Nov. 12, 1940. B. F. UPHAM 2,221,500

METHOD AND MEANS FOR FEEDING SHEETS

Original Filed March 11, 1938 3 Sheets-Sheet 1

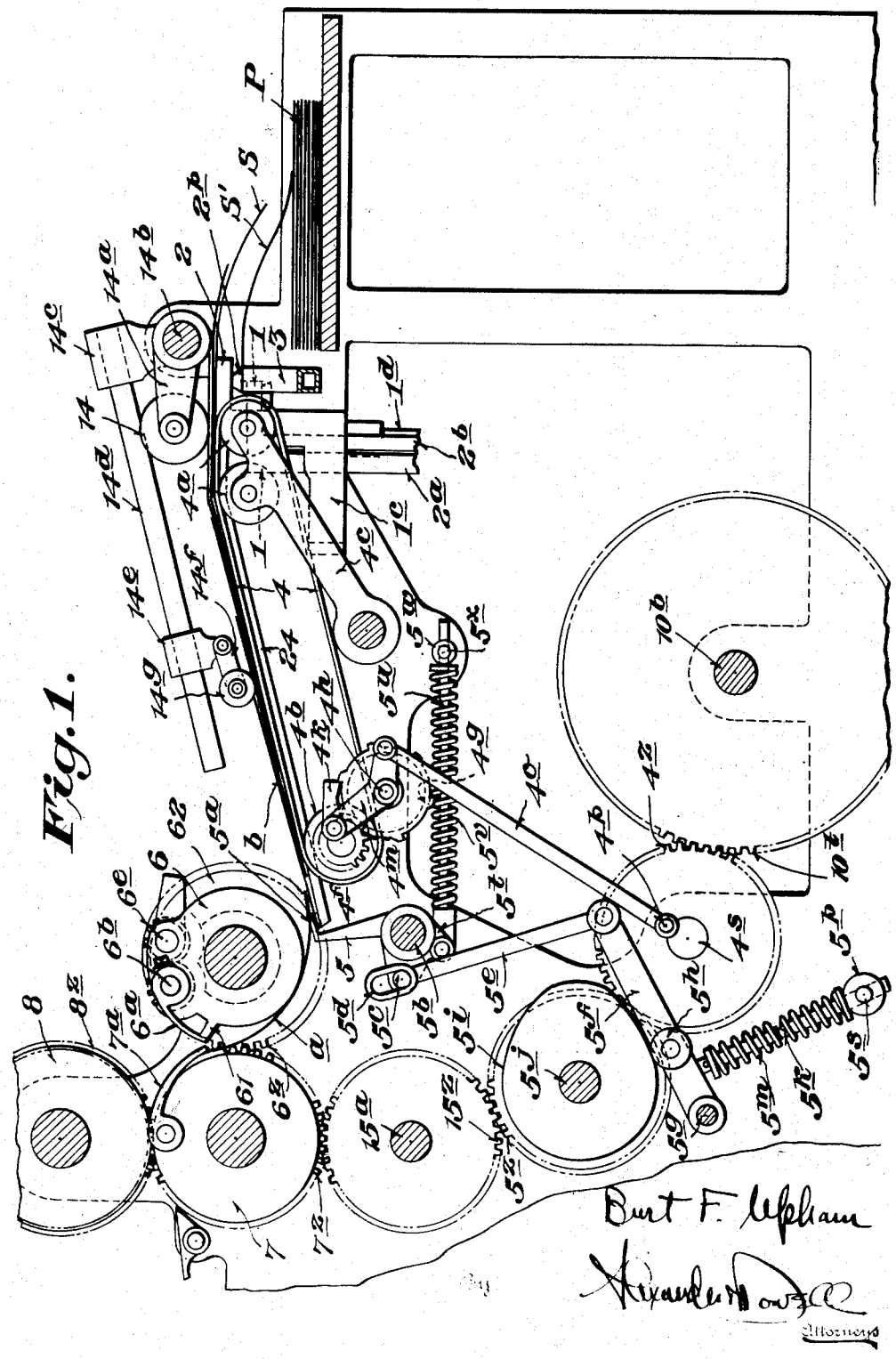

Fig. 1.

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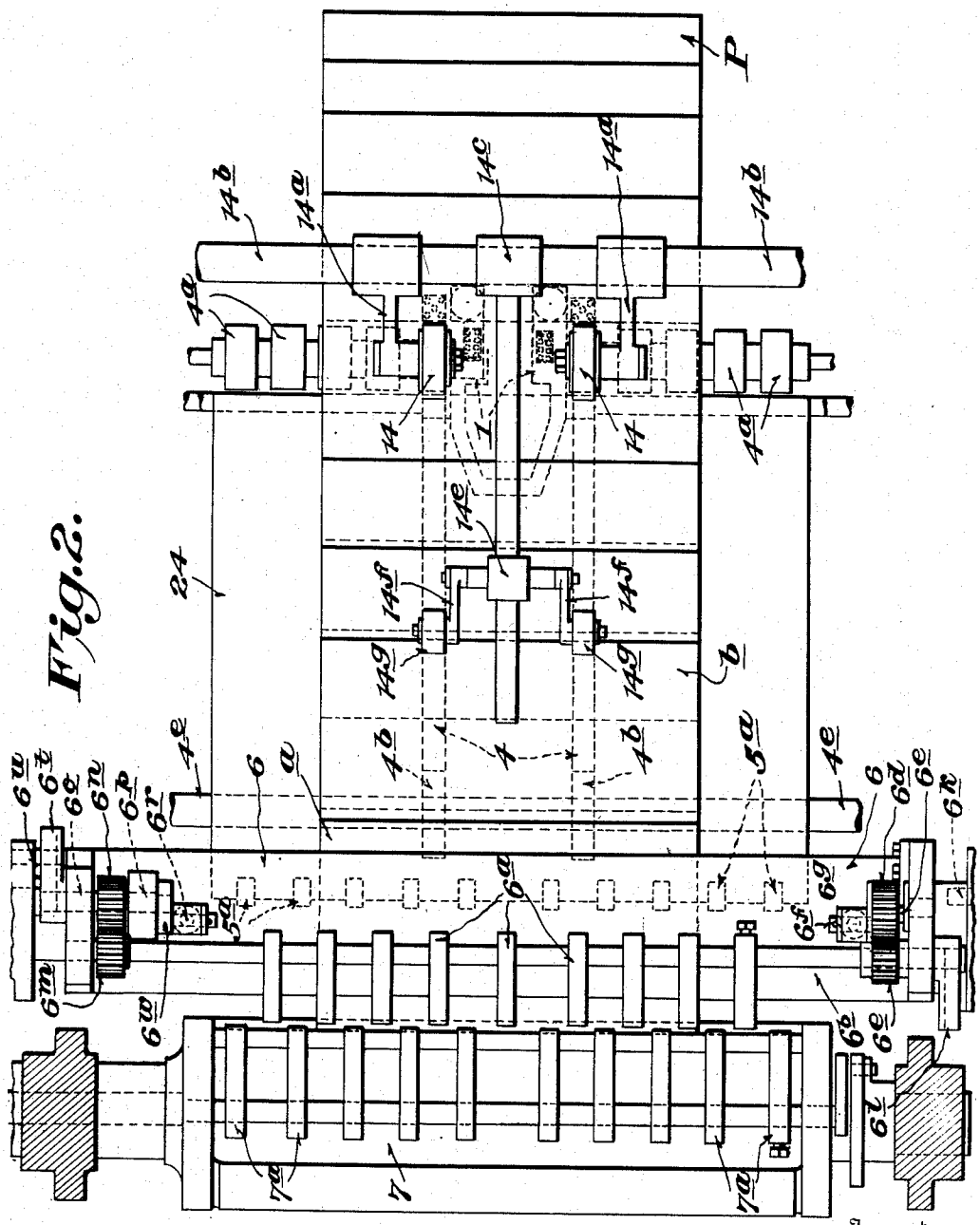
Original Filed March 11, 1938 3 Sheets-Sheet 2

Fig. 2.



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Original Filed March 11, 1938 3 Sheets-Sheet 3

Fig. 3.

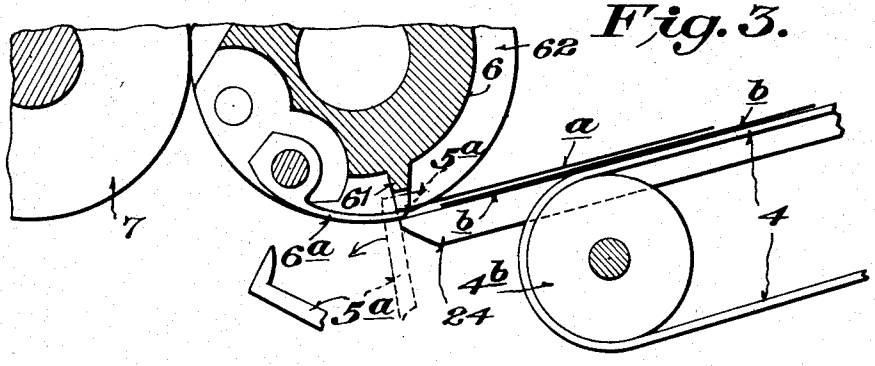


Fig. 4.

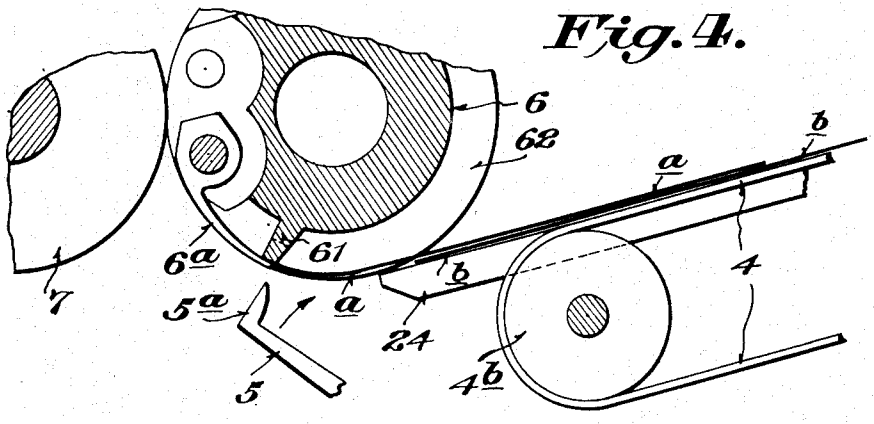


Fig. 5.

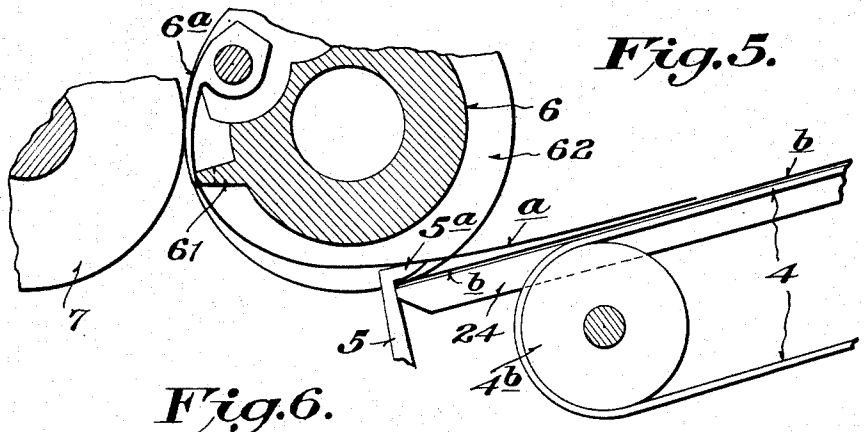
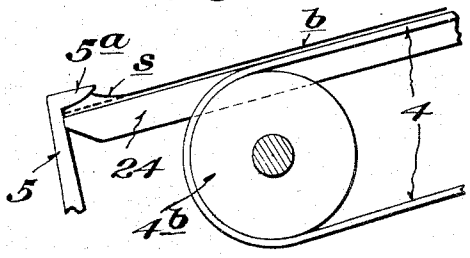


Fig. 6.



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UNITED STATES PATENT OFFICE

2,221,500

METHOD AND MEANS FOR FEEDING SHEETS

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Original application March 11, 1938, Serial No. 195,378. Divided and this application July 21, 1938, Serial No. 220,532

5 Claims. (Cl. 271—53)

My invention relates to printing presses and this application is a division of my copending application Serial No. 195,378, filed March 11, 1938.

The present invention includes a novel mode of and novel means for feeding sheets of paper to printing presses or other mechanism whereby the sheets are moved at less speed than the peripheral speed of the feed or impression cylinder to ensure proper positioning of the sheet against the sheet stops at the point where the leading edge of the sheet is seized by the impression cylinder grippers, or by the feed cylinder grippers. The principal objects of the invention are to enable rotary sheet printing presses to be operated at higher speeds when equipped with my automatic sheet feeder; and to enable the diameter of the cylinders to be reduced as compared with the impression cylinders in the presses now used to print sheets of same maximum size.

Preferably the sheets are fed in a so-called "stream" to the cylinder by a conveyor operated in such manner that the consecutive sheets on the conveyor overlap a short distance and it is only necessary to move the stream of sheets the length of such overlap in order to properly present them successively to novel stops which arrest the sheets in position for taking by the feed cylinder grippers or the like; and means are provided for retracting the stops to permit a sheet to be taken by the grippers, and for returning the stops to sheet arresting position before the sheet taken by the grippers has passed the stops; the construction being such that the stops will lift the rear end portion of the seized sheet and permit the leading edge of the following sheet to be positioned against the stops and under the following end of the preceding sheet before such sheet has entirely passed the stops.

The accompanying drawings illustrate one practical embodiment of my invention and I will describe the same in detail to enable others to understand and use the invention; and thereafter summarize in the claims the novel mode of operation and novel features of construction and novel combinations of parts for which protection is desired.

In said drawings:

Fig. 1 is a partial side elevation of a portion of a rotary cylinder printing press equipped with my novel sheet feeding and registering mechanism.

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

Figs. 3, 4 and 5 are detail views illustrating various positions of the sheet stops and sheets during the transfer of a sheet from the feed board to the impression cylinder.

Fig. 6 is a detail illustrating how the leading edges of sheets are prevented from improperly curling.

Referring to Fig. 1 the sheets are preferably successively taken from a pile P, as described in my aforesaid application, and delivered to a conveyor 4; the successive sheets on the conveyor overlapping, and the leading sheet in the stream being uppermost, and the last sheet in the stream undermost. The sheets are successively advanced by the conveyor over the feed board 24 to sheet registering stops or gages 5, which are normally positioned to arrest the leading edge of the sheet in position to be seized by the grippers of the impression cylinder, or in the embodiment of the invention illustrated in position for engagement by the grippers 6a of a feed cylinder 6 which delivers the sheet to the grippers 7a of an impression cylinder 7 coacting with a form cylinder 8 to print the sheet.

In Figs. 1 and 2 the foremost sheet *a* has been taken from the conveyor by the feed cylinder and the next sheet *b* has been fed up against the stops 5 beneath the sheet *a*. The progress of sheet *a* is as follows: After the leading edge of sheet *a* contacts the sheet stops 5 (see Fig. 3), the forward edge of the sheet is seized by the feed cylinder grippers 6a and simultaneously the stops 5 are moved out of the path of the sheet *a* which is advanced (see Fig. 4) on its way to be transferred to the impression cylinder 7 and while so advanced moves above the stops 5. The stops however are returned to their first (stop) position and under sheet *a* (see Figs. 5 and 1) before sheet *a* has entirely passed the stops, and the leading edge of the following sheet *b* is fed up to the stops under the following portion of sheet *a* (see Figs. 5 and 1), the upper ends of the stops 5 maintaining a predetermined space between the leading edge of sheet *b* and the under surface of sheet *a*.

In the conventional method of feeding presses, the leading edge of a sheet contacts with the press stops, and the stops are moved from the path of the sheet when it is grasped by the grippers, and before the stops can be returned to position the entire sheet must pass the stops; and such stops are not returned to sheet arresting position until after the tail edge of the sheet has passed. But in accordance with my invention the stops are returned to original sheet arresting position before the seized sheet has entirely passed the stops, and the major part of the time required

for the movement of the sheet past the stops is utilized for positioning the next succeeding sheet. Very important practical advantages result from this change in the method of operating the stops and advancing the sheets, as will appear from the following:

A number of factors determine the efficient speed at which a printing press or other sheet fed machine may be operated. There is always a maximum speed beyond which efficiency decreases. The circumference of the printing cylinders (or their equivalents) is a factor affecting this maximum. If the circumference can be reduced, the press (or its equivalent) becomes more efficient.

In the present type of press using the conventional method of feeding, a cylinder approximately 8" in diameter is required to print a sheet 14" lengthwise of the press. Such a cylinder operating at 15,000 impressions per hour would have a surface speed of 37,699 feet per hour. By using my method of feeding a press having cylinder only 6" in diameter could print a sheet approximately 14" lengthwise of the press. Such 6" cylinders are 18.8496" in circumference and except for the approximate 4.8496" required by the gripper gaps I can utilize the total available cylinder surface for printing. Assuming the efficient maximum speed of such 6" cylinder press to be 15,000 impressions per hour, its cylinders would have a surface speed of 23,562 feed per hour. Thus (if we take the surface speed of the 6" cylinder press as standard) the 8" cylinder press would produce only 11,250 impressions per hour and the smaller cylinder press would be approximately ⅓ more productive. This increase in speed is due to my aforesaid novel method of operation by which the interval between the presentation of one sheet and the next succeeding sheet to the sheet stops is shortened, and this makes it possible to decrease the circumference of the printing cylinders as aforesaid.

In the press shown the sheets are advanced approximately 2.875" with each cyclic movement of the press. If the smallest sheet is 3", lengthwise of the press, these sheets would have an overlap of ⅛".

My my invention and method instead of having to feed the succeeding sheet *b* against the sheet stops in the short interval between the passing of the tail end of sheet *a* and the seizing of the leading edge of the next following sheet *b* (as has heretofore been required), I begin feeding the following sheet *b* when the leading edge of the sheet *a* has moved past the sheet stops; and I utilize the major part of the time required for sheet *a* to be moved past the sheet stops, by the feed or impression cylinder, for positioning the succeeding sheet *b* against the stops.

I believe this to be a novel and efficient mode of feeding sheets at high speeds.

The cylinders **6**, **7**, **8** are rotated at uniform peripheral speed. In the construction shown cylinder **7** has a gear **7***z* on one end meshing with a similar gear **6***z* on feed cylinder **6**, and with a similar gear **8***z* on cylinder **8**.

The upper ends **5***a* of the stops or gages **5** preferably extend rearwardly and curve upwardly to hold sheet *a* out of the way of sheet *b* during the positioning of sheet *b* as hereinabove described. The leading edge of some sheets have a tendency to curl upwardly and the ends **5***a* are so shaped that the leading edge of a sheet will flatten as it contacts therewith (see Fig. 6). When the sheet stops are in arresting position they raise the following part of sheet *a* seized by the feed cylinder, and this lessens disturbance of sheet *b* by sheet *a* while it is moving over it. The raising of sheet *a* is permitted by recessing or reducing the diameter of the cylinder **6**, as at **62** in rear of the part **61** whereon the sheet is clamped by the grippers **6***a*. The outer edge of part **61** is slotted at proper points so that it will not interfere with the sheet stops **5** at the time when the grippers are about to seize the sheet arrested by the stops (Fig. 3).

The sheet stops **5** may be operated by any suitable means. In the construction shown they are fast to a rock shaft **5***b*, on which is a bell crank lever **5***t* having one arm pivotally connected to one end of a rod **5***u*, the free end of which passes through a rocking eye **5***w* having a stud **5***x* pivoted on an adjacent part of the frame. A spring **5***v* on the rod normally holds rock shaft **5***b* and gages **5** in sheet arresting position (Fig. 1). The other arm of lever **5***t* has a pin **5***c* engaged with a slot **5***d* in the upper end a rod **5***e* whose lower end is pivoted to the free end of a lever **5***f*; the other end of said lever **5***f* being pivoted on a stud **5***g* on the frame.

Lever **5***f* carries a pin or roller **5***h* which engages a cam **5***i* on a shaft **5***j*. Cam **5***i* is rotated in unison with the feed cylinder by means of a gear **5***z* on the cam shaft meshing with a gear **15***z* on a shaft **15***a*, gear **15***z* meshing with gear **7***z* on cylinder **7** (see Fig. 1). Lever **5***f* is pressed upwardly to hold roller **5***h* in contact with cam **5***i* by means of a spring **5***m* strung on a rod **5***k* whose upper end engages lever **5***f* and its lower end is slidably engaged with a rocking eye **5***p* having a stud **5***s* pivoted on an adjacent part of the frame.

Preferably the sheets are successively fed up to the stops **5** from a pile P by an endless conveyor **4** which runs over a roll or rolls **4***b* adjacent feed cylinder **6** and over rolls **4***a*, **4***a*, adjacent the pile P, as described in my aforesaid application. On the shaft of roll **4***b* is fixed a pinion **4***f* meshing with a pinion **4***g* on a stub shaft **4***h*. A ratchet **4***i* fast on pinion **4***f* is engaged by a pawl **4***k* on one end of an oscillatory lever **4***m*, the other end of which is connected by a rod **4***o* to a crank pin **4***p* on a gear **4***z* mounted on stub shaft **4***s*. Gear **4***z* meshes with the gear **5***z* that operates the sheet stops. By this construction the conveyor is moved intermittently to feed the stream of sheets forward during one-half a revolution of the feed and impression cylinders as described in my aforesaid application, but the invention is not restricted to an intermittently moving sheet conveyor nor to any particular means for operating said conveyor. When the leading edge of a sheet of paper is in contact with the gages **5** the tail of the sheet has been moved out of contact with the small rolls **14***g* that hold the stream of sheets to the tapes (see Figs. 1 and 2).

The feed cylinder and its gripper operating devices are preferably constructed and operated as described in my aforesaid application. Assuming the press to have 6" cylinders, as above referred to, Fig. 3 shows sheet *a* in position to be grasped by gripper **6***a* of the feed cylinder and stops **5** just starting to be withdrawn. Fig. 4 shows sheet *a* advanced approximately 2", and the sheet stops moved out of the path of sheet *a* to their furthest retracted position. Fig. 5 shows sheet *a* advanced approximately 4½" and stops **5** returned to sheet arresting position (as in Figs. 1 and 3). The approximately 4½" ad-

vance of sheet *a* and the simultaneous return of the sheet stops required approximately only 25% of the feed cylinder cycle, which results in leaving about 70% of the cycle available for the forwarding and position of sheet *b* against the stops. In Fig. 3 the leading edge of sheet *b* is approximately ¾'' from the sheet stops, and this is the approximate distance sheet *b* will be moved forward by the conveyor or feed tapes during the period the sheet stops will have been retracted and returned to position (Fig. 5). In a press having 6'' cylinders as described, the sheets on the feed board are moved approximately 2⅞'' during each cycle of operations of the press. Therefore sheet *b* will arrive at the sheet stops **5** shortly after they have returned to and come to rest in position to stop such sheet.

I have not considered it necessary to show the usual sheet side guides or gages which will be used (as usual) in connection with the front gages or stops **5**; but any one familiar with printing presses will understand that the additional time permitted by my method for positioning the sheets against the stops **5** also give additional time for the operation of the side guides, and consequently the impressions on the sheets will be more uniform and more accurate in register, especially when the sheets are to be printed in multicolor and at high speed.

While I have illustrated one practical embodiment of my invention, I do not consider it limited to the particular construction shown; nor to a rotating feed cylinder; nor to its use with rotary printing presses.

I claim:

1. Means for feeding sheets to sheet taking devices, comprising sheet stops for arresting the sheets in position to be taken by said devices, means for retracting the stops to permit a sheet to be taken by said devices, and means for returning the stops to sheet arresting position beneath the following portion of the sheet taken by said devices to permit the leading edge of the next following sheet to be positioned against the stops before the preceding sheet has entirely passed them; said stops shifting the overlapping portion of the preceding sheet into the confines of a taking cylinder to maintain a predetermined space between the leading edge of the next following sheet and the overlapping portion of the preceding sheet.

2. Means for feeding sheets to the sheet taking device on a cylinder; comprising sheet stops below the cylinder for arresting a sheet in position to be seized by the cylinder sheet taking devices, means for retracting the stops to permit a sheet to be taken by the cylinder, means for returning the stops to sheet arresting position under the rearward portion of the sheet seized by the cylinder, and means for positioning the next succeeding sheet against the stops before the preceding seized sheet has entirely passed the stops; said stops shifting the overlapping portion of the preceding sheet into a clearance of the taking cylinder to maintain a predetermined space between the leading edge of the next following sheet and the overlapping portion of the preceding sheet.

3. Means for feeding sheets to the sheet taking device on a cylinder; comprising sheet stops below the cylinder for arresting a sheet in position to be seized by the cylinder sheet taking devices, means for retracting the stops to permit a sheet to be taken by the cylinder, means for returning the stops to sheet arresting position so that said stops will lift the rearward portion of the sheet seized by the cylinder and permit the leading edge of the following sheet to be positioned against the stops before the preceding seized sheet has entirely passed the stops, said stops maintaining a predetermined space between the leading edge of the next following sheet and the overlapping portion of the preceding sheet, and said cylinder being reduced in diameter behind the sheet taking devices to permit raising of the sheet being taken by the devices.

4. Means for feeding sheets from a stream to a cylinder; comprising sheet stops below the cylinder for arresting sheets in position to be seized by the cylinder grippers, means for retracting the stops to permit a sheet to be taken by the cylinder, means for returning the stops to sheet arresting position to permit the leading edge of the next following sheet to be positioned against the stops before the seized sheet has entirely passed the stops, said stops shifting the overlapping portion of the preceding sheet into a cut-away portion of the taking cylinder to maintain a predetermined space between the leading edge of the next following sheet and the overlapping portion of the preceding sheet, a conveyor for forwarding a stream of sheets toward the stops, and means for actuating the conveyor.

5. Means for feeding sheets from a stream to a cylinder; comprising sheet stops below the cylinder for arresting sheets in position to be seized by the cylinder grippers, means for retracting the stops to permit a sheet to be taken by the cylinder, means for returning the stops to sheet arresting position in which position the stops lift the rearward portion of the sheet seized by the cylinder to permit the leading edge of the next following sheet to be positioned against the stops before the seized sheet has entirely passed the stops, said stops maintaining a predetermined space between the leading edge of the next following sheet and the overlapping portion of the preceding sheet, and said cylinder being reduced in diameter behind the grippers to permit raising of the rearward portion of the sheet seized by the grippers; a conveyor for forwarding a stream of sheets toward the stops, and means for actuating the conveyor.

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