Feb. 24, 1970 H. HARRISON 3,497,205

SHEET FEEDING MEANS

Filed Sept. 7, 1967 3 Sheets-Sheet 1

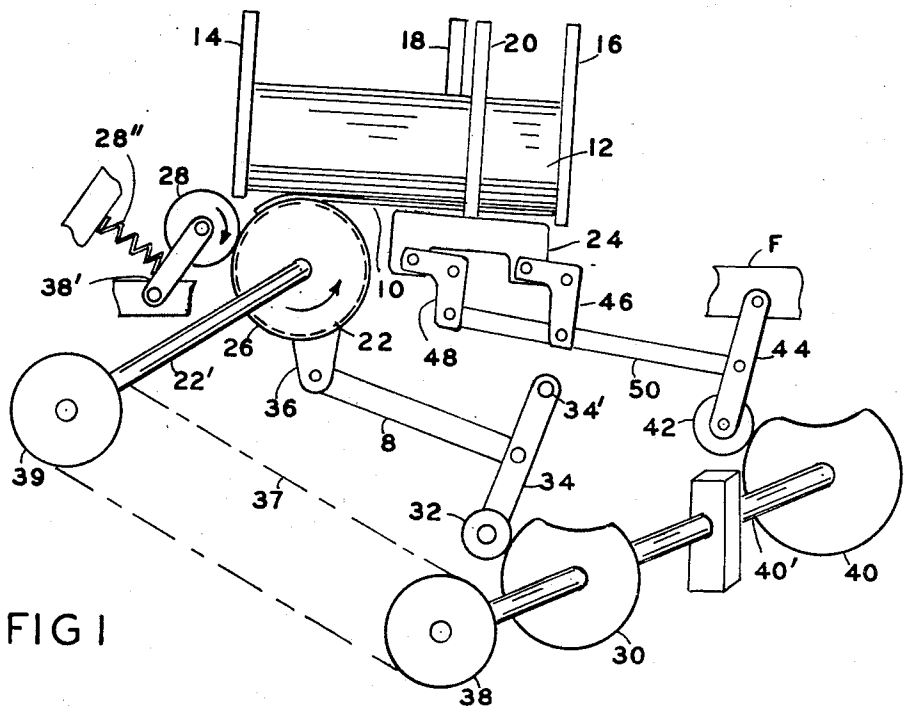

FIG 1

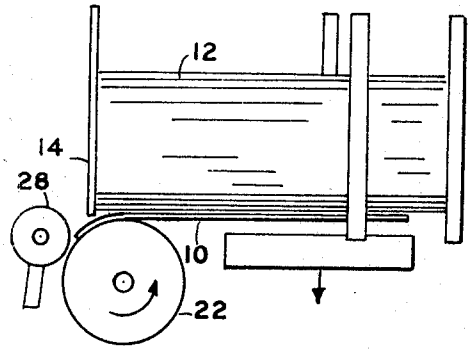

FIG 2

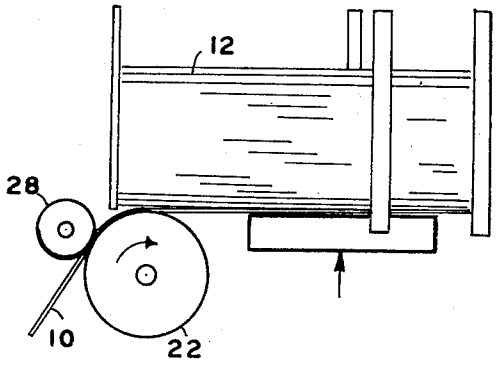

FIG 3

INVENTOR.

HENRY HARRISON

James P. Malone

Feb. 24, 1970 H. HARRISON 3,497,205

SHEET FEEDING MEANS

Filed Sept. 7, 1967 3 Sheets-Sheet 2

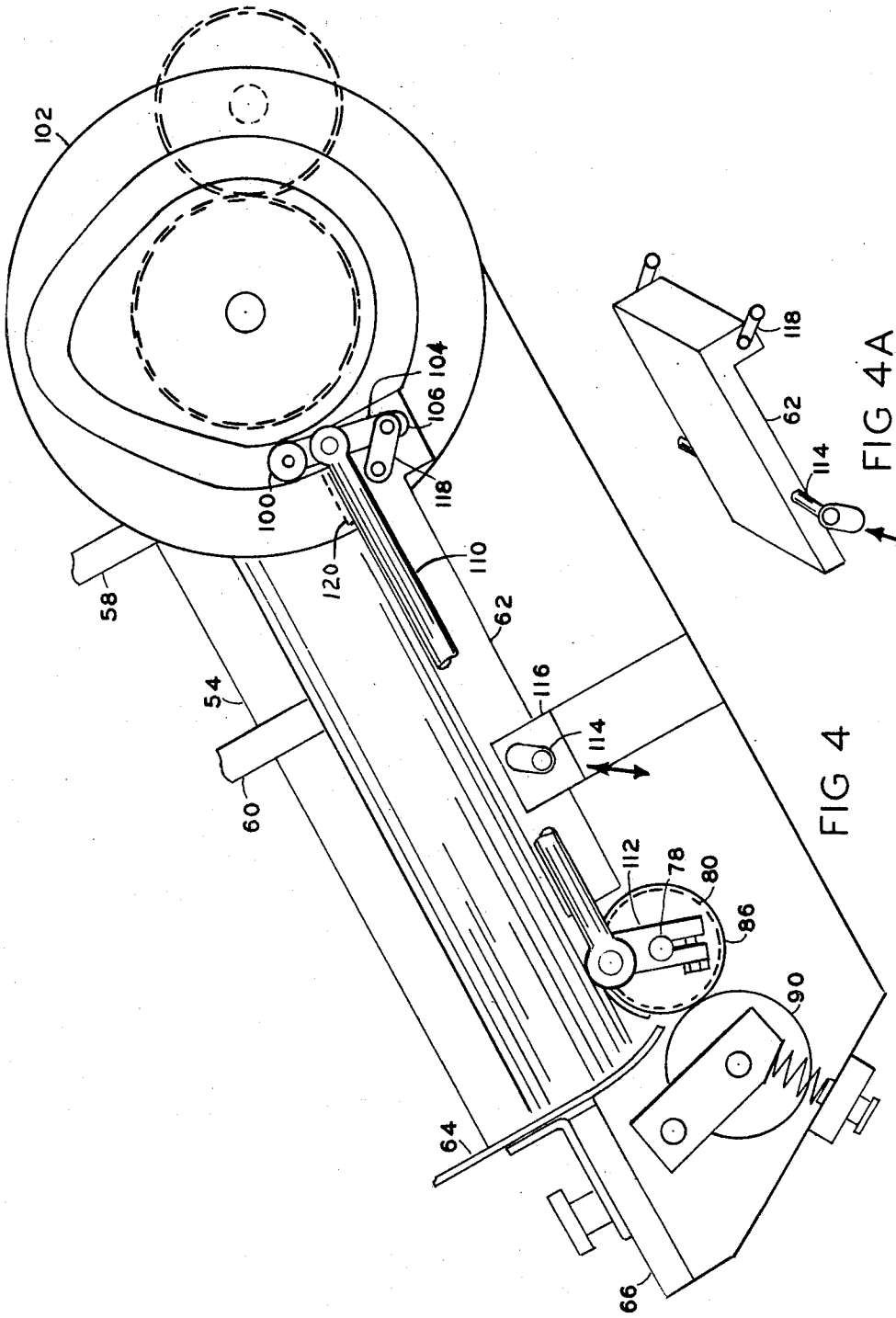

FIG 4

FIG 4A

INVENTOR.
HENRY HARRISON
James P. Malone

Feb. 24, 1970 H. HARRISON 3,497,205

SHEET FEEDING MEANS

Filed Sept. 7, 1967 3 Sheets-Sheet 3

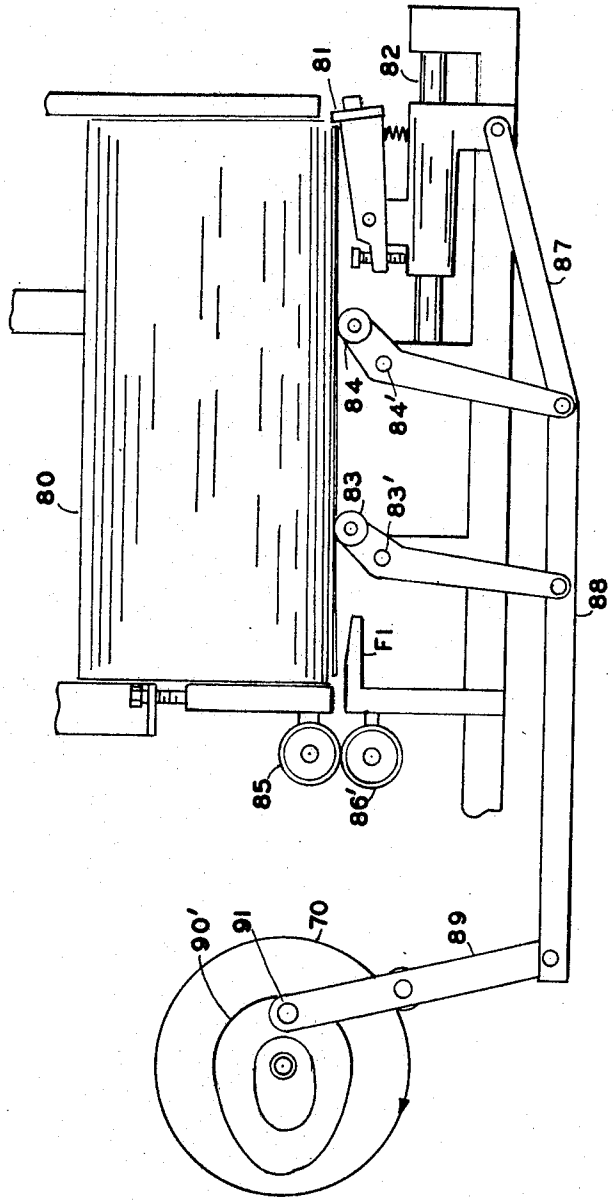

FIG 5

INVENTOR.

HENRY HARRISON

James P. Malone

United States Patent Office

3,497,205
Patented Feb. 24, 1970

3,497,205

SHEET FEEDING MEANS

Henry Harrison, Locust Valley, N.Y., assignor to Halm Instrument Co. Inc., Glen Head, N.Y.

Filed Sept. 7, 1967, Ser. No. 666,150
Int. Cl. B65h 1/06, 1/24, 3/06
U.S. Cl. 271—41 3 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for feeding sheets, envelopes, cards, thin plates, or the like from the bottom of a high stack. The platform on which the stack rests is periodically dropped in synchronism with the sheet feeding mechanism, so that the bottom sheet is free of the weight of the stack at least until the sheet is positively gripped and separated from the pile.

This invention relates to feeders for automatically delivering sheets, envelopes, cards, thin plates, or the like (hereinafter called "documents") from a stack to a processing machine, for instance, a printing machine.

There are well known advantages in taking documents from the bottom of such a stack, especially the advantage that the stack can be replenished without interrupting the feeding process. Another advantage is the mechanical simplicity which results from having the next sheet to be fed always in the same position in the stack as its predecessor.

A major disadvantage of bottom feeders is that the frictional resistance which must be overcome in taking a sheet from the bottom of the stack depends on the weight, and therefore on the height of the stack above it.

In a high speed machine such as a high speed printing press, a small stack of documents runs through in a short time. It frequently happens that the stack must be replenished at inconveniently short intervals, and therefore many expedients have been tried to increase the maximum height of a stack which could be fed. Prior to this invention, however, the maximum stack height has always been limited by the force which could be exerted by the feeder mechanism on the document, in separating it from the stack and moving it, against the frictional resistance of the weight of the stack, to the place where it is firmly gripped for transfer to the subsequent operating station.

The invention to be described was developed in conjunction with an oscillating vacuum sucker feeder such as in U.S. Patent No. 2,770,458. In this high speed feeder, which operates in excess of 60,000 documents per hour, the document's leading edge is sucked down against a cylindrical sucker, and then moved forward, by friction with the sucker, into engagement with driven spring loaded pinch rollers, which positively deliver it to a printing press. The force which this system can exert on the document for transferring it into engagement with the pinch rollers is necessarily limited by the active area of the vacuum sucker, and the gripping force per unit area exerted by the atmosphere, but the force exerted by the pinch rollers on the document is limited only by the tear strength of the document.

Another feeding mechanism commonly used is the pick type feeder in which the trailing edge of the document is engaged by short hardened picks, short enough

to engage only a single document, and propelled forward by the picks into engagement with a pair of pinch rollers. During the portion of the cycle when the picks are moving the document to the pinch rollers, the maximum force which can be used to overcome the friction of the weight of the stack is limited by the crushing or buckling strength of the edge of the document.

It is the primary purpose of my invention to provide a means for relieving the bottom document of a stack from the weight of the stack during the time that it is being transferred into engagement with pinch rollers or grippers, so that much higher stacks of documents can be fed. It will be evident to those skilled in the art that my invention can be applied not only to the two types of feeders referred to above, but also to many other kinds of document feeders which deliver documents from the bottom of a stack. Other objects and advantages of my invention, such as simplicity, freedom from adjustment, improvement of registry, and others, will be evident from the following description, which should be read in conjunction with the accompanying drawings.

Accordingly a principal object of the invention is to provide new and improved means to feed sheets from the bottom of a stack.

Another object of the invention is to provide new and improved means to feed sheets from the bottom of a stack comprising means to lift said stack in synchronism with said removing means.

Another object of the invention is to provide new and improved means to feed sheets from the bottom of a stack and means to take the weight off said bottom sheet while said bottom sheet is being removed from said stack.

Another object of the invention is to provide new and improved sheet feeder of the type having means to feed sheets from the bottom of the stack, means to take the weight of said stack off the bottom sheet of said stack while said bottom sheet is being removed, and means to synchronize said feeding means and said weight removing means.

These and other objects of the invention will be apparent from the following specifications and drawings of which:

FIGURE 1 is a side view of an embodiment of the invention.

FIGURES 2 and 3 are side views illustrating the sequence of operation of the embodiment of FIGURE 1.

FIGURES 4 and 4A are detail views of an embodiment of the invention.

FIGURE 5 is a side view of a modification of the invention.

FIGURE 1 is a schematic drawing of a feeder of a vacuum sucker type embodying my invention, showing the leading edge of the bottom document drawn down against the sucker.

FIGURE 2 shows the feeder of FIGURE 1 as the sucker advances the document into engagement with the pinch rollers.

FIGURE 3 shows the feeder of FIGURE 1 as the pinch rollers deliver the document to subsequent stages of the machine. FIGURE 4 shows details of a feeder of the vacuum sucker type embodying my invention. FIGURE 5 shows the application of my invention to a feeder of the pick feeder type.

Referring to FIGURE 1 the stack of sheets 12 rest

on platform 24 and is confined by the guides 14, 16, 18, and 20 which are suitably mounted to the frame of the machine. The platform 24 is oscillatably mounted by means of the parallelogram linkage comprising the members 46, 48 which are pivotally mounted to the platform 24 at one end and pivotally mounted at the other ends to the lever 50. The lever 50 is pinned at its right hand end to the lever 44 which is pivotally mounted to the frame F at its upper end. On the other end of the lever 44 is mounted a cam follower 42 which bears against the cam 40 which is rotatably mounted in the frame F on the shaft 40'. On the other end of the shaft 40' is mounted another cam 30 which operates cam follower 32 which is mounted on the lever 34 which is pivotally mounted on the frame by means of the shaft 34'. A member 8 is pivotally connected to the member 34 at one end and pivotally connected to an extension arm 36 which is fixedly connected to the vacuum sucker 22. The vacuum sucker 22 is freely mounted on the shaft 22' so that it can oscillate. A first pinching roller 26 is mounted on the shaft 22' and is driven in a counterclockwise direction by means of shaft 40', pulleys 38, 39 and belt or chain 37. Another pinching roller 28 is pivotally mounted on the frame by means of the member 38' and is spring loaded against the pinching roller 26 by means of the sping 28''.

Document 10 is the lowest sheet of a stack 12, confined by guides 14, 16, 18, and 20. Document 10, being sucked down against the cylindrical vacuum sucker 22, is curved, at its leading edge, ready to pass under the lower end of guide 14, which will prevent the escape of the rest of the stack 12. Stack 12 is resting on the platform 24. Driven spring loaded pinch rollers 26 and 28 are turning in the directions shown, but are not engaged with any document.

Turning now to FIGURE 2, document 10 is being advanced into engagement with the pinch rollers 26 and 28 by forward counterclockwise oscillation of the vacuum sucker 22, which is oscillatably mounted behind roller 26 on shaft 22'. The advance of vacuum sucker 22 counterclockwise is caused by the cam 30 acting through the cam follower 32, levers 34 and 36, and the tie rod 38, and therefore occurs in synchronism with the demand of the machine for delivery of a document at the same time. The platform 24 is accelerated downward away from the stack, leaving the stack 12 in a condition of free fall, so that none of the weight of the stack is resting on document 10. The downward acceleration of platform 24 is caused by cam 40, acting through cam follower 42, levers 44, 46, and 48, and tie rods 50 and 52. Since cam 40 and cam 30 are on a common shaft, the motion of the platform 24 is in synchronism with the motion of the sucker 22.

In FIGURE 3, document 10 is being positively drawn out from the stack 12 by the action of the pinch rollers 22 and 28. The stack 12 is again resting on the platform 24, which is moving back to its initial position. The remainder of the stack is prevented from escaping by the barrier guide 14 and by friction with the platform 24. The sucker 22 is returning to its initial position, and document 10 is sliding over its surface. When document 10 uncovers the ports of the sucker 22, the next document of the stack 12 will be sucked down, ready for delivery.

FIGURES 4 and 4A show details of a feeder of the vacuum sucker type, embodying this invention, which was constructed for feeding sheets of paper. The feeder is constructed on tiltable side frame 54, clamped to the main frame of the machine, so that the stack guides 58 and 60 are approximately 60° from vertical. This reduces the proportion of the weight of the stack resting on the movable platform 62. Barrier guides 64 are provided at the leading edge of the stack, adjustably mounted on a plate 66 joining the two side frames 54. The shaft 78 of the sucker 80 is journaled to the frames shown. Rollers 86 are mounted next to sucker 80. These rollers have a diameter approximately equal to the diameter of the sucker 80.

To actuate the sucker, cam roller 100, riding in the groove of box cam plate 102, moves arm 104, which is clamped to shaft 106 journaled to the frame. Tie rod 110 joins arm 104 to arm 112, clamped to the sucker shaft 78. Thus rotation of the cam plate 102 caused the sucker 80 to advance, moving the leading edge of a sheet of paper into engagement between the rollers 90 and 86; and then to return to its standby position. Belts or other takeaway means are preferably provided to remove the sheets from and drive the punch rollers. To this point, the feeder is substantially the same as the feeder described in Patent 2,770,458.

The improvement in the feeder of FIGURE 4 embodying the invention is the movable platform 62. Referring also to FIGURE 4A, this platform is supported on rollers 114 which roll in inclined grooves in blocks 116, 116', and on an eccentric crank 118 clamped to the shaft 106. Thus when the sucker is advancing a sheet of paper, the platform is simultaneously traveling forward and downward beneath the stack. When the sucker returns to rest position, the platform also return to rest position. By suitable choice of the radius of the eccentric crank 118, it has been possible to feed stacks of more than two thousand sheets of paper at rates as low as four sheets per second. Without the movable platform, reliable feeding of stacks of as many as five hundred sheets of paper is unusual.

In the feeder of FIGURE 4, the functions of cams 40 and 30 of FIGURE 1 have been combined into a single cam 102. The levers 44, 46, and 48 are replaced by the rollers 114 and the eccentric crank 118, and platform 62 takes the place of tie rod 52. A strip of anti-friction material 120 is fastened to the platform 62 near the back edge of its top surface, as by cementing on a strip of rubber. As it is returning up and back to rest position, the platform engages the bottom sheet of the stack, forcing it against the guides 58. Thus each bottom sheet is against the guides 58 when the sucker cycle begins. As a result, successive delivered sheets are in precise registry relationship with each other.

FIGURE 5 shows an embodiment of the invention in a pick type feeder. This type feeder pushes relatively stiff sheets off the bottom of the stack 80 by means of the pusher or pick 81 which is mounted for reciprocation on guide rod 82 and a corresponding rod, not shown, on the other side of the machine. The weight of the stack is supported by the members 83, 84 which are pivotally mounted on the frame F by means of the pins 83', 84'. The forward edge of the stack is supported by the frame member F1 and the adjustable member F2 is adjusted in spacing from the member F1 to permit only one sheet to be pushed into contact with the takeaway rollers 85, 86' which are continuously driven in the direction shown by the arrows.

The lifting and dropping motion and the pushing motion is provided by the linkage comprising the tie rods 87, 88, lever 89, cam 70 and cam follower 91 which rides in a groove 90' in the cam plate 70. The cam is driven in the direction shown by the arrow. Therefore when the lever 80 rotates clockwise due to the cam action, then the members 83 and 84 also rotate clockwise and drop the stack and at the same time pusher 81 is pulled by the tie rod 87 so as to push the bottom sheet into contact with the takeaway rollers 85, 86'.

Many modifications may be made by those who desire to practice the invention without departing from the scope thereby which is defined by the following claims:

1. In a sheet feeder of the type having means to feed sheets from the bottom of the stack,

acceleration means to take the weight of said stack off the bottom sheet of said stack while said bottom

sheet is being removed comprising a stack supporting platform which is oscillatable;

rotary, oscillatable means located at the stack bottom for removing sheets;

and means to synchronize the timed driving of said removing means when the platform is accelerated away from a stack support position.

2. Apparatus as in claim **1** wherein said stack supporting platform is mounted on an oscillatable linkage.

3. Apparatus as in claim **2** wherein the direction of oscillatable motion of said stack supporting means is up

and toward the trailing edge of the sheets being fed, and down and toward the leading edge of the sheets being fed.

References Cited

UNITED STATES PATENTS

1,153,295 9/1915 Dunnebier ..... 271—29 X

EDWARD A. SROKA, Primary Examiner

U.S. Cl. X.R.

271—29