June 13, 1939. B. F. UPHAM 2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC

Filed March 11, 1938 7 Sheets-Sheet 1

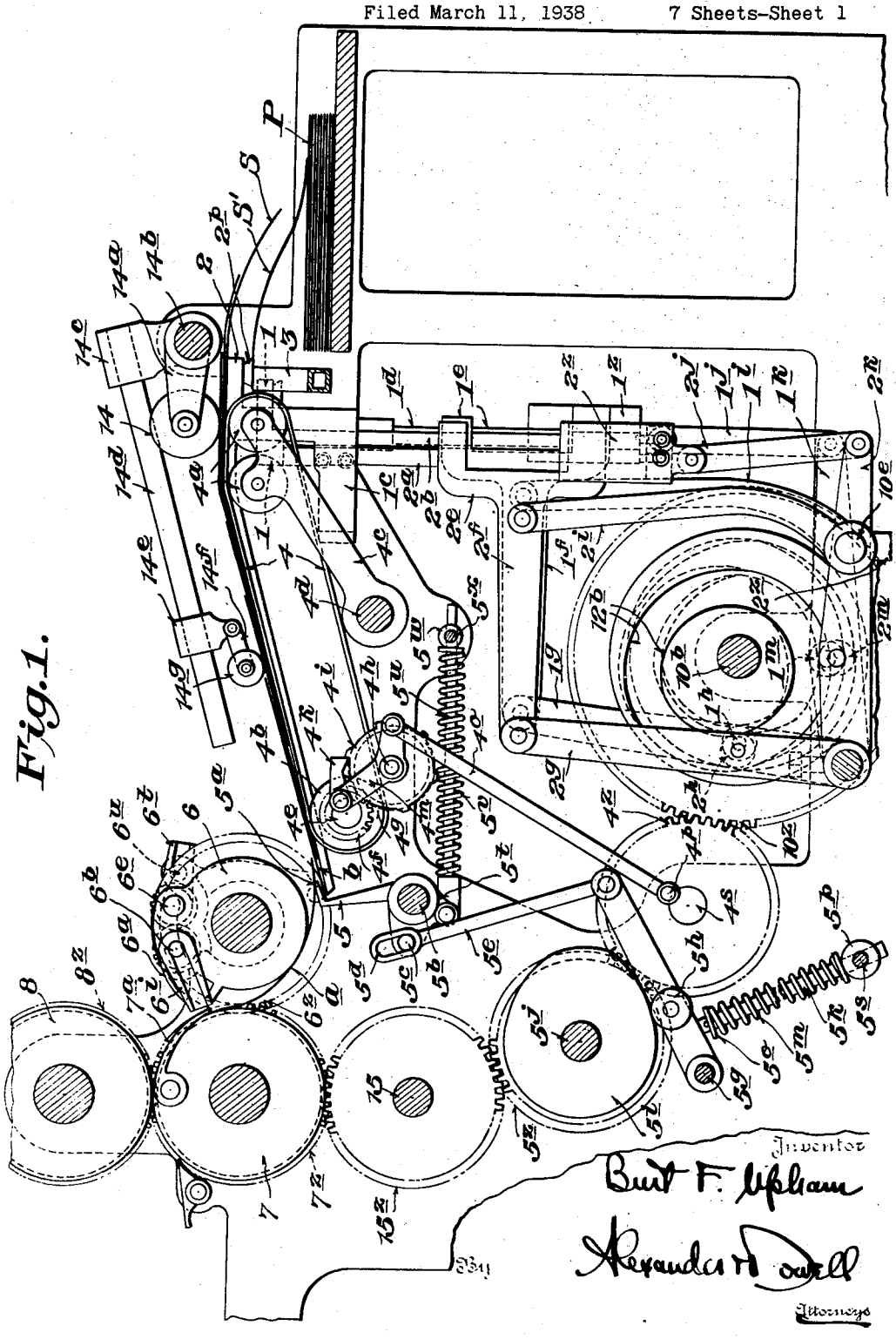


Fig. 1.

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June 13, 1939. B. F. UPHAM 2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC

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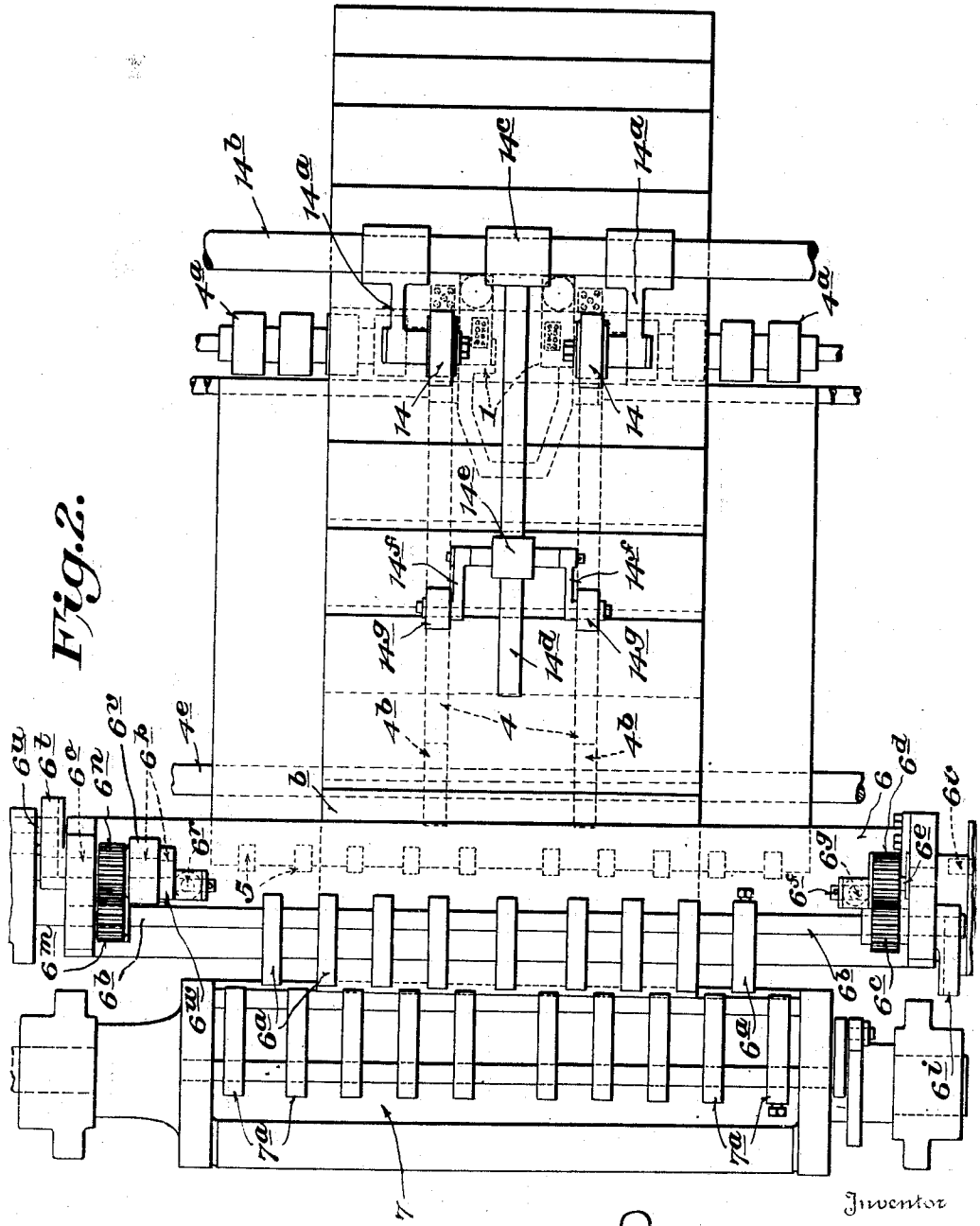


Fig. 2.

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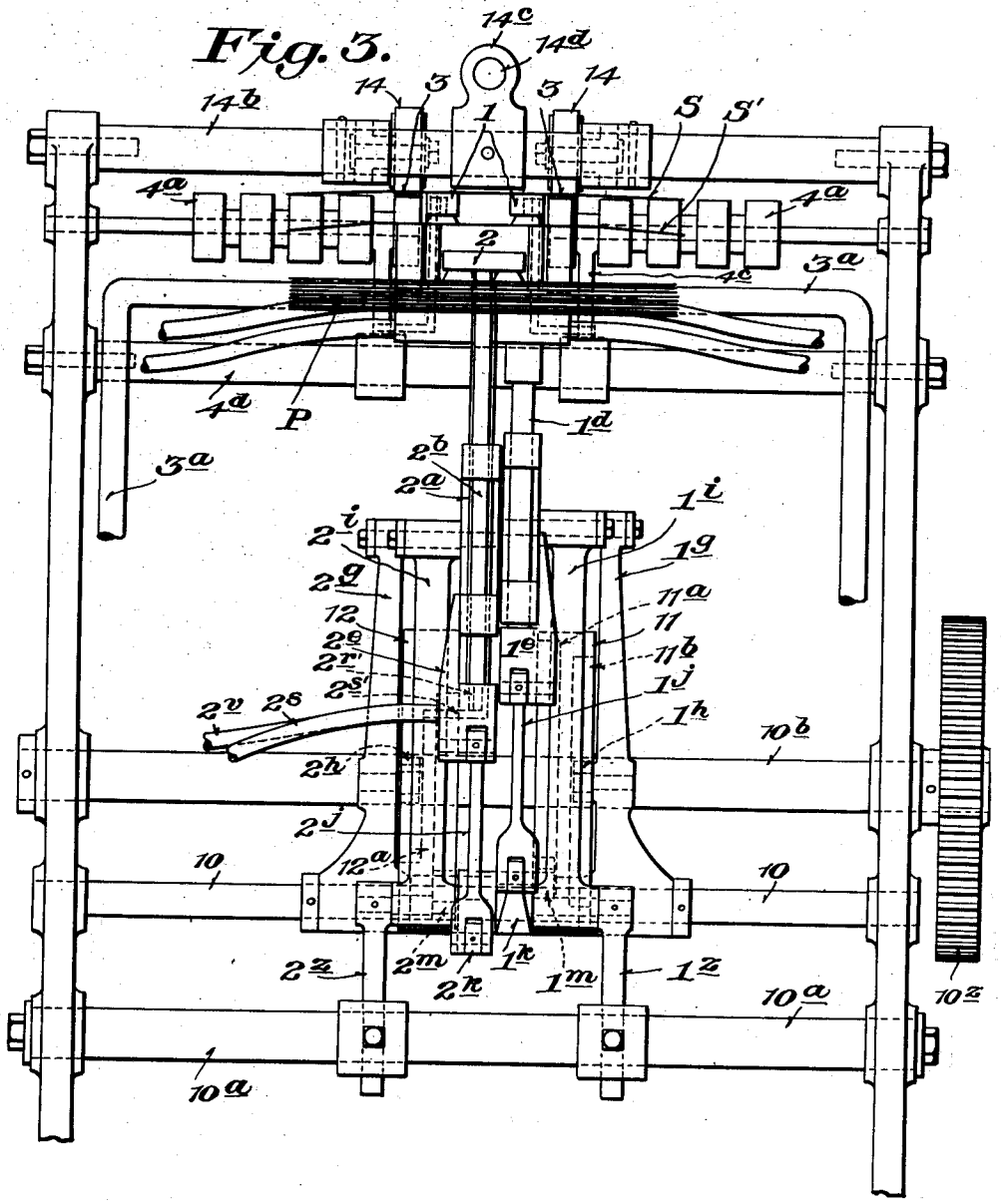
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FEEDING SHEETS TO PRINTING PRESSES, ETC

Filed March 11, 1938 7 Sheets-Sheet 3

Fig. 3.



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June 13, 1939. B. F. UPHAM 2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC

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Fig. 4.

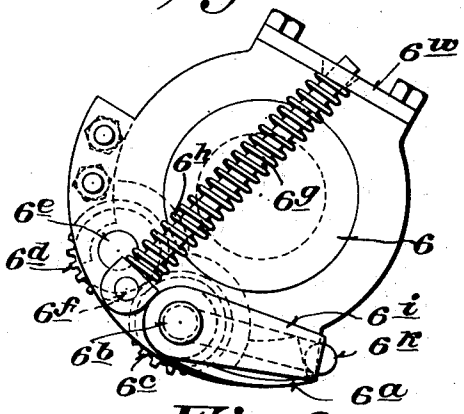


Fig. 5.

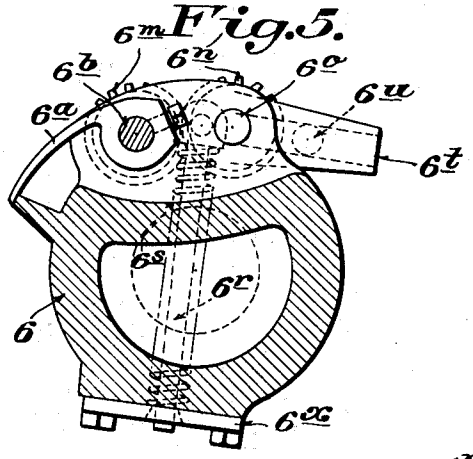


Fig. 6.

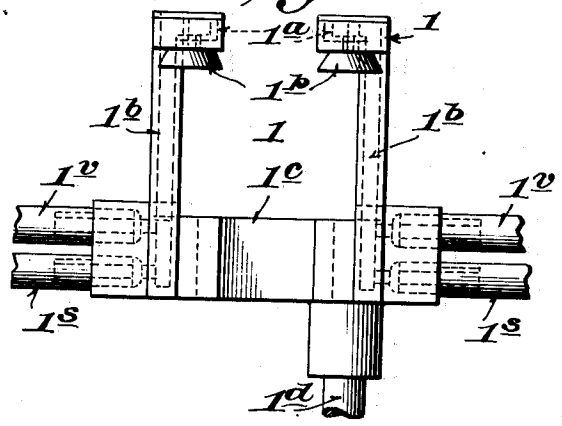


Fig. 8.

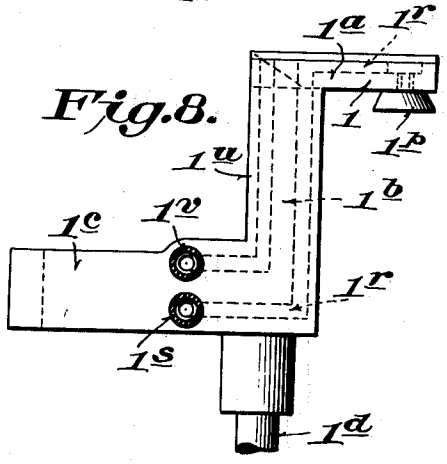


Fig. 7.

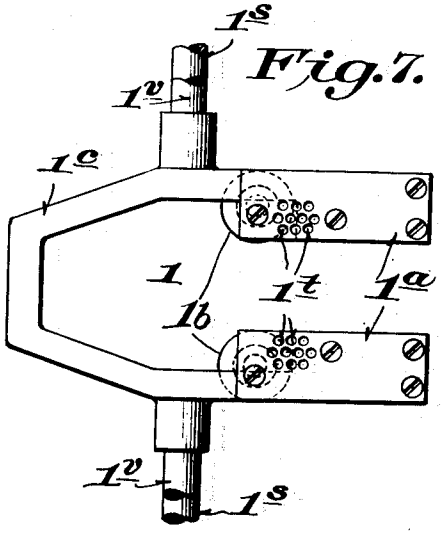
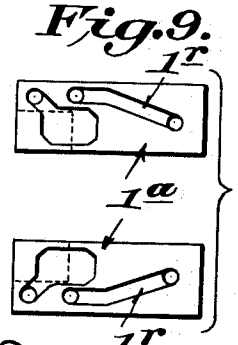


Fig. 9.



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June 13, 1939. B. F. UPHAM 2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC

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Fig.10.

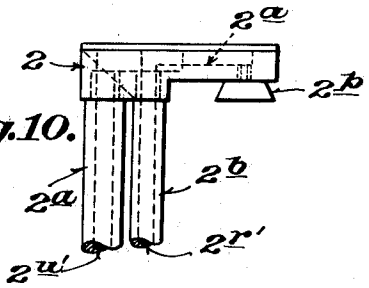


Fig.11.

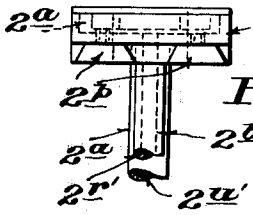


Fig.12.

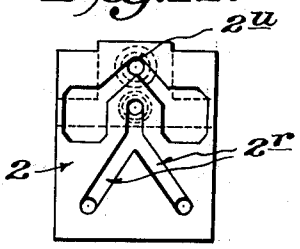


Fig.13.

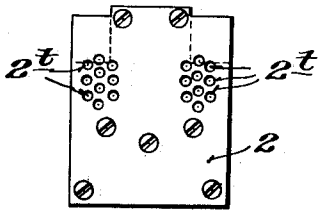


Fig.21.

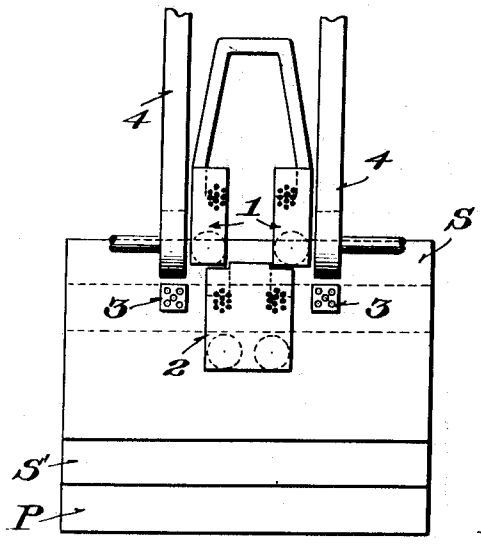
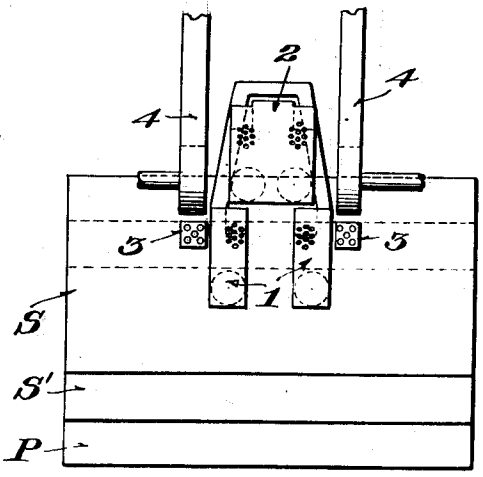


Fig.22.



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June 13, 1939. B. F. UPHAM 2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC

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Fig. 15.

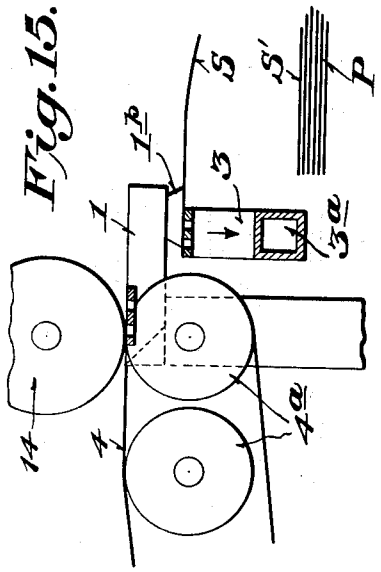


Fig. 17.

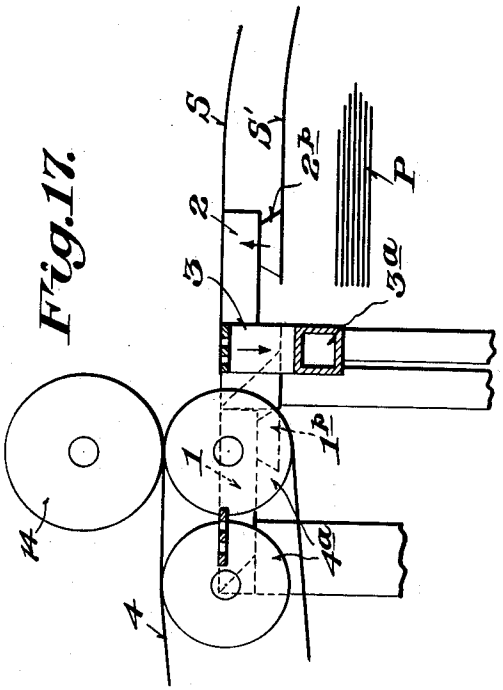


Fig. 14.

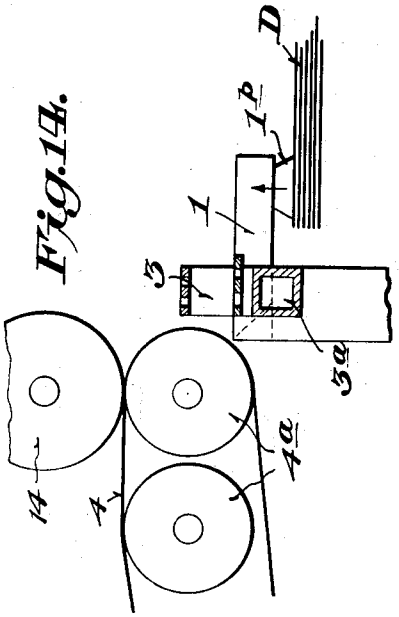
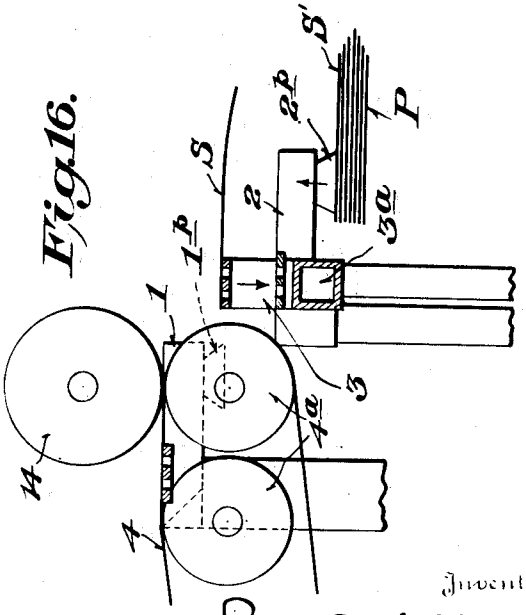


Fig. 16.



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June 13, 1939. B. F. UPHAM 2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC

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Fig. 19.

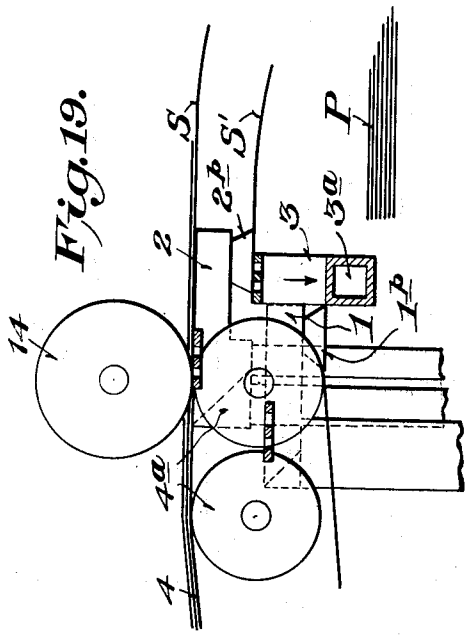


Fig. 18.

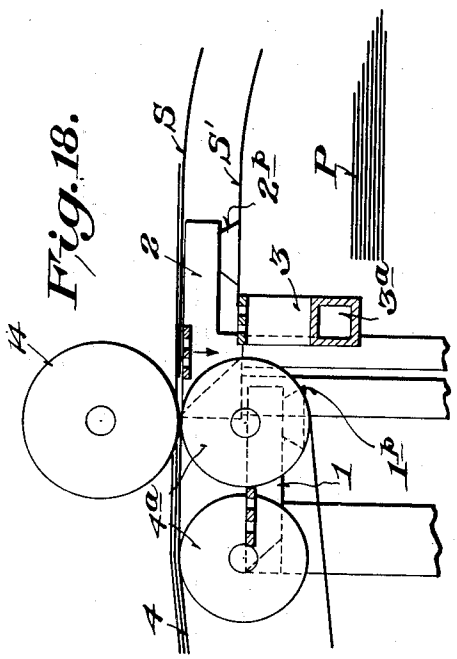
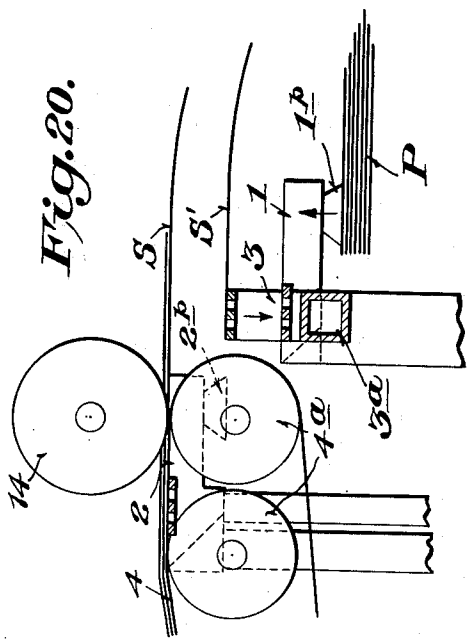


Fig. 20.



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Attorneys

Patented June 13, 1939

2,162,450

UNITED STATES PATENT OFFICE

2,162,450

FEEDING SHEETS TO PRINTING PRESSES, ETC.

Burt F. Upham, Grimsby, Ontario, Canada

Application March 11, 1938, Serial No. 195,378

20 Claims. (Cl. 271—27)

My invention relates to that class of feeders commonly known as "stream feeders" in which an overlapping series of sheets are advanced toward the impression cylinder or other mechanism to operate thereon.

My invention includes a novel mode of and novel means for feeding sheets of paper to printing presses or other mechanism. Its principal object is 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 impression cylinder to be reduced as compared with the impression cylinders in the presses now used to print sheets of same maximum size, and the sheets are moved at less speed than the peripheral speed of the 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, or the feed cylinder, grippers. Further objects are to provide novel means for supplying the sheets in a "stream" from the pile to the feed cylinder; also to provide novel means for consecutively removing sheets from the pile and delivering them to a conveyor operated step by step 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 the gages which arrest the sheets in position for taking by the feed cylinder grippers or the like.

The accompanying drawings illustrate one practical embodiment of my invention and I will first describe the same in detail to enable others to understand and use the same, and thereafter summarize in the claims the essentials of the invention and 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 feed mechanism.

Fig. 2 is a top plan view of the parts shown in Fig. 1.

Fig. 3 is a rear elevation of Fig. 1.

Fig. 4 is an end view of the feed cylinder showing its grippers just closed upon a sheet on the feed board.

Fig. 5 is a sectional view of the feed cylinder showing the mechanism actuating the grippers to release the sheet.

Figs. 6, 7, 8 and 9 are detail views of sheet carrier 1.

Figs. 10, 11, 12 and 13 are detail views of sheet carrier 2.

Figs. 14, 15, 16, 17, 18, 19 and 20 are detail views diagrammatically illustrating various positions of the sheet carriers in transferring a sheet from the pile to the feed board or conveyor sheet.

Figs. 21 and 22 are detail views showing the extreme positions assumed by the sheet carrier in their orbital movements.

In recent years this method of feeding sheets has been used almost exclusively by manufacturers of high speed printing presses, as the sheets travel at a slow speed relatively to the peripheral speed of the impression cylinder until they are necessarily taken by the feed or impression cylinder grippers (or their equivalent). Because of the thinness of the sheets, a sheet, if traveled at high speed is apt to be displaced by air currents or pockets and not be accurately positioned against the sheet stops with consequent improper impression and frequently necessitating stoppage of the press, but where stream feeding is employed the presses can be operated at higher speeds.

In stream feeders the paper pile is usually under the stream of sheets, and the sheets are necessarily raised from the pile and placed in the proper relation to the preceding sheet in the stream, and the foremost sheet in the stream is on top of the stream, and its leading edge is brought into contact with the sheet guides or stops. The sheets in the stream are in a like position to sheets placed on a feed board of a hand fed press of the cylinder type, except that there is a greater distance between the leading edges of successive sheets in the stream. I now describe my novel improvement in stream feeding sheets to printing presses, etc.

Referring to Fig. 1 the sheets are successively taken from a pile P 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 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 the impression cylinder 7, which coacts with a form cylinder 8 to print the sheet.

Figs. 1 and 2 show a sheet *a* which has just been taken from the feed cylinder by the im-

pression cylinder grippers. The progress of sheet *a* is as follows: When the leading edge of sheet *a* was contacting with the sheet stops **5**, the sheet was seized by the feed cylinder grippers and simultaneously the stops **5** were moved out of the path of the sheet which is advanced on its way to be transferred to the impression cylinder **7** and while so advanced is above the stops **5** which however are returned to their first (stop) position and are under sheet *a* (see Fig. 1) and before sheet *a* has entirely passed the stops. They are contacted by the leading edge of the following sheet *b* (under sheet *a*), the upper surfaces of the stops 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 the sheet contacts with the press stops, which are then moved from the path of the sheet which is grasped by the grippers; before the stops return to position the entire sheet must pass the stops, and the stops are not returned to their original position until after the tail edge of the sheet has passed. It will be seen that in my method the stops are returned to original position before the sheet has passed, and the major part of the time required for the passage of the sheet past the stops is utilized in positioning the next succeeding sheet.

Important practical advantages result from this change in the method of operating the stops, which 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 press, operating at 15000 impressions per hour would have a surface speed of 37699 feet per hour. By using my novel method of feeding a press with cylinders 6'' in diameter would print a sheet approximately 14'' lengthwise of the press. Such cylinders are 18.8496'' in circumference and it will be noted that 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 the 6'' press to be 15000 impressions per hour, its cylinders would have a surface speed of 23562 feet per hour. Thus (if we take the surface speed of the 6'' cylinder press as standard) the 8'' press would produce only 11250 impressions per hour and the smaller press would be approximately ⅓ more productive. This increase in speed is due to my novel method of operation by which the interval between the presentation of one sheet and the next to the sheet stops is shortened, and thus makes it possible to decrease the circumference of the printing cylinders.

By 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 of one sheet and the seizing of the leading edge of the next following sheet, 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 impression cylinder for positioning the succeeding sheet against the stops.

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''.

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 **7z** on one end meshing with a similar gear **6z** on feed cylinder **6**, and with a similar gear **8z** on cylinder **8**.

The upper ends of the gages **5** are bent rearwardly and upwardly as at **5a**, to hold sheet *a* out of the way of sheet *b* during the positioning of sheet *b* as hereinabove described. The sheet gages **5** may be operated as above described by any suitable means. In the construction shown the sheet gages **5** are fast to a rock shaft **5b**, on which is a bell crank lever **5t** having one arm pivotally connected to one end of a rod **5u**, the free end of which passes through a rocking eye **5w** having a stud **5x** pivoted on an adjacent part of the frame, a spring **5v** on the rod normally holds rock shaft **5b** and gages **5** in sheet arresting position (Fig. 1). The other arm of lever **5t** has a pin **5c** engaged with a slot **5d** in the upper end of a rod **5e** whose lower end is pivoted to the free end of a lever **5f**; the other end of said lever **5f** being pivoted on a stud **5g** on the frame. Lever **5f** carries a pin or roller **5h** which engages a cam **5i** on a shaft **5j**. Lever **5f** is pressed upwardly to hold roller **5h** in contact with cam **5i** by means of a spring **5m** strung on a rod **5k** whose upper end engages lever **5f** and its lower end is slidably engaged with a rocking eye **5p** having a stud **5s** pivoted on an adjacent part of the frame.

Cam **5i** is rotated in unison with the feed cylinder by means of a gear **5z** on the cam shaft meshing with a gear **15z** on a shaft **15a**, gear **15z** meshing with gear **7z** on cylinder **7** (see Fig. 1).

The sheets are successively fed up to the gages **5** from a pile P and (in the embodiment of my invention illustrated) by means of two orbitally acting and alternately operating sheet carriers **1** and **2** as follows:

The carrier **1** (see Figs. 6 to 9) consists of two similar spaced apart hollow heads **1a** on the upper ends of upright members **1b** connected by an approximately U-shaped member **1c** which is mounted on the upper end of a rod **1d** attached to a head **1e**, said rod passing through a guide block **1z** on the outer end of a bar **1f**, which is mounted on the upper ends of parallel swingable links **1g**, **1i** pivotally connected to bar **1f** (see Fig. 1) and respectively pivotally supported on cross-shaft **10** and a stud **1z** on a shaft **10a** adjacent pile P, (see Figs. 1 and 3). The head **1e** is connected by a link **1j** to the free end of a lever **1k** pivotally mounted on shaft **10**, said lever **1k** having a pin or roller **1m** which engages a race cam **11a** in the adjacent side of a cam disk **11** mounted on a driven shaft **10b**. Cam disk **11** also has in its opposite face a race cam **11b** which is engaged by a pin or roller **1h** on the adjacent link **1g**. Cam **11b** imparts a backward and forward motion to the guide block **1z** and cam **11a** imparts a rising and falling motion to the head **1e**. By these coacting means the desired orbital movement is imparted to carrier **1**. The construction described forms a link suspension for

the carrier 1 and will cause it to move in an orbital path, starting from its rearmost lowermost position over the pile P, then upward and inward to its uppermost and innermost position, thence rearwardly and downwardly to the pile. Various positions assumed by the carrier 1 in its orbital movement is illustrated in Figs. 14–20.

Each member 1a of carrier 1 is provided with an ordinary vacuum cup 1p on its underside, which cup connects with a suction duct 1r in member 1a. Said duct extends through parts 1b, 1c (Figs. 6 to 8) and is connected by a flexible tube 1s with suction controlling devices (not shown).

In the upper side of each member 1b of carrier 1 is a set of perforations 1t (Fig. 7) which communicates with a suction duct 1u extending through members 1b, 1c, and is connected by a flexible suction tube 1v with the suction controlling devices (not shown). The mode of operation of carrier 1 will be hereinafter explained.

A second sheet carrier 2 is provided to operate in alternation with carrier 1. Carrier 2 is supported by pipes 2a, 2b upon a head 2z. Pipes 2a, 2b pass through a guide block 2e attached to the rear end of a bar 2f supported on the upper ends of a link 2g pivoted on shaft 10, and a link 2i pivoted on a stud 2z on shaft 10a in line with stud shaft 10a (Fig. 3). The head 2z is connected by a link 2j to the rear end of a lever 2k pivoted on shaft 10 and having a pin or roller 2m engaging a race cam 12a in the adjacent side of a disk 12 fast on shaft 10b. In the opposite side of cam disk 12 is a race cam 12b which is engaged by a pin or roller 2h on the link 2g. Cam 12b imparts a backward and forward movement to guide block 2z; and cam 12a imparts a rising and falling motion to the head 2e. By these coacting means the desired orbital movement is imparted to carrier 2. The carrier 2 (Figs. 10–13) has two suction cups 2p on its underside adjacent its rear end and near opposite sides thereof. Each cup 2p connects with a suction duct 2r in the carrier, and this duct leads through pipe 2b (Fig. 3) to a duct 2r in head 2e which duct is connected by a tube 2s with the suction control devices (not shown).

Carrier 2 is also provided on its upper side adjacent its inner end and opposite sides with sets of perforations 2t which connect with a duct 2u in the carrier; said duct connects with the duct 2u' in pipe 2a which communicates at its lower end with a duct 2r' in head 2e and duct 2r is connected by a flexible tube 2v with the suction control devices (not shown).

By the construction shown carrier 2 is operated in an orbit similar to that of carrier 1; but preferably when carrier 1 is in its lowest rearmost position carrier 2 is in its uppermost inward position, and vice versa (see Figs. 20 and 16).

Located within the plane circumscribed by the orbits of carriers 1 and 2, are two short suction heads 3, respectively mounted on the inner ends of suction pipes 3a which are connected with the suction control devices (not shown).

The mode of operation of the carriers in transferring sheets from the pile is as follows:

Starting with the carriers 1 and 2 in the positions shown in Fig. 20; carrier 1 is in lowest rearwardmost position with its vacuum cups 1p in contact with the uppermost sheet S on pile P. As carrier 1 moves up and inwardly it lifts the top sheet S from the pile P (Fig. 14) and moves it up and inwardly until its forward end is over suction heads 3. At that moment suction is simultaneously cut off from cups 1p and applied through heads 3 whereby sheet S is retained on the heads while carrier 1 continues to move upwardly and inwardly away from the heads until it reaches its inward limit of travel and then returns outwardly and downwardly to starting position.

Meanwhile carrier 2 has moved outwardly and downwardly in its orbit until its suction cups 2p rest on the succeeding sheet (S') on top of the pile, and when carrier 1 starts downwardly carrier 2 holding sheet S' moves upwardly and inwardly under sheet S, and when vacuum ports 2t in the upper surface of carrier 2 contact the sheet S on heads 3, the suction holding sheet S on the heads is cut off, and simultaneously suction is applied to sheet S through the ports 2t of carrier 2 and carrier 2 lifts sheet S and moves it inward and upward, and simultaneously moves sheet S' over the heads 3, and when the leading edge of sheet S' is on the heads, the suction on cups 2p is cut off and simultaneously suction established in heads 3, so that sheet S' is retained thereon (see Fig. 19) while sheet S is moved on and delivered by carrier 2 to the conveyor 4 (Figs. 19, 20). Meanwhile carrier 1 returns to first position and when sheet S is delivered to the conveyor 4, a third sheet (next on top of pile P) is picked up by carrier 1 (Fig. 20), and when the ducts 1t in carrier 1 contact with the underside of sheet S' on heads 3 suction is cut off from the heads and simultaneously established in ports 1t so that sheet S' is picked off the heads 3 by carrier 1 and delivered to the conveyor 4 (as above described relative to sheet S). When the leading edge of said third sheet is brought over heads 3 it is delivered to the heads (as above described regarding sheet S).

The various positions assumed by the carriers are clearly illustrated in Figs. 14 to 20. Each carrier moves in a like orbit and at like speed, and when carrier 1 is in its lowest outermost position, carrier 2 is in its highest innermost position (Fig. 20) and vice versa (Fig. 16).

In their orbital movements when carrier 1 is moving downward and in the direction of the paper pile, carrier 2 is moving upward toward the conveyor 4, but the carriers are so constructed (see Figs. 21 and 23) that they do not interfere with one another in their orbital travel. Each sheet is picked from the pile by one carrier and deposited on heads 3; then it is taken from heads 3 by the other carrier and its leading edge inserted under the rear end of the pile of sheets on sheet conveyor 4 and between such sheets and an overlying roll 14. Above the stream of sheets on conveyor 4 are a roll 14 adjacent rearmost roll 4a, and a roller 14g intermediate roller 14 and the feed cylinder 6 (see Fig. 1). The roll 14 is journaled in arms 14a on a cross-shaft 14b, and roller 14g is journaled in arms 14f pivotally attached to brackets 14e mounted on rods 14d attached to brackets 14c on shaft 14b. Roll 14 cooperates with roll 4a in nipping and forwarding the last sheet inserted in the stream of sheets. Roller 14g assists in holding the stream of sheets on the pile, and is adjusted so that the rear end of the leading sheet in the stream will clear roller 14g just before its leading edge contacts gages 5.

In slow speed presses it would be practical to use but one carrier which would feed the sheets to the conveyor (during two successive cycles) first to the heads 3, then to the conveyor; but by using two carriers the speed of movement of the carriers and of sheets from pile to conveyor can

be materially reduced while the speed of press is enhanced.

The movement of the sheets just described applies to the beginning of feeding operations; but when the press is in operation there would be a stream of sheets on the conveyor 4 and over the paper pile (see Fig. 1) and as shown in Fig. 19 a sheet S would be inserted between the conveyor (on the one hand) and the stream of sheets and the upper roll (on the other). The sheet conveyor 4 is preferably operated intermittently (as hereinafter described) during ½ of a cycle of one revolution of the impression cylinder 7, but it is not my intention to limit myself to the particular method and conveyor operating means herein described. The insertion of the successive sheets in the stream of sheets when the press is functioning can occur just prior to the completion of the feeding movement of the conveyor. This would be advantageous as the carrier and the sheet conveyor would be moving slowly and the insertion would be more accurate than if it occurred when the parts were moving rapidly.

In the construction illustrated the endless conveyor 4 runs over a roll or rolls 4*b* adjacent feed cylinder 6 and over rolls 4*a*, 4*a*, at its end adjacent the pile P. The shafts of rolls 4*a* are rotatably mounted in the free ends of arms 4*c* mounted on a shaft 4*d* (Fig. 1). On the shaft of roll 4*b* is fixed a pinion 4*f* which meshes with a pinion 4*g* on a stub shaft 4*h*, and fastened to pinion 4*f* is a ratchet disk 4*i* which is engaged by a pawl 4*k* on one arm of an oscillatory lever 4*m* the other arm of which lever is connected by a rod 4*o* to a crank pin 4*p* on a gear 4*z* mounted on a stub shaft 4*s*. Gear 4*z* is driven by the gear 5*z* that operates the sheet stops 5. In this construction the conveyor is moved intermittently and feeds the stream of sheets forward during one-half a revolution of the feed and impression cylinders, gear 4*z* rotating in unison with the said cylinders. Gear 4*z* also meshes with the gear 10*z* on shaft 10*b* and drives said shaft, and for each revolution of gear 4*z* gear 10*z* is rotated one-half a revolution, and during each half revolution of gear 10*z* a sheet of paper is fed from the pile to the stream on the conveyor as above described. During approximately one-half of the cyclic movement of the press the pawl engaging the ratchet imparts movement to the conveyor tapes. The tapes are stationary during the remainder of the cyclic movement. As the sheet supporting part of the tapes move forward the rolls resting on them hold the sheets to the tapes so that the sheets have the same movement as the tapes. Note that in Fig. 2 the leading edge of sheet of paper *b* is in contact with the gages 5 but the tail of the sheet has moved out of contact with the small rolls 14*g* that hold the stream of sheets to the tapes. This can also be seen in Fig. 1.

It will be noted that sheet S is inserted in the stream (Figs. 19–20) simultaneously with the arrival of sheet S' at the vacuum heads 3.

The drawings show a press designed to print a minimum sized sheet approximately 3" x 5" and up to a maximum sized sheet approximately 14" x 18". In presses of larger size the minimum sheet would not be as small, and there would be more space widthwise of the press for the sheet carriers and their vacuum cups, (see Fig. 3), and the carriers might be arranged so that no portion of either carrier would need to travel within the orbit of the other.

The feed cylinder gripper operating devices are shown in detail Figs. 4 and 5.

In Fig. 4 the feed cylinder 6 is shown in position to take a sheet from the sheet conveyor. The grippers 6*a* are mounted on a shaft 6*b* journaled in the end of cylinder 6. A tumbler 6*i* is attached to the gripper shaft at the operator's side of the press, and the grippers are closed by the engagement of tumbler 6*i* with a pin 6*k* mounted in the adjacent side frame (see Fig. 2).

Owing to the small size of the cylinder 6 the ordinary gripper shaft operating devices would not be practical. In my construction on the gripper shaft 6*a* (Figs. 1 and 4) is fixed a pinion 6*c* meshing with a pinion 6*d* on a stub shaft 6*e* mounted on the adjacent end portion of the cylinder 6. On pinion 6*d* is a crank pin 6*f* engaged by the head of a rod 6*g*, the other end of which is guided in an opening in a plate 6*i* attached to the cylinder. A spring 6*h* interposed between the plate and head of rod 6*g* normally tends to cause the pinions to rock and hold grippers 6*a* in closed position. This closing occurs when tumbler 6*i* is tripped by pin 6*k*. At the other end of the cylinder (Figs. 2 and 5) a pinion 6*m* is fixed on shaft 6*b* and meshes with a pinion 6*n* on a stub shaft 6*o* mounted on a stud 6*v* in the cylinder adjacent the end thereof; and on the inner end of shaft 6*o* is a crank arm 6*r* to which is pivoted the head of a rod 6*r* the other end of which passes through a guide plate 6*x* on the cylinder. A spring 6*s* strung between the head of rod 6*r* and plate 6*x* normally tends to rock pinions 6*n*, 6*m* and hold the grippers 6*a* in open position. The shaft 6*b* however is held in gripper closing position (after it is closed by action of tumbler 6*i* and pin 6*k* above described) until a tumbler 6*t* on the shaft 6*o* of pinion 6*m* engages a pin 6*u* on the adjacent side frame (Fig. 2). The pins 6*k* and 6*u* are so positioned as to respectively operate the related tumblers at the proper times to cause the opening and the closing of the gripper fingers during each revolution of the feed cylinder.

In Fig. 5 the feed cylinder is shown in the position it would take shortly after a sheet had been transferred to the impression cylinder (Fig. 1). Because of the small diameter of the feed cylinder and the consequent shortness of the gripper shaft compression springs, I use two springs and cooperating devices mentioned above; which provide simple and novel means for operating the grippers of a press with small cylinders.

In the press shown, both tumbler pins 6*k* and 6*v* are located close to the path of the periphery of a 6" circle, and are respectively engaged by tumblers 6*i* and 6*t* to respectively close and open the grippers. The conventional tumbler has two channels lineally opposed and the pin that actuates the conventional tumbler when the grippers are closing is located as in my press, but the pin that opens the grippers with the conventional tumbler is located slightly nearer the center of the cylinder.

If it was attempted to use the conventional tumbler and pins with my small feed cylinder the closing pin would have to be so located near the center of the cylinder that the arc of movement of the closing tumbler would not be sufficient to move the tumbler into position to be entered by its opening pin. And therefore when the conventional tumbler is used the diameter of the cylinder cannot be reduced below a certain minimum.

While I have illustrated one practical embodi-

ment of my invention changes may be made within the scope of the invention, and it is not intended to limit the invention to the particular construction of the carriers or their operating devices; nor to a rotating feed cylinder, nor to the employment of such devices with a rotary printing press.

In accordance with official requirement for division, the mode of and means for feeding a sheet underneath the sheet taken by the impression or feed cylinder grippers has been made the subject-matter of a companion divisional application for Method and means for feeding sheets, filed July 21, 1938, Serial No. 220,532. The small cylinder and gripper actuating mechanisms thereof has been made the subject-matter of a companion divisional application for Gripper cylinders for printing presses, filed July 21, 1938, Serial No. 220,533. The claims for the mode of and means for transferring sheets from the pile to conveyor are retained in this application.

I claim:

1. The method of feeding sheets from a pile to a receiver, consisting in transferring the sheet from the pile to receiver in two successive steps, by first lifting a sheet from the pile and moving it part way to the receiver; and second again lifting said sheet and delivering it to the receiver.

2. The method of feeding sheets from a pile to a conveyor, consisting in first lifting the top sheet on the pile and moving said sheet part way to the conveyor and arresting it, and second engaging the under surface of said sheet and lifting it to the conveyor.

3. The method of feeding sheets from a pile to a stream of sheets on a conveyor, consisting in first engaging the upper surface of the top sheet on the pile and lifting said sheet and moving it part way to the conveyor, and second engaging the under surface of said sheet and lifting it to the conveyor.

4. The method of feeding sheets from a pile to a receiver; consisting in lifting the top sheet on the pile and depositing such sheet upon a support intermediate the pile and receiver, and thereafter lifting the sheet from the support and delivering it to the receiver.

5. The method of feeding sheets from a pile to a receiver; consisting in lifting the top sheet on the pile by means applied to its top surface; and depositing such sheet upon a support intermediate the pile and receiver, and thereafter lifting the sheet from the support by means engaging the underside of the sheet and delivering it to the receiver.

6. The method of feeding sheets from a pile to a conveyor, consisting in lifting the top sheet on the pile by suction applied to the upper surface of said sheet and depositing it upon a support intermediate the pile and conveyor and retaining it on said support by suction, and thereafter lifting the sheet from the support by suction means engaging the underside of the sheet and delivering it to the conveyor.

7. Means for transferring sheets from a pile to a receiver comprising a sheet support intermediate the pile and receiver, a carrier adapted to take a sheet from the pile and move it part way to the support, and to subsequently lift a sheet previously deposited on such support and deliver the latter sheet to the receiver.

8. Means for transferring sheets from a pile to a receiver comprising a sheet support intermediate the pile and receiver, an orbitally moving carrier adapted to lift the top sheet from the pile and move it part way to the support, and to pick up a sheet previously removed from the pile from such support and deliver it to the receiver.

9. Means for transferring sheets from a pile to a stream of sheets on a conveyor, comprising a sheet support intermediate the pile and receiver, an orbitally moving carrier adapted to lift the top sheet from the pile and move it part way to the support, and to pick up a sheet previously removed from the pile from such support and deliver it to the underside of the stream of sheets on the conveyor.

10. Means for feeding sheet from a pile to a receiver comprising a sheet support intermediate the pile and receiver, and a movable carrier adapted to first lift a sheet from the pile and deposit said sheet on said support, and to engage a previously fed sheet previously deposited on the support and deliver said sheet to the receiver.

11. Means for feeding sheet from a pile to a conveyor comprising a support intermediate the pile and conveyor, and a movable carrier adapted to first lift a sheet from the pile by suction and move said sheet to said support, and to then engage by suction a sheet previously deposited on the support and deliver such sheet to the conveyor.

12. Means for feeding sheet from a pile to a conveyor comprising a support intermediate the pile and conveyor, and a movable carrier adapted to first lift a sheet from the pile by suction applied to the top surface of the sheet and move said sheet to said support, and to engage by suction the underside of a sheet previously deposited on the support and deliver such sheet to the conveyor.

13. Means for feeding sheets from a pile to a receiver, said means including a sheet support intermediate the pile and receiver, a sheet carrier having sheet engaging means on both its upper and lower surfaces, and means for moving said carrier to contact its lower sheet engaging means with the top sheet on the pile and deposit said sheeet on the sheet support, and to engage by its upper sheet engaging means the underside of a sheet previously deposited on the support and deliver such sheet to the receiver.

14. Means for feeding sheets from a pile to a stream of sheets on a conveyor adjacent the pile, said means including a suction head intermediate the pile and conveyor, a sheet carrier having sheet engaging suction means on both its upper and lower surfaces, and means for moving said carrier to first engage its lower suction means with the upper side of the top sheet on the pile, and lift said sheet and deposit it on the suction head; and second to engage by its upper suction means the underside of a sheet previously deposited on the suction head and transfer said sheet to the stream of sheets on the conveyor.

15. Means for transferring sheets from a pile to a receiver; comprising a sheet support intermediate the pile and receiver, a pair of alternately operating sheet carriers each adapted to successively pick up a sheet from the pile and deposit it upon the support, and to also pick up a sheet previously deposited on the support and deliver it to the receiver.

16. Means for transferring sheets from a pile to a stream of sheets on a conveyor, comprising a sheet support intermediate the pile and conveyor, and a pair of sheet carriers alternately operating to successively pick up a sheet from the pile and deposit it upon the support, and to pick up a sheet

previously deposited on the support and deliver it to the underside of the pile on the conveyor.

17. In mechanism of the character specified; a sheet carrier, a vertically movable head on which the carrier is mounted, a guide block for said carrier, means for reciprocating the guide block in one plane, and means for reciprocating the head in an opposite plane whereby the carrier is moved in an orbit.

18. In mechanism as set forth in claim 17, the means for moving the guide block comprising a bar supporting the block, parallel links supporting the bar, and a cam for swinging the links.

19. In mechanism as set forth in claim 17, the means for reciprocating the head comprising a swingable lever, a link connecting the lever and head, and a cam for vibrating the lever.

20. In mechanism of the character specified; a sheet carrier, a vertically movable head on which the carrier is mounted, a guide block for said carrier, means for reciprocating the guide block, and means for reciprocating the head; the means for moving the guide block comprising a bar supporting the block, parallel links supporting the bar, and a cam for swinging the links; and the means for reciprocating the head comprising a swingable lever, a link connecting the lever and head, and a cam for vibrating the lever.

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