MOVABLE BAIL BAR

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ABSTRACT

Movable pressure bail bar for biasing a sheet stack towards a bottom feed separator roll. The bail bar is raised from pressure contact with the stack by a solenoid operated lever arrangement after the bottom most sheet is separated from the stack to minimize the drag of frictional contact between the separated sheet and the adjacent sheet in the stack. Lifting of the bail bar permits return of additional sheets separated along with the bottom most by a downstream retard roller.

5 Claims, 6 Drawing Figures
MOBILE BAIL BAR

BACKGROUND OF THE INVENTION

In order to more fully utilize the high speed copying capabilities of modern reproduction machines, it is desirable to employ an automatic document handler for placing original documents to be copied on the platen of the reproduction machine and removing them therefrom to minimize the necessity for operator involvement with the reproduction machine. To accomplish this, the document handling device first must separate the document to be copied from others awaiting copying. Following this, the document must be brought into position on the machine platen. There, the document is normally located in a certain position, copied and removed, to enable succeeding copies to be placed on the platen. The document handler must be designed to positively separate, feed, position, and return the documents to the document tray.

Under all circumstances the document must be handled with care to avoid tearing, creasing, or other mutilation or damage thereto. This is particularly true where the document is one of a kind. In attempting to design an automatic handler which will provide minimal wear and tear on the documents while assuring positive feeding thereof, prevent misfeeds or multi-feeds, and minimize jams in the document handler, a number of problems may be encountered.

SUMMARY OF THE INVENTION

This invention relates to an automatic document handler employing a bail bar to separate documents being fed by an automatic document handler from the documents returned by the automatic document handler. The bail bar is also utilized to provide a normal force on the paper to enable a feeder roll thereon to positively feed a single document or a number of documents from the stack of documents in the supply tray beneath the bail bar. The bail bar is lifted a preselected distance off from the remaining documents in the stack at a preselected time by a lift lever mechanism after initial feeding of each document to allow multi-fed documents to be returned to the document stack by a suitable multiple document rejecting mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, there is shown a document handler designated generally by the numeral 10 incorporating the bail bar mechanism of the present invention. The document handler 10 may be used with any suitable document processing apparatus, such as a reproduction machine 5 which is provided with a platen 6 on which the document to be copied is placed.

Document handling apparatus 10 includes a supply tray 12 for storing both documents 7 to be copied and documents 8 which have been copied. From tray 12, one or more documents are advanced from the bottom of supply 7 by an intermittently operated primary feed roll 14 into the nip of retard roll pair 16, 17. The lower roll 16 is driven in a document feeding direction (as shown by the dotted line arrow in FIG. 1) while the upper roll 17 is driven in the reverse or document rejection direction by a suitable slip coupling (not shown).

Frictional engagement between roll 16 and roll 17 normally provides sufficient driving force on roll 17 to override the drive input to roll 17 (i.e., the coupling slips) and thereby allows roll 16 to turn roll 17 in the document feeding direction.

When a single document is fed between rolls 16, 17 frictional engagement of roll 16 with one side of the document and the corresponding frictional engagement of roll 17 with the opposite side of the document is also sufficient to drive roll 17 in the document feed direction.

However, should more than one document be presented between roll pair 16, 17, the frictional engagement between roll 16 and the undersurface of the bottom document and between roll 17 and the upper surface of the top document will be greater than the frictional engagement between the multiple documents. Under these circumstances, the slip clutch driving roll 17 will not slip and roll 17 will be rotated in a document rejection direction to return the excess documents to the tray.

The document emerging from retard roll pair 16, 17 passes into the nip of intermediate roll pair 18, 19 and from there underneath deflector plate 21 to platen transport 20. Transport 20, which preferably comprises a belt type conveyor, first carries the document forward onto platen 6 until the entire document is positioned thereon. Transport 20 is then reversed to bring the document trailing edge against register 22. Register 22 locates the document in copying position following which the copy or copies are made by the reproduction apparatus 5.

When copying is completed, platen transport 20 is again started in reverse to move the document backwards off platen 6, register edge being previously retracted for this purpose. Deflector 21, which was previously lowered, guides the returning document upwardly into the nip of return roll pair 23. Roll pair 23 move the document along suitable return guides 26 through second and third return roll pairs 27, 28 respectively and back into tray 12. For a more complete description of an automatic document handler reference may be had to U.S. application Ser. No. 251,492 filed May 8, 1972, now U.S. Pat. No. 3,829,082 in the name of August Hoyser.

To maintain copy documents which have been designated for convenience by the numeral 8, segregated from the documents 7 awaiting copying and prevent inadvertent or premature refeeding of the returned documents 8 by feed roll 14 following feeding of the last one of the documents 7, a disposable bail or separator bar
32 is provided. Bail 32 is disposed substantially opposite to and above primary feed roll 14 to prevent documents resting thereon from contacting roll 14. The bail 32 is biased against primary feed roll 14 by suitable springs 34 forcing the documents to be fed against roll 14 to provide frictional engagement between roll 14 and the document resting thereagainst for positive feeding of the document by the roll 14. As stated heretofore, in the event that more than one document is carried up toward the separator roll pair 16, 17, due to the frictional force between the lower-most document and the document lying thereagainst, the retard roll 17 will operate in reverse to drive the excess documents back into the tray. Ordinarily, the documents in the tray are forced against the feed roll 14 by the bail 32. To allow the excess documents to be returned to the tray, the bail is lifted from the documents by a suitable mechanism to be hereinafter described.

To provide the required bail lift, lever arms 36 mounted on a rotatable shaft 38 are provided on each side of the document handler. The arms 36 are non-rotatably mounted on shaft 38 while extensions 39 of shaft 38 are rotatably mounted in suitable bearings (not shown) on the frame of the document handler. Bail 32 is provided with extensions 40 adapted for engagement with bearing ends 42 of levers 36, movement of levers 36 about the axis of shaft 38 causing the bearing ends 42 of levers 36 to lift the bail 32 from the surface of the documents in the stack 7.

In the embodiment illustrated in FIGS. 2 and 3, the opposite end of one of the levers 36 is provided with an arcuate surface 44 having serrations thereon. A second lever 46 pivotally mounted on a shaft pin 48 and secured thereto by a snap ring 49 is provided with a resilient pad 50 adapted for contact with the serrated surface on lever 36 upon rotation of lever 46 about pin 48. The arcuate surface 44 has an axis coinciding with the axis of shaft 38 to provide constant spacing between pad 50 and the serrations on surface 44 irrespective of the orientation of lever 36 for reasons to be hereinafter explained.

Actuating means, such as solenoid 52 is operatively connected to lever 46 to displace pad 50 a predetermined distance along an arc about pivot pin 48. As illustrated, the solenoid is connected to lever 46 by a cable 54 although it should be understood the solenoid could be directly connected to the lever. Further, a pneumatic cylinder, an electric motor with suitable cams or linkages or other similar devices could be utilized to impart pivotal movement to lever 46.

In the illustrated embodiment, solenoid 52 is actuated by a suitable control circuit (not shown) in response to the presence of a document at a selected location along the document path. For purposes of illustration only, a photodetector 53 is mounted on the document handler to detect the presence of a fed document immediately downstream from feed roller pair 18, 19. It should be understood that the detector could be mounted immediately downstream from roll pair 16, 17 if desired. The signal from the photodetector causes the solenoid 52 to be energized to rock lever 46 about pivot 48 to lift bar 32, removing the pressure on documents 7 to allow multiplied fed documents to be returned to the tray by retard roller 17.

Since the quantity of and thickness of the documents placed between bar 32 and feed roller 14 is variable and decreases as documents are fed from therebetween, the actual position of the bar 32 relative to the roll 14 is variable. The bail bar lift mechanism is therefore adapted to lift the bar a preselected distance from the stack of documents 7, irrespective of the actual location of the bar relative to the feed roll 14.

To accomplish this, a light spring 56 is provided to levers 36 to maintain bearing ends 42 against extensions 40 on bar 32 at all times. The arcuate sector 44 on lever 36 is designed to provide constant spacing between the surface thereof and the lift pad 50 on lever 46 irrespective of the bail bar location relative to the feed roll 14. Thus, a preselected stroke of the solenoid will move pin 50 of lever 46 about a preselected arc to contact sector 44 of lever 36 and lift bar 32 the desired distance from the top of the stack 7, for example, .010 inches, irrespective of the actual orientation of the bar 32 and the lever 36 when the lift mechanism is actuated.

In the embodiment illustrated in FIGS. 4, 5 and 6, a ball-ramp clutch is provided to move levers 36 and thereby lift bail bar 32 from the stack of documents 7. The clutch assembly 60 includes a mounting plate 62 adapted for connection by suitable means such as bolts 64 to the frame of the document handler. The base is provided with a shaft 66 integrally formed thereon. A first arm member 70 is rotatably mounted on shaft 66 and retained in position thereon by suitable collars 72 and 74. Arm member 70 is connected to one of the lever arms 36 by means of a link 76. A second arm member 78 is also rotatably mounted on shaft 66 and is biased by spring 79 against a stationary plate 80 secured to shaft 66 by means of a key 82 and a nut 84 which is in threaded engagement with shaft 66. Stationary plate 80 is provided with ramps 86 for receiving balls 88 therein. Ramps 90 extending in a direction opposite to ramps 86 are formed in second member 78 for engagement with balls 88. Second arm member 78 is connected to solenoid 52 by means of cable 54 and is provided with a clutch surface 92 adapted for cooperation with a clutch surface 94 formed on member 70.

Considering the operation of the clutch 60, upon actuation of solenoid 52, second arm member 78 will be rotated about shaft 66 through a preselected angle of rotation of arm member 78 relative to stationary plate 80 will cause balls 88 to ride up ramps 86 and 90, forcing surface 92 to second arm member 78 into contact with clutch surface 94 of member 70 to lock members 70 and 78 together and cause member 70 to rotate about shaft 66 and through link 76 move levers 36 to lift bail bar 32 off the stack of documents 7 in the tray.

Since member 70 is freely rotatable about shaft 66 relative to second member 78 when solenoid 52 is de-energized, arm member 70 will assume a position relative to second arm member 78 determined by the thickness of documents in the tray and therefore the location of bar 32. However, since member 70 will be contacted by member 78 after a predetermined rotational movement of member 78 caused by energization of solenoid 52 and thereafter be moved through a predetermined arc thereby, the bar 32 will be lifted from the stack of documents a predetermined distance, for example, .010 inches irrespective of the thickness of the stack thereunder.

By removing bail bar pressure from the documents when the separated document has reached a preselected position, a number of advantages are obtained.
Drag on the separated document is reduced, thereby reducing the force necessary for forwarding the document by subsequent means such as the feed roll pair 16, 17.

Multiply fed documents may freely fall back into the tray after being urged toward the tray by the retard roll 17. A further advantage is obtained by the cyclical movement of the bar 32 in that the documents in the tray are vibrated thereby, enhancing settlement and alignment of the documents in the document tray.

While we have described a preferred embodiment of our invention, it should be understood that the invention is not limited thereto, but may be otherwise embodied within the scope of the following claims:

What is claimed is:

1. Apparatus for separating and feeding individual sheets of material from a stack of sheet material comprising:
   separator means adapted for frictional engagement with the bottom sheet in the stack to displace the sheet in a direction parallel to the plane of the sheet;
   bail means adapted for engagement with the top of the stack, said bail means including biasing means to bias said bail against the stack to provide a force normal to the plane of the sheet for maintaining the bottom sheet of the stack in frictional engagement with said separator means;
   feed means for engaging and feeding the separated sheets away from the stack;
   lever means pivotally mounted on said apparatus for engagement with said bail means, pivotal movement of said lever means causing said lever means to lift said bail means from said stack, said lever means including a lever having an arcuate sector formed on one end thereof, the other end of said lever being adapted for contact with said bail means;
   biasing means for maintaining said lever in contact with said bail means irrespective of the thickness of the stack of sheet material under said bail means;
   and
   actuating means including an arm pivotally mounted on said apparatus for contact with said sector when said actuating arm is rotated through a predetermined arc, contact of said actuating arm with the sector portion of said lever causing the other end of said lever to move through an arc of predetermined length to lift said bail means a predetermined distance from the top of the stack irrespective of the thickness of the stack after engagement of the separated sheet by said feed means to minimize the drag on the separated sheet caused by frictional contact between the separated sheet and the adjacent sheet in the stack.

2. Apparatus according to claim 1 further including solenoid means operatively connected to said actuating arm, energization of said solenoid causing said arm to move through a predetermined arc for contact with and displacement of said sector to thereby lift said bail means.

3. Apparatus for separating and feeding individual sheets of material from a stack of sheet material comprising:
   separator means adapted for frictional engagement with the bottom sheet in the stack to displace the sheet in a direction parallel to the plane of the sheet;
   bail means adapted for engagement with the top of the stack, said bail means including biasing means to bias said bail against the stack to provide a force normal to the plane of the sheets for maintaining the bottom sheet of the stack in frictional engagement with said separator means;
   feed means for engaging and feeding the separated sheets away from the stack;
   lift means including lever means pivotally mounted on said apparatus for engagement with said bail means, pivotal movement of said lever means causing said lever means to lift said bail means from said stack;
   biasing means for maintaining said lever means in contact with said bail means irrespective of the thickness of the stack of sheet material under said bail means;
   and
   actuating means including clutch means having a first arm member connected to said lever means; a second arm member; and,
   solenoid means operatively connected to said second arm member, said first arm member being positioned by said lever means and said bail means when said solenoid is de-energized, said second arm member being adapted to move said first arm member and the lever means associated therewith through an arc of predetermined length when said solenoid assembly is energized.

4. Apparatus according to claim 3 wherein said clutch means includes a stationary member having ramp means formed therein, stationary shaft means associated with said stationary member, said first arm member being rotatably mounted on said shaft, said second arm member being rotatably mounted on said shaft opposite said stationary member, said second arm member having a surface thereon with ramp means formed therein opposite the ramp means formed in said stationary member;
   biasing means for urging said second arm member toward said stationary member, rotation of said second arm member about said shaft causing said second arm member to move axially along said shaft against said biasing means, said first arm member having a surface thereon adapted for contact with said second arm member when said second arm member is moved axially on said shaft, rotation of said second arm member after contact with said first arm member causing said first arm member to rotate through an arc of predetermined length to move said lever means and lift said bail means a predetermined distance from the stack.

5. Apparatus according to claim 4 wherein said clutch means further includes balls, disposed in said ramp means, rotation of said second arm member causing said balls to ride up in said ramps to force said second arm member away from said stationary member into contact with said first arm member, rotation of said second arm member after contact with said first arm member causing rotation of said first arm member.