A bidirectional document feed mechanism for permitting manual insertion and accurate alignment of individual documents. Bidirectional driving is under control of a drive roller and a pressure roller which form a primary document conveying means. During manual insertion of the document the drive and pressure rollers are separated and a document stop element aligns the inserted document. A secondary document conveying means is provided for holding the document and providing an initial feed in one direction until the document stop is removed from the document path and the primary document conveying means takes over. The secondary document conveying means responds to rotation of the drive roller in first and second directions in first and second different manners. More specifically, the secondary document conveying means comprises a subassembly which is tipped in first and second reciprocal directions depending upon the direction of rotation of the drive roller.

8 Claims, 6 Drawing Figures
DOCUMENT CONVEYING MECHANISM

BACKGROUND OF THE INVENTION

In connection with certain types of printing and/or computer applications, it is desirable to be able to selectively insert an individual document into a printer or printer-computer combination for performing certain operations which may require bidirectional motion of the document to facilitate to complete the required operations. Accordingly, a variety of systems and mechanisms for handling document forms have been devised. In applications wherein the document may comprise a ledger card, it is important that the document conveying means properly align the card so that the date printed for successive uses of the card appears in appropriate locations on the card. To facilitate such alignment, on an automatic basis, it is necessary to have an initial alignment of the card and a metered drive thereof. In addition, it is convenient to have the document include a means which can indicate the status of the account, a last balance, or other appropriate information, and which can be updated each time an entry is made on the document. To this end documents employed in the present system have a magnetic stripe on which data may be selectively recorded and revised. In such applications it is apparent that it may be necessary to insert a document into the mechanism allow it to move in one direction while the magnetic stripe is being read and then move the card in the reverse direction to position it for the printing of the appropriate information relating to the current cycle of operation; followed by additional motion in either/or both directions for the erasure and/or updating of the information recorded on the magnetic stripe and finally the ejection of the document from the mechanism. Obviously, as the above matters are considered, it is evident that accurate control must be maintained over the document and that it must be properly aligned upon insertion and not allowed to become skewed as it passes bidirectionally through the mechanism. One prior art technique which has found wide use for certain applications involves the use of special forms having edge perforations and cooperating pin feed wheels. The present structure is designed to eliminate the need for perforations and pin feed wheels while still providing accurate alignment.

SUMMARY OF THE INVENTION

The present invention incorporates primary and secondary document conveying means wherein the primary conveying means includes a drive roller and a pressure roller. In order to permit document insertion the pressure roller is moved away from the drive roller and a document stop is inserted in the natural path of the document in order to provide a means for aligning the leading edge of the document. After the document is inserted there is an initial rotation of the drive roller shaft which pivots the secondary document conveying means into cooperative relationship with the document. Subsequently the pressure roller is pivoted toward a cooperating relationship with the drive roller. In response to the pivoting of the pressure roller towards the drive roller the document stop is removed from the document path. The secondary document conveying means serves to clamp or hold the document in its initial position of alignment until such time as the pressure roller engages the document between it and the drive roller. It should be noted that the primary document conveying mechanism first grasps and controls the document from a position which is a predetermined amount upstream from the leading edge of the document. This provides complete and accurate control by the primary document conveying means and minimizes any tendency of the document to be skewed. The secondary document conveying and control means serves to hold the document in a known position for the interval of time between the removal of the document stop and the take over of the document control when the pressure roller presses the document firmly against the drive roller.

The features which characterize the invention will be found in the following specification and the new and novel aspects of the invention are distinctly set forth in the claims annexed to and forming a part of this specification. Some of the objects of the invention are:

To provide a new and improved bidirectional document conveying mechanism;

More specific object of the invention, to provide a new and improved document conveying mechanism which comprises a drive roller and a pressure roller;

To provide a document conveying means wherein the conveying means first contacts and controls the document a predetermined distance from the leading edge of the document;

To provide a secondary document holding and conveying means for controlling the document until such time as the primary document control means takes control of the bidirectional motion of the document;

To have the secondary document conveying and control means disassociated from the document when the document is moved along one of its bidirectional lines of motion;

To provide a secondary document conveying and control means which responds in first and second different manners to first and second reciprocal directions of rotation of the drive roller of the primary document conveying means;

To employ kinetic friction for selectively controlling the secondary document conveying means;

These and other objects and advantages of the invention will become more apparent as the following description is considered together with the various figures of the drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a perspective view of the portion of the document conveying means in which the invention is incorporated;

FIGS. 2 thru 5 show a side view of portions of the apparatus of FIG. 1 in the various attitudes the parts may assume during the bidirectional motion of a document; and wherein

FIG. 6 is a composite view showing the alternate positions of selected components.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more specifically to the drawing and particularly to FIG. 1 there will be seen a document conveying structure 101 which comprises primary document conveying means 102 and secondary document conveying means 103. The primary document conveying means 102 includes a drive roller 105 and a pressure roller 106. The drive roller 105 is supported on
and rotated bidirectionally by power shaft 107. The power shaft 107 may have hexagonal form, as illustrated, or it may be round and a key and key-way used to couple the drive roller 105 to the power shaft 107. The power shaft 107 extends through the drive roller 105 and is supported at each end by the machine frame (not shown) and rotated by bidirectional drive means symbolically indicated at 108.

The secondary document conveying means 103 comprises a block and bearing support 110 which may be molded as a single piece or which may comprise two parts which are coupled together by suitable means. If the block and bearing support 110 is molded of a single piece there will be an interior cross member (not seen in FIG. 1) which joins the two nearly symmetrical members 109L and 109R which comprise the block and bearing support 110. Rollers 111 and 112 have formed thereon, and as a integral part thereof, pulleys 113 and 114, respectively. The block and bearing support 110 includes at each end thereof arc-like cutouts 115 and 116 to accommodate the rollers 111 and 112. The radius of curvature of the arc-like cutouts 115 and 116 are designed to be just slightly less than the radius of curvature of the rollers 111 and 112. The roller 112 has a hexagonal bore through which the power shaft 107 may pass and by which the power shaft 107 may rotationally drive the roller 112 and the pulley 114. The pulleys 113 and 114 are coupled together by a belt 117 which is in tension and thereby tends to urge the pulleys, 113 and 114 and their associated roller 111 and 112, towards each other so that the rollers 111 and 112 are in contact with their respective arc-like cutouts 115 and 116. The pulleys 113 and 114 are confirmed within the opening 118 between the two portions 109L and 109R of the block and bearing support 110. In view of the fact that the arc-like cutout 116 has a radius of curvature which is slightly smaller than the radius of curvature of the roller 112 it will be evident that when the roller 112 is rotated in response to the rotation of the power shaft 107 the block and bearing support 110, together with the roller 111 and pulley 113, will tend to rotate about the power shaft 107 unless, or until, rotation thereof is restricted by some other means. For the moment it will suffice to say that such restriction is provided and that the range of angular pivoting of the block and bearing support 110 is response to the rotational movement of the roller 112 is limited. The pivoting of the support block 110 in response to the rotation of roller 112 is, of course, a result of the kinetic friction between the roller 112 and the support block 110. The kinetic friction is a result of the radius of curvature of arc-like cutout 116 being smaller than the radius of curvature of roller 112. After the block and bearing support 110 has reached the limit of its pivotal motion the roller 112 continues to rotate, the frictional forces developed between the roller 112 and the block and bearing support 110 will urge the block and bearing support 110 in the direction of rotation of the power shaft 107 and thereby introduce a pressure between the block and bearing support 110 and the member which restricts its pivotal motion. The choices of material of the roller 112 and the block and bearing support 110 together with the differences in the radius curvature of the arc-like cutout 116 and the roller 112 should be such that adequate forces are developed while at the same time retaining them within sufficient limits that unnecessary heat and wear are not developed. Experience has shown that a suitable combination of material may include steel for the roller 112 and a plastic sold under the trade name “Delrin” for the block and bearing support 110.

The right hand portion 109R of block and bearing support 110 includes arm 119 which contacts a frame member (not shown in FIG. 1) to restrict the pivotal motion of the block and bearing support 110 in at least one direction of its pivotal motion.

From the foregoing it will be seen that when the power shaft 107 is rotated in one of its bidirectional directions of rotation of the block and bearing support 110 will be pivoted to one limit of its pivotal motion and when the power shaft 107 is rotated in the other direction the block and bearing support 110 will be pivoted to its other limit of pivotal motion.

As may be seen in FIG. 1, the pressure roller 106 is rotationally supported on shaft 126 which in turn is supported by arms 127 and 128 which in turn are pivotally supported at their respective pivot points 129 and 130. By means which are not shown, and which do not form a critical feature of the invention, the pressure roller 106 and its supporting arms 127 and 128 may be selectively pivoted about pivot points 129 and 130 in order to move the pressure roller 106 towards, or away from, the drive roller 105. That is, in response to appropriate signals the pressure roller 106 may be pivoted towards or away from contact with the drive roller 105.

Extending from frame member 133 is stake 134. Pivotally supported on stake 134 is the L-shaped document stop 135 which has a bent over document stop section 136 and bent over tabs 137 and 138. Extending from the arm 127 is an actuator 139 which may engage the tab 138. Coiled about stake 134 is spring 140 having an end 141 which bears on the document stop 135 and another end 142 which bears on the actuator 139. The spring 140 urges the document stop 135 to pivot about the stake 134 in a clockwise direction as viewed from the left end of FIG. 1. When the pressure roller 106 is pivoted towards the drive roller 105 in response to the pivoting of the arms 127 and 128 about the pivot points 129 and 130, the actuator 139, which is coupled to the arm 127, pushes on tab 138 and causes the document stop 135 to rotate about stake 134 in a counter-clockwise direction. The document stop 135 is retained on stake 134 by any of a variety of conventional means (not shown).

Consideration should now be given to FIGS. 2 thru 8 of the drawing which show an end view of selected portions of the structure shown in FIG. 1. More specifically FIGS. 2 thru 5 illustrate portions of the secondary document conveying means 103, the pressure roller 106 and associated components and the document stop 135. The drive roller 105 is omitted in FIG. 2 thru 5 although it should be understood that the drive roller 105 is on the power shaft 107. It should also be observed that although the arm 127 pivots about pivot point 129 and that the shaft 126 pivots parallel to itself with pivot point 129 as a center that stake 134 remains fixed. It should also be understood that the structure shown in FIG. 1 may be duplicated so that there is a similar structure at each side of the document or intermediate of the document.

Consideration should now be directed more specifically to FIGS. 2 thru 5 while the detailed operation of the structure is described in connection with the inserter and bidirectional motion of a document 144. As
previously mentioned the document 144 may comprise a single sheet or card which has a predetermined width and length and which may include a magnetic stripe (not shown) which may have recorded thereon data relative to the status of the account represented by the document 144. In addition, the document 144 will have printed thereon, from time to time, various bits of information to update the printed record of the account. The present structure provides for the manual insertion of the document 144 into the computer-printer and for controlling the bidirectional motion of the document 144 as the magnetic stripe is read and updated and as the document 144 is moved bidirectionally to allow printing of the appropriate data in the desired field areas. It should also be understood that there are left and right boundary guides (not shown) which retain the document 144 in a proper orientation with respect to sideways motion. When the computer-printer is ready to accept a document 144 the elements of the structure are as illustrated in FIG. 2 with the document stop section 136 positioned directly below the gap 145 which separates the drive roller 105 and the pressure roller 106. Accordingly, the document 144 may be manually inserted into the machine until the leading edge 146 of the document 144 contacts the document stop section 136 as shown in FIG. 3. This causes the document 144 to be accurately positioned within the machine at a known point with respect to a reference line, the plane of document stop section 136. If desired, positioning of the document 144 can trigger subsequent machine actuation by interrupting a light beam between a light source and a photocell; or by actuation of a document actuated switch.

In order to drive the document 144 downward so that various actualizations such as reading or recording from or on, the magnetic stripe and/or the printing of date on the document 144, it is necessary to move the document stop section 136 out of the downward path of motion of the document 144. However, before the document stop section 136 is removed from the document path it is necessary to clamp the document 144 against accidental or unwanted downward motion. The clamping of the document 144 against undesired downward motion is achieved in response to the rotational motion of the power shaft 107 in the clockwise direction. That is, in response to the clockwise rotation of the power shaft 107 the secondary document conveying means 103 will be pivoted to the position illustrated in FIG. 3 so that the belt 117 contacts the document 144 and presses it against the guide plate 147 as shown in FIG. 3. Substantially simultaneously the arm 127 is pivoted about pivot point 129 to move the pressure roller 106 towards contact with the drive roller 105. Simultaneously with the pivoting of the arm 127 the document stop 135 is pivoted out of the path of motion of the document 144. That is, as the arm 127 pivots in the clockwise direction the actuator 139 pushes against the tab 138 and thereby document 144 is moved bidirectionally in response to the rotational motion of the power shaft 107 and the concomitant rotation of the drive roller 105. By means which are well known to those skilled in the applicable arts, it is a simple matter to move the document up or down by any desired amount by the simple expedient of keeping track of the angular rotation of the power shaft 107.

During the downward motion of the document 144 the belt 117 presses the document 144 against the guide plate 147 as shown in FIG. 4.

When the document 144 is driven in an upward motion in response to a counterclockwise rotation of the power shaft 107 the block and bearing support 110 will pivot about the power shaft 107 until the extension arm 119 comes into contact with the stop 148. If the document 144 is moved downward subsequent to an upward motion the secondary document conveying means 103, including block and bearing support 110, will again be pivoted in a clockwise direction about power shaft 107 until the belt 117 again comes in contact with the document 144 and pushes it against the guide plate 147.

When all of the necessary functions have been performed on the document 144 it may be ejected from the machine through the bottom by a downward motion, or it may be driven upward until the leading edge 146 of the document 144 is above the horizontal plane of the document stop section 136. Subsequently the pressure roller 106 and the arm 127 may be pivoted counterclockwise about pivot point 129 and simultaneously therewith the document stop section 136 will be pivoted to its stopping position below the document 144. The document 144 will fall until its leading edge 146 contacts the document stop section 136 and be retained there until such times as the document 144 is manually removed. The machine is now ready to accept another document and repeat the actuation as described. If the document 144 is removed by a downward motion thereof, such motion may be accomplished in response to a continuing rotation of the drive roller 105. Subsequent to the downward ejection of the document 144 the pressure roller 106, the arm 127 and the document stop 135 will all be restored to the position as shown in FIG. 2 so that the machine is prepared for the insertion of another document 144.

For selected modes of operation and applications the mechanism can be designed to provide a rapid upward motion of the document. That is, the drive roller 105 can be rotated rapidly by the drive means 108 until the document 144 is above the control of the drive roller 106. Under such conditions the document would have to be realigned for controlled downward movement. If this is required, the arm 127 and the document stop 135 will be pivoted to the positions shown in FIG. 2. Subsequently when a downward motion of the document 144 is required the second document conveying means 103 will assume the position shown in FIG. 3 in response to the rotation of the power shaft 107 and drive the document 144 in a downward direction until such time as the leading edge 146 of the document 144 comes into contact with the document stop section 136 if it is not already there. Accordingly, realignment and orientation of the document 144 will be assured. Continued downward motion of the document 144 may take place in the manner previously described.

FIG. 6 is a composite view which is similar to FIGS. 2 and 4 combined and includes some additional details of the document stop 135. More specifically, from FIG. 6 it may be seen that the document stop 135 pivots about stake 134 and that stake 134 does not move in response to the pivotal motion of arm 127. In addition, FIG. 6 clearly illustrates that the secondary document conveying means 103 including the block and bearing support 110 pivots about power shaft 107 in response to the rotation of power shaft 107.
While there has been shown and described what is considered at present to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the related arts. For example, in another structure the belt 17 could be recessed in the pulleys 113 and 115 and the pulley 113 made of suitable material to drive the document; or the pulleys 113 and 115 could be coupled by suitable gears. It is believed that no further analysis or description is required and that the foregoing so fully reveals the gist of the present invention that those skilled in the applicable arts can adapt it to meet the exigencies of their specific requirements. It is not desired, therefore, that the invention be limited to the embodiment shown and described, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

I claim:

1. A document conveying mechanism for controlling the bidirectional motion of a document along a predetermined path and comprising in combination:
   a. a document stop for limiting the initial displacement of a document in a first direction along said predetermined path;
   b. primary document conveying means including first and second rollers disposed on opposite sides of said document;
   c. a drive shaft attached to said first roller for moving said document in said first direction in response to rotation of said drive shaft in said first direction and in a second direction opposite to said first direction in response to rotation of said drive shaft in a second direction opposite to said rotation in said first direction;
   d. secondary document conveying means attached to said drive shaft and brought into contact with said document in said first direction in response to the rotation of said drive shaft; and
   e. control means for removing said document stop from the path of said document after said secondary conveying means has contacted said document.

2. The combination as set forth in claim 1 wherein said second roller is movable with respect to said first roller and a separation exists between said first and second rollers of said primary document conveying means while a document is inserted there between in said first direction until inhibited by said document stop.

3. The combination as set forth in claim 2 further including a guide plate to determine the boundaries of at least part of said predetermined path and for clamping said document between said guide plate and said secondary document conveying means when said secondary means is brought into contact with said document by the initial rotation of said drive shaft in said first direction.

4. The combination as set forth in claim 3 wherein said control means function to cause movement of said secondary roller of said primary document conveying means towards engagement with said document after said secondary document conveying means has clamped said document and to remove said document stop from the path of said document such that further rotation of said drive shaft results in movement of said document.

5. The combination as set forth in claim 1 wherein said secondary document conveying means includes first and second pulleys rotationally supported on a bearing block and coupled together by a friction belt with said secondary pulley attached to said drive shaft for rotation therewith.

6. The combination as set forth in claim 5 wherein said belt is under tension and said second pulley is supported on an individual roller which rotates with said second pulley.

7. The combination set forth in claim 6 wherein rotation of said individual roller of said second pulley exerts a torque on said bearing block for pivoting it in the direction of rotation of said individual roller.

8. The combination set forth in claim 7 further including stop means for limiting the extent of pivotal motion in a first direction of said secondary document conveying means.

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