United States Patent

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[54] **ORIGINAL HANDLING APPARATUS FOR COPYING MACHINES**
15 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **271/41**
[51] **Int. Cl.** **B65h 3/06**
[50] **Field of Search** 271/32, 29, 35, 41; 355/76, 82, 25

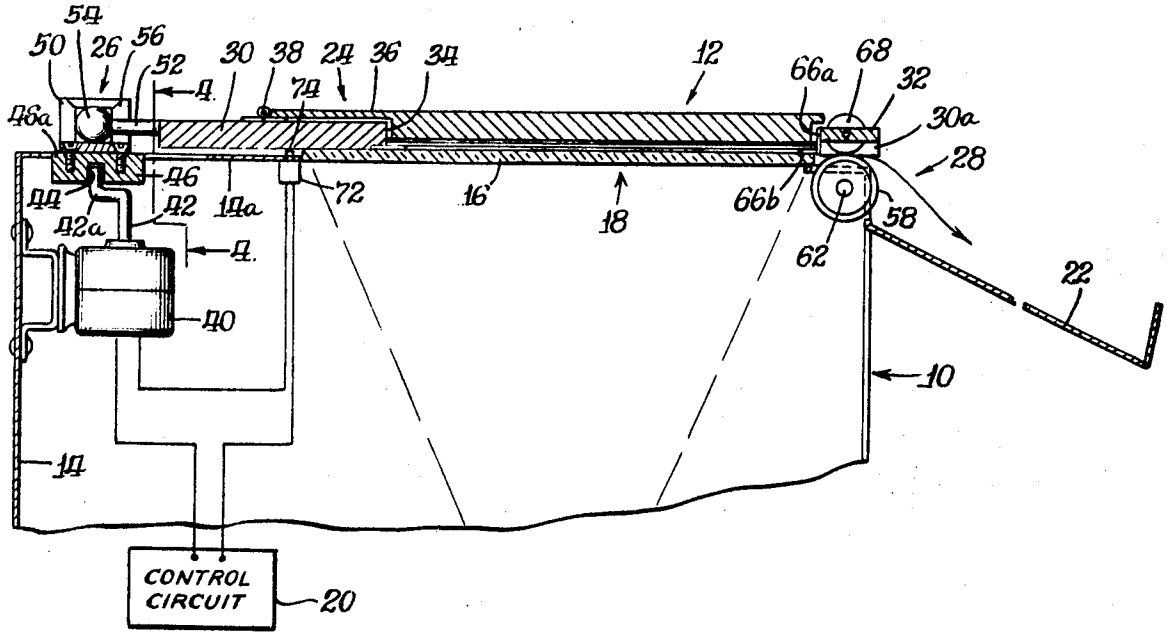
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Attorney—Mason, Kolehmainen, Rathburn & Wyss

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.



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SHEET 1 OF 3

Fig. 1.

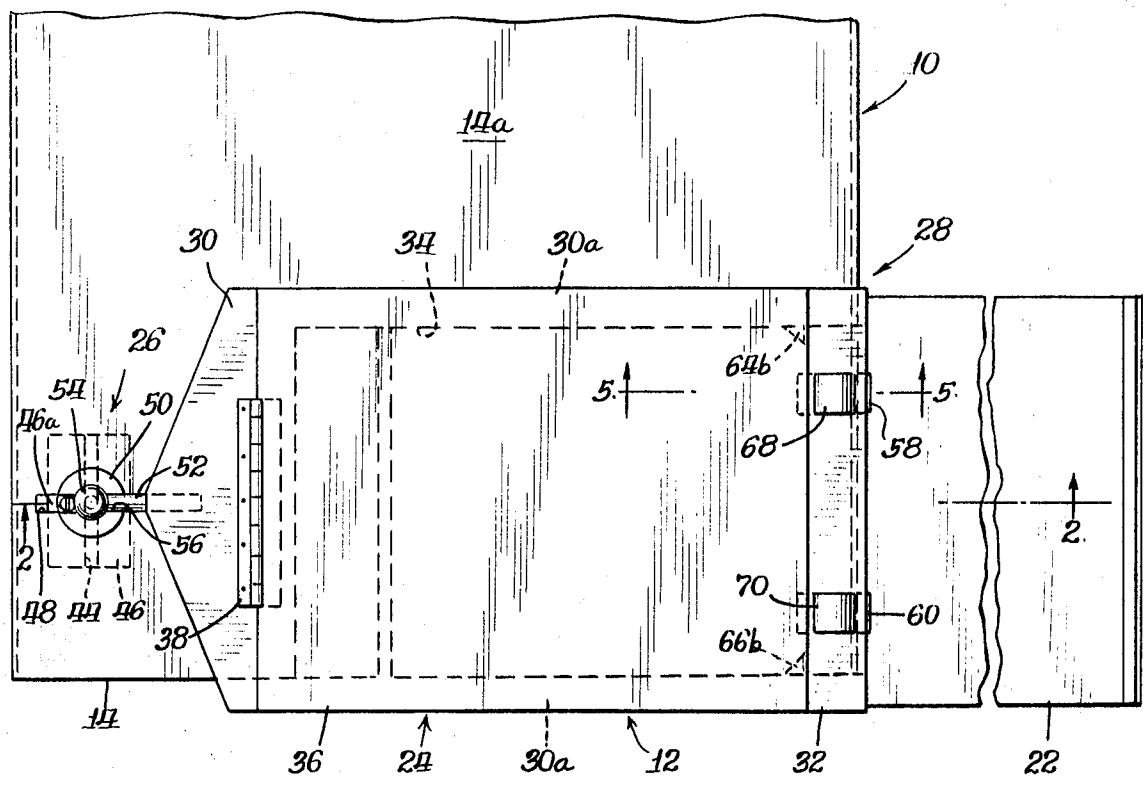
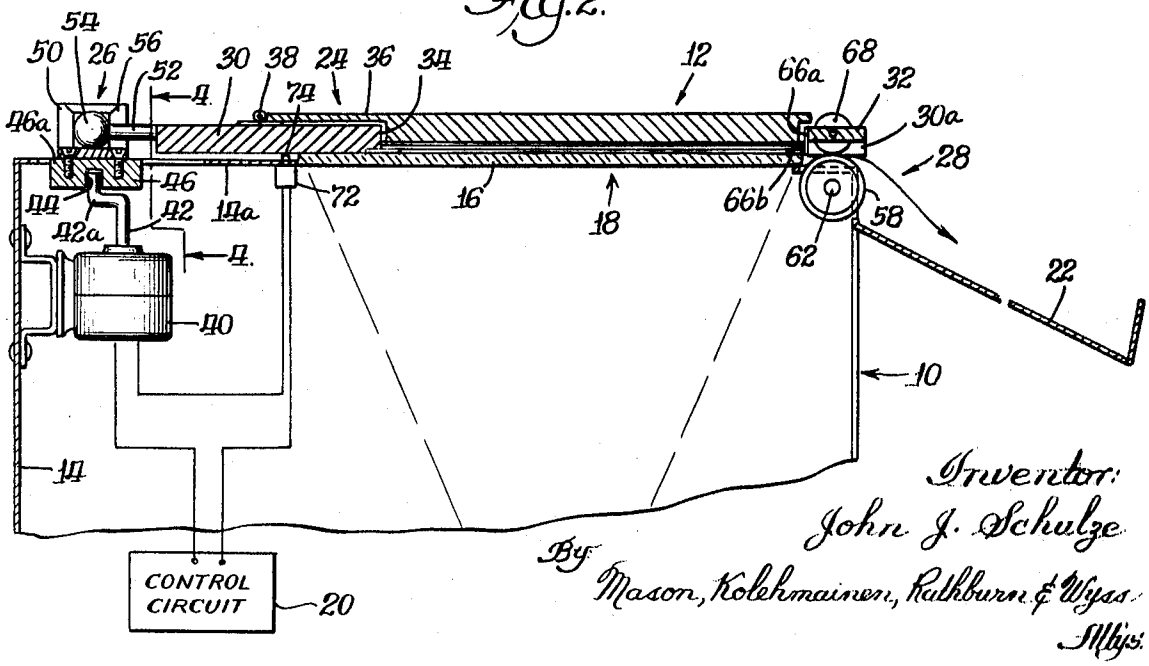


Fig. 2.



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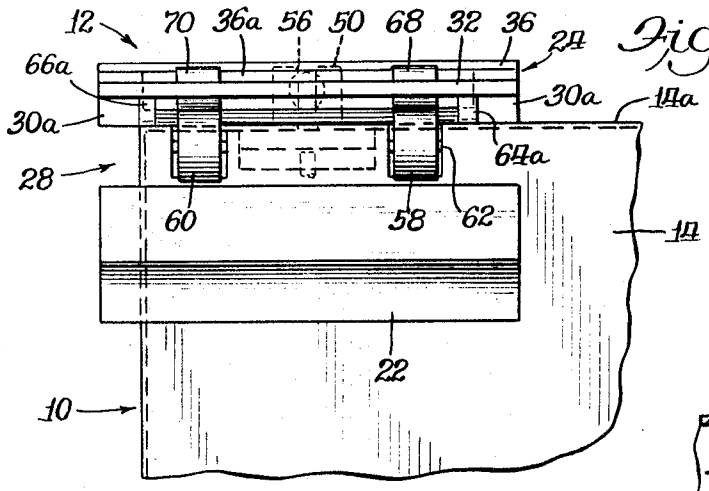


Fig. 3.

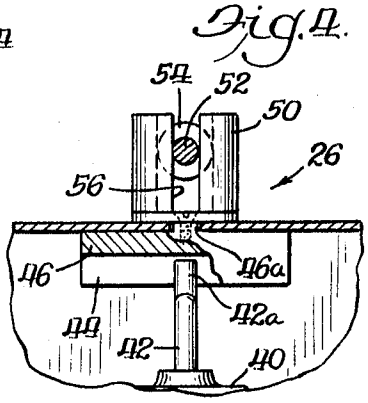


Fig. 4.

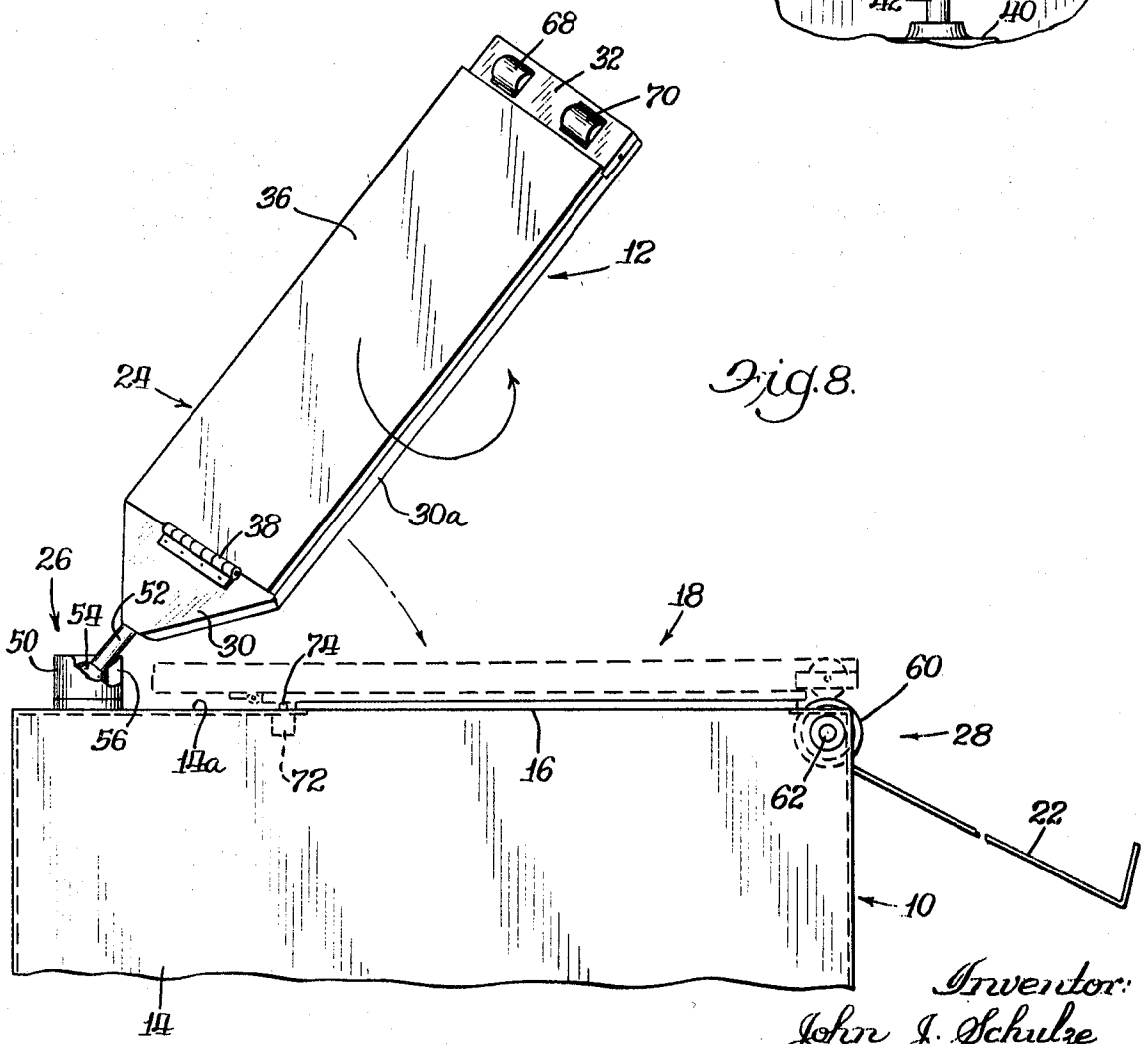


Fig. 8.

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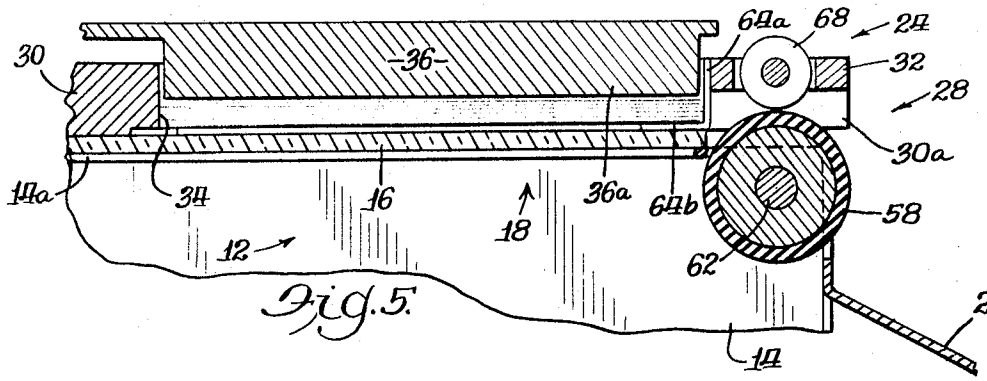


Fig. 5.

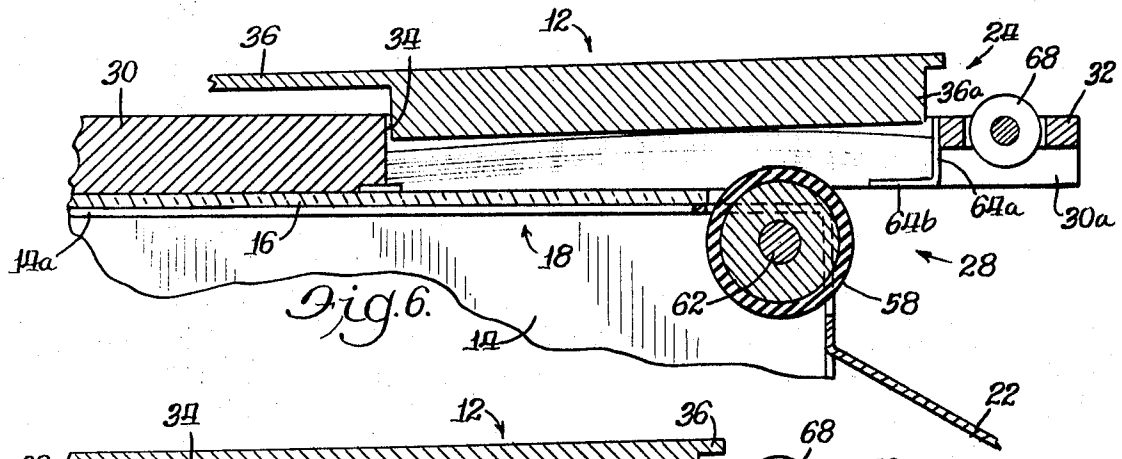


Fig. 6.

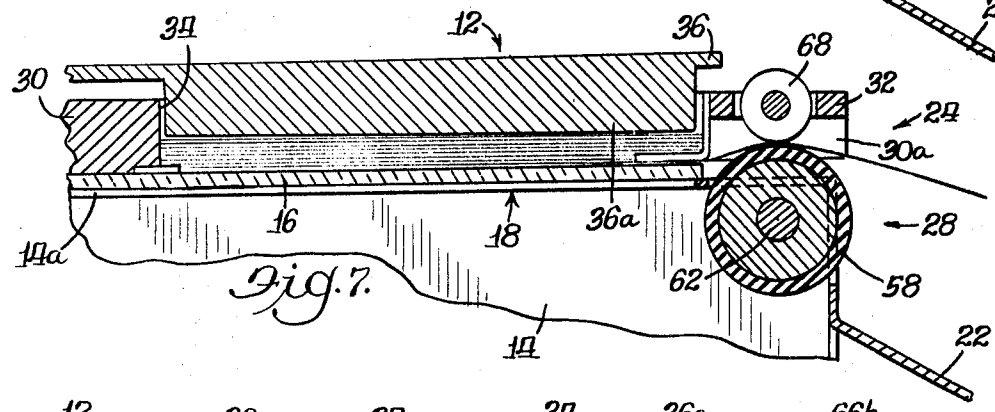


Fig. 7.

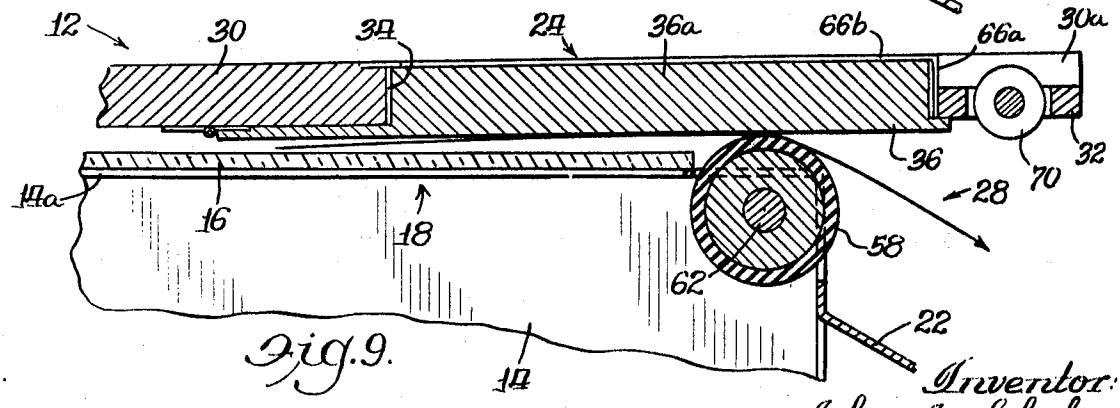


Fig. 9.

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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 defined by a transparent glass platen. When a copy is made, an original sheet such as a sheet of paper bearing a graphic image is manually placed on the platen 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 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 **14***a* of which is provided with a transparent glass platen **16** 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 down. 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 lends 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. 3,397,627.

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 station **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 **30***a* the ends of which are fixed to a crosspiece **32**. The frame **30** and crosspiece **32** cooperate to define a stack receiving opening or 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 **36***a* 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 one complete revolution. Any suitable single revolution 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 **42***a* the end of which is received in a slideway **44** of a slide block **46**. The slide block **46** includes an upwardly extending projection **46***a* received in a slot **48** in the top wall **14***a* 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 one 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 **14***a* 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 shank portion **64***a* and **66***a* forming an abutment for the front edges of the sheets in the stack. In addition, a separator portion **64***b* and **66***b* 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 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 deposited 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** permit 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 motion. As illustrated in FIG. **9**, when the sheet holding assembly **24** is moved forward, the original item held therebeneath 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 switch operating member **74** extending upwardly from the upper surface **14***a* 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 also 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 platen **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 an illumination operation 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 drive means upon 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 comprising 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, the work station 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 platen on its surface, holding means adapted to overlie an original placed on said platen, means for expelling the original from the platen 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.