ABSTRACT: An original handling apparatus for a copying machine is capable of handling not only single original sheets, but also stacks of original sheets to be copied as well as individual thicker original items such as books and the like. When a stack of sheets is to be copied, each sheet is first presented to an illumination station and then automatically fed from the machine. Single sheets or other relatively thin original items are also fed from the machine after illumination. When a thick item such as a book is copied the feeding mechanism is automatically disabled. Feeding of individual sheets from a stack or of single sheets is accomplished by means of a sheet-holding magazine mounted for movement between an illumination area and a sheet drive structure capable of engaging and removing sheets from the magazine.
ORIGINAL HANDLING APPARATUS FOR COPYING MACHINES

FIELD OF THE INVENTION

The present invention relates to sheet feeding and sheet handling apparatus and to a novel original handling apparatus for use with a copy-making machine.

BACKGROUND OF THE INVENTION

Many known copying machines of a commercially available type include an illumination area on the surface of the machine designed by a transparent glass plate. When a copy is made, an original sheet such as a sheet of paper bearing a graphic image is manually placed on the plate and illuminated. When the illumination process is completed, the original must be manually removed from the illumination area before another copy can be made. Since each original item must be manually located and then removed, the process of reproducing a stack of original sheets is inconvenient and time consuming.

Among the objects of the present invention are to provide an original handling apparatus for a copying machine capable of automatically removing an original item from the illumination area when the exposure process is completed; to provide improved original handling apparatus capable of sequentially presenting sheets from a stack of sheets to an illumination area and for feeding each sheet from the illumination area after illumination so that a copy-making process can be carried out on an entire stack of sheets without manual handling; and to provide original handling apparatus capable of handling relatively thin items such as thin sheets and relatively thick items such as books wherein relatively thin items are automatically fed from the machine and wherein the feeding apparatus is disabled when relatively thick items are copied.

Conventional sheet handling and sheet feeding apparatus for feeding individual sheets from a stack includes structure for holding the stack in a stationary location and frictionally operating means such as drive rollers or the like for engaging the uppermost sheet and propelling it away from the stack. Although this type of apparatus is suitable for many sheet feeding operations, it is subject to the disadvantage that the next sheet to be fed is obstructed by the drive rolls or other driving mechanism and to the additional disadvantage that feeding of the lowermost sheet rather than the uppermost sheet cannot easily be accomplished. As a result, this known type of sheet feeding apparatus is not suitable for presenting a series of original sheets at an illumination area located on the surface of a copying machine and feeding sequential sheets from the bottom of the stack.

Other objects of the present invention are to provide novel sheet feeding apparatus which does not obstruct the face of the next sheet to be fed and which conveniently can be used to feed the lowermost sheet from a stack of sheets; and to provide an improved sheet handling apparatus for presenting sheets from a stack to an illumination area and for automatically feeding them away from the area after illumination.

BRIEF SUMMARY OF THE INVENTION

In accordance with the above and other objects and advantages of the invention, there is provided an improved original handling apparatus for use with a copying machine having an illumination area on the surface thereof. An original holding member is movably mounted on the machine so that either a first or a second surface of the member may be positioned to overlie the illumination area. The first surface of the holding member serves to hold a single original item such as either a single sheet or a larger item such as a book at the illumination station. The second surface of the holding member includes structure for supporting a stack of original sheets with the lowermost sheet of the stack held in position at the illumination station.

When an illumination operation is completed, the original holding member is automatically moved from the copy-making position to an alternate position wherein the illuminated original is engaged by sheet driving means located on the machine at a region spaced from the illumination station. The sheet driving means frictionally engages the original and propels it away from the illumination area to a receiving tray or the like. When a copy is made of an item which cannot easily be fed, such as a book or the like, the sheet feeding apparatus is automatically disabled and the sheet-holding member remains stationary.

When a stack of sheets is fed, each sheet is first held over the illumination area during the illumination operation, after which the entire stack of sheets is moved along the surface of the machine to a position wherein the lowermost sheet of the stack is engaged by a frictional sheet drive means such as a pair of drive rollers. The lowermost sheet is then separated from the stack and driven away from the illumination area while the remainder of the stack is returned to the illumination area for illumination of the next lowermost sheet. This process continues until the entire stack of original sheets has been copied and fed from the machine.

DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the present invention will appear from the following detailed description wherein reference is made to the drawings, in which:

FIG. 1 is a fragmentary top view of a portion of a copy-making machine provided with improved original handling apparatus embodying the features of the present invention;

FIG. 2 is a fragmentary vertical sectional view of the apparatus of FIG. 1 taken along the line 2-2 of FIG. 1;

FIG. 3 is a fragmentary front view of the apparatus of FIG. 1;

FIG. 4 is an enlarged sectional view taken along the line 4-4 of FIG. 2;

FIG. 5 is an enlarged sectional view taken along the line 5-5 of FIG. 1;

FIGS. 6 and 7 are views similar to FIG. 5 illustrating the apparatus at different times during the process of feeding a sheet;

FIG. 8 is a fragmentary side view of the apparatus of FIG. 1 illustrating the operation of reversing the sheet-holding assembly; and

FIG. 9 is a view similar to FIGS. 5-7 illustrating a sheet feeding operation when the sheet-holding assembly is reversed.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT OF THE INVENTION

Having reference now to the drawings and initially to FIGS. 1 and 2, there is illustrated a fragmentary portion of a copy-making machine generally designated as 10 provided in accordance with the present invention with a novel and improved original handling apparatus designated as a whole by the reference numeral 12. The machine for the most part may be a well known and commercially available copy making machine including a housing 14, the upper wall 16 of which is provided with a transparent glass platen 18 defining an illumination station or area generally designated as 18.

In the process of making a copy with the machine 10, an original item to be copied is placed on the platen 16 with the image bearing face downward. A suitable light source (not shown) within the housing 14 illuminates the original and a light image is transmitted by way of a lens assembly (not shown) to expose a copy sheet at an exposure station. The sight of the lens assembly is indicated in broken lines in FIG. 2. The copy-making operation is carried out under the control of a suitable control circuit 20 shown only in block form in FIG. 2. A more detailed description of the construction and operation of the machine 10, believed not to be necessary to an understanding of the present invention, may be found in U.S. Pat. No. 3,597,627.
In accordance with important features of the present invention, the original handling apparatus 12 is capable of holding an original sheet to be copied over the platen 16 during the illumination operation and thereafter ejecting the original sheet from the illumination area into a receiving tray 22 disposed at the front of the machine. In addition, the original handling apparatus is capable of supporting a stack of sheets and serves sequentially to present each sheet to the illumination area and then to feed the illuminated sheet to the tray 22.

Referring to FIGS. 1–3 and 5–7, the operation of the original handling apparatus 12 in feeding a stack of sheets is illustrated. In general, the stack of sheets is supported by a magazine assembly or sheet holding assembly generally designated as 24. Each sheet of the stack is held over the illumination area 18 during a copy-making process after which the sheet-holding assembly 24 is moved by a drive assembly generally designated as 26 to a position wherein the outermost sheet of the stack is engaged by a sheet drive means generally designated as 28 and propelled into the sheet receiving tray 22.

Proceeding now to a more detailed description of the magazine or sheet-holding assembly 24, the assembly includes a main frame member 30 having a pair of legs 30a the ends of which are fixed to a crosspiece 32. The frame 30 and crosspiece 32 cooperate to define a stack receiving openended recess 34 having dimensions of a size suitable to receive original sheets to be copied. As best appears from a comparison of FIGS. 1 and 2, the recess 34 overlies the glass platen 16 at the illumination area 18 so that an original sheet placed face down within the recess 34 is presented to the illumination station for a copy-making process. The sheet-holding assembly 24 also includes a pressure member 36 pivotally fixed to the frame 30 by means of a hinge 38. The pressure member 36 includes a projection 36a of approximately the same size as the recess 34 serving to hold a stack of sheets within the recess and to press the stack downwardly toward the platen 16.

Upon completion of the process of illuminating the lowermost sheet of a stack of sheets placed in the magazine assembly 24, the drive assembly 26 is operated to move the magazine assembly 24 thereby to begin the operation of feeding the illuminated sheet from the stack. The drive assembly 26 includes a motor and clutch assembly 40 operated automatically by the control circuit 20 at the end of the illumination operation in order to rotate a drive shaft 42 of the motor through a sleeve reduction clutch device or the like may be used to assure that each time the motor and clutch assembly is energized the shaft 42 rotates through a single full revolution and then stops.

Rotation of the drive shaft 42 through one revolution serves to cause the sheet-holding assembly 24 to reciprocate across the surface of the machine. More specifically, the drive shaft 42 includes a crank portion 42a the end of which is received in a slidable 44 of a slide block 46. The slide block 46 includes an upwardly extending projection 46a received in a slot 48 in the top wall 14a of the machine housing 14. In order to transmit the reciprocating motion of the slide block 46 to the magazine or sheet holding assembly 24 during rotation of the drive shaft 42, the slide block is connected to a ball joint hub 50 which is in turn coupled to the sheet-holding assembly 24 by a rod 52 including a ball 54 at the end thereof. In order to prevent skewing of the sheet-holding assembly 24 during its reciprocating movement, the hub 50 includes a slot 56 receiving the rod 52.

When the magazine or sheet-holding assembly 24 is moved through a cycle of reciprocating movement by the drive assembly 26, the lowermost sheet of the stack of sheets held within the recess 34 is fed from the stack to the sheet receiving tray 22. More specifically, as the holding assembly 24 with a stack of sheets is moved from the illustrated position wherein the lowermost sheet is positioned at the illumination station 18, the lowermost sheet is moved into engagement with the original drive means 28 comprising a pair of sheet drive rollers 58 and 60. The rollers 58 and 60 are mounted on a drive shaft 62 and the upper portions of the rollers extend somewhat above the upper surface 14a of the housing of the machine 10. The rollers 58 and 60 are rotated in a clockwise direction as viewed in FIGS. 5–7 by a suitable drive means (not shown) and preferably the peripheral roller surface speed is approximately equal to the speed with which the sheet moves from the position of FIG. 5 to the position of FIG. 6 so that no movement of the lower sheet relative to the stack of sheets takes place until the sheet-holding assembly 24 reaches its forward position illustrated in FIG. 6. The surfaces of the rollers 58 and 60 are preferably of rubber or like material having a relatively high coefficient of friction when engaging the paper sheets of the stack.

Upon movement of the sheet-holding assembly 24 and the stack of sheets contained therein to the forward position illustrated in FIG. 6, the operation of feeding the lowermost sheet from the stack begins. As the stack of sheets stops and then begins to move back to the original position, relative movement between the sheet drive rollers 58 and 60 and the lowermost sheet causes the lowermost sheet to be moved forward with respect to the remaining sheets of the stack. In order to aid in separating the lowermost sheet from the stack, a pair of corner separators 64 and 66 are supported on the crosspiece 32 adjacent the corners of the stack. Each separator includes a single portion 64a and 66a forming a triangular projection along the edges of the sheet in the stack. In addition, a separator portion 64b and 66b of generally triangular configuration (FIG. 1) overlies the corners of the lowermost sheet of the stack so that as the sheet is moved forward it is flexed until the leading corners of the sheet snap over the separators.

As the magazine or sheet-holding assembly 24 returns to its initial position, a pair of idler rollers 68 and 70 rotatably supported on the crosspiece 32 come into engagement with the drive rollers 58 and 60. The lowermost sheet is caught between the drive rollers and the idler rollers and is pulled from the stack by movement of the drive rollers until it is positioned in the original receiving tray 22. Simultaneously, the magazine returns to its initial position and the next sheet at the bottom of the stack is in position over the platen 16 at the illumination station 18.

In accordance with an important feature of the invention, the original handling apparatus 12 is capable not only of feeding sequential sheets of a stack in the manner described above, but also can accommodate single sheets or single original items of greater thickness than a single sheet. More specifically, the construction of the ball joint hub 50 and ball 54 permits the magazine or sheet-holding assembly 24 to be swiveled over through 180° so that the surface of the pressure member 36 rather than the recess 34 may be presented to the illumination area. The surface of the pressure member 36 is preferably flat and is preferably of a white color so that an original sheet may be placed on the exposure area and be held flat and held in place by the surface of the pressure member 36. In addition, the surface of member 36 preferably exhibits a coefficient of friction with an original sheet greater than that of the platen 16 but less than that of the rollers 58 and 60.

When a copy is made of an original sheet or other relatively thin original item beneath the surface of the pressure member 36, the original is automatically fed from the illumination station to the original receiving tray upon completion of the copy. As illustrated in FIG. 9, this feeding operation takes place in substantially the same manner as described above in connection with feeding a sheet from the bottom of a stack. When the illumination operation is completed, the control circuit 20 energizes the motor and clutch assembly 40 to cause the sheet-holding assembly 24 to move through a cycle of movement. As illustrated in FIG. 9, when the sheet-holding assembly 24 is moved forward, the original item held therewith is brought into engagement with the drive rollers 58 and 60 and is fed into the tray 22.

In accordance with another feature of the invention, the machine 10 equipped with the original handling apparatus 12 is also capable of producing copies of original items, such as...
books or other bulky items, of a nature which cannot conveniently be fed from the exposure area to the tray 22. In order automatically to disable the sheet feeding mechanism when a copy is made of a bulky item, there is provided a switch 72 connected in controlling relation between the control circuit 20 and the motor and clutch assembly 40. In the illustrated embodiment of the invention, the switch 72 comprises a normally open switch having a switching operating member 74 extending upwardly from the upper surface 14a of the housing 14 to be engaged by the sheet-holding assembly 24 thereby to enable operation of the motor and clutch assembly 40 when a single sheet or a stack of sheets is copied. More specifically, as shown in FIG. 2, the switch 72 is held in its operated condition by engagement of member 74 with the frame 30 when a stack of sheets is copied. As shown in broken lines in FIG. 8, the switch 72 is not operated when a relatively thin original item is placed beneath the surface of the pressure member 36 at the illumination station 18. However, if a book or other bulky item is placed between the glass plate 16 and the surface of the pressure member 36, the original holding assembly is lifted to such an extent that the switch 72 is not operated and the sheet feeding mechanism is thereby disabled by disconnection of the circuit to the motor and clutch assembly 40.

Due to the novel interconnection of the sheet-holding assembly 24 and the drive assembly 26 consisting in the illustrated embodiments of the ball joint hub 50 and the rod 52 and ball 54, the sheet-holding assembly 24 can not only be easily swiveled to present opposite sides to the illumination station, but can also be removed from the machine 10 if desired. Furthermore, it should be understood that different sheet-holding assemblies 24 having, for example, recesses 34 of different dimensions for accommodating stacks of sheets of various sizes, may be provided.

What I claim and desire to be secured by Letters Patent of the United States is:

1. An original handling apparatus for a copying machine of the type having an illumination station on an external surface of the machine, said apparatus comprising an original holding member supported on said machine to overlie the illumination station, means mounting said holding member so that first and second surfaces of the holding member can be presented to the illumination station, means on said first surface of the holding member for holding a single original against the illumination station, and means on said second surface of the holding member for supporting a stack of originals with an outermost original against the illumination station.

2. The apparatus of claim 1, further comprising original drive means on the surface of the machine spaced from the illumination station, and means for moving said original holding member after illumination to move the illuminated original away from the illumination station and into engagement with the original drive means.

3. The apparatus of claim 2, means operable to disable said moving means when a single original exceeding a predetermined thickness is copied.

4. The apparatus of claim 1, said means on said second surface for supporting a stack of originals comprising a recess in said second surface for receiving a stack, and a pressure member adapted to rest on the stack for pressing the stack against the illumination station.

5. The apparatus of claim 4, said means on said first surface for holding a single original comprising a planar face of said pressure member.

6. The apparatus of claim 5, said mounting means comprising a ball and socket connector coupled between said holding member and the machine.

7. The apparatus of claim 2, said mounting means comprising a ball and socket combination including first and second relatively movable elements, said first element being connected to said holding member and said means for moving said original holding member comprising said second element.

8. Sheet handling apparatus for sequentially feeding sheets from a stack of sheets and comprising a generally horizontal surface, a magazine for supporting the stack of sheets with the lowest sheet over said surface, magazine drive means for moving said magazine from a first position to a second position and for returning said magazine to the first position, sheet drive means located at said second position, and means for urging said stack of sheets against the sheet station thereupon movement of the magazine to the second position thereby enabling said sheet drive means to remove the lowest sheet of the stack, said sheet drive means including drive roller means adjacent said surface and frictionally engageably with the lowest sheet upon movement of the magazine to the second position, and means for rotating said drive roller means at a peripheral speed and direction substantially equal to the speed and direction of the magazine moving toward said second position and for continuing said direction of rotation of said drive roller means during return of said magazine to said first position to provide relative movement between the drive roller means periphery and the lowest sheet in order to feed the lowest sheet from the stack.

9. The apparatus of claim 11, said drive means comprise drive roller means adjacent said surface and frictionally engageable with the lowest sheet for removing the lowest sheet from the stack upon movement of the magazine to the second position.

10. The apparatus of claim 9 further comprising corner separators for separating the lowest sheet from the stack.

11. Apparatus for presenting successive lowermost sheets of a stack to a work station, said apparatus comprising a generally horizontal surface, said surface being defined on the surface, a sheet drive means adjacent said surface at a location entirely spaced from the work station, a magazine supporting the stack of sheets with the lowermost sheet facing said surface, and magazine drive means for periodically reciprocating said magazine over said surface to move said stack of sheets between a first position wherein the entire lowermost sheet overlies the work station and a second position wherein the stack engages the sheet drive means, said sheet drive means including means engageable with the lowermost sheet for removing it from the stack.

12. In combination with a copy-making machine having a transparent plate on its surface, holding means adapted to overlie the original placed on said plate, means for expelling the original from the plate upon completion of an illumination process, and means for selectively preventing the operation of the expelling means in dependence upon the thickness of the original.

13. The combination of claim 12, said preventing means comprising a switch connected in controlling relation to said expelling means, and sensing means for controlling the condition of said switch in accordance with the spacing between the exposure platen and the holding means.

14. A sheet handling process forming part of a copy-making operation and comprising the steps of:

1. holding a stack of original sheets to be copied over an illumination area for illumination of the bottom sheet;

2. moving the entire stack of sheets from the illumination area;

3. pressing the stack of sheets against a sheet driving roller means; and

4. separating the bottom sheet from the stack as it is moved from the stack by the sheet driving roller means.

15. The process of claim 14 wherein the steps are repeated in sequence upon successive bottom sheets of the stack.