passed over. Supported alongside the press, for instance by a bracket 8, is a feed table 9 carried preferably adjustably, as by a post 10 which may be of rounded or cylindrical section and held in desired position by set screws or other suitable means, as adjusted in the socket of the bracket 8. Desirably, the table 9 is also tiltably adjustable, and for this the mounting may include spaced dependent ears 11 engaging with the upper end of the support post 10 and being clampable in desired angular position by a clamp nut 12 on bolt 13. Side frame members 14 are arranged on the table 9, and a stack of sheets S to be printed is receivable on the table between the side frames, a plate or support-panel 15 being slidable upon the table for such purpose. As illustrated in Figs. 1, 2 and 4 more particularly, this support-panel or pusher-plate 15 is moved forwardly in the advancing feed movement of the stack, by means of traveling belts 16 mounted at each side in the frames 14. The chains may engage the pusher-plate by lugs arranged to contact with and push the plate along, or the chains may be attached to projections 17, being bolted thereto through the links or through a special elongated link construction. Advantageously, guide-rollers 18 on the pusher-plate may travel in corresponding guide-ways in the frame members. For the drive of the chains 16, the shaft 18 carrying the chain-sprockets 19 may be driven through the intermediary of a worm-gear 20 and worm 21 on a shaft 22. The worm 21 is mounted in a housing 23 which is carried in turn by bracket 24 arising from the end of the table. Conveniently, a hand-wheel 25

may be secured to the upper end of the shaft 22 for use in adjusting positions. In accordance with the tiltable character of the mounting of the table 9, the drive connections for the shaft 22 may include a universal joint 26, and a shaft 27 driven through bevel gearing 28 by a shaft 29. Secured on the shaft 29 is a drive connection comprising a uni-directional intermittently frictionally engaging means which operates on forward motion and releases on reverse, thus allowing a variable length step-forward movement of the shaft. This may vary somewhat in detail construction, but advantageously may embody a hub member 30 fixed to the shaft 29, such hub member having wings 31 recessed at 32 for the reception of a spring 33 and plunger 34, the latter bearing against a roller 35 which rides in the space between an outer housing 36 and a face 37 on the body 30. The faces 37 are arranged on an incline or tangent such that when the rollers 35 are back at the rear of the recesses, free clearance is had between the abutment faces 37 and the outer housing 36, and the rollers ride freely. With the rollers however positioned toward the outer range of their excursion movement, binding occurs between the housing 36 and the faces 37. Such arrangement permits movement of the housing 36 in one direction to an indefinite degree, but on reversal of the direction of movement the rollers 35 quickly bind between the housing 36 and the abutting faces 37, and the member 30 is then carried in movement with the housing. The housing 36, thus being capable of corresponding relative movement with respect to the body member 30, is provided with a lug 38 to which is pivotally connected a link 39, this in turn being connected at its other end to an arm 40 of a bell-crank lever which is fulcrumed at 41, and whose other arm 42 carries a cam roller 43. The latter rides upon and is actuated by a cam 44 on shaft 45 which may be driven from the printing press, or may in fact be one of the shafts thereof. A spring *s* may be provided between the lever arm 40 and a convenient bracket below, the spring preferably surrounding a rod slidable in such bracket, whereby to assist proper return of the parts. The lever arm 42 extends beyond the cam roller 43 and engages between collars 46, 47, which may be adjustable as desired, on slide tube 48 mounted on a tubular guide 49, and connected above through a universal joint 50 with slide tube 51, which actuates the cross-head 6 and the sheet-feed means already referred to.

Mounted on the feed table in a bracket 52 in advance of the stack of sheets is a feeler 53, this being in the form of a contacting bar 54 secured to a rock-shaft 55 in the aforementioned arm or bracket 52. At its free or outer end, the rock-shaft 55 has a crank extension 56 which is pivotally connected to a

link 57 in turn pivotally connected to a lever 58 which is mounted on a bracket 59. Toward the inner end of the lever 58, the link 60 is pivotally connected and extends thence downwardly to the stud of the cam roller 43, a limited lost-motion connection slot *k* being provided for extreme positionings. The effect of such an assembly then is that each rise of the cam roller 43 reciprocates the link 60, and through the lever 58, the link 57, thus rocking the shaft 55 and the feeler 53 in synchronism. At its inner end, the lever 58 contacts a corresponding end of a lever 61 which is fulcrumed at 62 in the bracket arm 59. The outer end of this lever 61 is pivotally connected to a link 63, whose lower end is in turn pivotally connected with the link 39. Correspondingly, the throw-link 39, and the lever 61 are governed as to their amount of movement, by lever 58 as follows: The precise position of the end of the lever 58 at any time will depend upon the position of the feeler arm 54, and this is dependent in turn upon the position of the advancing face of the sheet stack *S*, or in other words, is dependent upon the rate of advance thereof as carried forward by the table-belts 16, modified however, by the rate of melting away of the stack as the sheets are picked therefrom by the picker-feeder one by one and carried to the press. The lever-arm 40 is connected to the link 39 by a pin-projection in slot *m* of the link. The length of the slot is such that the arm 40 can swing within the clearance of the slot and not advance the housing 36 when the levers 61 and 58 are in a certain normal or equilibrium position as determined by the stack of sheets *S* at the front edge of the table. This condition however, is changed when sheet-feed from the front of the stack allows feeler 54 to swing further in; and when this occurs the linkage down to lever 58 changes the position of the abutment end of the lever 58, and the lever 58 can then correspondingly change the lever 61 with its contacting end 67 against the abutment presented by the end of lever 58. At the same time the link 39 is raised out of its above-mentioned normal position and on the lift of the cam lever 42 the pin on lever 40 then reaches the end of slot *m* before the end of its travel and thus pulls the link proportionately down again to normal position. Such movements of link 39 actuate the housing 36 to turn the shaft 29 a corresponding step forward.

In the form shown in Fig. 8, the cam 44, cam roller 43, link 60*a*, lever 58*a* and link 57, are arranged analogously to the corresponding elements as already described, the lever 58*a* being fulcrumed in bracket 59*a*. At its inner end, the lever 58*a* abuts against the head of a rod 63*a* which is slidably mounted in brackets, and whose lower end rides on a latch 64 which is pivotally connected to the

frame at the point 65. The latch 64 at its free end rides in a recess 66 provided by a lug on the housing 36a. The latter is connected by means of another lug 38 with link 39, which in turn is connected with arm 40 of a bell-crank lever which is pivoted at 41. The other arm 42 of such lever connects with the cam roller 43 and link 60a. A spring *ts* may be provided between the link 60a and a convenient point on the frame, to assist in maintaining the parts in working position. In this arrangement, movement of the cam 44 reciprocates the link 60a and through the lever 58a, the link 57, which actuates the feeler at each throw. At the same time, the bell-crank lever arm 40 reciprocates in pin and slot connection *m* of the link 39 and may or may not occasion throw of the lug 38 and movement of the variable-throw housing 36a. The extent to which the latter may be moved will depend at any moment upon the position of the latch 64 against the lug 66, and the position of the latch is in turn dependent upon the position of the head 67a of slide-rod 63a as abutted by the inner end of the lever 58a as gauged by the position of the feeler 54. Correspondingly, the throw of the link 39 and housing 36 is gauged in accordance with the needs. In Fig. 9, a slight further modification is shown. In this, the cam 44, cam roller 43, link 60b, lever 58b, and link 57, are arranged as foregoing. The inner end of the lever 58b however, bears upon an arm 67b of a bell-crank lever pivoted at 68, the other arm 69 constituting a sort of pendulum-like member having a fork 70 at the lower end, riding over a pin 71 carried by the housing 36b. Lever 42b is fulcrumed at 41, and the other arm 40b of the lever extends to unconnectedly engage a pin 38b on the housing 36b. With this arrangement, the movement of the cam 44 reciprocates the link 60b, and through the lever 58b, the link 57, and correspondingly moves the feeler. At the same time, the lever arm 40b rocks, but the pin 38b will be in such position that it will move the housing 36b only at such times as determined by the position of the lever 69, as in turn ultimately limited by the position of the inner end of the lever 58b as in abutment against the arm 67b.

The shaft 29 extends on from the ratchet 36 for actuation of the sheet-stack movement at the delivery end of the press. Spiral gearing 72, 73, (see Figs. 10, 11) serves to transmit motion from the shaft 29 to a cross-shaft 74 which carries a pinion 75 meshing in rack-teeth of the vertical delivery table supporting stem 76. The delivery table progressively lowers to accommodate the received printed sheets, and since the turning of the connecting shafts is in the direction of clutch 30-36 it will be seen that an excessive weight on the delivery table might cause turning of the connecting shafts and over-ride the driving

mechanism of the feed table 9 and force the feed stack S out. A clutch 77, 78 is accordingly interposed, and when shaft 29 is turned by an actuation of drive clutch 30-36, the teeth of slip-clutch member 77 drive the member 78 to lower the delivery table correspondingly. If however, the delivery table lowering action by reason of weight should tend to exceed the limit to which the clutch 77 had driven, the teeth of clutch-member 78 would slip on the long incline faces of the other teeth and expand the clutch, forcing the splined member 77 back on its shaft 29 to seize and brake in the coned brake seat 86 affixed to the gear-box 87. On the shaft 74 a hand-throw-out clutch may be provided in order to allow desired retraction or adjustment of the feed table. This may comprise clutch members 79, 80, the latter being actuated by a hand-lever 81. When the clutch 80 is thrown out of engagement, the shaft 74 may be turned to adjust the height of the delivery table 7 as desired, a hand-crank *c* facilitating such operation.

The operation of the mechanism as a whole will be readily understood from the foregoing. A stack of sheets S to be fed is placed on the feed-table against the pusher-plate 15, and the stack and pusher-plate are adjusted to proper position to engage against the feeler arm 54. For such adjustment of position, the small hand-clutch 82 may be thrown out, being simply slid back out of engagement by grasping the handle-collar 83 (Fig. 12), the pins 84 being thereby slipped out of engagement in the gear drive 85. The clutch 82 may be splined on shaft 18 and the gear 85 may be loose. With the sheet-stack then properly set up in position against the feeler, the clutch 82, 83 is shoved back into engagement. The delivery table 7 is adjusted to desired height to receive the sheets as deposited by the sheet-delivery arm from the press. For such adjustment the clutch 80 may be thrown out of engagement by means of the clutch-handle 81, and the table may then be set to desired level. With the press now started up into operation, the shaft 45 as rotated thereby, turns the cam 44, and actuates the cam roller 43, moving the lever 42 and the link 60 with each rotation. The reciprocating movement of link 60 rocks the lever 58, and through the link 57 the rock-shaft 55, thereby swinging the feeler bar 54 back and forth into and out of contact with the forward sheet of the stack S. During the removal of the feeler, the picker-arm of the sheet-feed mechanism swings in, picks the foremost sheet from the stack and carries it into the press, all in detail as need not further be dwelled upon, it being sufficient to point out that the picker-arm is actuated from the cross-head 6 on the upper end of the slide rod 51 which is reciprocated up and down by the lever arm 42. At the same time, the other arm 40 of the lever

42 swings up and down in the slot connection of the link 39 (Fig. 1). When the feeler arm 54 shifts its position inwardly as the front sheet of the stack S is fed away, the linkage down to lever 58 changes the latter's position such that the lever 61 then re-sets the link 63, lug 38 and link 39 so that the lever arm 40 moves the link 39 and clutch housing 36, and since the variable-throw-housing 36 turns freely over the rollers 35 (Fig. 5) and core 30, in the up-throw, but immediately binds the rollers 35 against the abutments 37 on the reverse throw, the shaft 29 is stepped up to a corresponding amount. With the shaft 29 thus rotated a step the shaft 27 through the gearing 28 is correspondingly turned, and this, through the universal joint 26, extension shaft 22, worm 21, and worm-gear 20, drives the sprocket shaft 18 and moves the chain 16 and pusher 15 with the sheet-stack a step forward. By reason of the compensative nature of the driving mechanism connection, it is seen that the extent of such step forward is governed by the needs at any given instant, as gauged by the feeler arm 54. The variable-throw clutch drive-connection makes possible very closely regulatable increments of advance so that whether the sheets being fed are of a thinness represented by the lightest stock capable of being printed, or of a thickness represented by board stock in fractions of an inch, exact compensation can be had in any case. While the shaft 29 is thus transmitting motion for the step-up feed of the stack S on the feed-table 9, motion is also being transmitted through gearing 72, 73, to shaft 74 and pinion 75 to actuate the delivery-table support-stem 76 in a step-down movement. The extent of such downward step is the same as the extent of the forward movement imparted to the sheet-stack S on the feed-table, since at each such movement, a sheet is picked off of the feed-stack S by the picker-arm and is put in the press, and a printed sheet is picked up by the delivery-arm and deposited onto the delivery table 7.

Whether the gauging mechanism be of the detail shown in Fig. 7, or Figs. 8 or 9, the extent of the movement of the variable-throw-housing 36 within each throw is determined by the limiting position of the lever 58, or 58a, or 58b, as controlled by the position of the feeler against the foremost sheet of the stack on the feed-table.

Other modes of applying the principle of the invention may be employed, change being made as regards the details disclosed, provided the means 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 mechanism of the character described, means for supporting a stack of sheets on

edge, stack-moving means for advancing said stack to a feed-picking device, stack-moving means for retracting the sheet-stack as deposited by a delivery-depositing device, and means, including a pile-feeler, for controlling the feed-rate movement of each said stack-moving means in accordance with the sheet-thickness as each sheet is handled.

2. In mechanism of the character described, a feed-table, means for advancing a sheet-stack thereon, uni-directional driving means intermittently frictionally engaging on said movement and releasing on reverse, control-means for said driving means operable by movement of the sheet-stack the amount of the thickness of a sheet, a clutch for disconnecting the driving means, and a manually-operated means for moving the sheet-stack feed means.

3. In mechanism of the character described, a delivery table, uni-directional driving means intermittently frictionally engaging on forward movement and releasing on reverse, control-means for said driving means operable by movement of the sheet-stack the amount of the thickness of a sheet, a clutch for disengaging the driving means, and a manually operated means for moving the said table.

4. In mechanism of the character described, a delivery table, driving means for retracting said table, said means including a driven shaft carrying a hub-member, a driving-housing adjacent said hub-member and oscillatorily moved, and roller-means between said hub and said housing frictionally binding on said movement and releasing on reverse movement of said housing, and control-means for said driving means operable by movement of the sheet-stack the amount of the thickness of a sheet.

5. In mechanism of the character described, stack-moving means for advancing a sheet-stack to a feed-picker device, stack-moving means for retracting a sheet-stack as deposited by a delivery-depositing device, driving means including a driven shaft carrying a hub member, a driving housing adjacent said hub member and oscillatorily moved, and roller means between said hub and said housing frictionally binding on feed movement and releasing on reverse movement of said housing, and control-means for said driving means operable by movement of the sheet-stack the amount of the thickness of a sheet.

6. In mechanism of the character described, a feed table, means for advancing a sheet-stack thereon, driving means including a driven shaft carrying hub member, a driving housing adjacent said hub member and oscillatorily moved, and roller means between said hub and said housing frictionally bind-

ing on feed movement and releasing on reverse movement of said housing, and control means for said driving means operable by movement of the sheet-stack the amount of the thickness of a sheet.

7. In mechanism of the character described, a feed-table, a pusher-plate thereon, endless belt means for advancing said pusher-plate, a cam, a variable throw driving connection actuated by said cam, said driving connection including means for frictionally engaging on forward movement and releasing on reverse, and driving connections between said variable throw driving connection and said endless belts.

8. In mechanism of the character described, a feed-table, a pusher-plate thereon, means for advancing said pusher-plate, a cam, a variable throw driving connection, said driving connection including means for frictionally engaging on forward movement and releasing on reverse, lever means operated by said cam for actuating said driving connection, and means governed by the position of the foremost sheet advanced by said pusher determining the extent of throw of said driving connection.

9. In mechanism of the character described, a feed-table, a pusher thereon, means for moving said pusher, a cam, a variable throw driving connection, said driving connection including means for frictionally engaging on forward movement and releasing on reverse, lever means operated by said cam for actuating said driving connection, a feeler in advance of said pusher, and an abutment controlled by said feeler for determining the extent of throw of said driving connection.

10. In mechanism of the character described, a feed-table, a pusher thereon, means for driving said pusher, a cam, a variable throw driving connection, said driving connection including means for frictionally engaging on forward movement and releasing on reverse, means operated by said cam for actuating said driving connection, a feeler in advance of said pusher, an abutment lever connected with said feeler and having its position determined thereby, and means operated by said cam contacting with said abutment lever.

11. In mechanism of the character described, a feed-table, a pusher thereon, means for driving said pusher, a cam, a variable throw driving connection, means operated by said cam for actuating said driving connection, a feeler in advance of said pusher, an abutment lever connected with said feeler and having its position determined thereby, and a link and lever operated by said cam into contact with said abutment lever for controlling said means actuating the driving connection.

12. In mechanism of the character described, a feed-table, a pusher thereon, means for moving said pusher, a cam, a variable throw driving connection, said driving connection including means for frictionally engaging on forward movement and releasing on reverse, lever means operated by said cam for actuating said driving connection, a feeler in advance of said pusher, an abutment lever connected with said feeler and having its position determined thereby, a pivotally mounted latch engaged by a lug on said driving connection, and a slide-rod engaging said latch and coming into contact with said abutment lever.

13. In mechanism of the character described, a feed-table, a pusher thereon, means for moving said pusher, a cam, a variable throw driving connection, lever means operated by said cam for actuating said driving connection, a feeler in advance of said pusher, an abutment lever connected with said feeler and having its position determined thereby, and a pendulum-type lever having its lower arm in swinging engagement with said driving connection for limiting the effective throw of said driving connection and its upper arm adapted to contact with said abutment lever.

14. In mechanism of the character described, a delivery table, means for controlling the recession of said table, said means including a cam, a variable throw driving connection, operating connections between said cam and said driving connection, a shaft operated by said driving connection, and a clutch and brake intermediary between said shaft and said delivery table.

15. In mechanism of the character described, a feed table, a pusher thereon, means for advancing said pusher, a delivery table, gearing for retracting said delivery table, a cam, a variable throw driving connection; connections from said cam to said driving connection for operating the same, a shaft actuated by said driving connection, driving connections between said shaft and said pusher and said delivery table, a feeler in advance of said pusher, an abutment lever controlled by said feeler, and connections between said driving connection and said abutment lever for determining the throw of the driving connection.

16. In mechanism of the character described, a feed-table, a pusher thereon, a delivery table, a cam, a variable throw driving connection, driving connections between said cam and said variable throw connection, a shaft driven by said driving connection, connections from said shaft to said pusher and said delivery table, a feeler in advance of said pusher, an abutment lever operated by said feeler, driving connections

between said cam and said abutment lever,
and connections between said variable throw
driving connection and said abutment lever,
said connections including a reciprocating
5 member.

Signed by me this 14th day of July, 1931.

LAWRENCE R. JOHNSON.

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