July 8, 1947. M. E. MORRIS 2,423,563

PAPER FEEDER

Filed Sept. 26, 1945

Fig. 1.

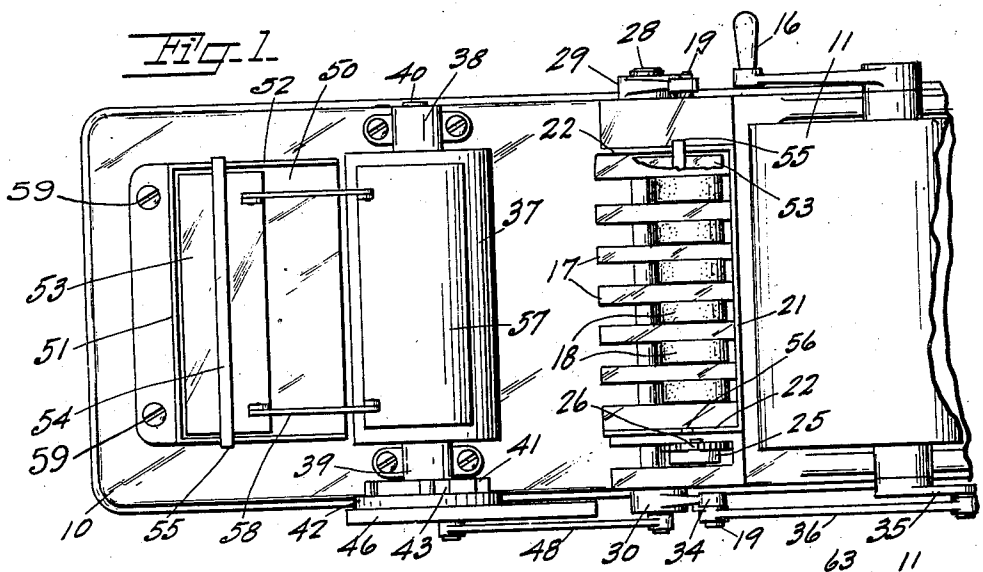
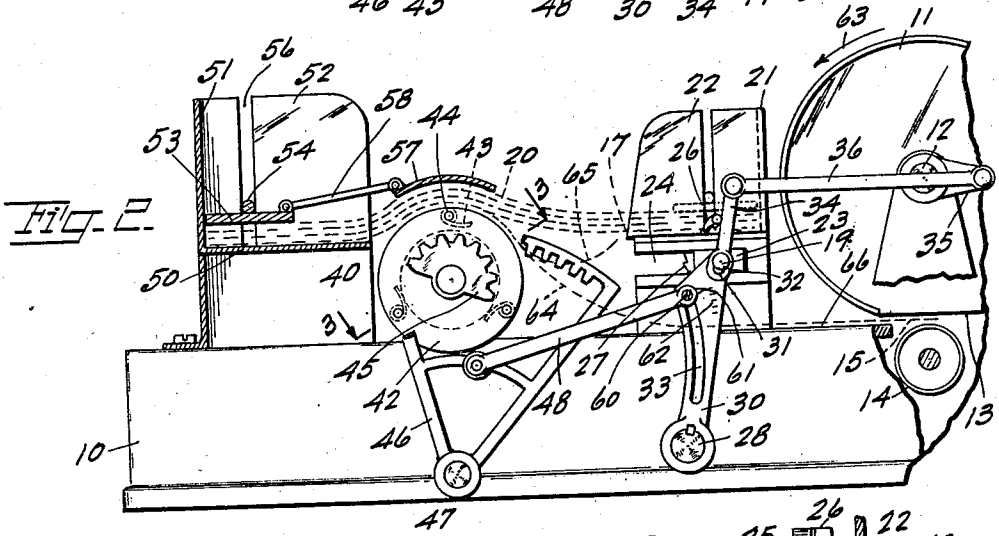


Fig. 2.



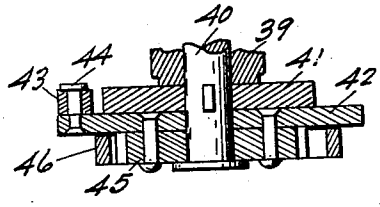


Fig. 3.

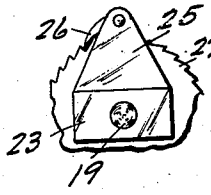


Fig. 4.

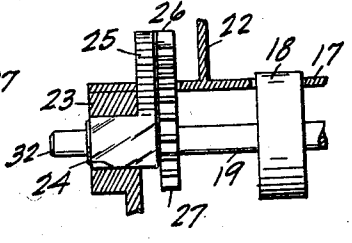


Fig. 5.

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PAPER FEEDER

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6 Claims. (Cl. 271—19)

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This invention, a paper feeder, is an improvement over conventional types of paper feeders, particularly in connection with Mimeograph, Ditto, and similar duplicating machines, and with small printing presses, in that, instead of the conventional way of feeding from the top of the stack, the paper is fed from the bottom of the stack, and the feeding is positive, with no possibility of feeding two sheets at a time as so often occurs with conventional feeders, because, in feeding from the top of the stack, reliance is placed on the weight of the following sheet and side clamps to prevent its lifting along with the sheet intended to be lifted or shifted, and the suction between two sheets is often too great for the weight and friction on sides of the paper to overcome.

With this invention, the paper is fed from the bottom of the stack, through differential friction at one end of the bottom sheet, by providing friction for moving the bottom sheet, of a value greater than the existent friction between the bottom sheet and the next superposed sheet and, through instant breaking of the existent vacuum therebetween.

The objects and advantages of the invention are as follows:

First, to provide a paper feeder which will feed sheets from the bottom of the stack sequentially.

Second, to provide a paper feeder which will assure the sequential feeding of paper to single sheets.

Third, to provide a paper feeder which feeds paper one sheet at a time from the bottom of a stack through the medium of differential friction between a retractor with the bottom of the lowermost sheet, and between the lowermost and next superposed sheet.

Fourth, to provide a paper feeder as outlined which will operate to deliver one sheet in timed relation for each operation of the machine in which it is to be used.

Fifth, to provide a paper feeder as outlined which is adjustable to deliver the sheets to a predetermined point.

Sixth, to provide a paper feeder as outlined which is capable of being operatively associated with machines of the types for which it is suited and with operative connections to cause its operation in synchronism with the machine.

Seventh, to provide a paper feeder which requires no source of vacuum, which is simple in construction and operation, one which cannot easily get out of order, and which can be economically constructed.

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In describing the invention reference will be made to the accompanying drawings, in which:

Fig. 1 is a top plan view of the invention as installed on a Mimeograph or similar type of duplicator.

Fig. 2 is a side elevation of Fig. 1 with certain portions broken away and other portions in section to clearly illustrate all operative elements.

Fig. 3 is an enlarged section taken on line 3—3 of Fig. 2.

Fig. 4 is an enlarged view of the crosshead block with its pawl arm and the ratchet, for control of the paper end retractor friction wheels.

Fig. 5 is a side elevation of Fig. 4.

The invention can be applied to the various types of duplicators, Ditto machines, small printing presses, and to other types of devices which require that one sheet of paper or other sheet material of a somewhat similar nature be fed at a time, and in the instant illustration, the duplicator consists of the frame or base 10 on which is rotatably supported the stencil drum 11 having a shaft 12 and a recessed portion 13 between the terminal ends of the stencil to provide space for the stencil end securing means and a space for insertion of the sheet which when brought to position rests on top of the impression roller 14 as indicated by the dotted line 15, the impression roller being limited in its upward movement while being resiliently urged upward, so that as the cylindrical portion of the periphery of the stencil drum reaches the impression roller, it grips the paper and feeds it through between the drum and roll while impressing the sheet through the stencil. This stencil drum is provided with driving means which may be a motor through a suitable reduction gearing, but which is illustrated as consisting of a hand crank 16.

The sheet-end retracting means consists of a support consisting of a comb-like structure 17 between the teeth of which are located friction rollers 18 formed integral with or fixedly mounted on a shaft 19, the comb-like structure and the rollers providing a support for the forward end of the stack of sheets 20. A thrust wall 21 is located at the forward end of this support, and side gauges 22 are provided to keep the stack even. A crosshead 23 is provided at each end of the shaft 19 and provides a bearing therefor, and is slidable in a slot 24 formed in the side walls of the supporting structure for the forward end support for the paper, and has a pawl arm 25 integral therewith. Mounted on this pawl arm is a spring-urged pawl 26 which cooperates with a ratchet 27 which is formed integral with or fixed

on the shaft 19. Thus the shaft 19 and its friction rollers can rotate counterclockwise but not clockwise.

A shaft 28 passes through the base and has a lever secured on each end, respectively 29 and 30, both of which have a slot bearing 31 for the ends 32 of the shaft 19 while lever 30 has an adjusting slot 33 formed in its main or lower portion, and also has an extension 34.

A crank 35 is fixed on the end of the stencil drum shaft 12, and a connecting rod 36 provides an operative connection between the crank 35 and lever extension 34.

Rotatably mounted in spaced relation to the front-end support is a friction roll 37 which is suitably supported in bearings 38 and 39, this roller being fixed on its shaft 40.

Fixed on the shaft 40 is a friction ratchet 41 and in cooperative relation thereto is a pawl support 42 on which is mounted a series of friction pawls 43, being indicated as bow springs which are fixed at one end on pins 44, though not limited to this type of structure, since a fine-tooth ratchet with a series of stepped pawls could be used, however, the friction type will permit of the slightest adjustments in feed and is therefore preferable.

This pawl support is made integral with or secured to a segmental gear 45 which is rotatable along with the pawl support, on the shaft 40. An inside sector gear 46 has its axis at 47 and cooperates with the gear 45. Obviously a complete gear could be substituted for the segmental gear and would be essential if a complete revolution or more was required of the roll 37, and the travel of the roll can easily be increased by a gear train between the two gears.

A connecting rod 48 connects the sector gear 46 with the lever 30, and is shown in its adjustment for maximum movement of the roll 37. The only reason for making the sector gear separate from lever 30 is to provide adjustment for the travel of the roll 37, so that the paper 15 can be delivered to any precise location. When such adjustment is not required, the sector gear can be made integral with the lever 30 with its axis on the same center, which would eliminate the stub shaft 47, connecting rod 48 and the slot 33.

A support and centering enclosure is provided for the follow end of the stack and consists of a floor 50, a back wall 51 and side walls 52, and the floor is on a level below the top of the friction or drive roll 37. In both, the forward and the rearward supports and centering means, a follower is provided and includes a shoe 53 having a hand grasp and guide member 54 with the guide member having lateral extensions 55 which slidably operate in slots 56 formed in the side walls.

A follower 57 for the drive roll 37 is hinged or otherwise coupled to one of the followers 53 and is illustrated as connected to the rear follower through pivoted links 58.

The adjustment and operation of the invention is easy and simple. The followers 53 and 57 are lifted out, the stack 20 of paper is placed in the hopper formed by the end supports and centering devices and the rearward centering device is adjusted by releasing the screws 59 and sliding the device forward until, with the forward end of the stack against the front wall 21, the rear wall 51 will be in contact with the rear end of the stack, after which the screws are again tightened. This adjustment permits the handling of paper of different lengths.

If the front end of the sheet is to be fed to exactly the same position as those which were last processed, irrespective of the lengths of the sheets, no other adjustment is necessary. However, if the sheet is not to be advanced so far between the stencil drum 11 and impression roll 14, then the screw 60 is freed and that end of connecting rod 48 is adjusted downward in the slot 33 to the point where the drive roll 37 will move the sheet to the exact position desired. A pointer 61 is easily provided on the connecting rod for registry with calibrations 62 on the lever 30, to indicate variations in the feed, so that, if say the feed is to be a half-inch less, the connecting rod can be adjusted downward the indicated half-inch of feed.

After the stack of sheets is in position, the followers are placed on top of the stack and will follow the stack as sheets are removed from the bottom, the followers being essential only for the last sheets to be fed to provide the necessary weight for cooperation of the feed and retractor wheels with the lowermost sheet, or where a relatively few copies are to be made.

With the stencil in position and properly inked, the stencil drum can be operated by motor or by hand continuously, with the stencil drum rotated in the direction of the arrow 63.

As illustrated, the drive roll has just completed feeding the lowermost sheet, the forward end of which is in position to be gripped by a further slight movement of the stencil drum 11, the paper bowing down as indicated at 64 with the follow end still held between the stack and the drive roll. However, since there is no resistance to the turning of the drive roll other than the friction and weight of the paper supported thereby, the paper will be pulled out as the stencil drum is rotated, providing just a desirable degree of tension to the sheet during the gripping stage. Operation however is not so limited, because the drive roll can just as easily be set back farther and made to feed far enough to completely release the sheet, though such procedure would not assure proper positioning of the sheet with so great a degree of certainty as when the terminal end of the sheet is still held.

As the stencil drum is rotated from the position shown, the crank 35 swings over and through the connecting rod 36 moves the lever 30—34 back along with its companion on the other side of the machine through the shaft 28, and these levers move the shaft 19 with all of its rolls and other equipment back to the rearward end of the comb-like structure with the pawl 26 cooperating with the ratchet 27 to keep the shaft with its friction wheels 18 from turning, thus providing direct friction with the lowermost sheet and forcing the end back to the edge of the comb-like support to the looped position indicated at 65 as the crank 35 reaches its opposite position.

At the same time during the travel of this lever, the lever, through the connecting rod 48, sector gear 46, and pinion 45 rotates the pawl support 42 counterclockwise viewing Fig. 2 without moving the drive roll 37, but with the pawls taking up on the friction ratchet 41 for a forward feed.

As the crank moves around to its initial position shown, the lever 30—34 is drawn back to its initial position, the pawls 43 engage the ratchet 41 and rotate the drive roll 37 clockwise, and simultaneously the shaft 19 with its rolls is moved forward but the rolls are now free to rotate and initial movement turns down the terminal end

of the retracted sheet to free it to drop to the platen 66 while the drive roll 37 feeds the sheet forward to the position indicated at 15, the rolls 18 merely rolling under the remaining sheets to their initial position.

The drive roll and retractor rolls 18 are provided with a suitable friction facing, such as live rubber, canvas, or even with a gritty surface coating if necessary for some specific type of material to be fed, the object being to have the coefficient of friction higher between the rolls and paper than between the respective sheets of paper.

If positive acting pawls with a toothed ratchet are to be employed, it will be necessary to have relatively fine teeth in the ratchet and an arcuate pawl with a series of teeth of different pitch than that of the ratchet or to provide a series of pawls as shown but in stepped relation, for fineness of adjustment, however, the friction type of pawl is preferable because it can pick up the ratchet at any point for precision feeding.

I claim:

1. Paper feeding means, in combination; means for releasing one end of the lowermost of a stack of sheets, and means for advancing the said lowermost sheet following release of said one end from under the superposed sheet of the stack of sheets, and means for operating said means for releasing and said means for advancing in synchronism; said means for releasing comprising a comb-like support for the stack of sheets, friction rolls operating between the teeth of said comb-like support and projecting thereabove for full cooperation with the underside of the lowermost sheet, means for moving said rolls in a plane parallel to said comb-like support and to the terminal end thereof and including means retaining said rolls against rotation when moved toward said terminal end and for freeing said rolls for rotation when moved in the other direction.

2. Paper feeding means, in combination; means for releasing one end of the lowermost of a stack of sheets, and means for advancing the said lowermost sheet following release of said one end from under the superposed sheet of the stack of sheets, and means for operating said means for releasing and said means for advancing in synchronism; a support for each end of the stack of sheets with the support at one end adjustable for variations in length of stack; the support at the other end including friction rolls and a comb-like structure for sequential support of the sheets and with said friction rolls movable in a plane parallel to said comb-like structure, and with said friction rolls locked against rotation when moved in one direction to retract the end of the lowermost sheet and free to rotate when moved in the opposite direction to prevent return of the end of the lowermost sheet to its initial position, and comprising means for releasing.

3. Paper feeding means, in combination; support and centering means for each end of a stack of sheets; a driving roll forming a support for the intermediate portion of the stack; means for sequentially rotating said driving roll in one direction for feeding the undermost sheet from the stack; and friction rolls in the forward one of said support and centering means and including means for reciprocating said friction rolls toward and away from said driving roll and means for retaining said friction rolls against rotation when moved toward said driving roll and freeing the friction rolls for rotation when moved away from said driving roll, for retracting the end of the lowermost sheet from under the stack, and returning to their initial position without disturbing the following sheet.

4. A paper feeder comprising; a support and gauging means for the forward end of a stack of sheets; an adjustable support and gauging means for the rearward end of the stack; a friction roller intermediately located between said supports for supporting the intermediate portion of the stack; friction members cooperating with the undersurface of the forward end of the lowermost sheet and means for driving said friction roller intermittently and said friction members reciprocally in synchronism, whereby movement of said friction members in one direction retracts and frees the forward end of the lowermost sheet and said friction roller immediately moves the sheet out from under the remainder of the stack and advances the same to a predetermined point.

5. A structure as defined in claim 4; said support and gauging means for the forward end of the stack including a base having a comb-like structure, and said friction members comprising rollers operating between the teeth of the comb-like member and projecting slightly there-above, a shaft having said rollers fixed thereon and having a sliding bearing block for each end and a pawl supported by one of said blocks, and a ratchet fixed on said shaft for cooperation with said pawl, whereby said pawl retains said rollers against rotation when the rollers are moved toward the terminal ends of the teeth to retract the lowermost sheet, with the rollers free upon return to roll freely under the next lowermost sheet to their initial position.

6. A paper feeder, in combination; a support and gauging means for the forward portion of a stack of sheets; an adjustable support and gauging means for the rearward portion of the stack; a friction roll located intermediate said supports and functioning as a support for the intermediate portion of the stack; friction means associated with the support for the forward portion of the stack and operating frictionally with movement toward said friction roll to retract the forward end of the bottom sheet of the stack and release it from the rearward end of the support for the forward portion, and operating non-frictionally on the return movement; and means for reciprocating said friction means and for intermittently driving said friction roller in synchronism, with said friction means releasing the forward end of the bottom sheet and the friction roller delivering the forward-end-released sheet from under the remaining superposed sheets to a predetermined point.

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