June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 1

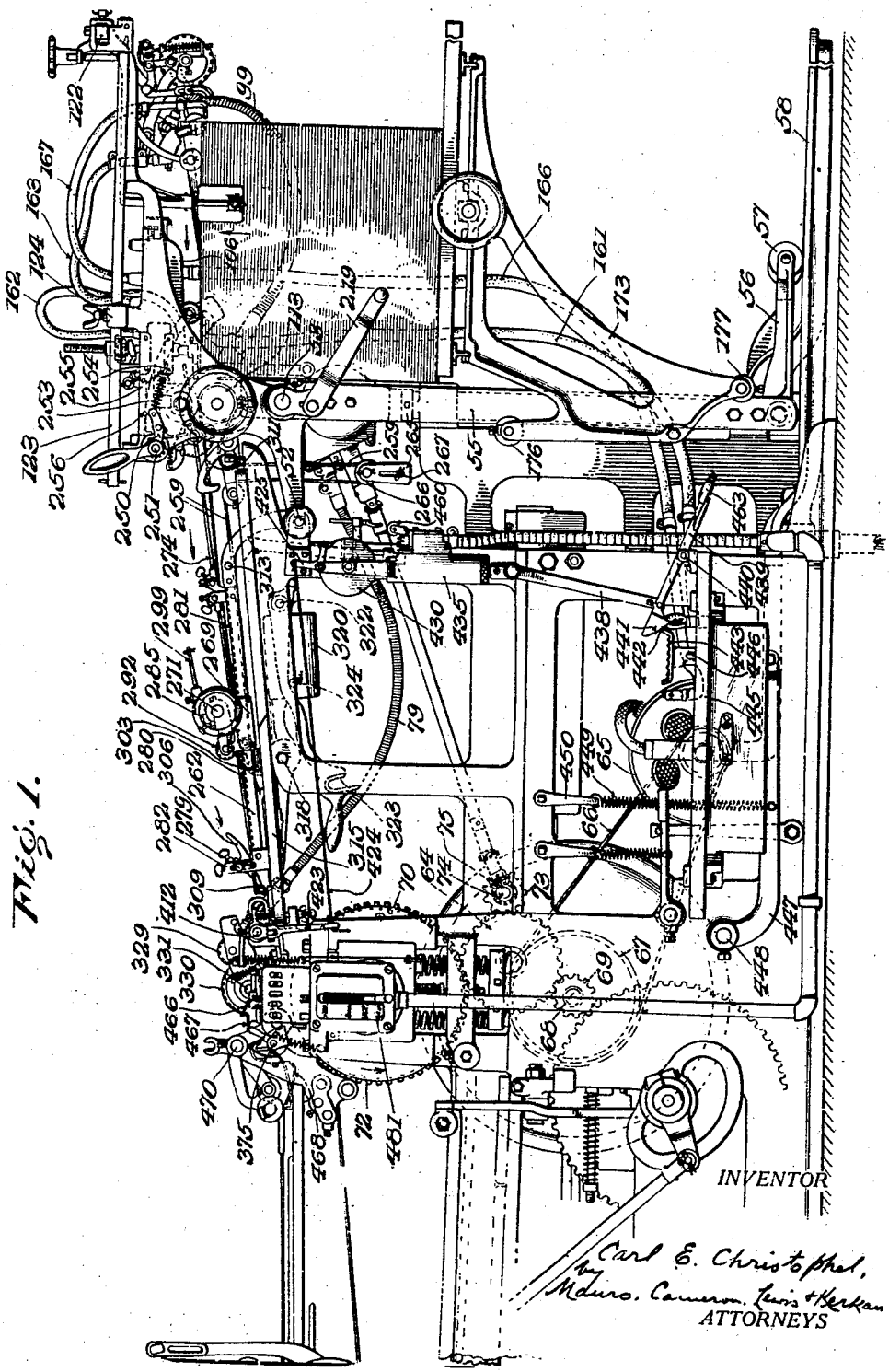


Fig. 1.

INVENTOR

Carl E. Christophel,
by Munn, Cameron, Lewis & Hopkins
ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 2

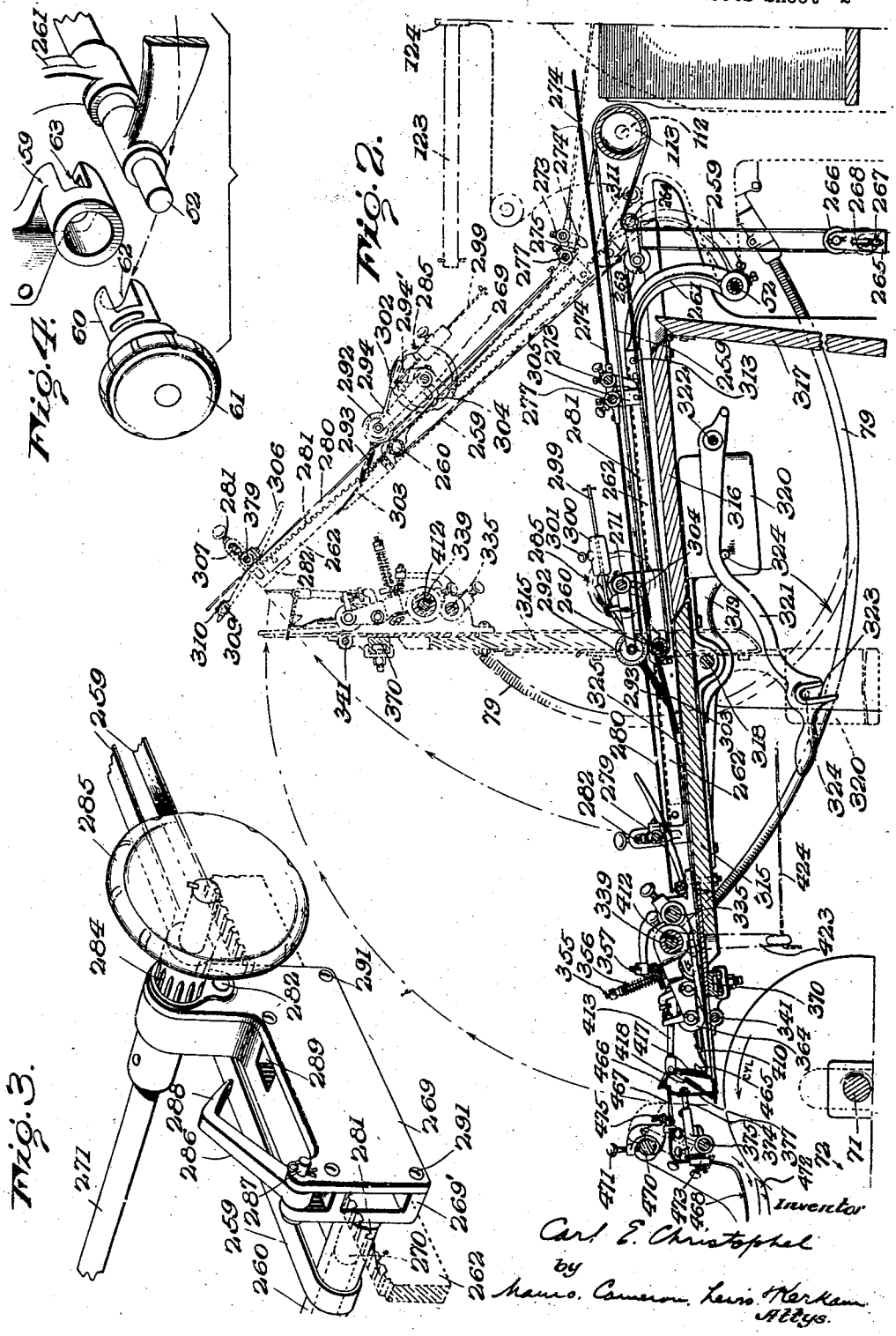


Fig. 2.

Fig. 4.

Fig. 3.

Inventor
Carl E. Christophel
by
Manno, Cameron, Lewis & Kerkam
Attys.

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 3

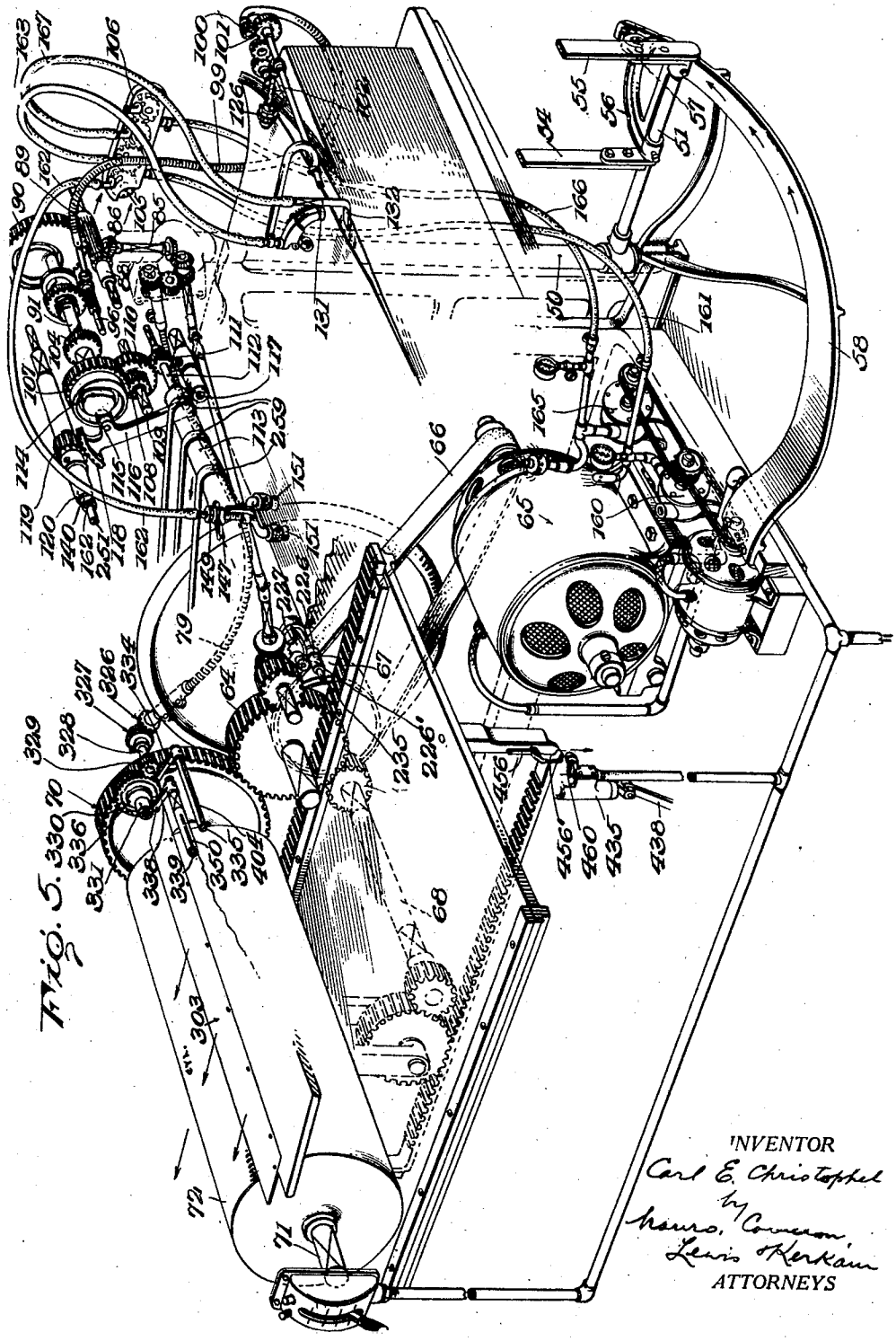


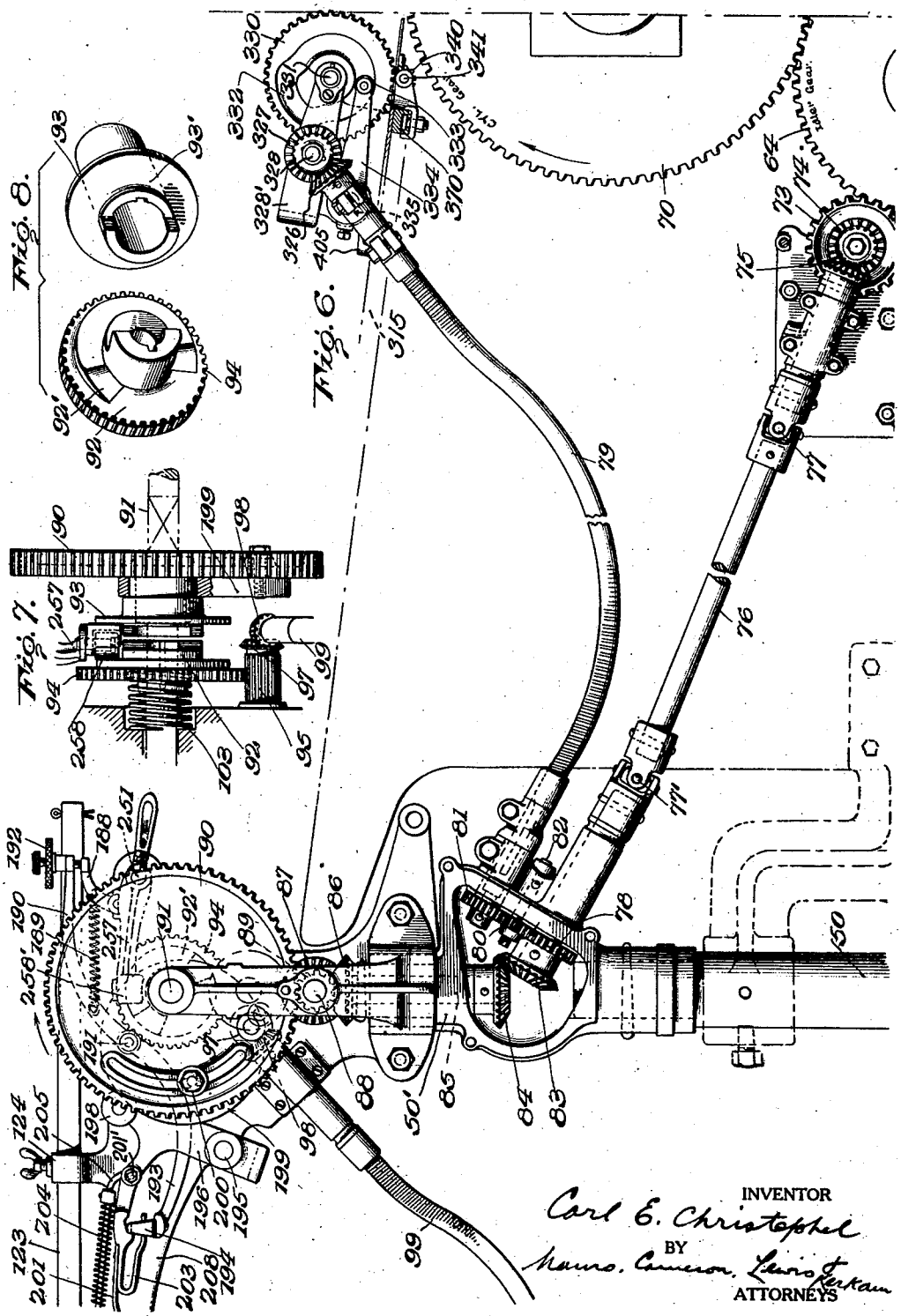
Fig. 5.

INVENTOR
Carl E. Christophel
by Howson, Cowson, Lewis & Kerkam
ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 4



June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 5

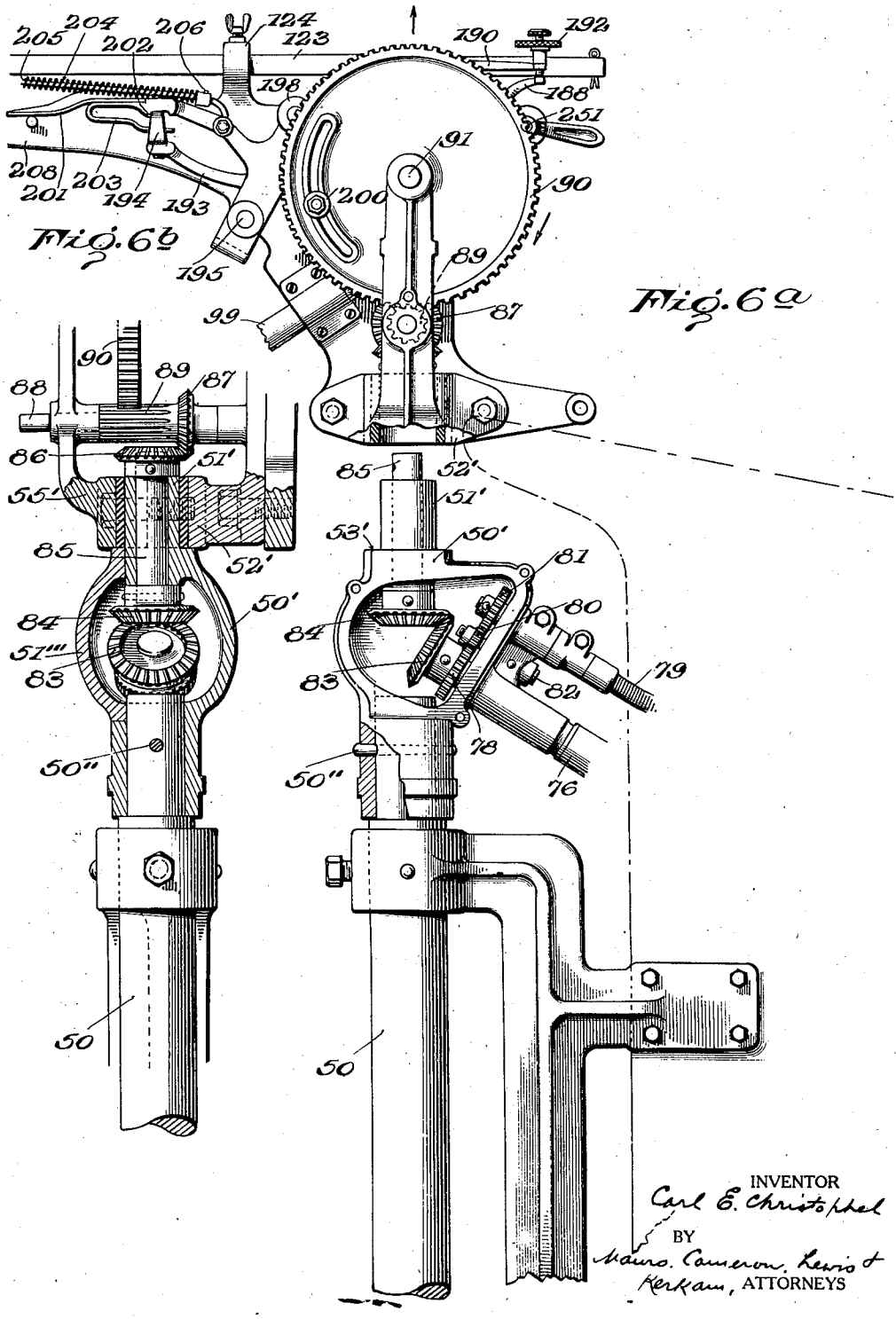


Fig. 6b

Fig. 6a

INVENTOR
Carl E. Christophel
BY
Mann, Cameron, Lewis & Kirkham, ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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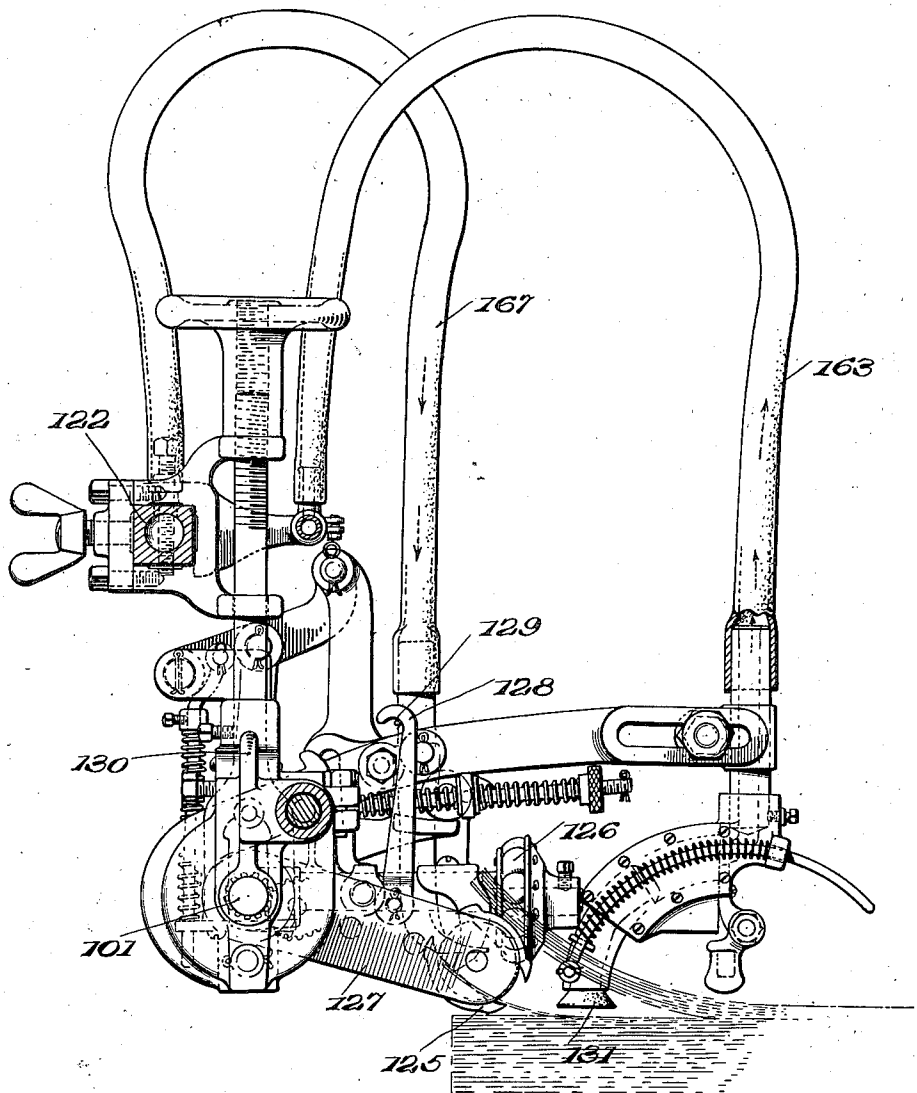


Fig. 9.

INVENTOR
Carl E. Christophel,
BY
Mauro, Cameron, Lewis & Herkam.
ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 7

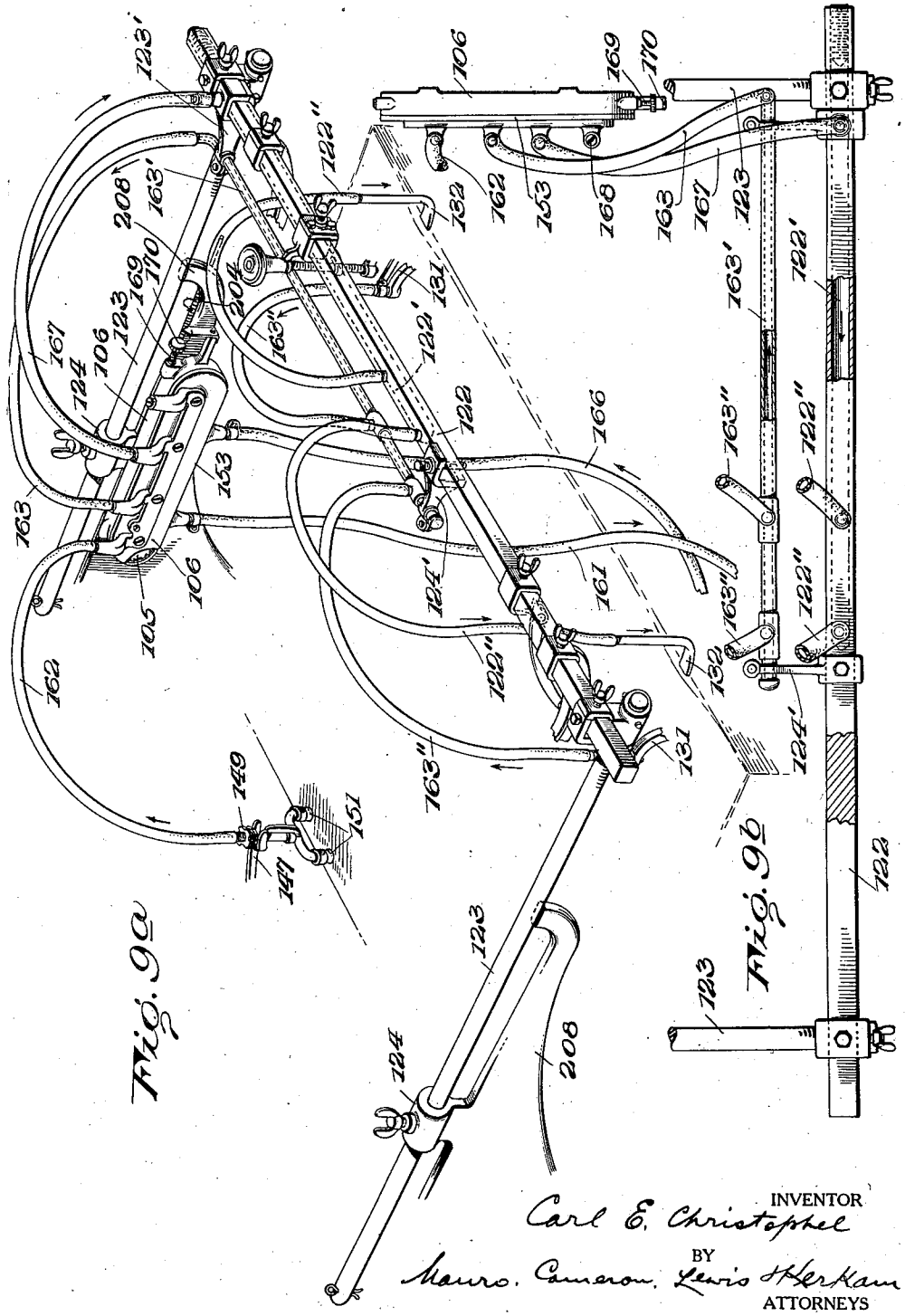


Fig. 9a

Fig. 9b

Carl E. Christophel INVENTOR

BY Mauro, Cameron, Lewis & Herkam.

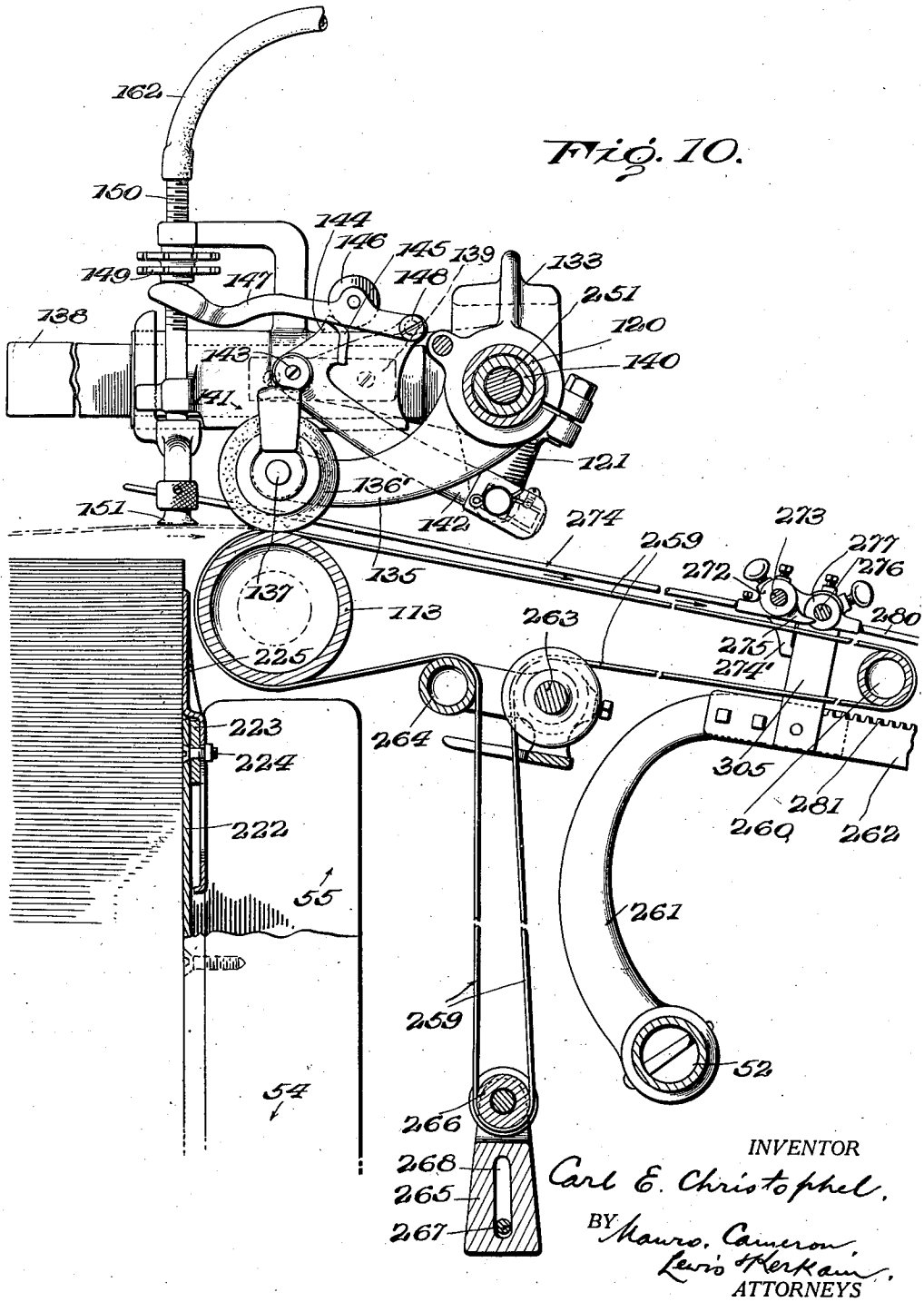
ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 10.



INVENTOR

Carl E. Christophel.

BY Mauro, Cameron, Lewis & Herkamp.

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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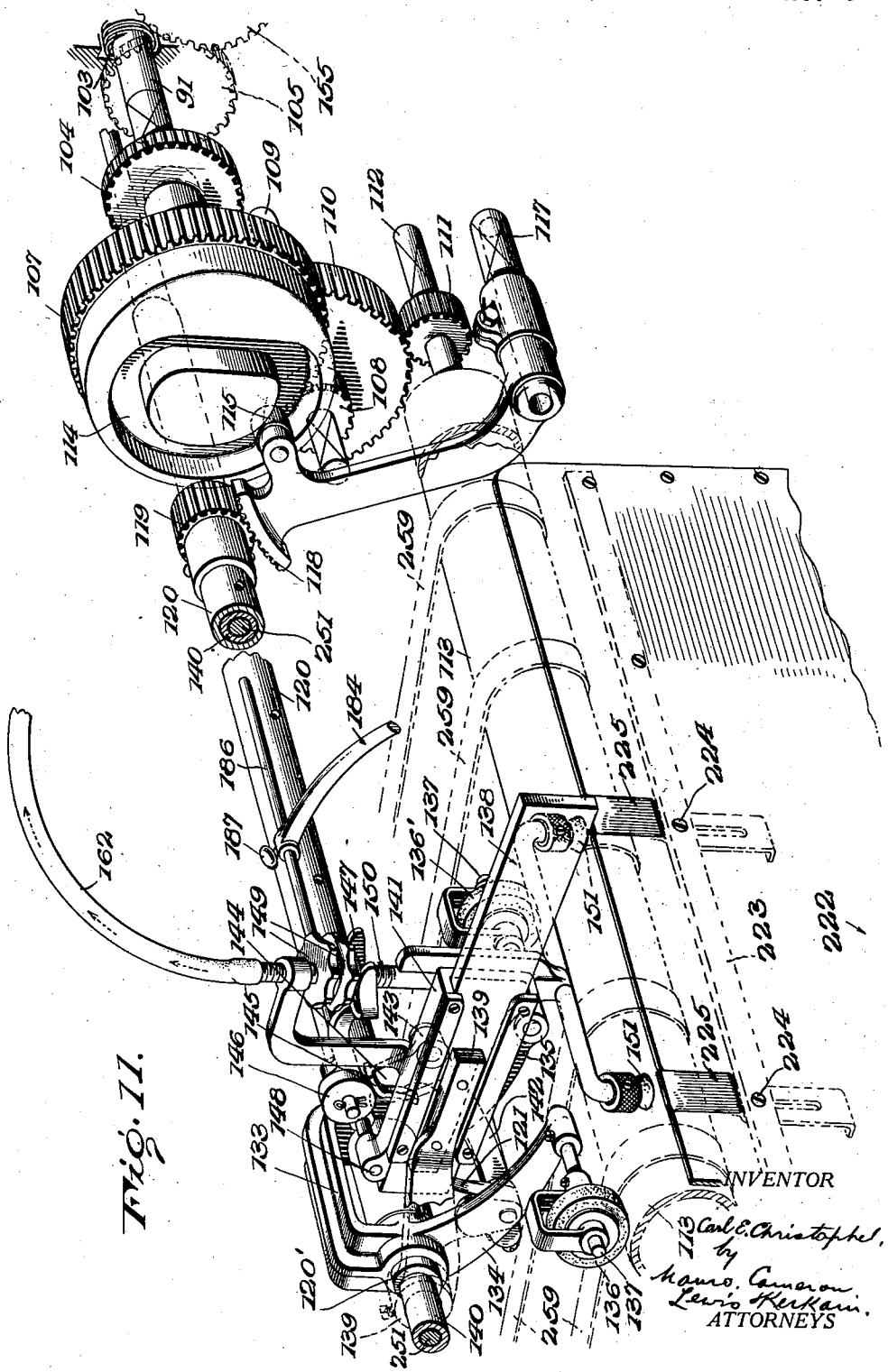


Fig. 11.

INVENTOR

Carl E. Christophel,

by Mauro, Cameron, Levis & Kerkam.

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 12.

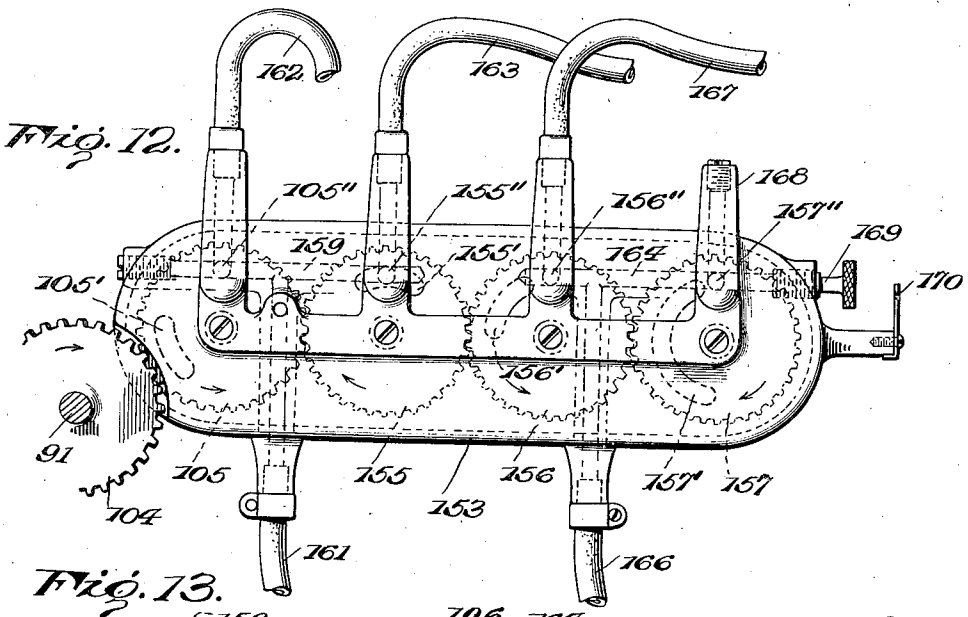


Fig. 13.

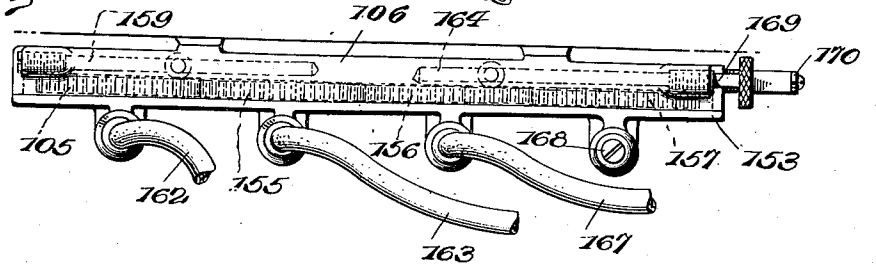
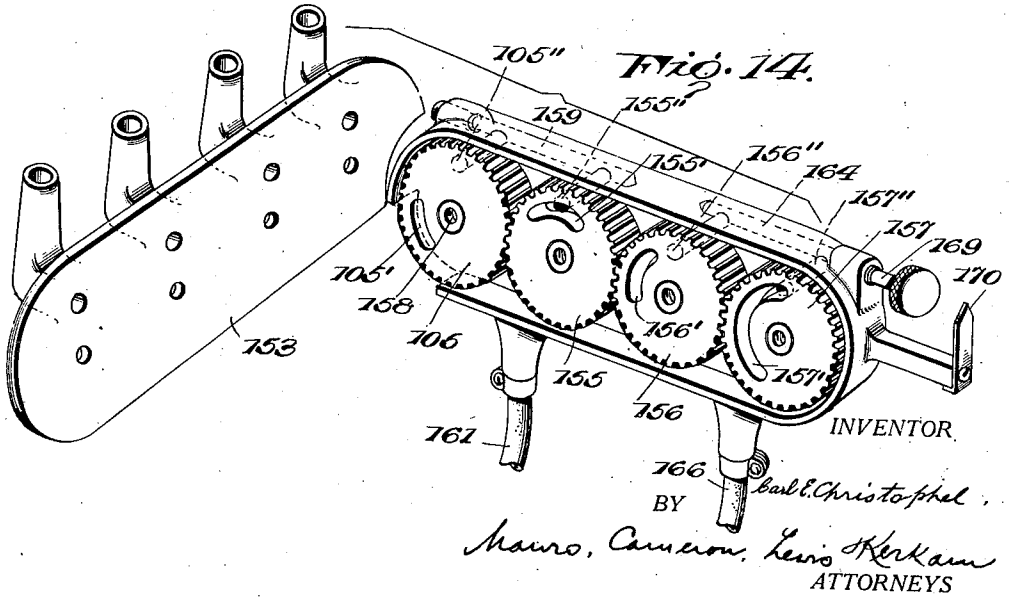


Fig. 14.



INVENTOR

Earl E. Christophel

BY

Mauro, Cameron, Lewis & Kerkam

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 11

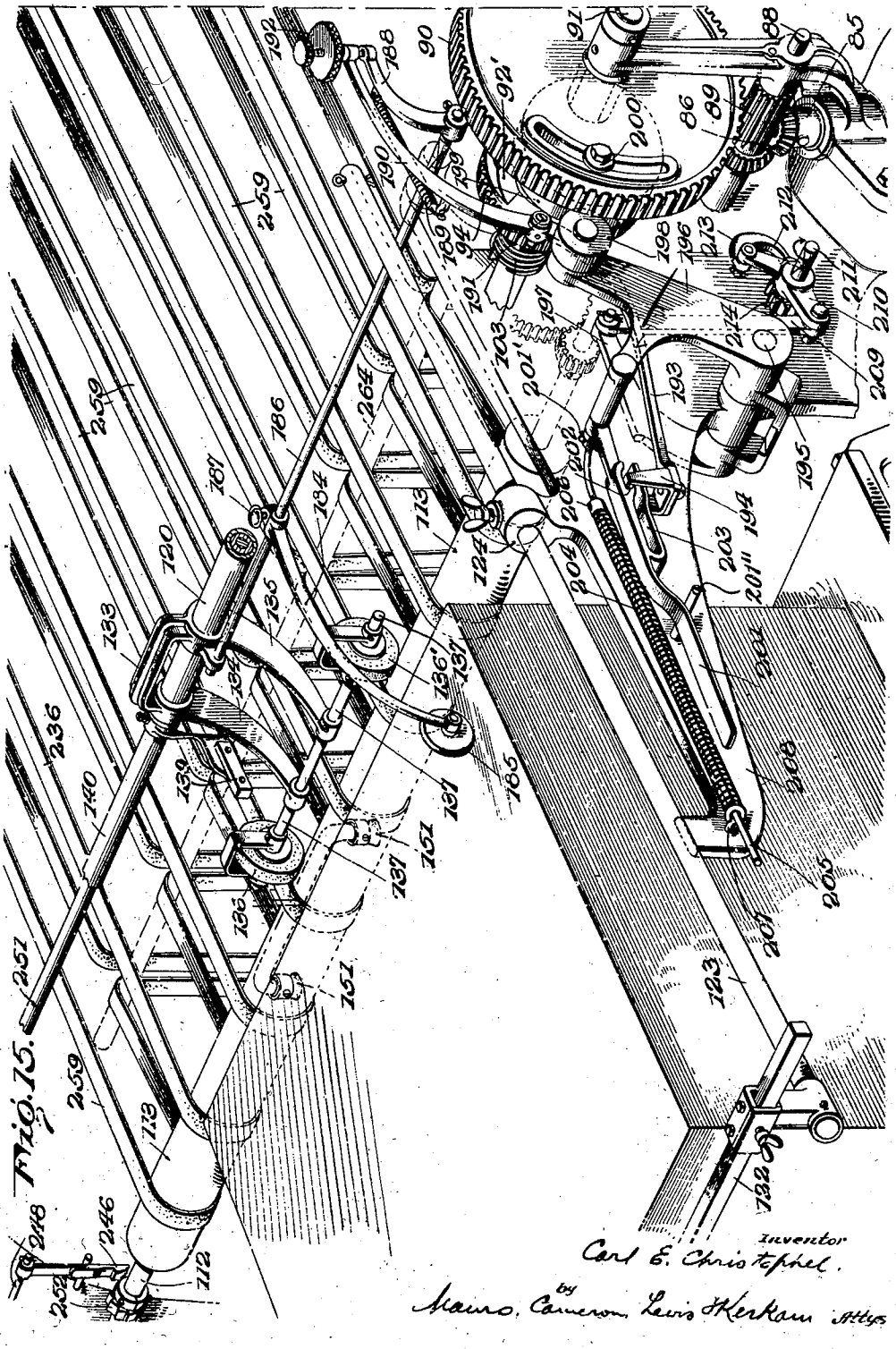


Fig. 15.

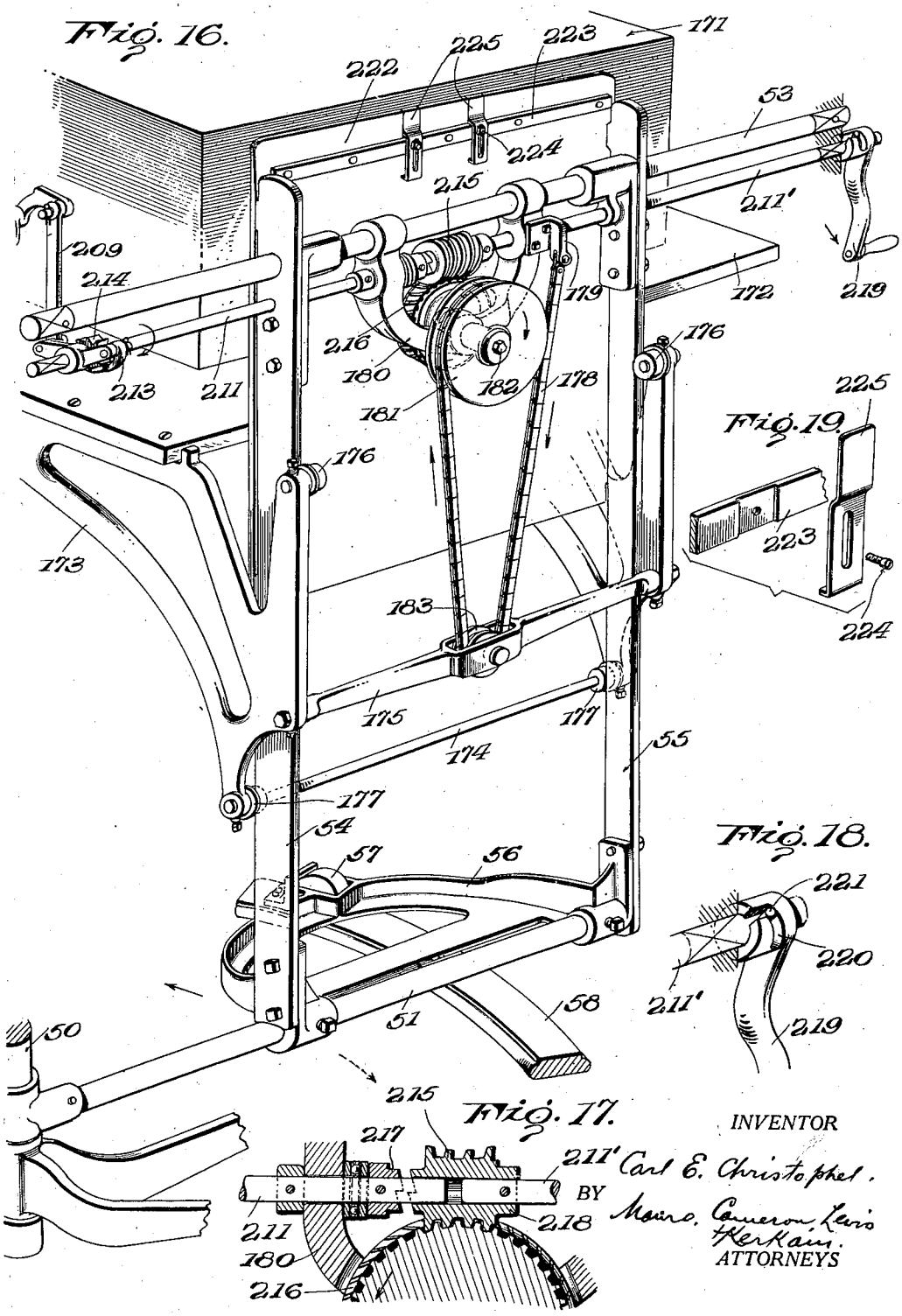
Inventor
Carl E. Christophel.
by Mauro, Cameron, Lewis & Kerkam Attys

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 16.



INVENTOR

Carl E. Christophel.

BY Munn, Cameron, Lewis & Kerkam.

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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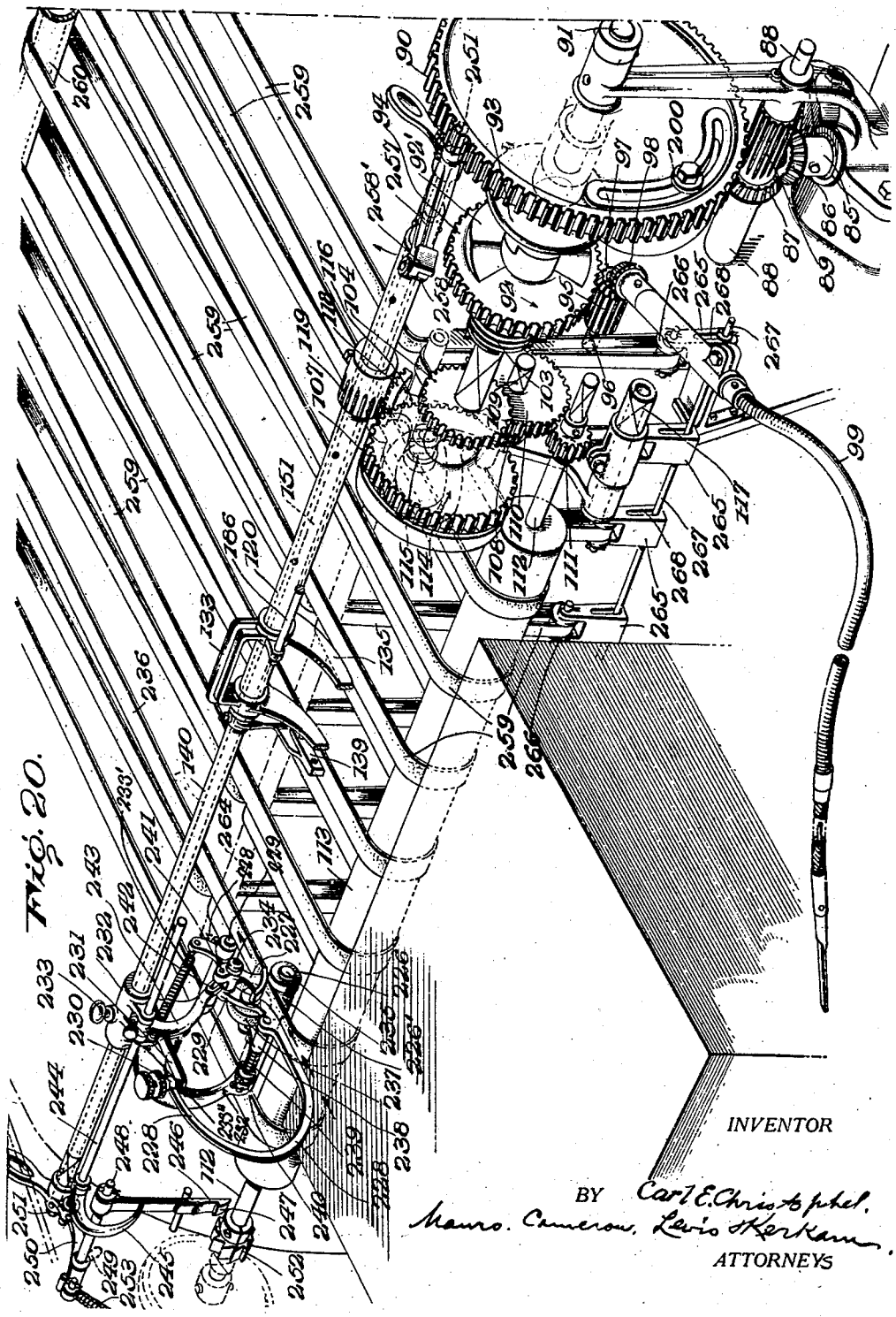


Fig. 20.

INVENTOR

BY Carl E. Christophel.

Mauro, Cameron, Lavio & Kerkam.

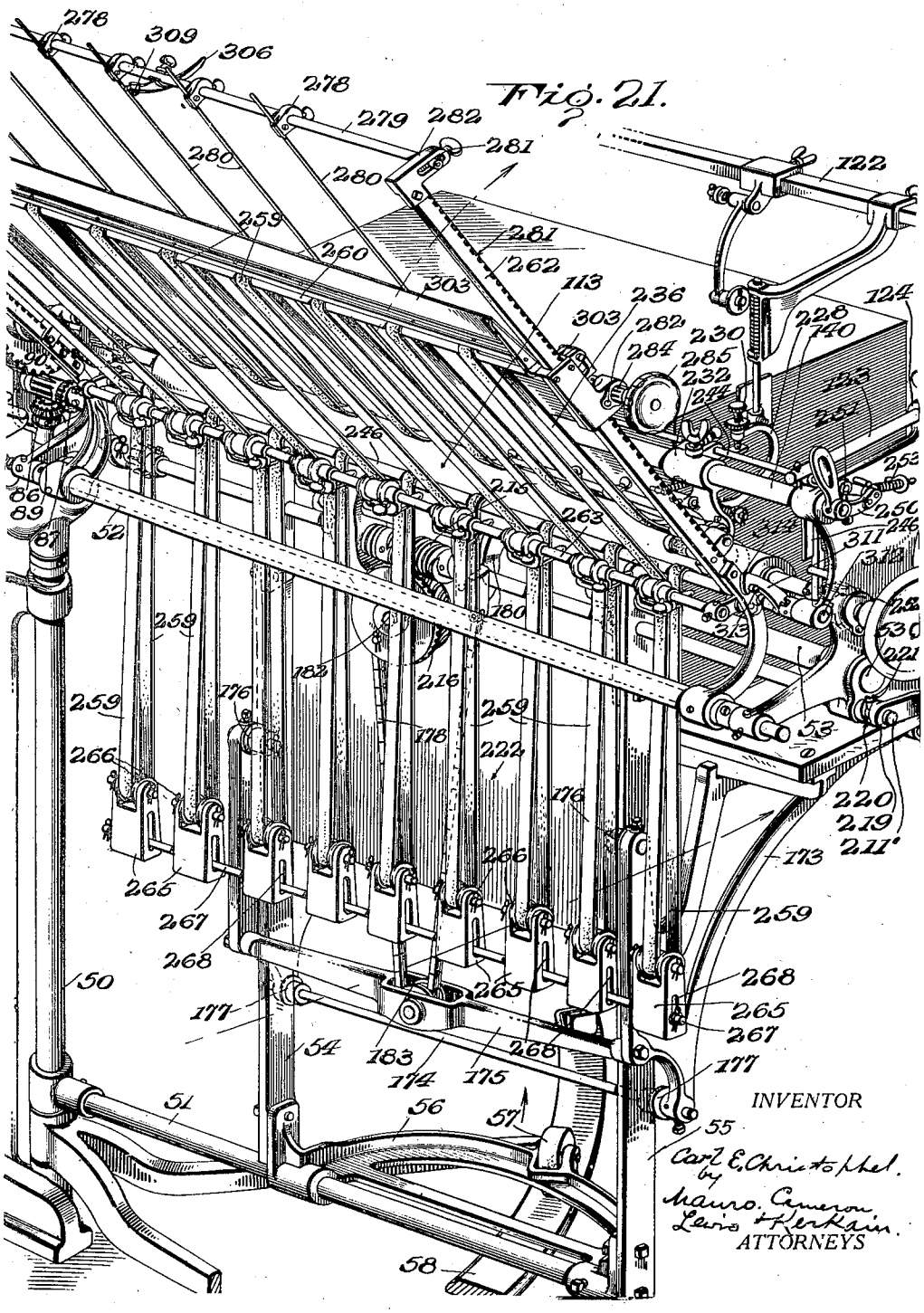
ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 21.



June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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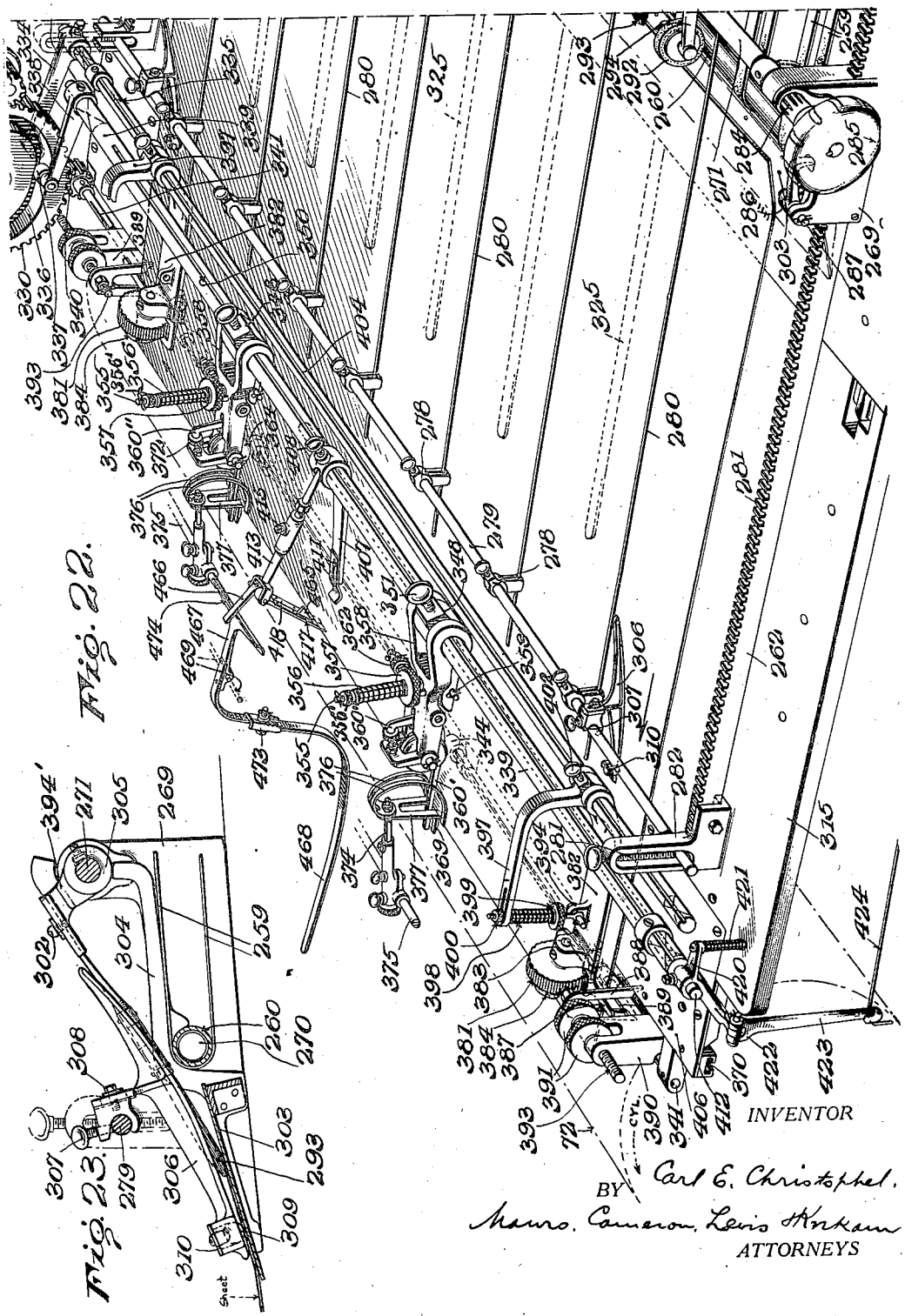


Fig. 22.

Fig. 23.

INVENTOR

BY Carl E. Christophel.

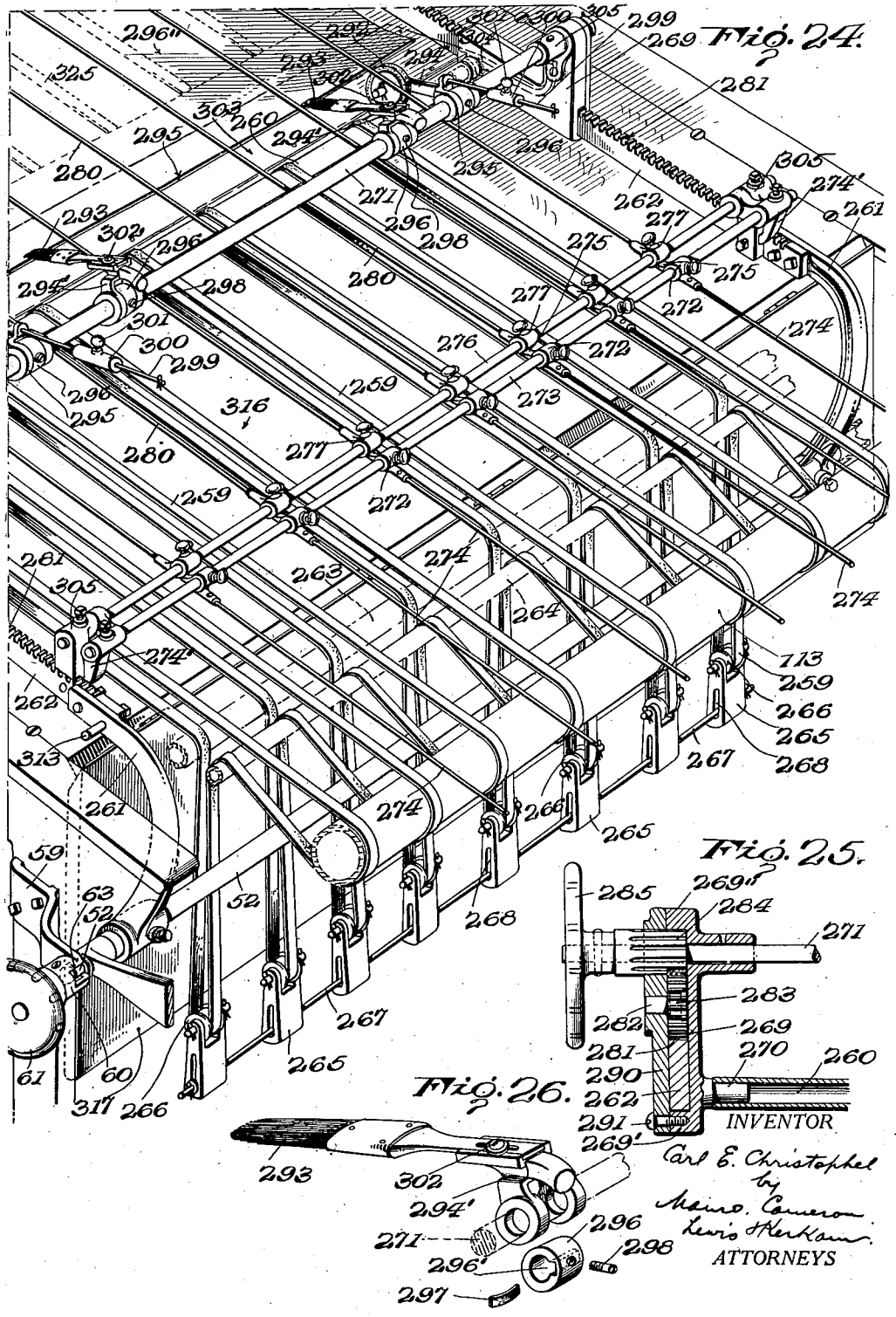
Mauro, Cameron, Lewis & Kirkham

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

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Filed Aug. 14, 1924 22 Sheets-Sheet 16



June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 17

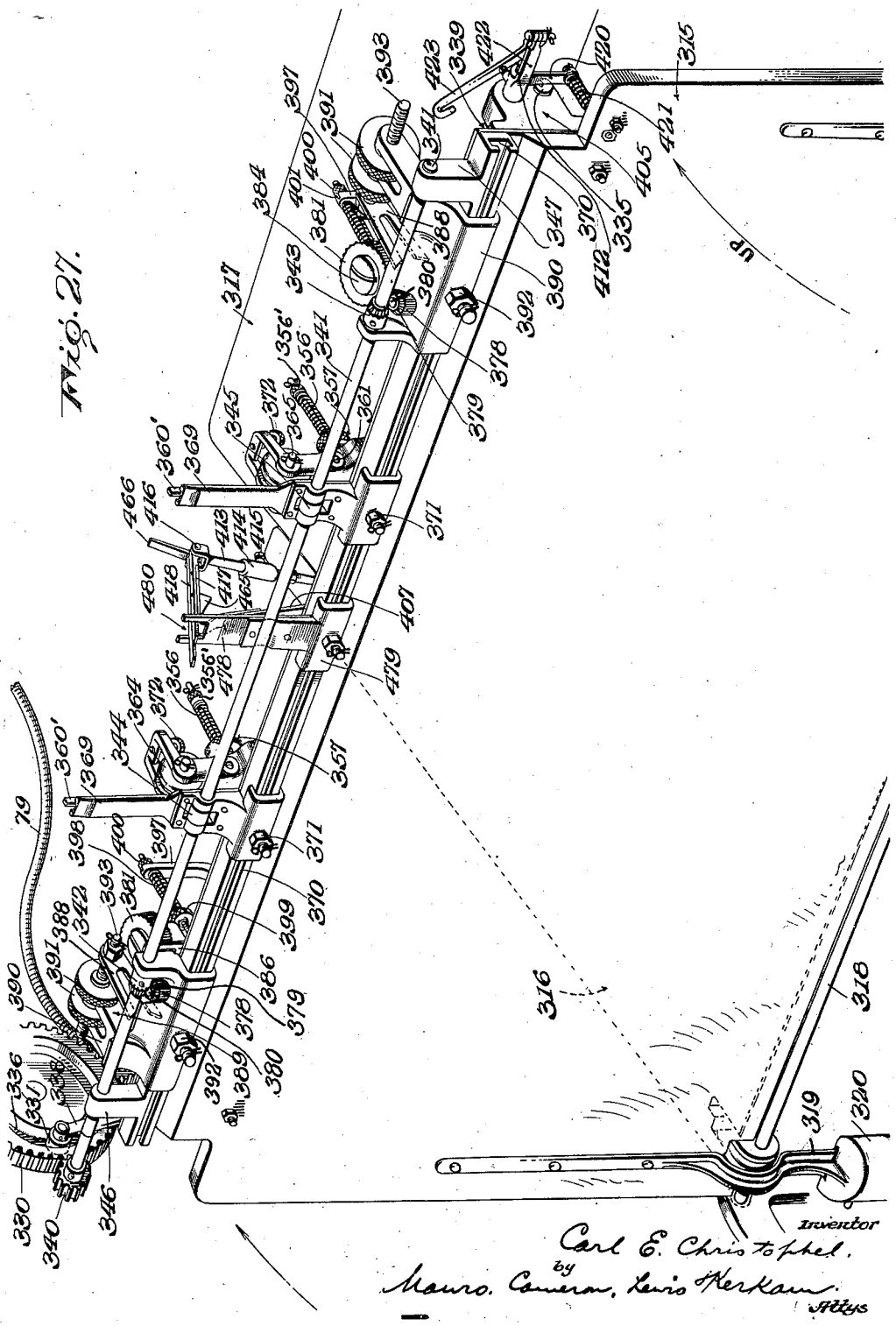


Fig. 27.

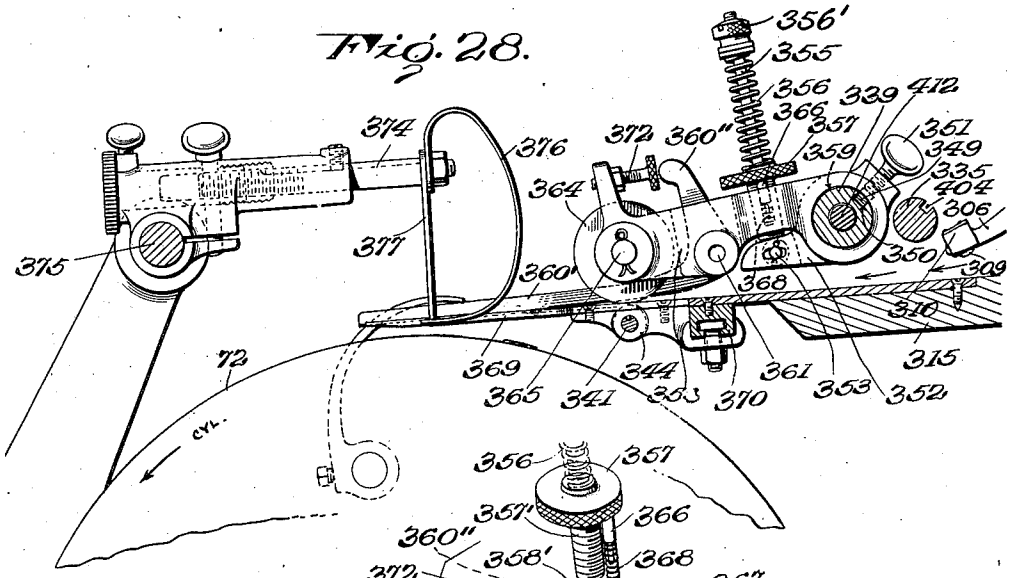
Inventor
Carl E. Christophel.
by Mauro, Cameron, Lewis & Herkamp.
Attys

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 28.



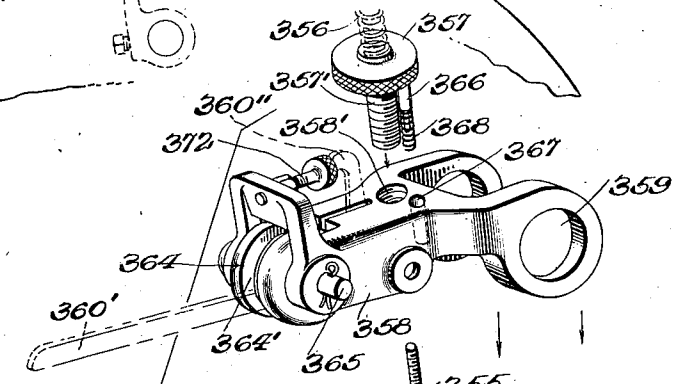
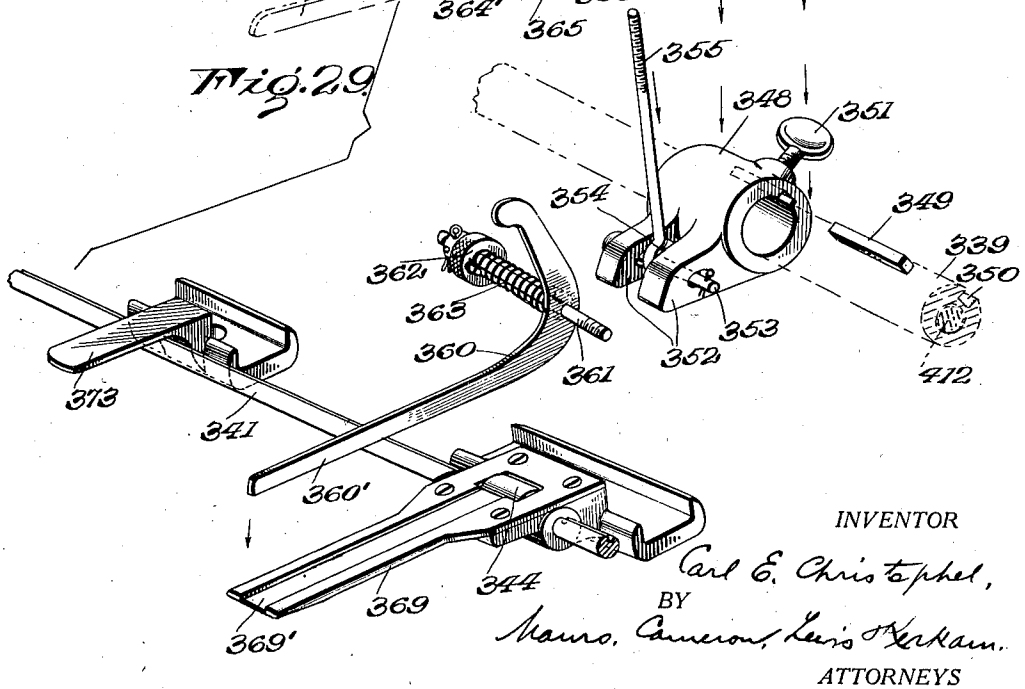


Fig. 29.



INVENTOR

Carl E. Christophel,

BY

Munn, Cameron, Lewis & Kerkam.

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 30.

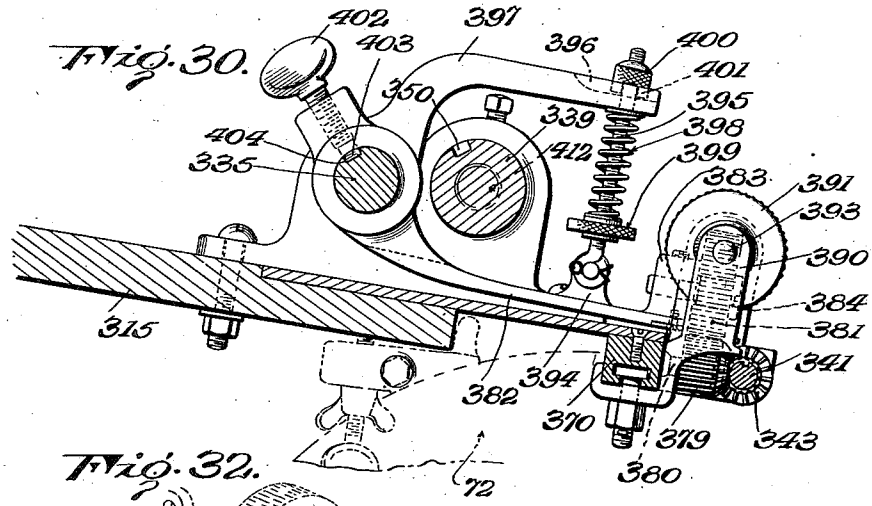


Fig. 32.

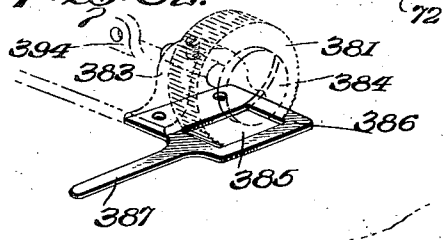
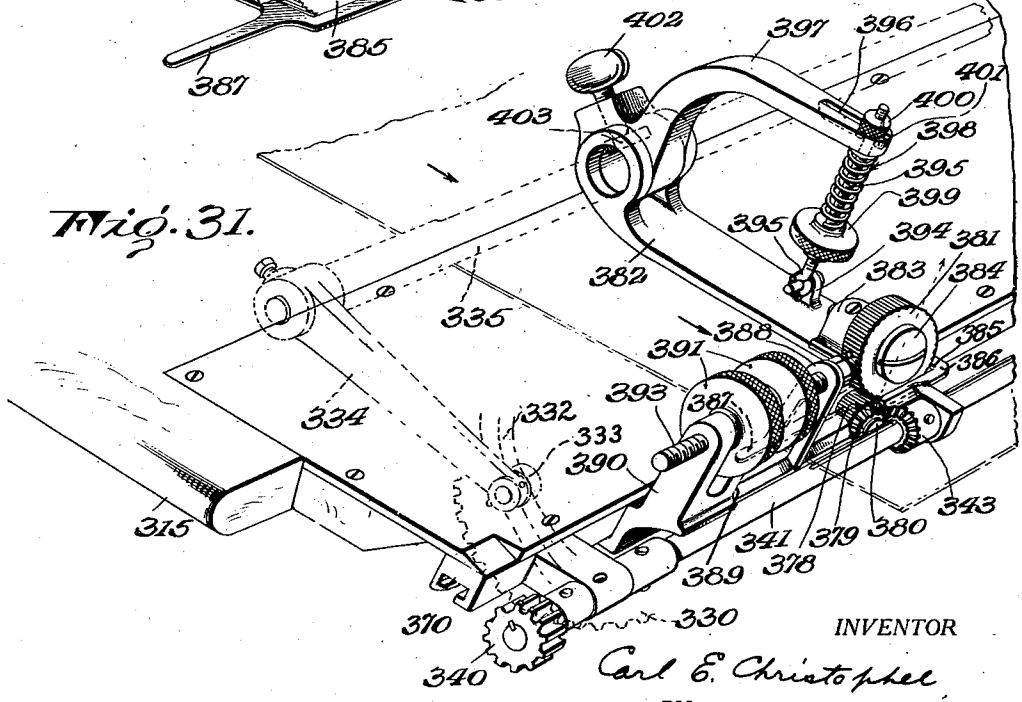


Fig. 31.



INVENTOR

Carl E. Christophel

BY

Mauro, Cameron, Lewis & Kerkam,

ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 33.

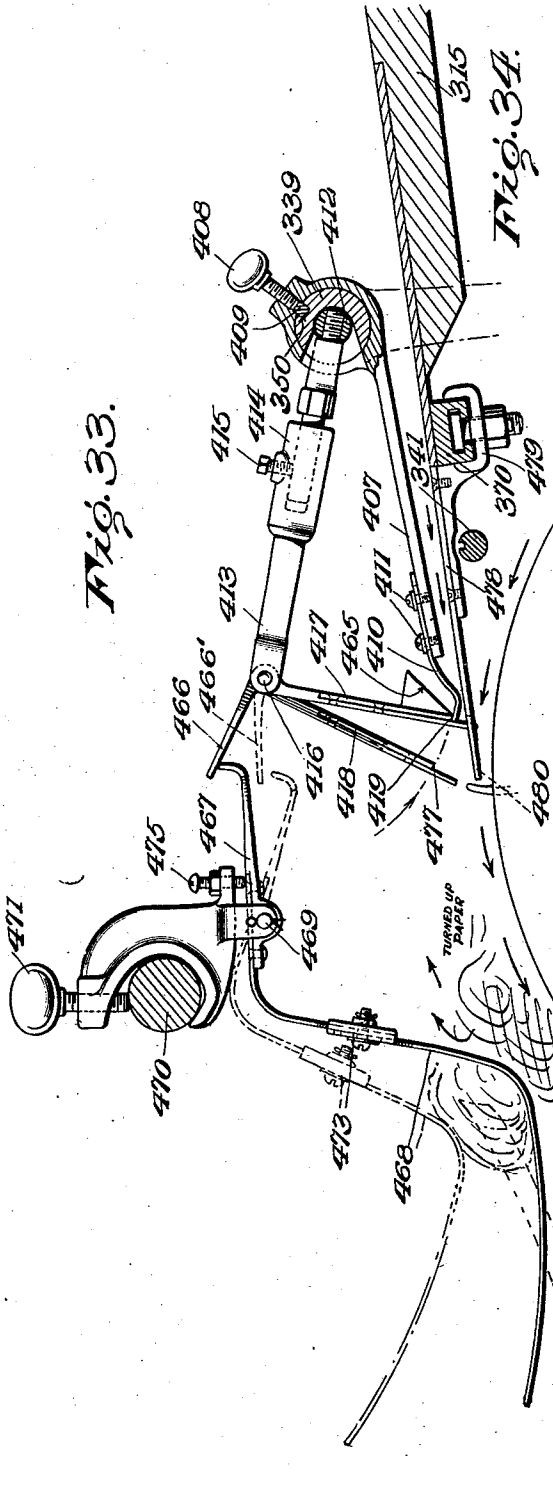
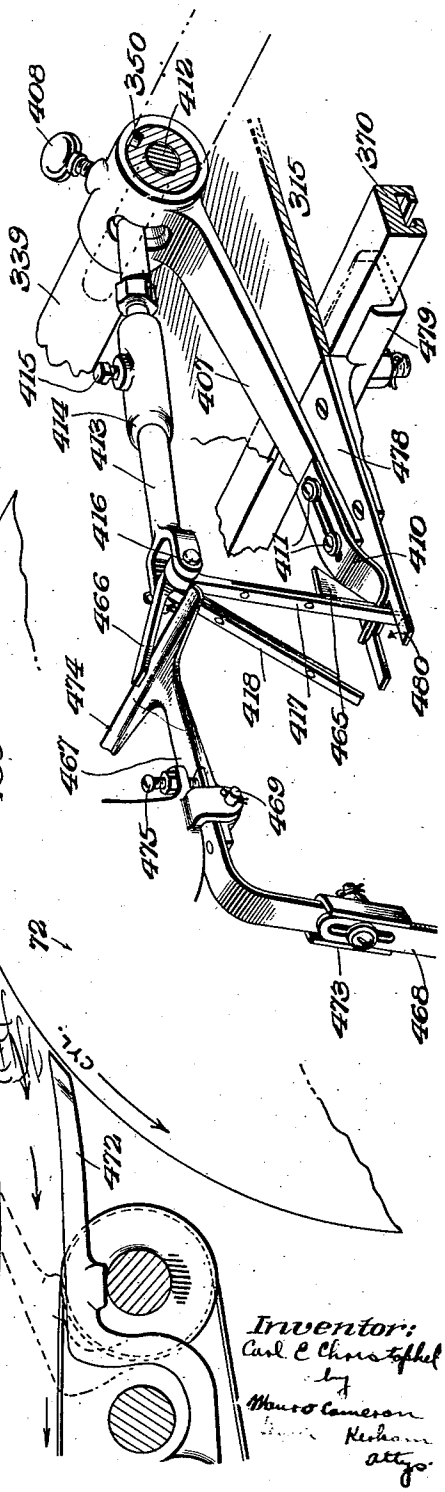


Fig. 34.



Inventor:
Carl E. Christophel
by
Munro Cameron
Kerkam
Attys.

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

Filed Aug. 14, 1924 22 Sheets-Sheet 21

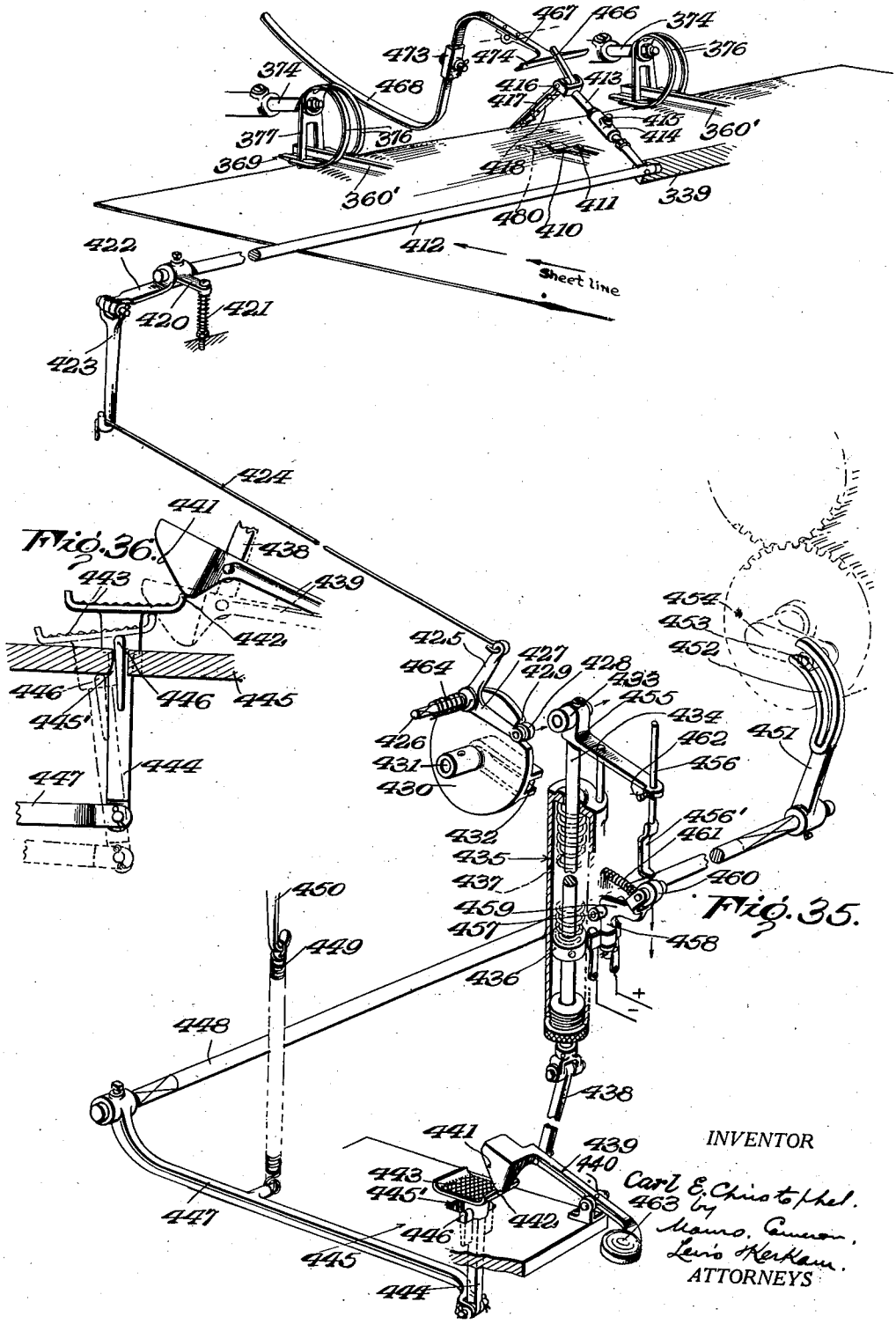


Fig. 36.

Fig. 35.

INVENTOR
Carl E. Christophel.
by Munn, Cameron, Lewis & Kerkam.
ATTORNEYS

June 10, 1930. C. E. CHRISTOPHEL 1,763,598

SHEET FEEDING DEVICE

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Fig. 37.

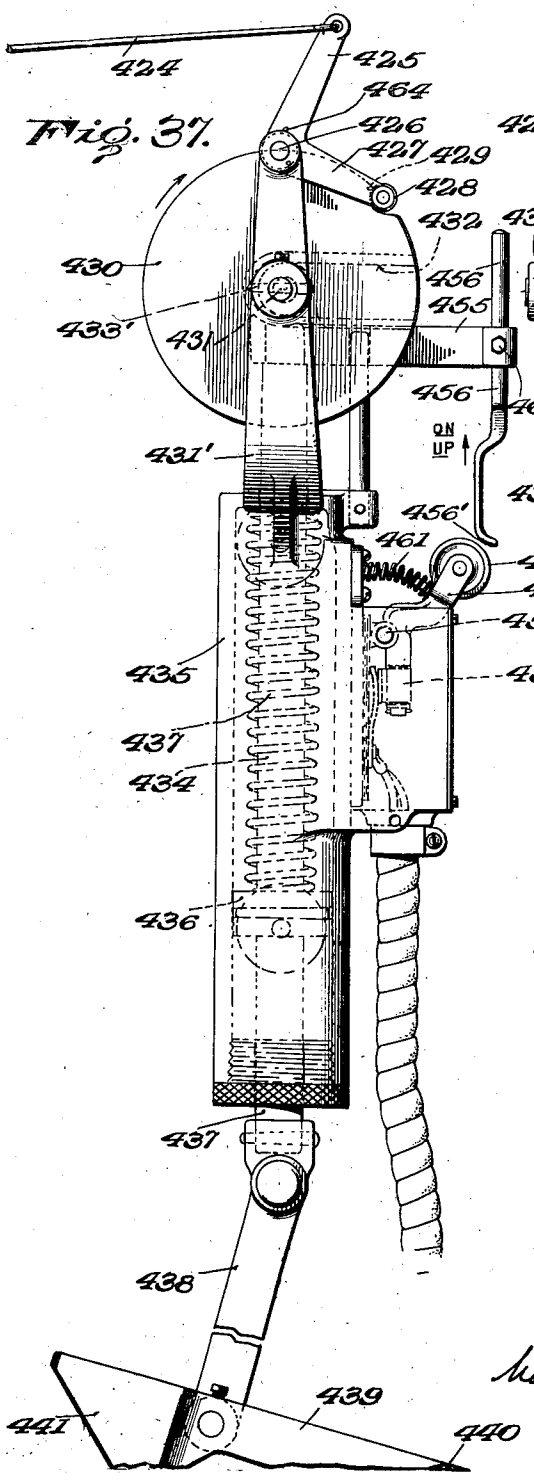
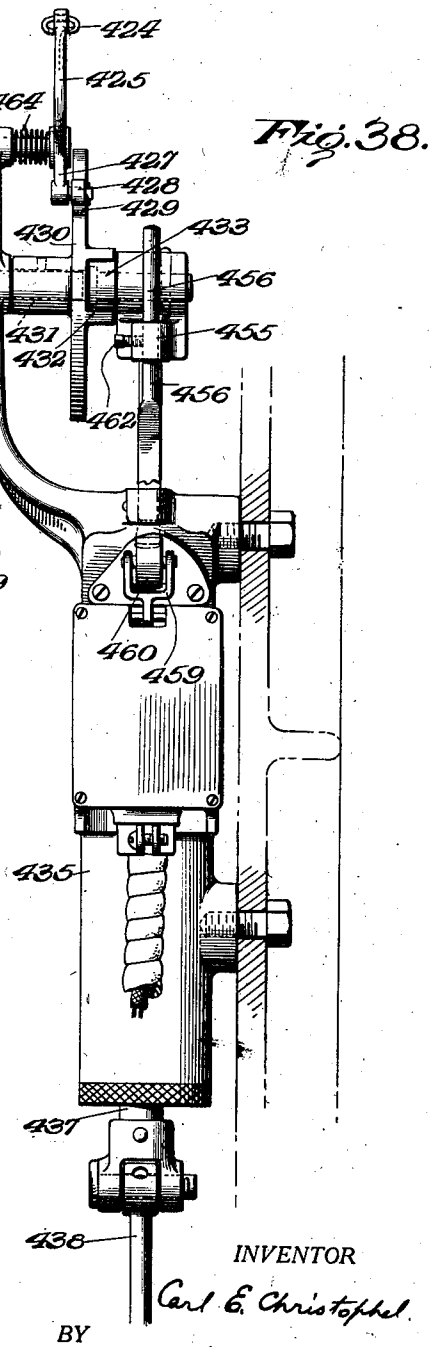


Fig. 38.



INVENTOR

Carl E. Christophel

BY

Munn, Cameron, Lewis & Kerkam

ATTORNEYS

Patented June 10, 1930 1,763,598

UNITED STATES PATENT OFFICE

CARL E. CHRISTOPHEL, OF PEARL RIVER, NEW YORK, ASSIGNOR TO DEXTER FOLDER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

SHEET-FEEDING DEVICE

Application filed August 14, 1924. Serial No. 732,046.

The present invention is an improvement in feeders particularly adapted for use in association with printing presses, but adapted for use in any association where such a device is desirable.

One of the objects of the invention is to provide a feeder mechanism of simplified and durable construction that will rapidly and efficiently feed sheets of paper or other material to any desired instrumentality. Speed and accuracy in feeding the sheets from a pile to the press guides or other destination necessarily requires the element of control of the sheets in their travel. Any interruption of the control, or any interruption in the feed of the sheets is at once reflected either in the speed in which the sheet is fed, the accuracy with which it is progressed along the prescribed path, or the condition in which it is received at the press guides. One prolific source of injury to the sheet occurs when the sheet is deposited by the forwarder on the feed roller shaft where it is engaged by the feed rollers that are lowered into engagement with the sheet while rapidly rotating, and which act to start and progress the sheet suddenly at high speed. This engagement by the vertically movable feed rollers frequently mutilates or injures the sheet and also displaces the same out of alignment.

With these considerations in mind, there is provided a feed mechanism in which the sheets are effectively separated, in which they are positively forwarded to the feed roller shaft, and in which the terminal speed of the forwarding device, the speed of the tape roller, and the speed of the tapes (if tapes are used) are synchronized, to the end that the sheet is uninterruptedly progressed forwardly from the time the forwarder engages the same until it reaches the press guides, and in which the movement of the sheet is substantially uniform from the time of the terminal delivery movement of the forwarder to the period when the sheet is delivered to the slow-down mechanism.

Heretofore feeders for printing presses and other instrumentalities have been complicated in construction, expensive in manufacture, and burdensome in upkeep, and in practical operation have required constant attention and supervision. Furthermore, it has been difficult heretofore to disassociate the feeders from the device to be fed without the expenditure of much time and labor in uncoupling parts, removing shafts and the like. In this connection, one of the objects of the present invention is to provide a feeder of unitary construction and on which all the feeding devices are mounted, that may be associated with and disassociated from the device to be fed readily and with great facility and without the necessity for any operation in this connection except the manipulation of a latch for locking or unlocking the feeder mechanism to the machine.

In attaining these objects, various features of improvement have been embodied in said device. In one embodiment of the inventive idea, the feeding elements, including the pile support and all the feeding devices, are mounted on a frame that is pivotally connected to a printing press of the flat bed variety, this pivotal form of mounting being of the type disclosed in the patents to Briggs, Nos. 480,447 and 480,448, dated August 9, 1892, so that the feeder may be swung aside to afford ready access to the rear end of the press.

In this connection, a further object of the invention is to provide a feeder that may be swung away from the press, and adjusted and set in the swung away position while the form on the press is being "made ready" for printing. Heretofore it was necessary to first make the form ready for printing, then connect the feeder to the press, and then set it for the job. By this invention all of these operations may be simultaneously performed, with a great saving in time.

A further object of the invention is to so mount the guide tongues for the press guides and the side registering mechanism, which heretofore have been carried by the press itself when no automatic feeder was employed, as to obviate any additional labor of adjustment. This is preferably effected by mounting these parts on a section of the feed board that may be elevated when the form is being made ready, in such relation that when the section is lowered the normal

adjustment is all that is required. This has the further advantage that should the feeder be disconnected and the device fed by hand, these parts would perform their usual and normal functions. In addition, the drive to these parts is uninterrupted, even when the section is swung up, so that the parts are always maintained in timed relation; and this is so whether the device is automatically or hand fed.

Another object of the invention is to provide an improved drive for the various parts of the feeder which makes it possible to drive the front end of the feeder and the devices at the rear end of the feeder so that the front end can be raised or lowered into operative relation to the press or other device to be fed without the removal of any of the parts, without affecting the timing of the various devices and without any adjustment or operation other than the mere physical swinging or moving of the parts into cooperative relation with the press or other device whether used separately, as when the press is hand fed, or in conjunction as when automatically fed.

A further object of the invention is to provide a sheet forwarding mechanism that will deliver the sheets to the feed roller at substantially the linear speed of the latter. Heretofore drop rollers have been raised and lowered into and out of engagement with the feed roller, and in timed relation with the movement of the forwarder, because the terminal movement of the forwarder was not the same as that of the feed roller or the tapes. But in the present device where the terminal movement of the forwarder is the same as that of the feed roller and tapes, the elevating and lowering of the drop rollers have been eliminated and the rollers are always maintained in engagement, during the normal operation of the device, with the feed roller. This obviates all the disadvantages heretofore encountered in raising and lowering drop rollers.

A further object of the invention is to provide a simplified and efficient air and suction control for the sheet separating and forwarding mechanism and particularly a device that is "fool proof" and does not invite unnecessary adjustments. Heretofore the air and suction control has been effected by large and complicated devices that were, for the most part, cam operated and were a source of continual annoyance as they were unnecessarily tampered with at the first sign of air or suction trouble. This object has been attained by the provision of a valve mechanism, preferably a plurality of valves being employed and provided on their peripheries with gear teeth that intermesh and have ducts that register with ports in the valve casing, said valves being rotated or driven from any suitable shaft.

Another object of the present invention is to accurately maintain the top of the sheet pile at a predetermined height and to effect this by a simplified, durable and efficient mechanism. Heretofore this mechanism has embodied a plurality of independently operated rotating cams subject to independent adjustment. One of these cams was for the purpose of operating the elevator ratchet and the other was for the purpose of elevating the governor roller in timed relation with the feeding mechanism of the forwarder. The present object has been attained by the provision of a simplified construction in which the first mentioned cam has been retained and the cam for elevating the governor roller during the sheet feeding movement has been connected to the control element so that in the movement of the latter, when the pile is to be elevated, the governor roller will be automatically raised to avoid interference with the proper forwarding of the sheet by the forwarding mechanism.

Another object of the invention is to provide a pile elevating mechanism which may be manually and automatically elevated and lowered, and which may be manually operated in an expeditious manner without any preliminary disconnection or rearrangement of any of the parts. Heretofore, in order to lower the pile support manually, it has been necessary to disconnect and readjust various parts of the pile elevating mechanism, which was objectionable in the time necessarily consumed for this work, and also because of the complicated mechanism necessarily employed. The present object has been attained in one aspect by the provision of a two-part shaft which, in the automatic operation, functions as a single unitary shaft but which, when the support is to be lowered manually or otherwise, is operated so that the part that carries the driving mechanism is automatically disconnected from the part that carries the ratchet which latter is engaged by the feeding pawl during the automatic operation of the device.

A further object of the invention is to provide a simplified and efficient calipering device. Heretofore the calipering mechanisms used have been cam operated and calipered either on the front or rear edge of the sheet, or sometimes both. These devices were objectionable because of the necessity for adjustment of the cam and because of the limited area of engagement of the calipering members with the sheet, and the limited time the members were in calipering position during one cycle of the machine. The present object has been attained by providing a calipering device that operates throughout the length of the sheet being fed and by eliminating the cam operation and the consequent necessity for adjustment of the cam. The control is instantaneous and the absence of

connections to the clutch are immediately set upon the passing of more than a predetermined thickness at any time during the operation of the machine, and if the calipering element engages any foreign substances thicker than the predetermined thickness for which the calipering device was set. When it is considered that sheets as large as 53″ x 74″ have heretofore been calipered only over an area of about 6 inches the advantages of the present calipering mechanism will be manifest.

Another object of the invention is to provide an adjustable conveyor for the sheets after they are deliverd by the forwarding mechanism which conveyor delivers the sheets to the front end mechanism at the same angle that they would be if hand fed, to provide a conveyor that will not frictionally engage the underside of the sheets when they are in engagement with the press guides, and one which may be readily removed from the feed board by the exertion of little effort. Heretofore the conveyor tapes have extended all the way from the forwarding device to the front end device, with the result that they tended to crowd the sheets against the press guides and deliver the sheet at a greater angle than was desirable. Also, when it was desired to elevate a conveyor frame from the feed board, this required the efforts of at least two operators and on account of its construction the conveyor could not be removed entirely clear of the feed board. The present object has been attained by providing a conveyor frame by which the effective lengths of the tape or tapes can be readily altered so that the sheets will be delivered onto the feed board and will still be under control by reason of the fact that the front of the sheet is engaged by the slow-down mechanism as the rear of the sheets passes from under the drive-up rollers; also, by reason of the fact that the sheet is delivered onto the feed board, they will be delivered to the press guides at the proper angle, that is to say the angle of the feed board. Further, the effort necessarily exerted in removing the conveyor frame from the feed board is minimized by providing a pivot on the feeder frame for the conveyor frame, the pivot point being preferably in a horizontal plane below that of the roller around which the tapes pass at the front of the machine, and the frame being properly counterbalanced by means that also preferably operate to take the slack out of the tapes. Further, the pivoting of the conveyor frame on the feeder insures that when the feeder is swung away from the press for the make ready or other operation the feed board will be completely cleared. The conveyor frame may, if desired, be locked in this elevated, swung away position.

A further object of the invention is to provide a feed board which may be used as well for manual as automatic feeding, which may be swung out of the way during the operation of make ready, and which in association with a pivoted feeder is adapted to be readily shortened but which, when hand feeding is desired, may have its effective length readily increased. These objects have been attained by providing a feed board of pivoted sections, the section nearest the device being fed preferably carrying the slow-down, registering and sheet detector mechanisms, and being adapted to be raised and lowered; and the section nearest the feeder being adapted to be swung down when the feeder is in operative position and swung up in line with the remainder of the board when the device is to be hand fed. When used in association with a conveyor frame that projects over the feed board and delivers the sheets thereon there is preferably employed anti-frictional devices on the section of the feed board nearest the device to be fed to insure that the progress of the sheet down the feed board to the device may not be retarded.

Another object is to provide an efficient slow-down mechanism, and also front registering and straightening mechanism, and to simplify the constructions and adustments which are necessarily made in preparing for any particular job. Heretofore it has been customary to mount the slow-down, the sheet straightener, the registering device, the press guides and press tongues as separate units, the press tongues being mounted on the sheet support and the other parts being mounted independently thereof. When changing from one size sheet to another it has heretofore been necessary to first change the location of the press tongues and the press guides and after the form was made ready and the feeder was put in operative position, it was then necessary to adjust the slow-down and sheet straightener mechanism. On account of the number of independent units it was practically impossible to get these parts into small enough space to feed the minimum size sheet that the press would take. This not only interfered with the operating of the press and feeder and impaired their function, but also limited the size of jobs that could be handled on the press. It also involved a great amount of labor in making the necessary adjustments. These difficulties have been overcome in the present invention by mounting the press tongue, the slow-down, sheet straightener and registering devices on the sheet support, and by so arranging and combining these devices that each press tongue and its associated slow-down, sheet straightener and registering device occupies practically no more space than is required for the press tongue. Further, by reason of the fact that the driving members of the slow-down devices are associated with

the press tongues and are adjustable therewith along the sheet support, the adjustments of these devices requires only a minimum of time. In addition, by mounting all of these parts on the sheet support, they have the same advantage and function when the device is being hand fed as when automatically fed, whereas heretofore when it was desired to hand feed it was necessary to remove all of these devices with the exception of the press tongue and press guides.

A further object of the invention is to provide an efficient and readily adjustable side registering device. Heretofore the side registering devices have been mounted on the front end attachment of the feeder and the registering elements and the guide plate were in fixed relation to each other. This had the disadvantage that when the printed matter was close to the edge of the sheet the side registering elements would mar the printing. Further, when making ready or in hand feeding, a separate side registering device had to be mounted on the sheet support inasmuch as the side registering mechanism that was normally employed was carried by the feeder which at this time was removed from the press. Adjustments under these conditions were necessarily double and involved considerable time. These disadvantages have been obviated and the device simplified and made readily adjustable by mounting the side registering mechanism on the sheet support, by providing an independent adjustment of the side guide plate so that it may be moved toward or from the side registering elements, and by providing automatic means for positioning the two side registering elements.

A further object is to provide a simplified sheet detector mechanism at the slow-down and press guides which operates if the sheet is out of alignment or if the sheet is missing, to stop the feeding mechanism, to trip the press or to stop the press or both. Heretofore a part of these detectors has been mounted on the press guides and a part on the front end of the feeder. Their structure and adjustments were complicated. In addition the detector finger engaged the front edge of the sheet before it was positioned against the press guides, and the action of the detector finger frequently displaced the sheet. Indeed it was sometimes necessary on small sheets to disconnect the detector. These disadvantages have been obviated and the detector made simpler and more readily adjustable by mounting the complete detector on the sheet support and by removing the detector finger from engagement with the sheet preferably by the action of the shaft that carries the slow-down mechanism. As soon as the upper slow-down element is elevated, the detector finger is removed from engagement with the sheet. A further advantage has been secured by associating the delivery detector, which operates if the sheet is being improperly delivered from the impression cylinder, with the sheet detector in such a manner that when the delivery detector is operated it will act through the sheet detector to stop the machine by the same mechanism that is employed by the sheet detector.

A further object is to provide a simplified, sensitive and yet positive control mechanism for tripping and stopping the press under the action of the sheet and delivery detector devices. To this end there has been provided a control disk adapted to be released upon the operation of the detectors, and a power device controlled by said disk and having a part engaging said disk slightly off center with respect to the axis on which said disk is mounted. This power device is provided with connections for tripping the press and preferably also with means for opening or closing (as the case might be) the motor circuit. If the press is not electrically operated means may be associated with the power device for shifting a belt and applying a brake in addition to the means for tripping the press.

While all of the features heretofore enumerated cooperate to produce a device of the highest efficienty, it will be appreciated that many of these devices may be used in other relations and for other purposes; and it is to be understood that the novelty of said devices resides not only in the particular combination in which they are used but in the devices per se. For example, the devices at the front end of the feeder have utility whether the sheets are automatically or hand fed, and whether they are mounted on a sectional movable feed board or otherwise, and similarly the various mechanisms have their full utility whether the feeder is pivoted or not; and the same applies to the various other devices and elements heretofore referred to and hereinafter described.

The device of the present invention provides, for the first time, a feeder which will successessfully separate and feed sheets of a large variety of sizes and characteristics. Heretofore feeders have been built that would handle only a limited range of stock of varying sizes and quality. It is one of the great difficulties in the manufacture of automatic feeders that paper of so many different sizes and characteristics has to be fed, and a feeder that will handle one or more of the numberless stocks will operate with indifferent success on some of the others. It is true that considering variations of size, thickness, finish and quality, thousands of different sheets are presented to the feeder; and one of the objects of the present inven-

tion is to provide a device which will more nearly feed at the speed of the machine being fed all of these varying sheets with greater speed, accuracy and general efficiency than any feeder that has heretofore been built, and wherein adjustments for varying sizes of sheets and varying thicknesses of paper stock and varying finishes of the sheets may be effected with facility and the minimum of labor.

Various other features of invention will be specified and pointed out in detail hereafter.

The invention will be better understood by reference to the accompanying drawings illustrating one embodiment of the inventive idea, and wherein—

Fig. 1 is a side view of a printing press of the flat-bed variety with which is associated a feeder embodying the present invention;

Fig. 2 is a side view of the feeding mechanism with certain parts removed for the sake of clearness, and showing the conveyor and the forward section of the sectional feed board in full and dotted line positions;

Fig. 3 is a detail of the conveyor adjusting device;

Fig. 4 is a detail of the means for locking the feeder frame to the press;

Fig. 5 is a perspective view with various parts omitted, illustrating the driving connections from the intermediate press gear to the front and rear ends of the feeder, and the means for supplying and controlling the air to the sheet-separating and forwarding devices;

Fig. 6 is a detail showing the drive from the intermediate press gear to the power distributing point at the pivot about which the feeder swings, and the drive to the several shafts at the front end of the feeder, the clutch on the cam shaft being shown in dotted lines;

Figs. 6^a and 6^b are details corresponding to Fig. 6;

Figs. 7 and 8 are details of the clutch;

Fig. 9 is a side elevation of the sheet separating mechanism;

Figs. 9^a and 9^b are details of the air and suction connections to the sheet separating and forwarding mechanism;

Fig. 10 is a side elevation, partly in section, of the sheet forwarding mechanism;

Fig. 11 is a perspective view of the sheet forwarding mechanism and the means for operating the same;

Fig. 12 is a side elevation of the air control mechanism; Fig. 13 is a corresponding top plan view; and Fig. 14 is a perspective view showing the several valves and gears with the cover of the casing removed;

Fig. 15 is a perspective view illustrating the automatic pile elevator control;

Fig. 16 is a perspective view of the pile support, together with means for elevating and lowering the pile;

Fig. 17 is a sectional detail showing the two members of the clutch disconnected and the separable two-part shaft; and Fig. 18 is a perspective detail showing the pin and cam-slot connection for disconnecting the two parts of the clutch;

Fig. 19 is a perspective detail of a pile control guide;

Fig. 20 is a detail perspective view of the calipering mechanism and the driving mechanism controlled thereby;

Fig. 21 is a perspective view of the pile support with the conveyor shown in elevated position and swung away from the press;

Fig. 22 is a perspective view showing the mechanism at the front end of the feed board including the slow-down and sheet straightening and front registering devices, the side registering devices, the press guides, the sheet detector mechanism and the delivery detector at the cylinder;

Fig. 23 is a detail side elevation, partly in section, illustrating a device for guiding the sheets from the conveyor onto the feed board, with sheet control devices;

Fig. 24 is a perspective view corresponding to Fig. 22 but illustrating the rear end of the feed board and showing the rear section of the feed board in its lowered position, and the arrangement of the conveyor when the feeder is locked to the press, and also the means for locking the feeder to the press;

Fig. 25 is a sectional detail corresponding to Fig. 3 showing the means for adjusting the conveyor for different sized sheets;

Fig. 26 is a perspective detail with parts separated, of the tail brush that engages the rear edges of the sheet and holds the same in engagement with the press guides;

Fig. 27 is a perspective view of the front end of the feed board, the same being shown in an elevated position, and showing the means for adjusting parts of the slow-down devices and the side registering devices;

Fig. 28 is a side elevation, partly in section, of a slow-down device and its associated press guide; and Fig. 29 is a detail or pulled out view of the various parts of the slow-down, sheet straightening and front registering device;

Fig. 30 is a transverse view partly in section of the side registering mechanism; Fig. 31 is a corresponding perspective; and Fig. 32 is a detail showing the positioning tongue and the upper rotary member of the side registering device;

Fig. 33 is a longitudinal elevation, partly in section, showing the sheet detector mechanism and the delivery detector at the press cylinder; and Fig. 34 is a corresponding perspective view;

Fig. 35 is a perspective view with various parts omitted and others separated, showing

the sheet detector mechanism and the operation of the device controlled thereby for tripping and stopping the press; and Fig. 36 is a detail of the same;

Fig. 37 is an elevation of the trip disk and associated parts; and Fig. 38 is a view at right angles to that of Fig. 37.

Referring to the drawings, wherein like reference numerals indicate like parts, it is pointed out that the invention is shown, for the purposes of illustration, in association with a printing press of the well known flat-bed type. The feeder is, however, adapted for various other uses and purposes.

Feeder mounting

(Figs. 1, 4, 5, 6, 6ª, 6ᵇ, 16, 21, and 24. Sheets 1, 2, 3, 4, 4ª, 10, 12, and 14.)

In the particular embodiment illustrated in the drawings, the feeder is mounted on a frame which is pivoted to one of the side frames of the printing press. This pivot is preferably in the form of a vertical stationary shaft 50, and the frame of the feeder comprises a plurality of transverse members 51, 52, 53 and 140, and vertical members 54 and 55, which latter are carried by the member 51 and connected to the member 53. The lowest transverse member 51 has a bracket 56 connected thereto in which is mounted a roller 57 that rides on a track 58 that projects from the rear frame of the press. The feeder is thus swung about the stationary vertical shaft 50 with little effort from its position in association with the press to a position as remote from the same as desired, so that easy access is had to the rear of the press for placing the forms on the bed of the press or for making corrections and alterations to the form. The feeder frame is so constructed and arranged that it will stand at any desired place along the track to which it may be moved, but means are provided for locking the feeder in association with the press when sheets are to be automatically fed from the pile to the impression cylinder.

This locking mechanism (see Figs. 4, Sheet 2, Fig. 24, Sheet 14) consists generally of a recessed casting 59 secured to one of the side frames of the press, which casting has associated therewith a sleeve 60 adapted to be rotated by a hand piece 61, and which sleeve is provided with a recess 62 that is adapted to register with a recess 63 in the casting. When it is desired to lock the feeder to the press, the recesses 62 and 63 are brought into register and the feeder is swung into position in association with the press so that one end of stay shaft 52 will pass into said registered openings. Sleeve 60 is then rotated to bring opening 62 out of register with opening 63 in the casting 59 so that an imperforate part of the sleeve 60 opposes the removal of the shaft from the casting.

Feeder drive

(Figs. 1, 5, 6, 6ª, 6ᵇ, 7, 8, 10, 11, 15, and 20. Sheets 1, 3, 4, 4ª, 6, 7, 9 and 11.)

The various parts of the sheet engaging, feeding and control mechanisms are preferably driven from the press or other device to be fed, and are always maintained in timed relation therewith, whether the feeder is in its feeding position with respect to the press or whether it has been moved or swung away from the press, or whether the front end of the feeder board is raised or lowered. In the particular embodiment of the inventive idea herein illustrated, the drive of the various parts of the feeder is effected from the intermediate gear 64 which is driven from any suitable source of power 65 through belt 66, pulley 67 mounted on shaft 68 carrying pinion 69 that meshes with and drives said intermediate gear 64.

This intermediate gear 64 meshes with and drives the cylinder gear 70 mounted on a shaft 71 on which the impression cylinder 72 is carried.

The drive of the feeder is effected through gear 73 that meshes with the intermediate gear 64. Gear 73 has compounded therewith a bevel gear 74 that meshes with a bevel gear 75 mounted on one end of a shaft 76 provided with two universal connections 77 and 77′. The other end of said shaft is provided with a gear 78 that drives the front end of the feeder and a Bowden wire 79 through gears 80 and 81, the former being an idler gear mounted on a stub shaft 82. Adjacent the gear 78 is a bevel gear 83 that meshes with a bevel gear 84 mounted on the lower end of a short vertical shaft 85, which projects through a gear casing 50′ that is pinned to shaft 50 by a pin 50″. This gear casing 50′, that is provided with a suitable cover plate 50‴, also has an extended portion 51′ (Fig. 6ª) that projects into a bracket 52′ and which normally rests on a shoulder 53′ on said casing. The bracket 52′ is secured to the feeder frame and bolted to the bracket 52′ is a bracket 55′ in which shafts 88 and 91 have bearings.

The upper end of shaft 85 carries a miter gear 86 that meshes with a miter gear 87 mounted on a short transverse shaft 88. This shaft 88 carries an elongated pinion 89 with which meshes a large gear 90 mounted on a cam shaft 91 of the feeder. Said shaft 91 has also mounted thereon a two-part clutch, one part 92 being keyed on the shaft 91 and the other part 93 being loose thereon, the gear 90 being compounded with the part 93. The clutch is adapted to be opened by the operation of the calipering mechanism hereinafter described, or manually, to disconnect the driving mechanism of the feeder. The drive of the mechanism at the rear end of the feeder is normally effected through

the clutch by means of gear teeth 94 provided on the periphery of clutch part 92, which gear teeth mesh with an elongated pinion 95 mounted on a short stub shaft 96, with which pinion there is compounded a bevel gear 97 which meshes with a bevel gear 98 carried by one end of a Bowden wire 99. The other end of this Bowden wire carries a pinion 100 that meshes with a gear 101 carried by shaft 102 on which is mounted the separator mechanism of the feeder, as hereinafter described.

The clutch member 92 is spring pressed toward the right by a spring 103 that tends normally to hold it is clutched relation with its companion part 93. This spring encircles the cam shaft 91. Adjacent said spring and carried by said shaft 91 is a gear 104. This gear meshes with gear 105 carried in casing 106, which casing encloses the valves that control the distribution of air to the separator, forwarder and air blast, as hereinafter described.

Adjacent gear 104 is a gear 107 that meshes with a pinion 108 carried by a stub shaft 109, which shaft also carries a gear 110 that meshes with a pinion 111 carried by shaft 112. This shaft carries the feed roller 113 around which the conveyor tapes pass.

Compounded with gear 107 is an internal cam 114 in which engages a roller 115 carried by an arm 116 pivoted on a hollow bushing 117 carried by the frame of the machine. This arm is provided at its free end with a toothed sector 118 that meshes with a gear 119 mounted on a tube 120 to which is fixed a depending arm 121 through which is transmitted motion to the forwarding device, all as more fully hereinafter described.

It will therefore be seen that when the clutch 92—93 is opened, either manually or automatically, all of the feeder mechanism, including the separator, forwarder and the means for driving the air valves will be disconnected.

Sheet separating mechanism

(Figs. 1, 5, 9, 9ª and 9ᵇ. Sheets 1, 3, 5 and 5ª.)

The mechanism for separating successive sheets from the pile may be of any suitable or desired character so long as it will efficiently and surely separate the sheets so that the same may be fed forward to the printing press or other instrumentality. It is preferred, however, that the sheet separating mechanism disclosed in my Patent No. 1,475,621, dated November 27, 1923, be employed. Dependent upon the size of the sheets that are to be fed, one or more of such mechanisms may be utilized. If two are employed they are preferably mounted one near each corner of the sheet pile, though, if desired, they may be moved closer together, as is preferably the case when card-board is being fed. As here shown the separating mechanism or mechanisms is or are mounted on a transverse rod or tube 122 which is carried by two longitudinally disposed rods 123, which rods are carried by the side frames of the feeder. These longitudinal rods may be adjusted lengthwise of the machine at 124 so that the separating devices may be moved nearer to or farther away from the forwarding devices.

As disclosed in my said Patent No. 1,475,621 there is preferably employed a rotary platen 125 which is driven through suitable gearing from shaft 101. Cooperating with this rotary platen is the sheet-straightening means in the form of a combing wheel 126 which is also suitably rotated. The gearing that drives the platen 125 from the shaft 101 is carried in a casing 127 to which one end of an arm 128 is connected. The other end of said arm is provided with a hook 129 that is adapted to be hooked over bracket 130 so that, when desired, the platen 125 and the combing wheel 126 may be held in an elevated position out of operative engagement with the sheet pile. This is desirable when thicker card-board is being fed or when the separation is being effected solely by means of the collapsible sucker 131.

After the topmost sheet is separated from the pile either by the action of the collapsible sucker 131, or by the cooperative action of the platen 125 and the sheet-straightening means 126, air is preferably introduced beneath said topmost sheet through the hollow foot clamp 132 to complete the separation of the same.

Sheet forwarder

(Figs. 10, 11, 15 and 20. Sheets 6, 7, 9 and 11.)

After the sheet is separated from the pile it is seized along its forward edge by the forwarding device which moves the sheet from the pile onto the conveyor that carries it forward to the slow-down, straightening and registering device. Preferably, I employ a forwarder of the general type disclosed in my application Seral No. 599,359, filed November 6, 1922, in which there is disclosed a suction mechanism which, by suitable connections, is lowered into engagement with the top sheet of the pile, then elevated and then reciprocated along a track bar to deposit the sheet on the feed roller and associated conveyor. While in the present construction I preferably continue to employ the track bar and the suction mechanism that is lowered and raised, I have eliminated the drop rollers that are normally elevated and lowered into engagement with the sheet and have substituted rollers that during the normal operation of the feeder rest upon and are rotated by the feed roller. I have also embodied these rollers as part of my forwarder construction. A housing 133 is loosely

mounted on tube 120 and is provided with arms 134 and 135 in which are carried rollers 136 and 136′ that rest upon and are rotated by the feed roller, said rollers 136 and 136′ being adjustably mounted upon transverse pins 137 carried by said arms 134 and 135. The rollers 136 and 136′ may be swung away from the feed roller 113 for the purpose of removing a sheet or for any other reason. A horizontal track 138 is carried by a bracket 139 keyed or otherwise secured on a tube 140 adjacent the end 120′ of tube 120. This tube 140 is fixedly mounted in the side frames of the feeder and projects through the tube 120. This track 138 is preferably fixedly secured so that it has no vertical movement, though in some embodiments it may be found desirable to mount said track 138 on the housing 133 so that it may move with the same.

A carraige 141 is reciprocated along said track 138 through arm 121 fixedly secured to the tube 120 and positioned on said tube between arms 134 and 135. The lower end of said arm 121 is connected to the link 142, which latter is secured to the said carriage at 143. An arm 144 integrally connected to said link 142 is provided with a cam surface 145 that engages a roller 146 carried by arm 147 pivoted at 148 on said carriage 141. The free end of said arm engages the adjusting nuts 149 carried on the tube 150 that carries the sucker mouths 151. Through the connections described it will be understood that as the tube 120 is oscillated back and forth from the cam 114 as heretofore described, the carriage 141 will be reciprocated along said track 138 and simultaneously the sucker mouths 151 will be elevated and depressed. The particular sequence of operations is that, after the sheet is separated the sucker mouths 151 are first lowered into engagement with the uppermost sheet, then elevated to raise the sheet, then the carriage is moved forwardly toward the feed roller 113, the sheet being introduced between said feed roller 113 and the cooperating rollers 136 and 136′: Thereafter, the carriage is reciprocated back toward the sheet pile, the sucker mouths 151 are again lowered into engagement with the top sheet of the pile and the sequence of operations is repeated.

Particular attention is directed to the fact that the speed of the sheet at the time it is delivered to the feed roller 113 and the conveyor is the same linear speed as that of said feed roller 113 and the conveyor. This is effected by the particular configuration given to the cam 114 (Fig. 11) which is so cut as to progressively increase the speed of the carriage as it moves to deliver the sheet to the feed roller so that the speed that it attains at the time the sheet is delivered is the speed of the feed roller 113. By this means the sheet is kept continuously in motion from the time the forwarder takes hold of the same until the sheet reaches the press guides, and the motion of the sheet is uniform from the time the forwarder delivers the sheet to the feed roller 113 until the sheet reaches the slow-down mechanism.

Air control for the sheet separator and sheet forwarder

(Figs. 1, 3, 9, 10, 11, 12, 13, and 14. Sheets 1, 3, 5, 6, 7, and 8.)

The topmost sheet of the pile is first seized by the suction member 131 at the separator, after which a blast of air passes through the foot clamp 132 to float the sheet, and thereafter suction is applied at the forwarder through suction mouths 151 to move the sheet into engagement with the feed roller 113 and the conveyor associated therewith. In reverse order the suction at the separator 131 is first cut off, then the air through the foot clamp 132 is next cut off and lastly the suction on the forwarder 151.

It is highly important that the air control be effected by a simple and efficient mechanism in order that the rapid and accurate separation and forwarding of the sheets shall be effected and in order that the proper sequence of operations shall be maintained. Heretofore the air controls have been for the most part cam operated, and these have been a prolific source of difficulty, inasmuch as adjustments of the timing were frequently made both by skilled and unskilled operators. The present air control is so arranged and enclosed as to discourage tampering and so adjusted at the factory as to require little, if any, attention in the subsequent operation of the feeder. In the present embodiment a much simplified control has been provided in the form of a rotary valve mechanism, here shown as a plurality of rotary valves which are provided on their peripheries with gear teeth, so that the various members are operated one from the other, and are always, during the operation of the device, in intermeshed relation, thus controlling, by fixed gearing, the proper sequence of operation and the proper and exact control of the air and suction to the various parts.

As herein shown, a casing 106 is mounted on the side frame of the machine adjacent the gear 104 carried by the cam shaft 91, which casing is adapted to be closed by a cover 153. This casing carries a plurality of rotary valve members 105, 155, 156 and 157. While four such members are herein shown, a larger or smaller number may be employed if desired. Each of these members is mounted on a transverse shaft 158. The member 105, as heretofore stated, meshes with gear 104 on cam shaft 91 and is driven thereby, this member 105 in turn meshing with a driving member 155, which latter in turn drives member 156, and so on. The member 105 is provided with

a duct 105′, member 155 with a duct 155′, member 156 with a duct 156′, and member 157 with a duct 157′. The ducts 105′ and 155′ are adapted to register with orifices 105″ and 155″ respectively, and these two orifices in turn are connected with a channel 159 provided in the casing 152. This channel 159 is connected to a suction pump 160 through a tube 161 which connects with the lower end of the casing 152. As the members 105 and 155 rotate, bringing their ducts into register with the said orifices, suction will be applied through tube 162 to the forwarder 151 and through tube 163 to the collapsible sucker 131 at the separator.

The duct 156′ in valve member 156 is adapted to register with orifice 156″ associated with channel 164 which is connected to a blower 165 through a tube 166. So long as the duct 156′ is in register with orifice 156″, the blast will pass through a tube 167 to the hollow foot clamp 132.

In Fig. 5 wherein there is shown only a single sheet separating mechanism 131 and 132, the connections 163 and 167 are shown as extending directly from the casing 106 to said devices 131 and 132. When, however, two separating mechanisms are employed I prefer to connect the suction tube 163 to a pipe 163′ (Figs. 9ª and 9ᵇ) from which pipe are leads 163″, 163″, to the two collapsible suckers 131. Also I prefer to connect the air tube 167 to bar 122 which is provided with a recess 122′, from which recess extend leads 122″, 122″, to the hollow foot clamps 132. The pipe 163′ is carried by brackets 123′, 124′ that are carried by the hollow bar 122. The suckers 131 and the foot clamps 132 are longitudinally adjustable along the bar 122.

An additional orifice 157″ is associated with the channel 164, and a blast would pass through the nipple 168 and through a suitable tube to any desired point where air might be required.

A stem 169 is screw-threaded into the end of casing 152 and operates to obturate the duct 157″ when the valve 157 is not in use. A stop 170 is provided to prevent the stem from being screwed outwardly so far that it may become disconnected.

The size of the ducts in the several rotary valves and their relative arrangements are determined by the particular sequence of operations that are to be performed. The valves may be removed from their shafts and replaced at any desired angular adjustment to insure that the suction and blast are being applied respectively at the proper times; and after this adjustment is once made it will be appreciated that the relation will be fixedly and accurately maintained by reason of the intermesh of the several rotary valve elements. As is indicated above one or more rotary valves might be employed. Further, the ducts might be provided in the casing and the ports in the rotary valve mechanism.

Automatic control of pile elevating mechanism

(Figs. 15 and 16. Sheets 9 and 10.)

The pile is automatically elevated so that the uppermost sheet of the pile is always presented to the separating mechanism in the desired manner at the desired place. The pile of sheets indicated at 171 (Fig. 16) is carried by the support 172 which is carried by a pair of brackets 173 that are connected by cross-rods 174 and 175, said brackets being provided with rollers 176 and 177 that engage the uprights 54 and 55 to facilitate the raising and lowering of the pile and the pile support.

A chain 178 is secured at one end to an angle piece 179 mounted on a bracket 180 that is carried by the cross-rod 53. This bracket 180 carries a spool 181 mounted on a shaft 182 on which the other end of said chain is wound. The chain 178 passes around an idler roller 183 carried by the cross-rod 175. The spool 181 is rotated in a clockwise direction (as seen in Fig. 16) to elevate the pile, and is rotated in a counter-clockwise direction to lower the pile.

The pile may be elevated automatically and may be elevated and lowered manually. The means whereby this automatic elevation of the pile is effected is controlled through a governor arm 184 on the free end of which is mounted a roller 185 that engages the topmost sheet of the pile. The other end of this arm is carried by a rod 186 on which it is adjustable angularly and longitudinally by means of a setscrew 187. The rod 186 is mounted at one end in the housing 133 of the forwarder mechanism and at the other end in the side frame of the feeder. On the end of the rod adjacent the side frame of the feeder is mounted an arm 188, the free end of which tends to move upwardly through the action of a spring 189, one end of which spring is connected to said arm 188 and the other of which is anchored to one arm of a lever 190 pivoted at 191 to the side-frame of the feeder. This arm 190 carries an adjusting screw 192 which bears on the free end of arm 188 so that a fine adjustment of the height of the governor roller may be effected. The other arm 193 of the lever which is pivoted at 191 is provided with a hook 194. This hook normally constitutes a stop to prevent the elevation of the pile. When, however, the pile has been lowered a predetermined distance, an arm or control member 201 that passes through said hook 194 and which is normally held stationary by the hook will no longer be stopped by the same.

The particular construction whereby this is effected embodies a U-shaped casting piv-

oted on a stub-shaft 195, said casting having two arms 196 and 197. The arm 196 carries in its free end a roller 198 that engages a cam 199 carried on the inner face of gear 90. This cam may be adjusted with respect to said arm 196 by means of the pin and slot connection 200. Projecting forwardly from said arm 196 is the control member 201 which is pivoted at 201′ on the arm 196 and supported at one end by a pin 201″ secured to the side frame 208 of the feeder. The control member 201 is further provided with a catch 202 that normally engages the hook on the member 194, and said control member is also provided with a cam 203 which engages said hook, as will be more fully hereinafter described. A spring 204 encircles a rod 205 which is pivoted on the arm 196 at 201′, one end of said spring reacting against a collar 206 on said rod and the other against an eyelet 207 receiving the free end of rod 205 and carried in the side frame 208 of the feeder. This spring 204 tends to hold the roller 198 in engagement with the cam199 and to maintain the catch 202 in engagement with the hook 194. Further, in view of the fact that the point 201′ is in a horizontal plane slightly higher than that of the pivot point 191, the spring 204 acts during the normal operation to depress the far end of the lever 190 to periodically elevate the governor roller 185.

To the free end of the arm 197 is connected one end of a link 209, the lower end of which is connected to one arm of a bell-crank lever 210, loosely pivoted on a pile elevating shaft 211, the other arm 212 of which carries a pawl 213 that is adapted to engage a ratchet 214 fixedly secured to the shaft 211. Rotation of this shaft in a clockwise direction, as seen in Fig. 15, effects an elevation of the pile support 172, by means of the rotation of the spool 181 through a worm 215 fixed on shaft part 211′ and engaging a worm wheel 216 fixedly mounted on shaft 182.

During the normal operation of the feeder, the cam 199 bears against the roller 198 sufficiently to counteract the pressure of the spring 204 to relieve the engagement of the catch 202 with the hook 194, so that if the roller 185 lowered sufficiently the hook 194 could disengage itself from the catch 202, in which event the spring 204 would force the arm 196 and the roller 198 forwardly so that the latter would follow the cam 199. Further, in this event, the arm 197 would swing downwardly, lowering the link 209, swinging the bell-crank 210—212 on its pivot 211 and raising the pawl 213 the distance of one ratchet tooth. Thereafter, as the arm 196 was forced rearwardly or toward the left (as seen in Fig. 15) by the cam 199, the shaft 211 would be rotated in a clockwise direction the distance of one ratchet tooth 214, thus elevating the pile support a corresponding distance. As this elevation of the pile support is effected, the catch 202 would again be automatically engaged with the hook 194.

It is necessary that the operation of the governor roller 185 in raising and lowering should not interfere with the operation of the forwarding suckers 151 in removing the sheet from the top of the pile. Heretofore the elevation of the governor roller to obviate this possibility has been effected by a separate cam, to time this action so as not to interfere with that of the forwarder. This required independent attention and adjustment and additional parts. In the present device the cam surface 203 on the member 201 has been provided so that, as the arm 196 and the cam member 201 move forwardly to follow the cam as the governor roller is lowered, the necessary elevation of the governor roller to permit of the removal of the sheet by the forwarder will be effected by the cam surface 203 engaging the top of the hook 194, thereby, through the connections described, elevating the roller 185 from the uppermost sheet of the pile.

It is pointed out that the two-arm lever pivoted at 191 is so fulcrumed as to be rocked during the normal operation of the device by the spring 204 to remove the governor roller from the pile. The weight of the roller 185 lowers it onto the pile when the cam forces the roller 198 to the left.

Independent elevation and depression of pile support

(Figs. 15, 16, 17, 18, 19. Sheets 9 and 10.)

As heretofore described, the pile is automatically elevated under the control of the governor roller 185. It is necessary to lower the support to replenish the pile and to raise the pile to the proper feeding position. It is desirable that this be accomplished rapidly and effectively. Heretofore, in lowering the support, it has been necessary to disconnect the feed means, such as the pawl 213 and the ratchet 214. By the present invention means are provided whereby it is unnecessary to disconnect these operative parts at any time, either when the support is being lowered or when it is being raised. This simplifies the construction and operation of the device and obviates the danger of any breakage.

This end is secured by making the shaft 211 separable and preferably in two parts, one part carrying a clutch member 217 and the other part 211 carrying a clutch member 218, which latter is formed integrally with the worm 215. The clutch members 217 and 218 have cooperating jaws so that during the normal automatic operation of the device to elevate the support the shaft functions as a one-piece shaft. When it is desired to lower the support the part 211′ of said shaft is disconnected, preferably by moving it longitudinally to uncouple the clutch, thereby permitting the part 211 of the shaft to remain sta-

tionary. Under these conditions, rotation of the part 211′ of the shaft will operate to rotate the spool 181 in a counter-clockwise direction to lower the support. The uncoupling of the shaft members 211 and 211′ is effected by means of a handle 219 or other suitable mechanism that engages the end of the shaft 211′. This handle is provided with a cam groove 220 that engages a pin 221 carried by the end of said shaft 211′. When the handle 219 is moved in the direction of the arrow (Fig. 16), the initial movement of the handle will, through said cam and pin connection, effect a longitudinal displacement of the shaft 211′, thus uncoupling the clutch 217—218, and the continued rotation of said handle will lower the pile support as described. Reverse rotation of the handle will elevate the pile support, but in this reverse rotation the two parts of the shaft will turn as a unit, the ratchet 214 simply rotating idly under the pawl 213. The end thrust exerted at the worm 215 will hold the clutch members in engagement even though the pressure is not being exerted against the flat engaging faces of the clutches. It will be understood that the lowering or raising might be effected through suitable power connections in place of the handle 219.

A plate 222 against which the rear of the pile of sheet rests, is provided with a transverse strip 223 on which are mounted, by a pin and slot connection 224, a pair of plates 225 which may be vertically adjustable to compensate for different heights and sizes of sheets, if desired.

Sheet calipering mechanism

(Figs. 1, 7, 8, 15, and 20. Sheets 1, 4, 9, 11, and 13.)

The successive sheets as they pass between the rollers 136 and feed roller 113 also pass between the two elements 226 and 227 of a calipering mechanism positioned in the line of feed of the sheets. If only a single sheet is fed, the device will not operate. If more than one sheet is fed, or if more than one thickness is presented to the calipering elements, the calipering mechanism will operate to interrupt the various feeding operations.

The calipering member 226 is preferably a roller over which the sheet passes and the calipering member 227 is preferably a pivoted segment under which the sheet passes, and means are provided for adjusting these elements toward and from one another. This adjustment is secured by means of a lever 228 pivoted at 229 to the caliper housing, said lever being of substantially U-shape and carrying in one end an adjusting screw 230 that rests on the top of a fixed stationary plate 231 secured to the housing 232 which latter is adjustable along the tube 140 and fixed in any desired position of adjustment by means of the set-screw 233. The adjusting screw 230 is maintained in engagement with the plate 231, by a spring 233′ which has its opposite extremities connected with the forward end of lever 228 and a projection 233″ of the housing 232, respectively. The segment is pivoted to the lever 228 at 234, and adjustment of the latter will effect the movement of the upper member toward or from the lower member.

The roller 226 is mounted on a shaft 235 carried by a part of the housing 232. This roller is rotated by a conveyor tape 236. To effect this rotation a rubber coating 226′ is placed over part of said roller 226, and is engaged by said conveyor tape 236. Said tape is pressed into engagement with said rubber coating 226′ by a roller 237 that is mounted on the arm 238 carried by the lever 228, the pressure of said roller 237 on the conveyor tape 236 being adjusted by means of a spring 239, the spring adjustment being modified by the adjusting nut 240.

When a sheet passes between the roller 226 and the sector 227 during the normal operation of the machine, when only one sheet at a time is being fed, the sector will remain substantially stationary. If, however, more than a single thickness is fed between the roller and the sector, the sector will move in the direction of the sheet feed, thus moving the upper end of the sector. This upper end carries a pin 241 that engages in a slot 242 in the free end of a lever 243, the other end of which is secured to a transverse rod 244. The movement of this lever will cause the transverse rod to be swung in a clockwise direction (Fig. 20). A detent 245 carried by this rod will accordingly be swung away from a weighted pendent 246 provided with a tooth 247, which weighted pendent is pivoted on a pin 248 which projects through a slot 249 in the side frame of the feeder and which pin is carried by one arm 250 of a bell-crank lever which is pinned to the clutch throw-out shaft 251. The pendent 246 is so weighted that when the detent 245 is swung away from the same a tooth on the pendent 246 will be moved into engagement with one of the teeth on a ratchet wheel 252 mounted on the feed roller shaft 112.

The bell-crank lever 250 which is pivoted on the clutch throw-out shaft 251 is provided with a snap-action spring 253, a pin being pivoted to one end of the lever and passing through an eye-bolt secured to the side frame of the feeder, a pin 254 (Fig. 1) being pivoted to one end of the lever and passing through an eye-bolt 255 secured to the side frame of the feeder. The spring 253 which encircles the pin 254 reacts against one arm of the bell-crank 250 and the eye-bolt 255. The eye-bolt 255 is so positioned with respect to the point at which the pin is connected to the bell-crank lever 250 as to securely hold the same

against a stud 256 fixed to the side of the feeder frame. This position of the parts corresponds to the normal operation of the machine when the caliper is not operated.

When the caliper is operated and the rotation of the feed roller shaft 112 causes the weighted pendent 246 to be depressed, the bell-crank 250 will rock the shaft 251 and the spring 253 will hold it fixedly in that position until the parts are manually returned to their upper position. Referring particularly to Fig. 20, Sheet 11, it is noted that the clutch throw-out shaft 251 extends completely across the machine, said shaft projecting through tubes 140 and 120. On said shaft 251, preferably at the end remote from the bell-crank 250, is an arm 257 in the free end of which is mounted a roller 258 which when shaft 251 is rocked as aforesaid, engages between the two parts 92 and 93 of the clutch member. The part 92 of the clutch member is provided with a cam surface 92′ which, as the clutch rotates, will engage said roller 258, and said part of the clutch will accordingly be forced out of engagement with the other part 93 of the clutch which is mounted on the driving end of the cam shaft. A shoe 258′ engages the face 93′ of the clutch member 93 when the shaft 251 is rocked to engage roller 258 with the cam on clutch part 92. This facilitates the separation of the two parts of the clutch, and holds the clutch part 93 in place during this operation.

Inasmuch as all of the operations at the feeding end of the machine are controlled by the driven member 92 of the clutch which has been moved out of engagement with the driving member 93 of the clutch, it will be seen that the operation of the calipering device entirely interrupts the feeding operation of the feeder and that, inasmuch as no sheets are being fed to the forward end of the feeder, the detector (which will be hereinafter described) will operate to trip the press. The net result is that the calipering device operates to trip and stop not only the feeder, but indirectly the press.

It will therefore be appreciated that when the shaft 244 is rocked by the movement of the sector in the direction that the sheet is fed, the detent 245 will be swung away from the weighted pendent 246 so that the latter will engage the ratchet 252 and be depressed by the rotation of said ratchet, thus, through the bell-crank 250, rocking the clutch throw-out shaft 251 and depressing the arm 257 so that the roller 258 will engage the cam surface 92′ on the clutch member 92, thus separating the two parts of the clutch and stopping the operations of the feeding mechanism. It will be noted that this calipering device has no timed element and that, therefore, the parts will be immediately set upon the action of the calipering member.

Tape conveyor

(Figs. 1, 2, 3, 4, 15, 20, 21, 22, 23, 24, 25, 26. Sheets 1, 2, 9, 11, 12, 13, 14.)

The sheet is fed from the feed roller 113 onto a conveyor, here shown as comprising the tape 236 and a plurality of tapes 259, that carry the sheets to the slow down, straightening and registering devices. These tapes, as heretofore stated, pass around and are driven by the feed roller 113. The upper reaches of the tapes pass forwardly around a member or roller 260 that is carried by a pivoted frame constituted by the stay shaft 52 and the side frames 261 and 262, and the lower reaches of the tapes pass backwardly parallel with the upper reaches and over an idler roller 263 mounted on a stay shaft fixed to the frame of the feeder. From this idler roller the tapes pass downwardly in a vertical direction and then upwardly over a second idler roller 264 parallel with the roller 263, and then back around the feed roller 113. Preferably carried in the loop of each tape is a counterweight 265 which is provided with an idler roller 266 around which the tape passes. A rod 267 passes through elongated openings 268 in each of the counterweights to prevent them from swinging idly. These counterweights hold the tapes 259 at the proper tension and also act as a counterbalance when the conveyor frame is being raised or lowered through a wide angle (Fig. 2) to inoperative and operative positions above and below the top of roller 113, respectively. The tapes are made of a length to accommodate sheets of various sizes, so that said tapes will pass around roller 260 in whatever position the said roller may be moved.

This roller 260 is mounted in each end in a carriage 269, each end of the roller engaging a stud 270 projecting from the carriage. The two carriages are connected by a stay shaft 271. Each carriage is mounted and movable along one of the side members 261, 262 of the pivoted frame. Between the two side frames extend three transverse rods or bars on each of which is mounted a plurality of sleeves which are adjustable along their respective bars. The sleeves 272 of the rearmost bar 273 carry a plurality of top rods 274 between which and the tapes 259 each sheet passes. These particular top rods 274 pass rearwardly over the feed roller 113, and together with the sleeves 272 are adjustable transversely along the rod 273. Each sleeve 272 is provided with a forwardly extending lug 275 that is adapted to engage the transverse rod or shaft 276 to prevent too great an angular movement of the rod 273. This construction permits the rods 274 to pivot about the rods 273 when the frame is swung upwardly or downwardly, so that the said rods 274 will automatically assume their proper position with respect to the tapes 259.

Lugs 274' on shaft 273 engage a suitable abutment and limit the downward movement of top rods 274.

The transverse rod 276 carries a plurality of sleeves 277 between which and the sleeves 278 carried by the third transverse rod 279 there extends another series of top rods 280. The transverse rod 279 is vertically adjustable by means of a pair of screws 281 that pass through the same and also through a bearing 282 on the side members 261, 262. A screw and bearing is thus provided at each end of rod 279. This is for the purpose of adjusting the height of the top rods 280 with respect to the tapes 259 so that the top rods may be adjusted as the tapes are shortened and lengthened for different sizes of sheets. It will be understood that the normal inclination of these top rods 280 is downwardly toward the press guides, and that when the tapes are lengthened to handle smaller sheets it will be necessary to elevate the top rods 280. If the tapes are shortened to handle larger sheets, these top rods 280 will be lowered. Preferably the tapes are so associated with the feed board as to deliver the sheets thereon so that the latter will be delivered to the press at the angle of the feed board.

The tapes are lengthened and shortened by moving the pair of carriages 269 in which are carried the transverse roller 260 around which the tapes pass. The side members 262 along which these carriages 269 are moved are provided along their upper surfaces with rack teeth 281. Mounted in each of said carriages on a stud 282 is a pinion 283 (Fig. 25) that meshes with each rack teeth 281. Meshing with said pinion is an elongated spur gear 284 that is fixed on shaft 271. This shaft 271 is provided on one end with a hand-wheel 285 and rotation of the same in a clockwise direction, as seen in Fig. 22, will move the carriages 269 forwardly toward the press, thus lengthening the carrying surfaces of the tapes 259. Said carriages are held in their adjusted position on the rack teeth 281 by means of a latch 286 pivoted on one of said carriages at 287 and having a tooth 288 (Fig. 3) that projects through an opening 289 in the top of said carriage into engagement with the rack teeth 281. This carriage, as will be particularly seen from Figs. 3 and 25, is constituted by a casting having flanges 269' and 269'' from which the bearings for the shafts 260 and 271 project, and a cover 290 engages said flanges and encloses the operative parts within the carriage, being held in place by a plurality of screws 291 or otherwise. When it is desired to shorten the carrying surfaces of the tapes 259, the latch 286 is raised and the hand-wheel 285 is turned in a counter-clockwise direction as seen in Fig. 22. The counterweights 265 carried by the tapes 259 always tend to shorten the carrying surfaces of the same and thus assist the counter-clockwise movement of the hand-wheel 285.

On the shaft 271, on which the hand-wheel 285 is mounted, there is carried a pair of drive-up wheels 292 and a pair of tail brushes 293. These drive-up wheels and the tail brushes are mounted on arms 294, 294', respectively, and together with said arms, may be adjusted along the shaft 271 to any desired position. Each of the arms 294, 294' is provided with a pair of eyelets 295 through which the shaft 271 projects. Each of the arms 294, 294' is held in position by a collar 296 which is feathered on the shaft 271 and spaced between the eyelets 295. Each collar is provided with a recess 296' in which engages a small arch-shaped piece of clock spring 297 (Fig. 26). A screw 298 passes through the collar 296 and presses upon the clock spring 297 to hold the adjacent arm in any desired position of adjustment. Projecting rearwardly from each arm 294 is a rod 299 on which there is carried a counterweight 300 which can be slid along said rod and held in any desired position by a set-screw 301. This counterweight determines the pressure that the drive-up roller 292 will exert on the sheet.

The drive-up wheels 292 and the tail brushes 293 are thus provided with similar mountings on the shaft 271. In addition, the tail brushes 293 have longitudinal adjustment along their arms 294' by means of the pin and slot connections 302 (Fig. 26).

The function of these drive-up rollers is to positively feed the sheet forward into engaging position with the slow-down devices hereinafter described. As will be observed, these drive-up wheels rest upon and are rotated by the roller 260 around which the tapes 259 pass, and accordingly these drive-up rollers exercise a positive drive and control on the sheets until the forward edges of the same are about to pass under the control of the slow-down mechanism. In view of the fact that these drive-up wheels are carried by the shaft 271, they always have a definite relation to the shaft 260 on which they rest and by which they are rotated.

The tail brushes 293, as clearly seen in Fig. 24, project forwardly beyond the range of movement of the drive-up rollers 292. As seen in Fig. 24, these brushes are in engagement with the rear edge 295 of the sheet 296. In the position shown, the front edge of the sheet 296 has passed the slow-down straightening and registering mechanism and is in engagement with the press guides, and side registry is in process. The function of the tail brushes is to prevent any backward movement of the sheet away from the press guides, and any such movement is promptly resisted by the engagement with the edge 295 of the bristles of the tail brushes 293.

Adjacent tape roller 260 and carried by the feed board is a guide plate 303 (Fig. 23) in-

clined downwardly in a fore and aft position with its lower front edge in engagement with the feed board so that the sheets are guided from off the tapes 259 onto the feed board of the press. This guide plate is provided with a pair of rearwardly extending arms 304 that pass over the roller 260, the rear extremities of said arms engaging the under side of the bearings 305 that carry the shaft 271. It will thus be seen that, through these connections, as the conveyor frame is raised or lowered, the plate 303 will be raised and lowered therewith.

As seen particularly in Figs. 22 and 23, the rod 279 has mounted thereon a pair of guides 306. These guides may each be held in any desired position of angular adjustment with respect to rod 279 by means of set-screw 307, and said guides may each be held in any desired position of vertical adjustment with respect to the feed board or plate 303 by means of the pin and slot connection 308. The forward extremities of these guides each carry a ball bearing 309 which is carried by a suitable recess, the ball being held in place by a cover 310. The function of these guides is to properly guide the sheet to the side registering mechanism and the weight of the ball bearings tends to hold the sheet straight as it is being moved by the side registering mechanism. In Fig. 22 the guides are shown in the position they occupy with respect to their associated mechanism in handling one size of sheet. In Fig. 23 the guides are shown in the position they may occupy in handling smaller sheets; that is to say, the roller 260 and the inclined plate 303 have been moved to their foremost position so that the guides 306 are operating directly over the inclined plate 303.

The conveyor frame may be moved to an elevated position when the feeder is swung away from the press (if a pivoted feeder is employed) or at any other desired time and for any of various reasons, as will be apparent to those skilled in the art, and this without disconnecting any of the parts or affecting or requiring any adjustments. When swung to its upward position it may be held there by engagement of a suitable latch 311 (Fig. 21). As shown the latch 311 has a limited movement of rotation and is pivoted on a stud 312 projecting from one of the side frames of the feeder, and this latch is adapted to engage by gravity a stud 313 mounted on the side member 262 of the conveyor frame. A cam face 314 on the front of the latch engages the stud 313 as the frame is elevated, so that the latch is automatically cammed into latching engagement with said stud. When it is desired to lower the conveyor frame, it is only necessary to raise said latch and to permit the frame to lower against the action of the counterweights 265.

Feed board

(Figs. 2, 13, 14, and 15. Sheets 2, 13, 14 and 15.)

As heretofore stated, the sheets pass from the tapes 259 over the inclined plate 303 and onto the feed board of the press on the front end of which is mounted the slow-down and front registering mechanism and also the side registering mechanism, the sheets being delivered onto the feed board at a distance from the slow-down, straightening and registering mechanism substantially that of the length of the sheet. As here shown, the feed board is composed of a plurality of parts 315, 316 and 317. In some cases a greater or less number of sections may be employed or the feed board may, for certain purposes of the invention, be simply a sheet support made of a single piece. As here shown, the sections or parts 315 and 316 are pivoted on a cross-bar 318 mounted in the side frames of the press. The section 315 is provided with a pair of rearwardly extending arms 319 that are secured to the under side of the section and on which are carried a pair of counterweights 320. When the forward section is swung to the position shown in dotted lines in Fig. 2 and in full lines in Fig. 15, the counterweights will act to counter-balance the board. In certain instances, it is, however, desirable to positively latch the section in its elevated position and, for this purpose, there is provided an arm 321 pivoted to the frame of the press at 322 and provided with a recess 323. When the section 315 is swung to its uppermost position, the recess 323 engages a pin 324 carried by one of the counterweights 320 and positively holds said section 315 in its elevated position. When it is desired to lower said section it is only necessary to raise the lever out of engagement with the pin 324.

The section 316 may also be elevated about pivot 318, said section staying in its upright position as it passes beyond a vertical plane through the axis 318. Section 317 is, as shown, hinged to the section 316. During the normal operation of the press, this section is in the position shown in full lines in Fig. 2. When, however, the feeder is moved away from the press and it is desired to feed the press by hand, the section 317 is elevated into alignment with sections 315 and 316 and latches (not shown) on said section 317 snap into recesses in the side frames of the press and hold the same in its elevated position.

If desired, this feed board may be provided with anti-friction members 325 to lessen the friction between the feed board and the sheets. These members may be in the form of strips of any desired size or material and are preferably adjustable transversely of the feed board to compensate for sheets of

different sizes. As here shown, said anti-friction members 325 are carried by the section 315 of the feed board and are (as shown in Fig. 2) of substantially U-shape, so that said members are readily engaged with the top and under surfaces of section 315 and are held in any desired position of adjustment by the resiliency of the metal employed.

When section 315 of the feed board which carries the front and side guiding mechanism, the slow-down mechanism, the press feeding mechanism, and the driving connections for these parts, is elevated, ready access is had to the impression cylinder and other parts of the press and at the same time the said mechanisms carried thereby are maintained in position to function in their normal manner as soon as this section is again lowered.

Sheet slow-down, straightening and front registering mechanism

(Figs. 2, 3, 4, 5, 6, 22, 27, 28 and 29. Sheets 2, 3, 4, 13, 15 and 16.)

After the sheets pass from the tapes 259 and over the anti-friction members 325, they come under the influence of the sheet slow-down, straightening and registering mechanisms. This mechanism operates to quickly and efficiently slow-down the motion of the sheet and to straighten and register the sheet against the press guides without injury to the front edge of the sheet. After the front edge of the sheet engages the press guides, the slow-down sheet straightening and registering mechanism ceases to function, the sheet is operated on by the side registering mechanism and is then seized by the press grippers.

In the inventive embodiment shown, the sheet is fed into engagement with a pair of devices, each of which consists of two movable members one of which is positively driven and the other, preferably, frictionally driven therefrom. These members operate at a surface speed less than that of the conveyor. There is thus secured an efficient slowing down of the sheet as it is delivered to the press guides. Further, if the sheet is not presented squarely to the press guides it is straightened and registered by the action of the two members engaging the upper and the other the lower surface thereof. The timing of the two sets of slow-down, sheet straightening and registering devices is such that the upper and lower member of each device engages the sheet for a brief period after the front edge of the sheet is presented to the press guides. This results that if the sheet is not straight the advanced portion of the front edge of the sheet will be engaged with one press guide and the lower driven member at this side will be idly rotated in frictional engagement with the sheet. The two members of the other device will continue to advance the retarded edge of the sheet until it has been presented to its press guide. Thereupon, the sheet being straightened and registered, against the press guide, the two upper members will be elevated out of engagement with the upper surface of the sheet.

While for the purpose of the slow-down operation it is necessary that the cooperating members be moved at a speed slower than the linear speed of the conveyor, for the purpose of straightening and registering the sheet it is only necessary that the members should move or rotate without regard to the relative speed thereof and that of the conveyor. The action of the slow-down, sheet straightening and registering devices on the front edge of the sheet insures an efficient operation whatever the variation in size of the sheets being fed while, as here shown, two sets of slow-down, sheet straightening and registering devices are employed, one operating on each side of a center line of movement of the sheet, it may be desirable at times to use only a single device.

The slow-down, sheet straightening and registering mechanism is preferably operated through a flexible connection (particularly if a sectional or pivoted feed board is employed) from a suitable source of power. As here shown, I use the Bowden wire connection 79 (Figs. 6 and 27) the forward end of which is journaled on one of a pair of brackets 405 mounted on the feed board section 315 as hereinafter described. The connection 79 carries on its forward end a bevel gear 326 that meshes with a bevel gear 327 mounted on a stub shaft 328 that is journaled in a bracket 328′ (Fig. 6) secured to or formed integrally with one of the brackets 405. This stub shaft carries a pinion 329 meshing with a gear 330 carried by a stub shaft 331 journaled on the bracket 328′. This gear 330 is provided with a cam groove 332 on its outer face in which engages a roller 333 carried by an arm 334 secured on the end of a shaft 335. This shaft is journaled on the brackets 405 and carries the upper members of the side registering mechanism, as will be hereinafter more fully described.

On the inside of gear 330 is formed a second cam groove 336 (Fig. 22) in which engages a roller 337 carried in the free end of an arm 338 mounted on a tube 339 that is also journaled on the brackets 405. On this tube 339 is mounted the upper members of the slow-down sheet straightening and registering mechanism as well as the detector pendulums. Meshing with gear 330 is a pinion 340 that is mounted on the end of shaft 341. This shaft 341 (Fig. 27) has feathered thereon a pair of bevel pinions 342 and 343. These pinions drive the lower members of the side registering mechanism. Said shaft 341 also has feathered thereto two rollers 344 and 345 which constitute the lower members of the

slow-down sheet straightening and registering mechanism. As will be seen from Fig. 27, shaft 341 is mounted in bearings 346 and 347 which are carried on the under face of section 315 of the feed board. Through the connections described, this shaft 341 is driven at a speed less than the linear speed of movement of the conveyor tapes.

Each slow-down sheet straightening and registering device, as here shown, is adjustable transversely along the tube 339 at the front edge of the feed board. The upper members of the sheet slow-down straightening and registering device are periodically elevated out of engagement with the lower members by the oscillation of tube 339. Each of said devices has a block 348 (Figs. 28 and 29) feathered onto the tube 339, the feather 349 engaging in a slot 350 in the tube. A screw 351 engages the feather 349 and holds the block in any desired position of adjustment on the tube 339. Said block 348 is provided with a pair of ears 352 through which extends a pin 353, said pin passing through an eyelet 354 in the lower end of a vertically projecting pin 355 on which is mounted a spring 356 and an adjusting nut 356′ forming an abutment for one end of said spring. This pin 355 passes through an adjusting screw 357 forming an abutment for the opposite end of spring 356 and carried on a frame 358 having perforated ears 359 through which the tube 339 passes and on which said frame is loosely mounted. Said frame is positioned on said tube by said block 348.

A bell crank lever 360 may be and is preferably pivoted at 361 in said frame 358, the long arm 360′ of said lever being held downwardly under any desired tension by means of an adjusting nut 362, engaging a spring 363 carried by said pivot pin 361. The spring 363 is a tension spring, being anchored at one end to the bell crank 360 and at its other end to the side of the adjusting nut 362. The adjusting screw 357 through which the vertical pin 355 passes is provided with a screw-threaded portion 357′ that passes through a screw-threaded opening 358′ and engages the eyelet 354 and, if desired, the top of the upper surfaces of ears 352. This adjusting screw is operated to adjust the height of the upper slow-down member 364 which is mounted on a pin 365 carried by the frame 358. Said slow-down member is here shown as a roller grooved at 364′ and the long arm 360′ of the bell crank 360 passes through said groove in the slow-down roller.

This slow-down roller 364 cooperates with one of the rollers 344 or 345 mounted on shaft 341 which, as stated, is driven at such speed with respect to the surface speed of the tapes that the sheet is subjected to a slow-down action when the forward edge of the sheet is engaged between said rollers, and the speed of movement of the sheet is quickly slowed down to such a point as to insure against the breaking or buckling of the forward edge of the sheet against the press guides. The slow-down roller 364 is preferably frictionally rotated from the roller 344.

To maintain the adjusting screw 357 in the desired position of adjustment, a spring pressed plunger 366 engages the under surface thereof. This plunger is carried in a recess 367 in the frame 358, a spring 368 engaging the lower end of said plunger 366 and operating to hold the same in yielding engagement with the under surface of the adjusting nut 357.

The bell crank 360 is so mounted on its pivot 361 that the weight of the long arm 360′ cooperates at its highest efficiency with the slow-down rollers 344 or 345 and 364 to slow-down, straighten and register the sheet that is to be presented to the press guides. The long arm of this lever rests on a press guide tongue 369 that is carried by and adjustable along a slotted bar 370 carried on the under surface of the section 315 which bar carries the bearings 346 and 347 for shaft 341. The shaft 341 projects through said tongue and the rollers 344 and 345 are positioned in openings in said tongues. Said tongues are held in any adjusted position along said bar 370 by means of the adjusting nuts 371 (Fig. 27). It will thus be observed that adjustment of the press guide tongues will also effect the adjustment of the lower members 344 and 345 of the slow-down, sheet straightening and registering devices.

The tongues 369 are each provided with a channel 369′ which receives the long arm 360′ of the bell crank 360. As the sheet passes between the rollers 344 and 364, the long arm 360′ of the bell crank forces the same into the grooves 369′, thus slightly crimping the sheet and acting to prevent the sheet from buckling as it is fed into engagement with the press guides. An adjusting nut 372 is carried by the frame 358 and normally there is daylight between said nut and the short arm 360″ of the bell crank 360, but through this connection the long arm 360′ can be adjusted farther away from the tongue should it be desired to do so, as for example if very thick stock is being handled. As a matter of fact, with certain classes of stock the use of the lever 360 may be entirely omitted, if desired.

In association with the tongues 369 there may be employed one or more additional tongues 373 for supporting the front edge of the sheet as it passes to the press guides.

The press guides are, as here shown, two in number, one associated with each of the slow-down sheet straightening and front registering devices. Each of these guides

is carried by an arm 374 mounted on the front guide shaft 375 which is periodically raised and lowered during the normal operation of the machine. The guides comprise a pair of curved spring members 376 projecting on each side of the guide plate 377 which in turn straddles and bears upon the tongue 369. The spring members 376 insure the proper guiding of the sheet to the guide plate 377.

It will be understood that through the means described the front edge of the sheet will be brought to rest against the vertical plate of the press guide in an easy and efficient manner; and when the sheet has been moved into engagement with the guide plates 377 the tube 339 will be rocked by the cam 336 to remove the roller 364 and the long arm 360′ of the bell crank from engagement with the top of the sheet.

Side registering mechanism

(Figs. 1, 2, 22, 27, 30, 31, 32. Sheets 1, 2, 13, 15, 17.)

The sheet as it is fed forward to the slow-down, straightening and front registering mechanism also passes between the movable elements of the side registering device, and this side registering device operates to side register the sheet immediately after the front edge of the sheet has engaged the press guides and the front registering and straightening mechanism has been elevated out of engagement with the sheet by the rocking of the tube 339.

This side registering mechanism comprises essentially an upper and a lower member. The lower member here shown as a roller, is clearly illustrated in Fig. 27 and is indicated by the numeral 378. This roller 378 is a knurled roller and has bevel teeth 379 formed on the surface thereof, which teeth 379 mesh with a bevel gear 343 so that the knurled roller 378 is driven from the shaft 341. The knurled roller 378 is mounted on a stud 380 carried by a bracket 390 hereinafter referred to. The upper member or roller 381 is knurled on its periphery and is mounted on a plate 382 that is mounted on the shaft 335. The roller 381 is carried by a boss 383 mounted on said plate 382, said roller 381 being eccentrically mounted on the boss 383 by means of an eccentric stud 384. The eccentric mounting is clearly shown in dotted lines in Fig. 30. Member 381 is rotated from lower member 378 through engagement with the sheet to be side registered. Member 381 projects through an opening 385 in an extension 386 mounted on plate 382. This extension 386 is provided with a positioning guide 387 that projects through the bifurcated side register guide plate 388 against which the side edges of the sheet, shown in dotted lines in Fig. 31, is registered. The extremity of said guide member engages the front face 389 of the bracket or abutment 390 that carries the adjusting nut 391, the distance from the end of the positioning guide or member 387 to the center of the opening 385, therefore being the same as the distance from the center of the lower driven roller 378 to the face 389 of the bracket or abutment 390 (Fig. 31). This positioning guide 387 thus insures that the roller 381 shall always occupy the desired operative position with respect to the lower roller 378. The object of mounting the upper wheel 381 eccentrically on the stud 384 is to provide an adjustment between the guide plate 387 and the base plate of the side registering mechanism in order to facilitate the handling of sheets of different thicknesses, the plate 387 being adjusted closer to the base plate for the sheets to prevent buckling during the side registering operation.

It will be observed (see Fig. 27) that the bracket 390 may be adjusted transversely of section 315 of the feed board along the T-slotted bar 370, and fixed in any desired position of adjustment by the lock nut 392. It will be observed that this bracket carries therewith the adjusting nuts 391 and the lower knurled roller 378, the bevel gear 343 being movable with these parts to various positions of adjustment thereof. Adjustment of the plate 382 to correspond with the adjustment of these parts renders it desirable to secure with facility an accurate positioning of the upper rotary member 381 with respect to the knurled roller 378, and this positioning is effected laterally by means of the member 387 passing through the bifurcated side guide 388 into engagement with the face 389 of the bracket or abutment 390.

The bifurcated side guide plate 388 is carried by a screw 393 mounted in the bracket 390 and this plate 388 may be secured in any desired position of adjustment by means of the adjusting nuts 391.

The plate 382 is provided with an ear 394 to which the lower end of a pin 395 is pivoted. The upper end of this pin passes through a slot 396 in an arm 397 which is feathered on shaft 335. A spring 398 reacts against the lower face of said arm through a washer and the other end of said spring reacts against an adjusting nut 399 on a screw threaded part of said pin. The tension of the spring 398 is adjusted by this adjusting nut 399 and the positioning of the upper member 381 vertically with respect to the lower member 378 is secured by a nut 400 carried on the end of this pin. This nut is provided with a pair of keys 401 that engage in the slot 396 in the arm 397. When it is desired to modify the relation of the upper member 381 with respect to the lower member 378, the pin 395 is elevated so that the keys 401 are removed from the slot 396, the nut 400 is then rotated and the keys are permitted to reenter the slot. The

nut 400 provided with the keys 401 is also utilized when one or the other of the side registering devices is disconnected, this disconnection being readily effected by elevating the pin 395 and turning the nut so that the keys are disposed transversely of the slot 396. This holds the upper feed roller out of operative relation with the lower fed roller. The plate 382 is loosely mounted on the shaft 335 and is positioned thereon by means of a set-screw 402 that engages a feather 403 carried by a key-way 404 in the shaft 335, said feather engaging in a recess in arm 397 which is also carried by the shaft 335. It will accordingly be understood that as the shaft 335 is oscillated through the arm 334 from the cam 332, the plate 382 and the roller 381 will be elevated and depressed by the movement of arm 397 and pin 395.

The ends of the shaft 335 and the tube 339 are rotatably mounted in brackets 405 (Fig. 27), which brackets are carried on the upper face of the metal base-plate 406 that is secured to the front edge of the section 315 of the feed board by screws or other suitable means. The key-slot bar 370 as heretofore described, is secured to the under face of the metal base-plate 406. It will accordingly be seen that all of the parts carried by the shafts 335, 341 and the tube 339 are mounted on one side or the other of the metal base-plate 406, and that accordingly all of said parts can be removed as a unit from the feed board by removing the metal base-plate 406.

Further, in view of the fact that the metal base-plate 406 is carried by the section 315 of the feed board, all of the parts may be elevated and lowered with said section as a unit. In view of the fact that these parts are driven through the flexible Bowden wire connection 79, the section 315 of the board and all of the parts described can be elevated for the purpose of "make ready" or any other purpose without disconnecting any of the parts or affecting any of the adjustments, and, reversely after the "make ready" has been effected the section 315 may be lowered into operative relation with the press without disturbing the relation of any of the parts at the forward end of the feed board or affecting the timing or adjustment thereof. It will be understood that the cams 332 and 336 are so timed as to provide the proper sequence of operations with respect to the slow-down, sheet straightening and side registering operations.

Sheet detector

(Figs. 1, 2, 22, 27, 33, 34, 35, 36, 37, 38. Sheets 1, 2, 13, 15, 18, 19, 20.)

A sheet detector is preferably provided which operates to trip the press or other instrumentality in the event that no sheet is delivered to the press guides or in the event that the sheet is improperly presented to the press guides. The tripping of the press prevents the operation of the impression cylinder.

This detector mechanism preferably comprises an arm 407 which is carried by the tube 339 that carries the slow-down, straightening and registering mechanism and is secured thereon by means of a set-screw 408 which bears on a key 409 carried in the key-way 350. This arm 407 is provided with an extension 410 which is adjustable longitudinally of said arm 407 by means of the pin and slot connection 411. A rod 412 is carried in said tube 335, and to this rod there is secured in any desired manner, as by a screw threaded connection, an arm 413. This arm is in two parts and may be lengthened or shortened by means of the sleeve 414 and the adjusting screw 415. In the free end of said arm is pivoted at 416 a pendent 417. Also mounted on this pivot is a second pendent 418 which is normally held in the position shown in full lines in Fig. 33.

The arm 407 being carried by the tube 339 that carries the slow-down and sheet straightening and registering mechanism, it will be appreciated that said arm 407 is vertically oscillated with the slow-down and sheet straightening and registering mechanisms. Just before the sheet reaches the press guides and after it has been operated upon by the slow-down and sheet straightening and registering mechanism, the front edge of the same engages the pendent 417 and swings it toward the left as seen in Fig. 33. This permits the arm 407 to freely rise as the sleeve 335 is oscillated. In the event that no sheet comes in contact with the pendent 417, the parts will remain in the position shown in Fig. 33, with the end of the extension 410 engaging the shoulder 419 on the pendent 417. Accordingly, as the arm 407 is elevated the arm 413 will likewise be elevated, thus rotating the rod 412. The rotation of this rod effects the tripping of the press.

On the end of the rod 412 is mounted an arm 420 between the free end of which and the section 315 of the feed board is a compression spring 421 that tends to hold the arm 413 in the position shown in Fig. 33. Also mounted on the end of said rod 412 is a second arm 422 to which is pivoted a depending part 423. The lower end of this depending part is provided with a hook over which engages one end of a link 424, the other end of which is secured to one arm 425 of a bell crank lever pivoted at 426, the other arm of which lever 427 carries a roller 428 that engages in a notch or cut-out portion 429 in cam disk 430 pivoted on a stub shaft 431 carried in a casting 431′ secured to one of the side frames of the press. This cam disk 430 is provided with a cam slot 432 in which engages a roller 433 mounted on the upper end

of a power device. This power device includes a plunger 434 which projects into a cylinder 435 and carries a piston 436 between which and the top of the cylinder there is confined a compression spring 437 which normally tends to force the parts associated therewith downwardly.

The lower end of said plunger 434 projects through the lower end of the cylinder 435 and is connected to the upper end of a link 438, the lower end of which is connected to a lever 439 pivoted at 440 which lever is provided with a cam face 441 that engages the edge 442 of a foot treadle 443 carried on the upper end of a treadle arm 444. This treadle arm passes through an opening 445′ in the foot board 445 and is provided on each side with a fin 446 which fins are spaced from the underside of the treadle a distance corresponding approximately to the thickness of the foot board. As will be hereinafter more fully described, when the treadle is depressed, these fins will engage the under imperforate part of the foot board and hold the parts in a depressed, locked position.

The lower end of the foot treadle 444 is pivoted to the free end of an arm 447 which is carried on a transverse shaft 448. A spring 449 connected at one end to the arm 447, and anchored at the other end to the frame of the press by means of a hook 450, tends normally to hold the parts in an elevated position. On the end of the transverse shaft 448, remote from the arm 447, is mounted a lever 451 provided with a cam slot 452 that engages a roller 453 carried on an arm 454, the operation of which trips the press in any usual or well known manner.

Through the connections described, the impression cylinder will be tripped. Power is preferably cut off either by opening or closing the electric circuit, as the case may be, when the plunger 404 is depressed.

Carried on the upper end of the plunger 434 is a transverse arm 455 in the free end of which is carried a rod 456 provided with a cam face 456′ that is adapted to rock a bell crank lever pivoted at 457. One arm 458 of the bell crank lever carries the switch contacts, or other means for opening or closing a circuit, and the arm 459 carries a roller 460 that is engaged by the cam 456′. A spring 461 tends to hold the parts in the position shown in Fig. 35. As the plunger 434 is lowered, the cam 456′ will engage the roller 460 and rock the bell crank lever to open the contacts.

The member 456 is made adjustable in the arm 455 by means of a set-screw 462. The reason for this is that it is sometimes necessary to operate on an open circuit arrangement. When this is the case the cam 456′ will normally engage the roller 460 to hold the arm 458 away from the contacts. Under these conditions, when the plunger 434 is lowered the power will be cut off by the engaging of the contacts, this being effected by the cam surface 456′ passing out of engagement with the roller 460.

As the plunger 434 is lowered it will be understood that the treadle lever will be depressed through the opening 445′ in the foot board 445 until the fins 446 have passed through the board. The action of the cam 441 at that time will cause the foot treadle to be swung toward the left to the dotted line position (Fig. 36) so that the fins will then engage the underside of the foot board, and thus lock the parts in that position. When it is desired to return the parts to their set or normal position, this may be readily effected by bearing down on the pedal member 463 which will rock the lever 439 around the pivot 440, thus returning the plunger and associated parts to their uppermost position and automatically repositioning the roller 428 in the notch 429, the roller snapping into this position under the influence of the spring 464 which encircles the pivot 426. After this has been effected, the press cylinder is released by moving the foot-treadle slightly to the right so that the fins 446 will again assume the position shown in full lines in Fig. 35, under the influence of the spring 449.

It is pointed out that the roller 433 that engages and rides in the camway 432 is not positioned in exact alignment with the stub shaft 431, but is arranged slightly eccentric thereto as clearly shown in the dotted line position 433′ in Fig. 37. The reason for this is to insure a facility of rotation of the cam disk 430 when the roller 428 is rocked out of engagement with the notch 429. In view of the fact that this roller 433 is mounted so nearly concentric with the axis of the shaft 431, it requires very little effort to remove the roller 428 from the notch 429. In view of the necessity for a strong spring 437 and in view of the fact that it is desirable to release the spring by a very slight effort, it will be appreciated that the particular eccentric mounting of the roller 433 with respect to the axis of the stub shaft 431 is a matter of importance, inasmuch as it secures a firm and positive control of a large force in a positive and yet sensitive manner.

While the device, as illustrated, is shown in association with a control for an electric circuit, it will be understood that many presses are driven by belt power and that this same mechanism is adapted for the shifting of the belt from a tight to a loose pulley.

In order to facilitate the removal of the pendent 417 after the same has been engaged by the free edge of the sheet and to prevent said pendent from unduly pressing upon or interfering with the advance of the sheet, a cam 465 is preferably mounted thereon, which cam is engaged by the extension 410 as the finger 407 is elevated, thus camming the

pendent 417 upward and outward and away from the sheet.

The second pendent 418 which, as heretofore described, is pivoted on the axis 416, is provided with a horizontal arm 466 which projects forwardly and is normally engaged by a short arm 467 of a delivery detector 468 pivoted at 469 on a stay shaft 470. This delivery detector 468 may be adjusted angularly about said stay shaft 470 by means of the adjusting screw 471, and said detector may be raised or lowered with respect to the press stripper fingers 472 by means of the telescoping connection 473. This detector 468 may also be adjusted longitudinally of the stay shaft 470 and, in view thereof, the short arm 467 is provided with an extended surface 474 that engages the under surface of the arm 466. This short arm 467 is adjustable with respect to the arm 466 by means of a set-screw 475.

In the normal operation of the parts, when sheets are being delivered from the impression cylinder 476, the delivery detector 468 and associated parts occupy the position shown in full lines in Fig. 33. If, however, a sheet should be improperly delivered from the impression cylinder, the detector 468 would be elevated to the dotted line position shown in Fig. 33 by the buckling or crumpling of the sheet, thus lowering the short arm to the dotted line position, and thus permitting the arm 466 to lower to the dotted line position 466′. This would accordingly permit the second pendent 418 to swing down into a position where the shoulder 477 thereon would be engaged by the extension 410 on the next elevation of the arm 407. When this is effected the rod 412 would be rotated as heretofore described in connection with pendent 417, and the operation of the control mechanism to trip the impression cylinder and stop the press would be repeated.

In order to insure the proper engagement of the sheets with the pendent 417, there is preferably provided a plate 478 (Figs. 27, 33 and 34) mounted on a bracket 479 carried by the T-slot bar 370. This plate 478 has a cut-out portion 480 in which the free end of the pendent 417 normally engages, and in which the free end of the second pendent 418 engages when it is lowered by the operation of the delivery detector 468.

Operation

Assuming that the feeder is swung away from the press, and the conveyor frame and the member 315 of the feed-board to be in the position shown in dotted lines in Fig. 2, in order to start the automatic feeding of sheets, the feeder frame would first be swung into association with the press and locked there by means of the locking member 60, (Fig. 4). Thereafter, the section 315 of the feed-board and the conveyor frame would be lowered to the full line position shown in Fig. 2. The parts being now in their operative position, the press is started by throwing the switch 481 (Fig. 1) and through the drive connections described, power will be transmitted from the intermediate gear 64 (Fig. 5) to the mechanisms at the rear end of the feeder and also to the mechanisms at the front end of the feeder. Successive sheets will be separated by the devices, preferably operating along the rear edge of the sheet, and then forwarded by the forwarding mechanism 151 onto the conveyor tapes 259, at which time the sheet then passes through the caliper and is progressed forwardly between the roller 260 and the drive-up rollers 292. These rollers deliver the sheets into position to be operated on by the slow-down and sheet straightening and registering mechanism. After the sheet passes this mechanism, it engages the press guides and at this time the rear edge of the sheet is engaged by the tail brushes 293. Immediately after the sheet engages the press guides and the slow-down and sheet straightening and registering mechanism has been elevated, the side registering mechanism operates on the sheet to side register the same. Thereafter the side registering mechanism and the press guides are elevated, and the press grippers on the impression cylinder seize the forward edge of the sheet.

Through the mechanism described it will be observed that a positive control of the sheet is exercised at all times from the moment the forwarder engages the same, and it will also be noted that the movement of the sheet is uniform from the time the sheet is delivered by the forwarder to the conveyor until it is engaged by the slow-down and sheet-straightening mechanism; and that it is continuous until the sheet engages the press guides. These considerations make for simplicity of construction, speed of operation, and accuracy of control of the sheets. The construction described renders this feeder adaptable and efficient for use in connection with sheets of varying sizes, quality and characteristics. The simplicity of construction renders this feeder particularly adaptable for use in connection with small presses and the ease and simplicity of adjustment makes it effective, efficient and economical in both short and long runs.

While one expression of the inventive idea has been heretofore described and illustrated in detail, it is to be understood that the invention is not limited thereto, and that the inventive idea may be embodied in various mechanical expressions within the limits of the appended claims.

What is claimed is:

1. In combination, a device to be fed, a sheet feeder connected thereto, a conveyor for progressing the sheets to said device, a for-

warder mechanism delivering the sheets to said conveyor at substantially the linear speed of the latter, and slow-down mechanism engaging the front of the sheet as the rear of the sheet passes out of engagement with the conveyor.

2. In combination, a device to be fed, a sheet feeder connected thereto, a conveyor for progressing the sheets to said device, a forwarder mechanism delivering the sheets to said conveyor at substantially the linear speed of the latter, and slow-down mechanism and feed rollers the former engaging the front of the sheet while the latter is passing out of engagement with the rear thereof.

3. In combination, a device to be fed, a feeder connected thereto, sheet separating and feeding mechanism exercising a continuous control on the successive sheets until they are delivered to said device including a forwarder, a conveyor receiving the sheets therefrom, and a movable slow-down device spaced forwardly of said conveyor and engaging the front of the sheet while the rear thereof passes from the conveyor.

4. In combination, a device to be fed, an automatic feeder pivoted to said device, sheet feeding mechanism mounted on said feeder including a conveyor frame, and driving connections to the mechanism on said feeder uninterrupted at all times.

5. In combination, a device to be fed, an automatic feeder pivoted to said device, sheet separating and feeding mechanisms mounted on said feeder including a pivoted conveyor frame, and means for driving the mechanisms on said feeder uninterruptedly and always in timed relation so that the feeder may be adjusted and set when swung away from the device.

6. In combination, a device to be fed, a feeder frame pivoted thereto, and means for locking the feeder frame to the device comprising an apertured member secured to said device, a projection on the feeder frame adapted to engage in the aperture of said member, and a similarly apertured rotary element cooperating with said member, the apertures being brought into register when the projection is engaged and said element being then rotated to place said apertures out of alignment.

7. In combination, a device to be fed provided with a sheet support, a pile feeder pivoted to said device, sheet engaging mechanism on said feeder, sheet control mechanism at the front end of said support, and continuously connected means driving said sheet engaging and control mechanisms under all conditions.

8. In combination, a device to be fed having a feed board adapted to be elevated and lowered, a sheet feeder support adapted to be swung into and out of operative engagement with the device to be fed, sheet engaging devices arranged on the feed board and the sheet feeder support, and uninterrupted driving connections for said sheet engaging devices whatever the position of the sheet feeder support or that of the feed board.

9. In combination, a device to be fed, a sheet feeder support carrying a supply of sheets and adapted to be swung into and out of operative engagement with said device around a vertical axis, a power transmission device mounted on said axis, sheet engaging devices arranged on the sheet feeder support, and uninterrupted driving connections for said sheet engaging devices from said power transmission device whatever the position of the sheet feeder support.

10. In combination, a device to be fed, a sheet feeder support carrying a supply of sheets and adapted to be swung into and out of operative engagement with said device around a vertical axis, a power transmission device, sheet engaging devices arranged on the sheet feeder support, and uninterrupted driving connections for said sheet engaging devices from said power transmission device whatever the position of the sheet feeder support and maintaining the driving and driven parts in timed relation.

11. In combination, a device to be fed having a feed board adapted to be elevated and lowered, a sheet feeder support adapted to be swung into and out of operative engagement with said device and around a vertical axis, a power transmission device mounted on said axis, sheet engaging devices arranged on the feeder support and the feed board, and means for continuously driving said sheet engaging devices from said power transmission device whatever the position of the feeder support and feed board.

12. In combination, a device to be fed having a feed board adapted to be elevated and lowered, a sheet feeder support adapted to be swung into and out of operative engagement with said device and around a vertical axis, a power transmission device mounted on said axis, and means for uninterruptedly driving said sheet engaging devices from said power transmission device whatever the position of the feeder support and feed board and maintaining the driving and driven parts in timed relation.

13. In combination, a device to be fed, an automatic feeder for said device, a casing, power transmission gears mounted therein, sheet separating and control mechanism, and driving connections between said gears and said mechanism, said automatic feeder being pivotally movable about said gear casing.

14. In combination, a device to be fed, an automatic feeder for said device, a casing, power transmission gears mounted therein, sheet separating and control mechanism, and driving connections between said gears and said mechanism, said automatic feeder being

mounted on and pivotally movable about said gear casing and said driving connections being uninterrupted regardless of the position of said feeder.

15. In combination, a device to be fed, an automatic feeder for said device, a vertical shaft, a gear casing mounted in line therewith, power transmission gears mounted therein, sheet separating, feeding and control mechanism, and driving connections between said gears and said mechanism, said automatic feeder being mounted on and pivotally movable about said gear casing.

16. In combination, a device to be fed, an automatic feeder for said device, a gear casing, power transmission gears mounted therein, sheet separating and control mechanism, and flexible driving connections between said gears and said mechanism, said automatic feeder being mounted on and pivotally movable about said gear casing, and said driving connections being uninterrupted regardless of the position of said feeder.

17. In combination, a device to be fed, a feed board associated therewith and adapted to be raised and lowered, an automatic feeder for said device, a casing, power transmission gears mounted therein, sheet separating mechanism on said feeder, a sheet control mechanism on said feed board, and flexible driving connections between said gears and said mechanisms, said feeder being pivotally movable on said gear casing, and said driving connections being uninterrupted regardless of the position of said feeder or feed board.

18. In combination, a feed roller, sheet forwarding mechanism movable at a progressively increasing speed and alone engaging the sheets to deliver them uninterruptedly to said roller at substantially the linear speed thereof, and top rollers continuously engaging said feed roller during the normal operation of the device.

19. In combination, a feed roller, sheet forwarding mechanism adapted to be elevated, depressed and reciprocated, and means actuating said forwarding mechanism in its reciprocating movement at an increasing speed to deliver the sheets to the feed roller at substantially the linear speed of the latter.

20. In combination, a feed roller, sheet forwarding mechanism, and means for reciprocating the same to move the sheets toward the feed roller at an increasing speed and to deliver the sheets to the feed roller at substantially the linear speed of the latter.

21. In combination, a stay shaft, a forwarder frame mounted thereon, sheet carrier mechanism mounted on said frame, a tube encircling said shaft, and means oscillating said tube for reciprocating said carrier mechanism.

22. In combination, a feed roller, a stay shaft, a sheet forwarder frame carried thereby, sheet carrier mechanism mounted on said frame, a tube encircling said shaft, and cam operated means oscillating said tube for moving said sheet carrier mechanism toward said feed roller at an increasing speed.

23. In combination, a feed roller driven at a predetermined speed of rotation, a stay shaft, a forwarder frame carried thereby, sheet carrier mechanism mounted on said frame, a tube encircling said shaft, and cam operated means oscillating said tube for moving said sheet carrier mechanism toward said feed roller at an increasing speed and delivering the sheet to said feed roller at substantially the linear speed of the latter.

24. In combination, a sheet feeder, means to be fed therefrom, a single set of conveyor tapes interposed between the sheet feeder and said means, a driven shaft on the sheet feeder frame and around which said tapes pass, a roller around which the tapes also pass, a support for the roller connected with the sheet feeder frame, and rack and gear means for adjusting the roller and said shaft relatively to vary the effective length of the conveyor tapes.

25. In combination, a sheet feeder, means to be fed therefrom, a single set of conveyor tapes interposed between the sheet feeder and said means, a driven shaft on the sheet feeder frame and around which said tapes pass, a roller around which the tapes also pass, a support pivoted on the sheet feeder frame and carrying said roller, and rack and gear means for adjusting the roller and said shaft relatively to vary the effective length of the conveyor tapes.

26. In combination, a sheet feeder, means to be fed therefrom, a single set of conveyor tapes interposed between the sheet feeder and said means, a driven shaft on the sheet feeder frame and around which said tapes pass, a roller around which the tapes also pass, a conveyor frame carrying the roller and connected with the sheet feeder frame, a carriage for each end of the roller and slidably mounted on said conveyor frame, and rack and gear means for moving the carriages along the conveyor frame to vary the effective length of the conveyor tapes.

27. In combination, a sheet feeder, means to be fed therefrom, a single set of conveyor tapes interposed between the sheet feeder and said means, a driven shaft on the sheet feeder frame and around which the tapes pass, a roller around which the tapes also pass, a carriage for each end of the roller and slidably mounted on the conveyor frame, rack and gear means for moving the carriages along the conveyor frame to vary the effective length of the conveyor tapes, and means for fixing the carriages in any desired position of adjustment.

28. In combination, a sheet feeder, means to be fed therefrom, a single set of conveyor

tapes interposed between the sheet feeder and said means, a driven shaft on the sheet feeder frame and around which the tapes pass, a roller around which said tapes also pass, a conveyor frame carrying said roller and connected with the sheet feeder frame, a pair of carriages for the roller and slidably mounted on the conveyor frame, a rack for each carriage and extending along said conveyor frame, a driving gear on one of said carriages and meshing with one of the racks, and means for rotating said gear.

29. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a driven shaft, a conveyor passing therearound, a roller around which the conveyor also passes, a pair of carriages in which said roller is mounted, a rack for each carriage, a driving gear carried by one of said carriages and meshing with one of said racks, means for rotating said gear, a latching member carried by one of said carriages and engaging teeth of the rack to hold said roller in the desired position of adjustment, and means for taking up the slack of the conveyor.

30. In combination, a driven roller, a conveyor frame pivoted independently of said roller for swinging movement through a wide angle to an inoperative position above the driven roller, a second roller mounted on said frame, sheet conveying means passing around said rollers, means for adjusting the rollers relatively to vary the effective length of the sheet conveying means, and means carried by said sheet conveying means adapted to take up the slack therein and counterbalance the conveyor frame.

31. In combination, a driven roller, a conveyor frame pivoted independently of said roller for swinging movement in opposite directions through a wide angle to operative and inoperative positions below and above the top of the driven roller, respectively, a second roller mounted on said frame, sheet conveying means passing around said rollers, means for moving the second roller along the conveyor frame to vary the effective length of the sheet conveying means, and weighted means carried by said sheet conveying means and adapted to take up the slack therein and counterbalance the conveyor frame.

32. In combination, a driven roller, a feed board arranged forwardly thereof, a conveyor frame normally projecting over said feed board and arranged for swinging movement upwardly to an inoperative position above the feed board, a second roller carried by the conveyor frame, sheet conveying means passing around said rollers, and means for counterbalancing the conveyor frame supported by said sheet conveying means.

33. In combination, a driven roller, conveyor tapes passing therearound, a frame pivoted at one side of said roller for swinging movement in opposite directions to operative and inoperative positions below and above the top of the driven roller, respectively, a roller on said frame around which the conveyor tapes also pass, means for moving said rollers relatively to vary the effective length of the tapes, and a plurality of weighted elements supported by the tapes in loops thereof extending wholly between the axis of the driven roller and the pivotal axis of said frame, said weights being adapted to take up the slack in the tapes and counterbalance the frame.

34. In combination, a rotatable roller, a feed board arranged forwardly thereof, a sheet conveyor driven by the rotatable roller and arranged to project over the feed board for swinging movement relative thereto, and means carried by the sheet conveying portion of the conveyor for counterbalancing said conveyor.

35. In combination, a rotatable roller, a conveyor frame pivoted at one side thereof for swinging movement in opposite directions to operative and inoperative positions, a second roller carried by the conveyor frame, sheet conveying means passing around said rollers, means for moving the rollers relatively to vary the effective length of the sheet conveying means, a pair of guide rollers for the sheet conveying means arranged between said rotatable roller and the pivot for said conveyor frame, and conveyor tightening and counterbalancing means supported by the sheet conveying means in a portion thereof depending from said guide rollers.

36. In combination, a driven roller, a conveyor frame pivoted below and forwardly of the driven roller for swinging movement in opposite directions to operative and inoperative positions, a second roller carried by the conveyor frame, conveyor tapes passing around said rollers, a pair of tape guiding devices arranged in spaced relation between said driven roller and the pivot for said frame, and conveyor tightening and counterbalancing weights supported by said tapes in loops thereof depending from said pair of tape guiding devices.

37. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a driven shaft, a conveyor passing therearound, a roller around which the conveyor also passes, a frame carrying said roller, sheet controlling means engaging the front edge of the sheet, arms pivoted on said frame and provided with counterweights, and feed wheels on said arms driven by said roller and engaging the rear edge of the sheet to feed the same to the controlling means.

38. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a driven roller over which the sheets are fed, slow-down mechanism engaging the front edge of the sheet, and counterweighted feed wheels engaging and being frictionally

driven from said roller and engaging the rear edge of the sheet to feed the front edge to the slow-down mechanism.

39. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a conveyor frame, a driven roller carried thereby and over which the sheets are fed, slow-down mechanism engaging the front edge of the sheet, arms pivoted on said frame and provided rearwardly with adjustable counterweights, and feed wheels carried by said arms forwardly thereof and driven from said roller and engaging the rear edge of the sheet to feed the same to the slow-down mechanism.

40. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a conveyor frame, a driven roller carried thereby and over which the sheets are fed, slow-down mechanism engaging the front edge of the sheet, feed wheels carried by said frame and driven from said roller and engaging the rear edge of the sheet, and means for varying the pressure of said feed wheels on said roller.

41. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, guides and slow-down mechanism to engage the front edge of the sheet, a conveyor frame, a transverse rod carried thereby, and a feed roller and a tail brush mounted on said rod and adjustable therealong.

42. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, guides and slow-down mechanism to engage the front edge of the sheet, a conveyor frame, a transverse rod carried thereby, a feed roller, and a tail brush mounted on said rod and being adjustable therealong, said roller engaging the rear of the sheet when the slow-down engages the front thereof and said tail brush engaging the rear edge of the sheet when the front edge thereof engages said guides.

43. In a device of the character described, the combination of a sheet engaging member, a carrier therefor comprising a pair of spaced eyelets, a transverse rod passing through said eyelets, a positioning sleeve carried by said rod and located between said eyelets and provided with a longitudinal recess, a spring carried by said recess and engaging said rod, and means applying pressure to said spring to secure said sleeve in position.

44. In combination, a feed board, a conveyor frame projecting thereover, a conveyor carried thereby, a pair of transverse members carried thereby, a downwardly inclined plate for guiding the sheets from said conveyor onto said feed board, and a rearward projection from said plate engaging over one and under the other transverse member.

45. In combination, a pivoted conveyor frame, a conveyor carried thereby, a feed roller around which said conveyor passes, a plurality of transverse members carried by said frame, and a plurality of sets of longitudinally arranged top rods carried by said members, one set projecting rearwardly over said feed roller and adapted to pivot when said frame is elevated.

46. In combination, a conveyor frame, a conveyor carried thereby, a feed roller around which said conveyor passes, a plurality of transverse members carried by said frame, and a plurality of sets of longitudinally arranged top rods carried by said members, one set projecting forwardly toward the device to be fed and being adjustable vertically.

47. In combination, a pivoted conveyor frame, a conveyor carried thereby, a feed roller around which said conveyor passes, a plurality of transverse members carried by said frame, and a plurality of sets of longitudinally arranged top rods carried by said members, one set projecting forwardly toward the device to be fed and being adjustable vertically, and the other set projecting rearwardly over said feed roller and adapted to pivot when said frame is elevated.

48. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a sheet support therefor, a conveyor frame projecting over said sheet support, a conveyor carried thereby, and means for varying the effective length of said conveyor and delivering the sheets onto said sheet support at substantially a distance from the slow-down mechanism corresponding to the length of the sheet.

49. In a sheet feeding device, the combination of a source of sheet supply, a device to be fed, a sheet support therefor, a conveyor frame projecting over said sheet support, a conveyor carried thereby, and means for varying the effective length of said conveyor dependent upon the size of sheets being fed in order to deliver said sheets onto the sheet support at a substantial distance from said device whereby the sheets are presented to said device at the angle of the sheet support.

50. In combination, a device to be fed, a sectional feed board associated therewith and the section nearest said device being adapted to be raised and lowered, slow-down and front and side registering mechanisms carried by said section, a source of power, and uninterrupted driving connections therefrom to said mechanisms whether said section is raised or lowered.

51. In combination, a device to be fed, a sectional feed board associated therewith and the section nearest the device being pivoted and adapted to be raised and lowered, slow-down and front and side registering mechanisms carried by said section, a source of power, and means connected therewith for driving said mechanisms and adapted to con-

tinuously maintain them in timed relation whether said section is raised or lowered.

52. In combination, a device to be fed, an automatic feeder pivoted thereto, and a sectional feed board for said device having the section nearest the feeder pivoted so that the same can be swung down out of the way when the feeder is in operative position and swung into alignment with the other sections when the feeder is swung away and swung up when access to the device is desired.

53. In combination, a device to be fed, a sectional feed board for the same, and substantially U-shaped anti-frictional strips carried by one of said sections, one arm of each strip engaging the top of the section and the other arm the underside thereof.

54. In combination, a device to be fed, a sectional feed board for the same, and substantially U-shaped anti-frictional resilient strips carried by one of said sections, one arm of each strip engaging the top of the section and the other arm the underside thereof.

55. In combination, a device to be fed, a sectional feed board for the same, the section nearest said device being pivoted and movable to an upper and a lower position, a conveyor frame projecting over said board and delivering the sheets onto said board at a substantial distance from said device, and anti-friction means carried by said pivoted section.

56. In combination, a sheet support, a plate carried at the forward end thereof, and front and side registering devices and sheet detector mechanism carried by said plate and removable with said plate from said support as a unit.

57. In combination, a sheet support, a plate carried at the forward end thereof, and front and side registering devices and sheet detector mechanism carried by said plate and removable with said plate from said support as a unit, said devices and mechanism being adjustable along said plate.

58. In combination, a sheet support, a plate carried at the forward end thereof, front and side registering devices and sheet detector mechanism carried by said plate and removable with said plate from said support as a unit, said devices and mechanism being provided with upper and lower members, and a bar carried on the underside of said plate along which the lower members of said devices and mechanism are adjustable.

59. In combination, a sheet support, a plate carried at the forward end thereof, a pair of oscillating shafts mounted on said support, front registering, side registering, slow-down and sheet detector mechanisms connected to said oscillating shafts, a rotating shaft carried on the underside of said plate, and rotary means associated with the front registering and side registering mechanisms mounted thereon.

60. In combination, a device to be fed, a sectional feed board for the same, the section nearest said device being provided with a counterbalance weight, and a gravity actuated latch engaging said weight when said section is elevated to position and latch it in said elevated position.

61. In combination, a device to be fed, a sectional feed board for the same, the section nearest said device being provided with a counterbalance weight, a pin carried by said weight, and a pivoted gravity latch automatically engaging said pin when said section is elevated to position and latch said section in elevated position.

62. In combination, sheet delivering means, a pair of slow-down elements receiving the sheet from said means and movable at a slower surface speed, one of said elements being positively driven and the other frictionally driven from said positively driven element, a rock shaft, means loosely mounted thereon carrying one of the slow-down elements, and a member fixed on the rock shaft and yieldably connected with said loosely mounted means.

63. In combination, sheet delivering means, a pair of slow-down elements receiving the sheet from said means and movable at a slower surface speed, one of said elements being positively driven and the other frictionally driven from the positively driven element, a rock shaft, means loosely mounted thereon carrying one of the slow-down elements, a member fixed on the rock shaft, and adjustable connections between said member and said loosely mounted means.

64. In combination, sheet delivering means, a lower driven slow-down element receiving the sheet from said means and driven at a slower surface speed, an upper slow-down element movable into and out of engagement with the lower slow-down element and driven thereby, a rock shaft, means loosely mounted on the rock shaft and carrying the upper slow-down element, a member fixed on said rock shaft, and adjustable and yieldable connections between said member and said loosely mounted means.

65. In combination, a lower slow-down roller, an upper slow-down roller movable toward and away from the lower slow-down roller, a rock shaft, a frame loosely mounted thereon carrying the upper slow-down roller and having spaced apertured ears through which the rock shaft extends, a lug fixed on the rock shaft between said ears and extending below the frame, and an adjustable connection between the lug and said frame.

66. In combination, a lower slow-down element, an upper slow-down element movable toward and away from the lower slow-down element, a rock shaft, a frame loosely

mounted thereon carrying the upper slow-down element, a lug fixed on the rock shaft and extending below said frame, an adjusting nut interposed between said frame and the lug and threaded in one of said parts, a pin connected with the lug and extending above the frame through an opening in said nut, an abutment on the upper part of the pin, and a spring arranged on the pin between the frame and said abutment.

67. In combination, a lower slow-down roller, an upper slow-down roller movable toward and away from the lower slow-down roller, a rock shaft, a frame loosely mounted thereon and carrying the upper slow-down roller, a lug fixed on the rock shaft and extending under the frame, a nut on the top of the frame and threaded therethrough into engagement with the lug, a spring-pressed plunger interposed between the frame and the nut and frictionally engaging the latter, a pin pivotally connected with the lug and extending loosely through the nut above the frame, an abutment on the upper part of the pin, and a spring arranged on the pin between said pin and said nut.

68. In combination, sheet delivering means, a shaft driven at a slower speed than said means, slow-down devices and side registering devices, and rollers mounted on said shaft and constituting parts of said slow-down and side registering devices engaging the undersides of the sheets and cooperating with parts of said devices operating on the upper surface of the sheets.

69. In combination, sheet delivering means, a sheet support, a guide tongue mounted thereon and carried thereby, and a slow-down roller driven at a slower speed than said delivering means and being adjustable transversely of said support with said guide tongue.

70. In combination, a sheet support, a guide tongue mounted thereon and carried thereby, and a driven roller associated with said tongue and being adjustable transversely of said support with said tongue.

71. In combination, sheet delivering means, a shaft driven at a slower speed than said means, a guide tongue mounted on said shaft and being adjustable transversely therealong and provided with an opening, and a slow-down device provided with a driven roller, said roller being mounted on the shaft in said opening of said guide tongue.

72. In combination, a sheet support, a guide tongue mounted thereon and carried thereby, and a member cooperating with said guide tongue and engaging the upper surface of the sheet.

73. In combination, a sheet support, a guide tongue mounted thereon and carried thereby, and an adjustable lever cooperating with said guide tongue and engaging the upper surface of the sheet.

74. In combination, a sheet support, a guide tongue mounted thereon and carried thereby, a driven roller, a grooved roller cooperating therewith, and a pivoted lever extending through the groove in said roller and adapted to press the sheet against said guide tongue.

75. In combination, a lower slow-down roller, a grooved tongue extending forwardly thereof, an upper slow-down roller movable toward and away from the lower slow-down roller, a rock shaft, means rocked thereby and carrying the upper slow-down roller, and an element carried on said means and cooperating with the grooved tongue to crease the sheet at the front thereof.

76. In combination, a sheet support, a slow-down mechanism comprising a driven roller, a second roller associated therewith, an arm on which said second roller is mounted, an oscillating shaft carrying said arm, and means for adjusting the relative position of said rollers comprising a lug mounted on said shaft and connections between the same and said arm.

77. In combination, a sheet support, a slow-down mechanism comprising a driven roller, a second roller associated therewith, an arm on which said second roller is mounted, an oscillating shaft carrying said arm, and means for adjusting the relative position of said rollers comprising a lug mounted on said shaft and a spring-pressed connection between said lug and arm.

78. In combination, a sheet support, a slow-down mechanism comprising a driven roller, a second roller associated therewith, an arm on which said second roller is mounted, an oscillating shaft carrying said arm, and means for adjusting the relative position of said rollers comprising a lug mounted on said shaft and an adjustable spring-pressed connection between said lug and arm.

79. In combination, a sheet support, a slow-down mechanism comprising a driven roller, a second roller associated therewith, an arm on which said second roller is mounted, and an oscillating shaft carrying said arm, said arm being adjustable along said shaft.

80. In combination, a driven shaft, a slow-down device and a side registering device, a pair of members both associated with and driven by said shaft and constituting parts of said devices adapted to engage one side of a sheet, and a pair of elements arranged to cooperate with said pair of members and constituting parts of the slow-down and side registering devices adapted to engage the opposite side of said sheet.

81. In combination, a driven shaft, a slow-down element and a side registering element both associated with and driven by said shaft and adapted to engage one side of a sheet,

a pair of rock shafts, and a slow-down member and a side registering member movable by said shafts toward and away from said slow-down and side registering elements respectively and adapted to engage the opposite side of said sheet.

82. In combination, a slow-down member and a side registering member both adapted to engage one side of a sheet, a driven shaft carrying one of said members and geared to the other member, and slow-down and side registering members arranged to cooperate with said first named members respectively and adapted to engage the opposite side of the sheet.

83. In combination, a driven shaft, a slow-down member and a side registering member both associated with and driven by said shaft and adjustable longitudinally thereof, and separately mounted slow-down and side registering elements movable toward and away from said members respectively and both adjustable relative thereto.

84. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven roller, a second roller adjustable laterally thereof, and a positioning member associated therewith for positioning the rollers in their relation to each other.

85. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven roller, a second roller mounted above said driven roller and adjustable laterally thereof, and a positioning member for adjusting said second roller with respect to said driven roller.

86. In combination, a sheet support, a side registering mechanism mounted thereon and comprising a driven roller, a second roller adjustable laterally thereof, an arm in which said second roller is mounted, an oscillating shaft carrying said arm, and means for positioning said second roller above said driven roller.

87. In combination, a sheet support, a side registering mechanism mounted thereon and comprising a driven roller, a second roller, means for positioning said rollers with respect to each other, a guide plate adapted to be engaged by the lateral edge of the sheet, and independent means for adjusting the position of said guide plate.

88. In combination, a sheet support, a side registering mechanism mounted thereon and comprising a driven roller, a second roller, a positioning element for adjusting the position of said second roller with respect to said driven roller, a guide plate through which said positioning element extends, and means for independently adjusting the position of said guide plate.

89. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven member, a roller cooperating therewith and adjustable laterally thereof, and means for positioning said roller with respect to said driven member.

90. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven member, a roller cooperating therewith, an arm on which said roller is carried, a shaft on which said arm is mounted, a second arm on said shaft, connections between said arms near their free ends, and means for holding said first mentioned arm in inoperative position.

91. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven member, a roller cooperating therewith, an arm on which said roller is carried, a shaft on which said arm is mounted, a second arm on said shaft, connections between said arms near their free ends, and means for holding said first mentioned arm in inoperative position, said means including a spring-pressed pin and a nut carried thereby and adapted to be rotated.

92. In combination, side registering mechanism, means adjustable toward and away from said mechanism for guiding the sheets thereto, and a sheet engaging member on said adjustable means acting to prevent displacement of the sheet during the side registering operation.

93. In combination, an extensible sheet support, side registering mechanism forwardly thereof, a rod carried by said support for movement therewith toward and away from said side registering mechanism, a guide pivoted on said rod, and a ball carried thereby and engaging the sheet during the side registering operation to prevent displacement of said sheet.

94. In combination, a sheet support, a side registering mechanism, a rod carried by said support, a guide pivoted thereon and adjustable thereon angularly and longitudinally of said rod, and a weight carried by said guide and engaging the sheet during the side registering operation to prevent displacement thereof.

95. In combination, sheet feeding means including a conveyor, a normally stationary feed board on which the sheets are deposited by said conveyor, side registering and slow down mechanism that operate on the sheet and then leave it momentarily stationary on said feed board, and cylinder grippers that seize the sheet after it has become stationary on the feed board.

96. In combination, a feed board, a pivoted frame projecting thereover, endless conveyors carried by said frame, and means for counterbalancing said frame and for taking up the slack in said conveyors.

97. In combination, press guides and slow down mechanism, and means engaging the forward edge of the sheet on opposite sides

thereof to crease and stiffen the same as it is moved into engagement with the press guides.

98. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven roller, a movable element, a roller carried by said movable element and adapted to cooperate with the driven roller, an abutment, and means on the movable element arranged to engage said abutment and thereby automatically position the roller on said movable element with respect to said driven roller.

99. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven roller, a movable element, a second roller carried by said movable element and adapted to cooperate with the driven roller, an abutment, and an extension on the movable element having an opening for the second roller and a positioning guide or member adapted to engage said abutment and thereby automatically position the second roller with respect to the driven roller, the distance from the end of the positioning guide or member to the center of said opening being the same as the distance from the center of the driven roller to the abutment.

100. In combination, a sheet support, a side registering mechanism mounted thereon comprising a driven roller, a movable element, a roller carried by said movable element and adapted to cooperate with the driven roller, and means on said movable element for positioning the roller carried thereby in two directions with respect to said driven roller.

101. In combination, a sheet support, a side register mechanism comprising a pair of rollers mounted on said support for relative lateral adjustment, and a member for positioning said rollers in operative relation to each other when relative lateral adjustment is imparted thereto.

102. In combination, a sheet support, a side register mechanism comprising an upper roller and a lower roller both mounted on said support for independent lateral adjustment, and a member for positioning the upper roller over the lower roller when one roller is adjusted laterally with respect to the other.

103. In combination, a sheet support, a side register mechanism thereon comprising a driven roller, a second roller, and an arm on which said second roller is mounted, an oscillating shaft carrying said arm and along which the same is adjustable, and means for positioning the second roller over the driven roller when the arm is adjusted along said shaft.

104. In combination, a sheet support, a side registering mechanism thereon comprising a driven member and a cooperating roller mounted for relative lateral adjustment, and means for positioning the roller with respect to the driven member when relative lateral adjustment is imparted thereto.

In testimony whereof I have signed this specification.

CARL E. CHRISTOPHEL.