

[54] **DOCUMENT FEEDING MECHANISM**

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[52] U.S. Cl. **271/3, 95/24, 271/18 A, 271/57, 271/DIG. 9, 355/122**

[51] Int. Cl. **B65h 3/16**

[58] Field of Search **271/3, 4, 5, 18 A, 18 R, 271/42, 43, 57, 54, DIG. 9; 355/122; 95/24, 30**

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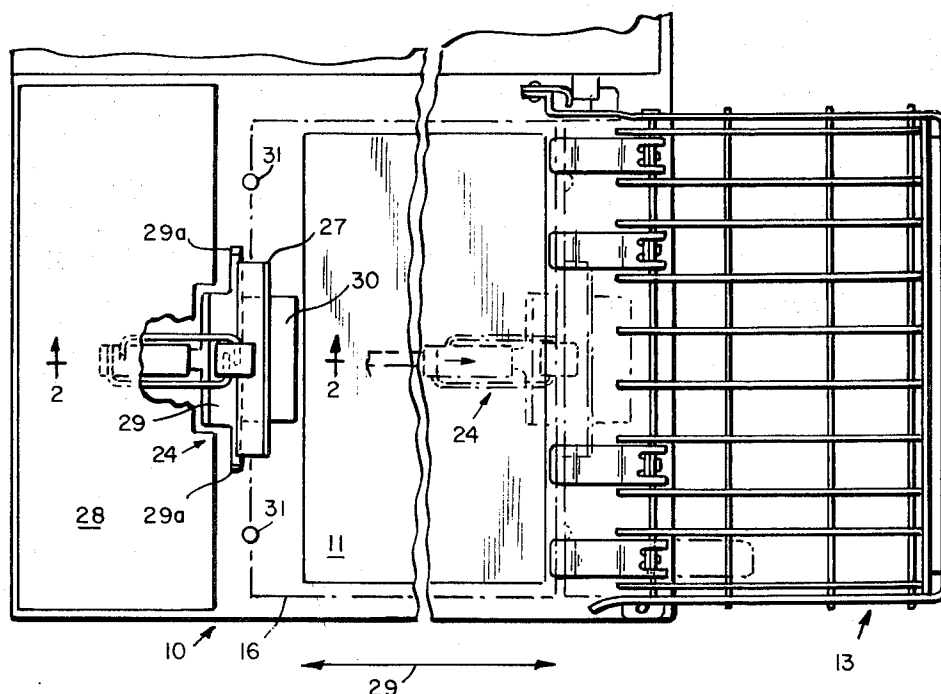
Attorney, Agent, or Firm—Dike, Bronstein, Roberts & Cushman

[57]

ABSTRACT

A mechanism for feeding originals to a copier apparatus so that the apparatus in one mode of operation automatically makes copies of related documents and delivers such copies in a predetermined collated arrangement and in another mode of operation makes copies of a plurality of unrelated documents, each of which may require a different number of copies, and automatically delivers the desired number of copies of each unrelated original. Each original is placed in a semi-rigid carrier device and the carriers are appropriately stacked near the copier apparatus. A reciprocating pick-up arm removes the carriers from the stack, one by one, delivers them to the copier apparatus exposure window and returns them to the stack in order for recirculation, if desired, in the first mode of operation. In the second mode of operation, each carrier has an encoding device for indicating the numbers of copies desired and the reciprocating pick-up arm removes each carrier from the stack for delivery to the exposure window, one at a time, at which location a decoding device decodes the encoded information and permits the copier apparatus to make the desired number of copies before removing that original and delivering the next original for copying.

26 Claims, 12 Drawing Figures



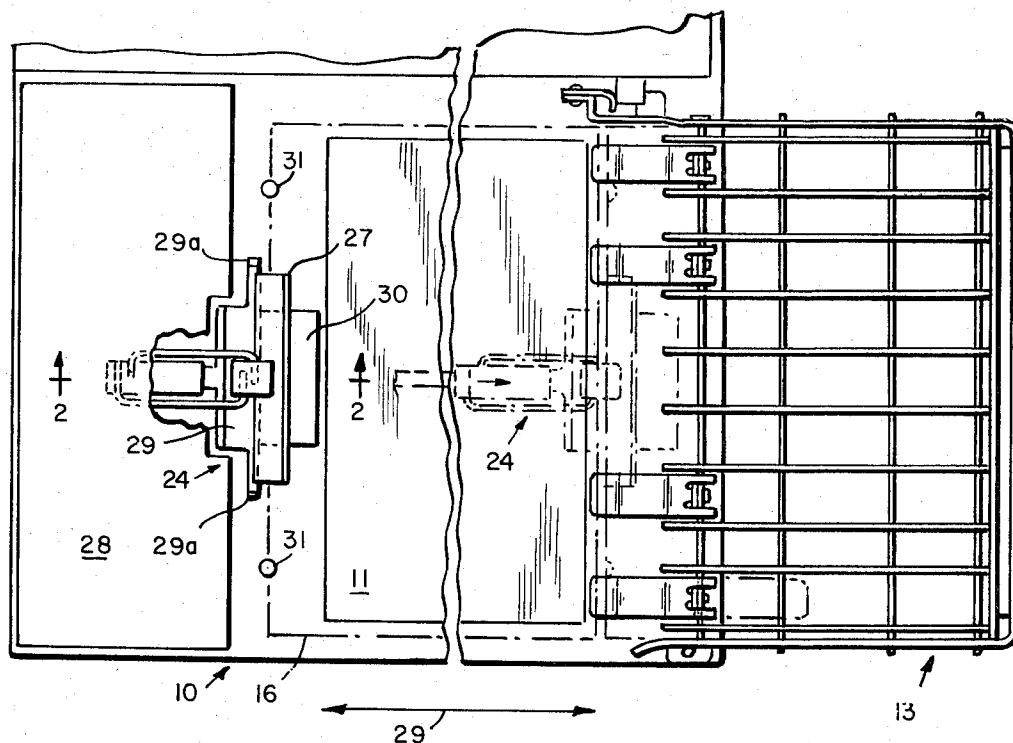


FIG. 1

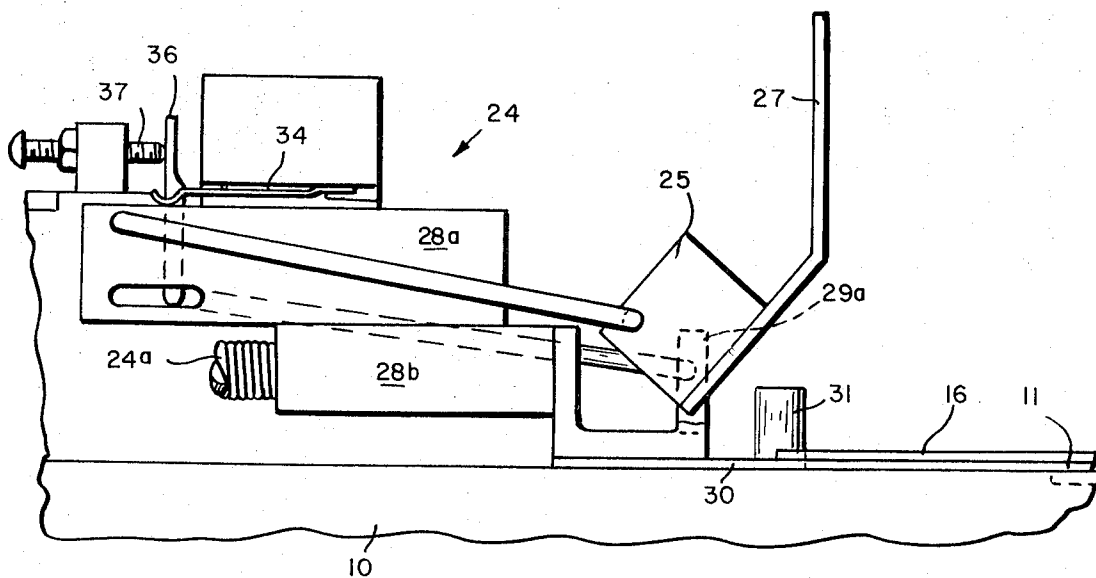


FIG. 2

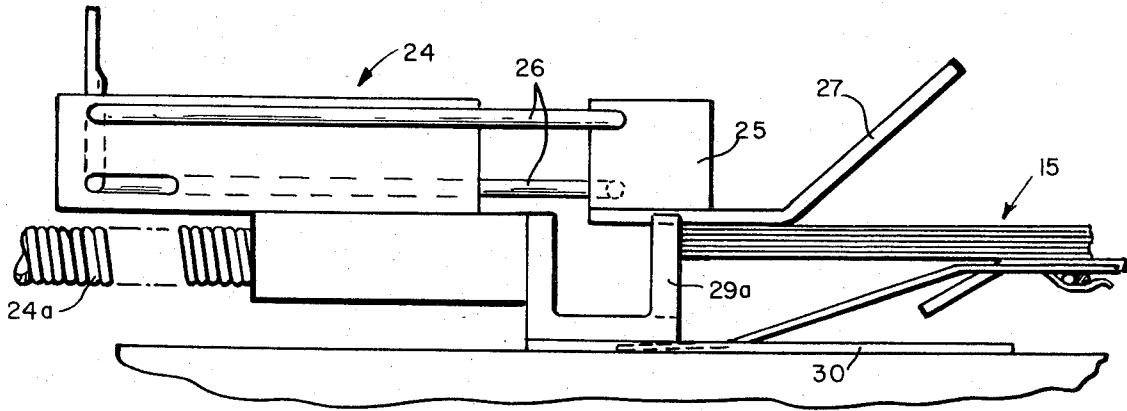


FIG. 3

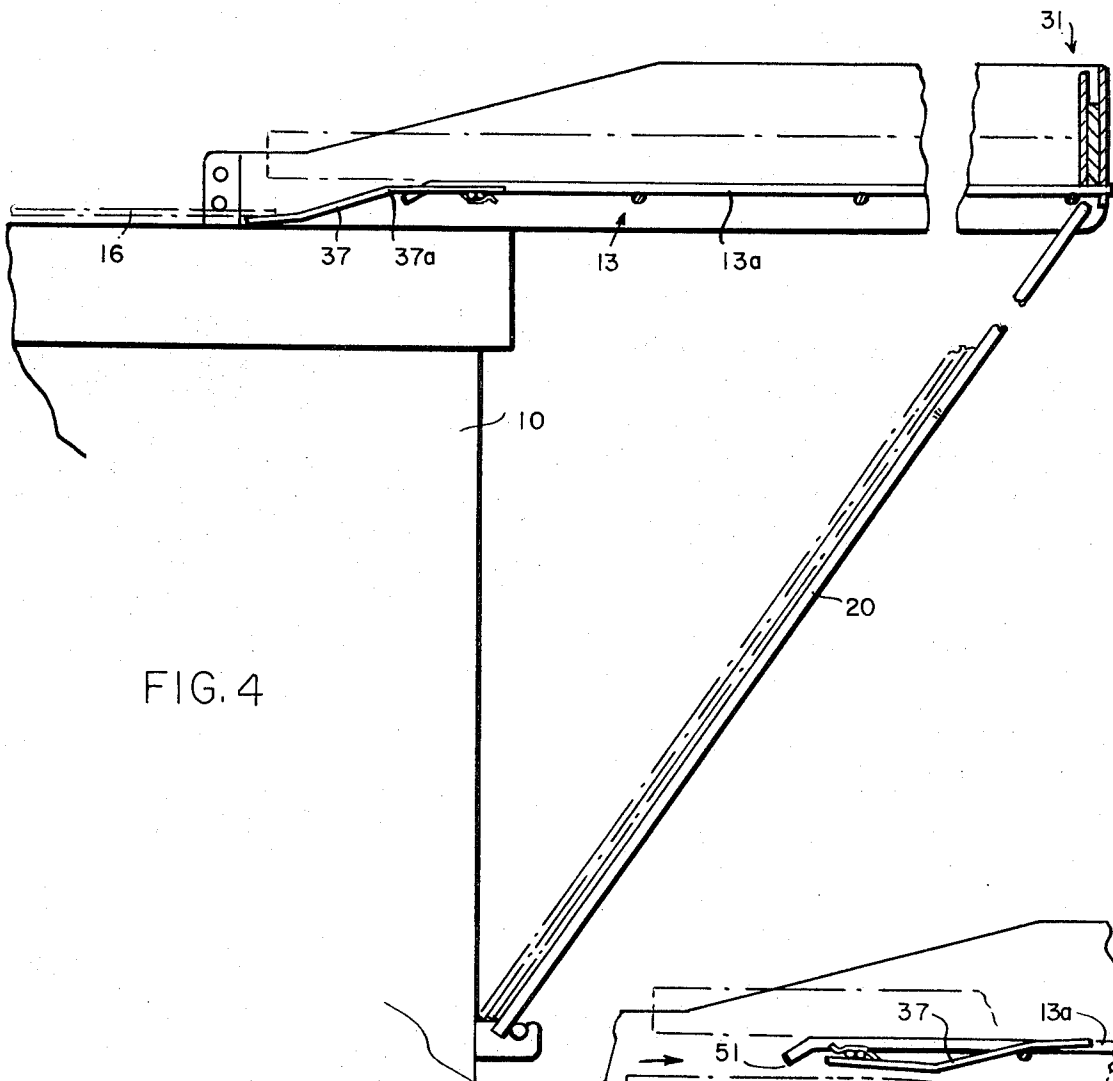


FIG. 4

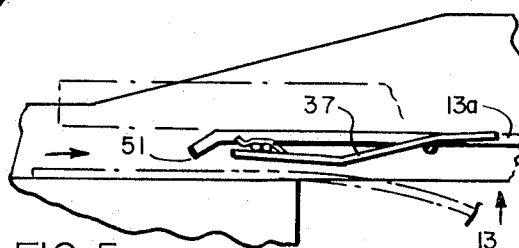
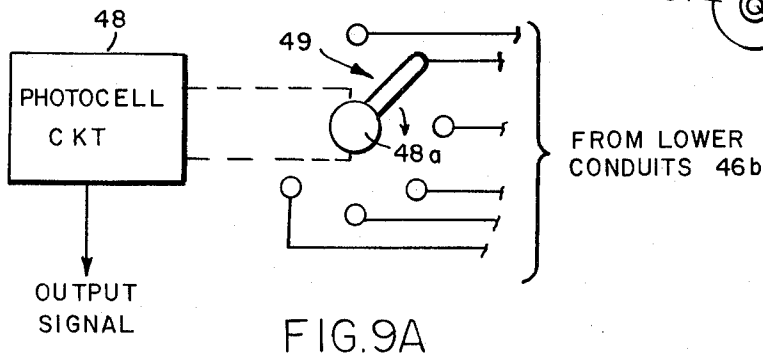
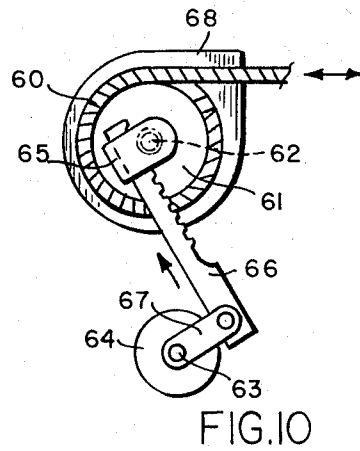
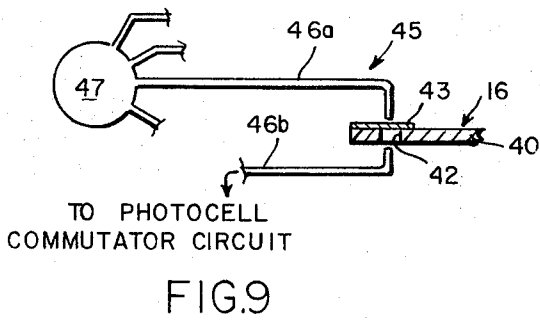
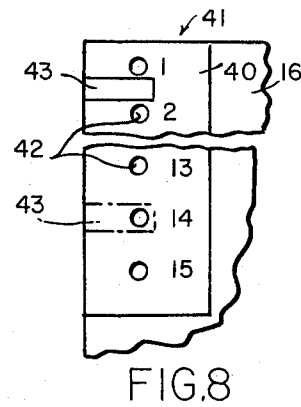
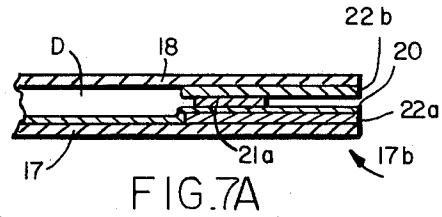
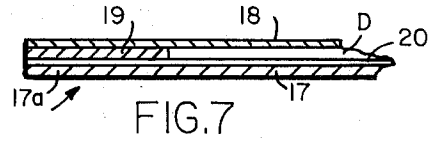
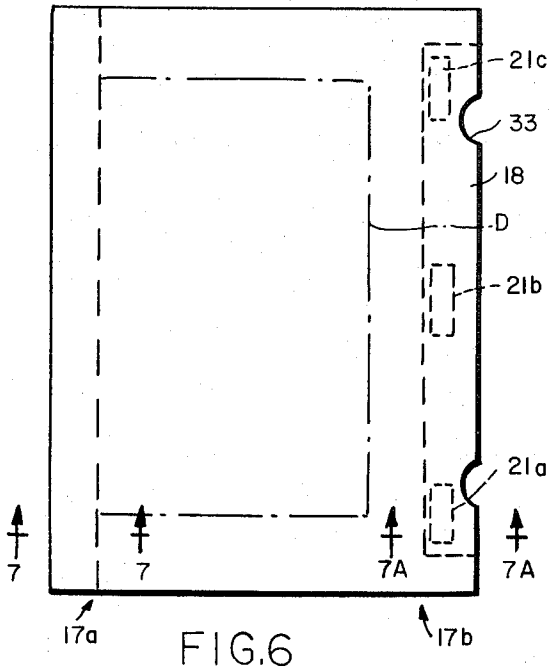


FIG. 5



DOCUMENT FEEDING MECHANISM

This invention relates generally to copying machines and, more particularly, to mechanisms for feeding documents to a copying machine in an automatic fashion.

In using copying machines it is often desirable to make copies of related original documents, such as a multipage report, and with presently available machines it is usually necessary to feed each of the documents by hand and subsequently to collate manually the copies that are so obtained. Further, it is often desirable to provide one or more unrelated original documents each of which may require a different number of copies from the others. In such cases it is usually necessary for an operator to be present so as to feed each document to the machine manually and to set the machine each time for the desired number of copies for each such document.

This invention, however, permits the automatic recirculation of related originals so that a desired number of copies are automatically arranged to emerge from the copying machine in a predetermined collated arrangement. The invention further is adapted to permit a plurality of unrelated original documents, each of which may require that a different number of copies be made therefrom, automatically to be fed to the machine in such a manner that the desired number of copies of each original emerge from the machine pick-up, even though the machine be effectively left unattended during the copying process.

In accordance with the invention, each of the original pages of documents to be copied is placed within separate appropriately rigid, or semi-rigid, carrier or pallet means, which means are then placed in a suitable rack or basket which is mounted adjacent the exposure window of the copying apparatus. In the first mode of operation, when a collated arrangement of a series of related original documents is required, the carrier means, each containing one page of the series of documents, are placed in a stack within the rack so that the carrier containing the initial page to be copied is accessible at one end of the stack. For example, the stack may be placed in the rack so that such page is available at the top of the stack and the carrier containing the last page is at the bottom thereof. A reciprocating pick-up is then utilized to remove the first carrier (i.e., the top page) from the stack by any appropriate pick-up means, such as magnetic means, and to move such original page to the exposure window where the copy is then made.

The pick-up arm then returns the original to the bottom of the stack on the adjacent rack through a suitable ramp engaging means. The pick-up arm then removes the second carrier (i.e., the next page to be copied) which at that point rests at the top of the stack, to the exposure window and, following exposure, returns that original page to the bottom of the rack below the initial page which had previously been returned to the stack. The operation is then repeated until all of the related originals have been removed, exposed, and returned to the stack at which point the initial page is again at the top of the stack and the copies which have emerged from the copying apparatus are collated in the desired order at the output thereof.

If the copier apparatus is one which delivers the copies as they are made in a manner such that the copy of the initial page is at the top of the delivered pile thereof

and copies of the subsequent pages are delivered in sequence therebelow, the carriers containing the original pages are stacked in the rack so that the first page of a multi-page report is at the top of the stack and the remaining pages placed in sequence below with the last page of the report at the bottom of the stack.

On the other hand, if the copier apparatus delivers copies such that the copy of the initial page is at the bottom of the delivered pile thereof and copies of subsequent pages are delivered in sequence above the copy of the initial page, the carriers containing the original pages are stacked in the rack so that the last page of a multi-page report is at the top of the stack and the remaining pages in reverse sequence below with the first page of the report at the bottom of the stack.

If more than one collated copy of the series of related originals is desired, the process is repeated as many times as required in order to produce the desired number of sets of collated copies of the overall report. An appropriate switching mechanism can be set by the operator to produce such required number of copies. For example, if three sets of a 15 page report are required, the operator places the original pages of the report in their carriers in the desired order on the rack and then appropriately sets a switch, or dialing, mechanism on the machine so as to actuate the machine for making 45 copies, in which case three sets of 15 pages each will be delivered by the copying machine in the desired collated arrangement.

The invention can also be arranged to operate in a second mode of operation in which one or more unrelated original pages of documents are placed by one or more different operators into the rack in an unspecified order, with the requirement that different numbers of copies of each of the unrelated pages may be needed. An appropriate encoding means is placed on the carrier means so that the operator can indicate by a suitable code on the encoding means the number of copies desired. When the carrier containing a particular original is delivered to the exposure window by the pick-up arm, the code representing the desired number of copies of that particular original is appropriately read out by a suitable read-out device which thereupon produces an actuation signal which sets the machine into the correct operating condition to make the desired number of copies. Following the making of such copies the carrier may thereupon be delivered to an appropriate collecting station adjacent the stack and coded carrier holding the next unrelated original is removed from the stack to the exposure window where operation of the read-out device again actuates the machine to produce the desired number of copies of that document required.

The invention can be described in more detail with the assistance of the accompanying drawings therein:

FIG. 1 shows a top plan view of one embodiment of the invention and its location with respect to the exposure window of an appropriate copying apparatus;

FIG. 2 shows a side elevation view of the pick-up arm used in the embodiment of the invention of FIG. 1;

FIG. 3 shows a side elevation view of the pick-up arm shown in FIG. 2 in another position during operation of the invention;

FIG. 4 shows a side elevation view of the rack portion of the embodiment of the invention of FIG. 1;

FIG. 5 shows a portion of the rack shown in FIG. 4;

FIG. 6 shows a top plan view of a carrier means used in the invention;

FIGS. 7 and 7A show side views in cross-section of portions of the carrier means taken along the lines 7—7 and 7A—7A of FIG. 6;

FIG. 8 shows a view of an encoding means used on a carrier means of the invention;

FIGS. 9 and 9A show diagrammatic views of a read-out device for use in connection with the encoding means of FIG. 8; and

FIG. 10 shows a plan view of a portion of the mechanism for imparting motion to the pick-up arm shown in FIGS. 1—3.

With reference to FIG. 1 the document feeding mechanism of the invention can be used with an appropriate copying apparatus such as one of the electrophotographic type, for example, as described generally in U.S. Pat. No. 3,425,777, issued to K.J. White on Feb. 4, 1969. Such a device is partially depicted as copying apparatus 10 in FIG. 1, which apparatus has an appropriate record or viewing window 11 on the surface of which an original document to be copied can be placed. In the conventional use of such devices it is generally necessary for the operator to change the document following reproduction thereof in a manual fashion after the desired number of copies of each page and then manually to sort out or collate the copies delivered at the output station of the machine so as to make up the total number of copies of the report that are required.

Moreover, if multiple copies of unrelated original documents are to be copied on the machine, it is usually necessary for the operator to place each original on the record window and appropriately set a dial mechanism to the number of copies required and actuate the machine for making and delivering such desired number. In order to make multiple copies of a subsequent unrelated original an operator must remain in attendance at the machine and remove the previously copied original and place the subsequent unrelated original on the window of the machine and reset, or redial, the machine for the desired number of copies of the latter document.

The feeding mechanism of this invention permits the automatic operation of the copier machine in two operational modes, a first mode in which one or more copies of a plurality of related documents automatically are made and delivered at the output of the machine in a collated, or preselected, order. Such mode of operation is initially discussed below. While not presently readily available to the general public commercially at this time, some prior art devices for producing a similar result have been disclosed in U.S. Pat. Nos. 3,449,710 issued to Sahley on Mar. 10, 1970, and 3,536,320 issued to Derby on Oct. 27, 1970.

In the first patent listed above, the unprotected pages of a multi-page report, for example, are placed in a stack in a prearranged manner such that the lowest numbered page is placed at the bottom of the stack and the highest numbered page at the top thereof. The stack is then placed in a first feeder station located at one side of an exposure window and pages are fed through an elaborate belt feed arrangement from such feeder station to an exposure window from the bottom of the stack. When a page has been exposed, the original is then moved to a second receiver station located at the opposite side of the exposure window. Subse-

quent pages, as they are copied, are then placed on top of the preceding exposed pages so as to reform the stack at a second receiver station. If a second copy of the related documents is required the documents must then be fed from the bottom of the stack at the receiver station to the exposure window and then back to the first feeder station where they are again appropriately restacked. In this manner, for making multiple copies of the report, the documents are appropriately transferred back and forth between stations.

Such an arrangement is relatively complex mechanically and requires two externally located stations which are placed on either side of the exposure window. In some applications it would not be possible to use such feeding and receiving station because of excessive space requirements, sufficient room often not being available to accommodate the presence of two stations at either side of the machine. Moreover, there is nothing shown in the mechanism of the Sahley Patent to permit the operation of such system in a mode wherein varying numbers of copies of unrelated originals can be made with the machine left effectively unattended. Further, because of the extensive mechanical parts which are fixed in place directly over the exposure window the copier apparatus cannot be used in a normal manner (i.e., without the feeder arrangement) without completely removing such from their obstructing location above the window.

The device shown in the Derby Patent mentioned above also utilizes a relatively complex mechanical conveyor system having a plurality of endless belts actuated by elaborate gearing and roller devices. As in Sahley, such system requires a relatively large amount of space at the side and top of the copying machine to accommodate the conveyor mechanism. In such device the documents which are also unprotected as in Sahley, are fed from the bottom of the stack thereof in order to make multiple copies of related originals, and the originals are fed through somewhat elaborate mechanical guiding means in order to assure the correct placement of originals at the exposure window from where they can be returned to the original stack for recirculation. Moreover, like the Sahley system, that shown in the Derby Patent is limited in that it cannot be adapted to operate in the second mode of operation discussed above wherein varying copies of unrelated originals are to be copied by a machine effectively left unattended.

This invention on the other hand, provides for a document feeding mechanism which is similar in its mechanical construction from those described in the prior art patents discussed above and, accordingly, can be made more compact so as to permit the mechanism to be mounted on existing copying apparatus, or made integral with such an apparatus during its manufacture, so that the overall apparatus can fit into relatively confined areas. Moreover, the mechanism is arranged so that it is readily adaptable to operate in both modes of operation discussed above wherein multiple copies of related documents are produced at the output of the machine in a desired prearranged collated order and varying numbers of copies of unrelated originals are produced by the machine without attendance by an operator.

In the invention the documents to be copied are placed in protective, rigid, or semi-rigid, carrier or pallet means prior to the copying process. The carriers,

each holding a single page document for reproduction, are stacked in prearranged order, for example, for operation of the system in the first mode of operation wherein multiple pages of related documents are to be made so that the first page is at the top of the stack and subsequent pages are arranged in order down to the last page which is placed at the bottom of the stack. The stack is then placed on an appropriate rack which is readily mounted at the side of an exposure window of a copying apparatus as discussed below in more detail with references to FIGS. 1-4.

An exemplary carrier means 16 is shown in FIGS. 6, 7, and 7A and comprises a rigid or semi-rigid base member 17 having a white coating 20 and a transparent cover member 18. The cover 18 is appropriately adhered to the base 17 in a hinged fashion along one side thereof so that the cover may be raised and lowered with ease by an operator. At the hinged end, cover 18 is cemented, or otherwise adhered, to a metallic member 19 which extends along the length of edge 17a and is in turn cemented to the coating 20 of base member 17. The metallic member 19 is made of a magnetic material, for purposes to be described subsequently, and acts also as a spacer when the document to be copied is inserted into the carrier.

A single page document D to be reproduced is then inserted between the transparent cover 18 and the coated base 17 with the side of the page to be reproduced being arranged adjacent the transparent cover 18 so that it can be viewed through the latter. At the opposite edge 17b a metallic strip 22a extending parallel to edge 17b is affixed to base 17 and the coating 20 covers the exposed surface thereof as well as the upper surface of base 17. A plurality of magnetic members 21a, 21b, and 21c are appropriately affixed to the coating 20 and spaced along the edge 17b opposite from the hinged edge 17a. A metallic strip element 22b is affixed to the underside of cover 18 and, accordingly, has portions thereof oppositely disposed and magnetically attracted with respect to magnetic members 21a, 21b and 21c. Accordingly, the presence of metallic strips 22a and 22b and magnetic members 21a, 21b, and 21c assures that the cover is tightly closed and readily retains the document therein without fear of its accidentally falling out or escaping from the carrier during handling of the carrier either manually or by the feeding mechanism.

In order to insert a document D into the carrier, the operator merely raises the transparent cover manually against the attractive force of the above described closure magnets and slips the document therein, and places the transparent cover back over the document so that the latter is effectively locked in by the action of the closure magnets.

The carrier base 17 may be made of an appropriate material such as card stock, or vulcanized fiber, while the transparent cover may be made of an appropriate plastic material such as cellulose acetate or a polyester material.

When each of a plurality of related documents which are to be reproduced has been inserted into separate ones of a plurality of carrier means 16, the carriers are stacked, for example, so that the first page is at the top of the stack 15 and the last page is at the bottom of stack 15 with the transparent covers 18 facing downwardly as shown in FIGS. 3 and 4. The stack is placed in a rack, or basket, means 13 mounted adjacent one

side of exposure window 11 by a frame member 20 as shown therein.

A pick-up assembly 24 is connected to an appropriate reciprocating device, such as a reciprocating motor assembly 28, via a flexible shaft 24a, which as described in more detail below, causes the assembly to move from a position at or near one side of the exposure window 11 to a position at or near the rack means 13 beyond the other side of window 11 over a general path range indicated by arrow 29 as shown in FIG. 1. At the end of pick-up assembly 24 is a pick-up head 25 which is connected to an upper block 28a of assembly 24 through parallelogram frame member 26 of a pantograph type so that pick-up head 25 can be moved in a vertical direction while maintaining a parallelism with the horizontal surface of exposure window 11. The head 25 has attached thereto a member 27, in the form of an upwardly inclined planar surface, projecting outwardly from the head 25 and laterally extending beyond the sides of the head, as shown in FIG. 1. Pick-up assembly 24 further includes a U-shaped member 29 attached to lower block 28b, member 29 having a pair of upwardly projecting posts 29a at either end of the front portion thereof as shown in FIGS. 1-3. Posts 29a come into contact with the end of stack 15 during the pick-up operation as shown in FIG. 3. A thin, metallic and slidable member 30 is affixed to and projects outwardly from the bottom of U-shaped member 29 so as to be movable along the surface of the window 11 during the reciprocating motion of the pick-up assembly 24. Pick-up assembly 24 is adapted to move from the exposure window toward and away from the rack 13 as described in more detail below.

A stop means in the form of posts 31 are positioned along one side of exposure window 11, a pair of such posts being used, for example, in the particular embodiment as shown. Corresponding semi-circular indentations, or notches, 33 are cut in the cover and base of carrier means 16 so that when a carrier is moved onto the exposure window the notches 33 partially encircle the posts 31 so as to align the document correctly at the window.

During operation of the mechanism for reproducing collated copies of a multi-page report the reciprocating pick-up assembly 24 is moved toward stack 15 which has been placed in rack 13, the inclined projecting member 27 striking the edge of the topmost carrier which is adjacent the exposure window. The pick-up head 25 thereupon rides upwardly with the upward motion of projecting member 27 to a position substantially as shown in FIG. 3 wherein the bottom of projecting member 27 is oppositely disposed to and above the central portion of the metallic strip element 22a on topmost carrier 16 at which point the pick-up head 25 is momentarily stopped. The topmost carrier is then magnetically attracted to the pick-up head through the attractive force of magnet element 21b, strip 22a and member 27 and pick-up assembly is then moved away from stack 15 in a direction toward exposure window 11 taking with it the topmost carrier which holds the first page of the report to be reproduced. As can be seen best in FIG. 4, the remaining carriers of the stack are held in place during the removal of the topmost carrier by a retaining magnet assembly 31 which provides an attractive force with respect to magnetic element 19 at the hinged edges of the carriers.

Although the coupling between the pick-up head and the carrier means is described as utilizing magnetic means, other means may be used to permit the head to draw the carrier off from the stack. For example, an appropriate mechanical coupling may be used wherein a suitable clamping or latching device may be used on the head to mechanically grasp or latch on to a corresponding suitably shaped portion of carrier for this purpose.

As can be seen, the top of the stack is continually exposed so that an operator may, at any time during the operation of the apparatus, add to or remove from the stack one or more carrier means. Thus, in one exemplary operation in which many copies of a multi-page report are being made, it may be required that some of the report copies omit or add certain pages which are included or omitted in other copies thereof. The operator can readily remove or add such pages from (or to) the stack at the appropriate times during operation so that the collated copies at the output of the copier apparatus are suitably arranged.

The pick-up assembly conveys such topmost carrier downwardly and to the left towards exposure window 11, the carrier being effectively held at edge 17b between the bottom of projecting member 27 and the top of slidable member 30. The carrier 16 is thereby moved to a position in which semi-circular notches 33 are keyed into corresponding posts 31 as shown in FIG. 2. In one embodiment of the invention, the pick-up assembly head is further moved to a position slightly beyond stop posts 31, with the carrier being retained in position on the window by the latter stop means by the magnetic attraction between slidable member 30 and the magnetic elements on the carrier. The movement of pick-up assembly 24 and head 25 overcomes the magnetic attractive force between magnet 22 and projecting member 30 so that carrier 16 effectively drops off pick-up head 25 and remains in its aligned position on exposure window 11. Projecting element 36 mounted on block 28a comes into contact with the end of an adjustable screw stop 37 and causes head 25 and projecting member 27 to rotate upwardly away from window 11 as shown in FIG. 2. When the feeder arrangement is inoperative the head 25 is retained in such upward position so that the exposure window 11 is not obstructed in any way by the feeder mechanism and the copier apparatus can be readily operated in a conventional fashion.

Following such exposure, reciprocating assembly 24 begins its return movement in a direction toward rack 13 so that the pick-up head 25 is positioned opposite carrier means 16 on the window and the attractive force between member 27 and magnet 22a on the carrier causes such carrier to be picked up by the pickup head and slidable member 30 so that it is slidably moved along window 11 toward the rack in a direction away from exposure window 11. As shown in FIG. 4, upon reaching rack 13 the carrier 16 comes into contact with an inclined ramp means 37 which causes the carrier to move upwardly into a position below the lowermost carrier in stack 15, the edges of the carriers in the stack projecting slightly beyond the topmost corner 37a of ramp means 37 so that the returned carrier is readily slidably inserted between the rack bottom 13a and the lowermost carrier of the stack. The overall stack is thereby raised slightly so that the next page of the report, which is retained in what is now the topmost

carrier of the stack, is then in a position to be removed from the top of the stack.

When the returned carrier is fully inserted at the bottom of the stack the pick-up head 25 of pick-up assembly 24 is again in a position over the topmost carrier of the stack at which point it picks up what is now the topmost carrier containing the next page and repeats the same reciprocating exposure operation with respect to the document carried therein. Following such exposure, that carrier is then inserted at the bottom of the stack and the process repeated until all of the pages have been appropriately exposed and the first page is again at the top of the stack.

In an exemplary arrangement of the operation of the feeder mechanism and the copier apparatus, the copier can be actuated to begin the exposure cycle thereof. Accordingly the copier apparatus may be arranged to make a specified number of exposures, for example, by the setting of a printable dial control as is well known, or be arranged to provide an indefinite number of exposure wherein copies are continually made until an operator shuts off the apparatus, also by the use of appropriate and well known switching controls. In any event, actuation of the copier apparatus is arranged simultaneously to actuate the feeding mechanism of the invention. Thus, appropriate and conventional pulse circuitry (not shown) may be used to start the operation of the motor for producing the desired reciprocating motion when the copier apparatus operation begins. As the head 25 moves to the right from its rest or inoperative, position (Such as shown in FIG. 2) switch 34 is caused to operate so as to actuate suitable and conventional lock-in circuitry which locks in the operation of the motor and pick-up assembly. When head 25 returns to a position at the window and drops off the carrier which has been picked off from the stack, the copier apparatus makes a copy of the original contained in the carrier and the head continues its motion to the position shown in FIG. 2, at which point operation of switch 34 causes the lock-in circuitry to be deactuated and the motor to be shut off. As the next copy cycle begins, the pulse circuitry again actuates the motor and the same cycle of operation takes place, the pick-up assembly returning the carrier from the window to the stack and moving the next carrier from the stack to the window for copying the original contained therein. Such operation continues until the last copy has been made at which time the copier apparatus circuitry is shut off and the pick-up assembly remains in its inoperative or rest, position.

As mentioned above, the shaft which drives pick-up assembly 24 is of a flexible nature and may be formed, for example, of a flexible tubular coil or spring 60 which is effectively compressed longitudinally to provide a relatively stiff member along the direction of motion of the pickup assembly. At the same time, spring 60 can be relatively easily flexed, or buckled, in a direction perpendicular to its longitudinal direction. Spring 60 is attached at one end to lower block 28b of pickup assembly 24 and at the other end to a cylindrical reel member 61 which is adopted to rotate on a staff 62, is shown in FIG. 10.

Staff 62 is coupled to the shaft 63 of a motor 64 via appropriate linkages 65, 66 and 67. As motor shaft 63 rotates, a reciprocating motion is imparted to spring-shaft 60 and, accordingly, to pick-up assembly 24. A suitable guide member 68 is used to promote the de-

sired reciprocating motion. Thus, when the pick-up assembly 24 is in the position shown in FIG. 2, the spring-shaft 60 is substantially coiled about reel 61 and when assembly 24 is moved to its position adjacent the rack 13 the spring-shaft 60 is essentially completely extended from reel 61.

By the use of a structure such as shown in FIG. 10, less space is required for the driver assembly. If a rigid shaft were used to drive pick-up assembly 24, the shaft would be required to project to a location considerably beyond the view window of the copier apparatus and the space required for the overall feeding mechanism would be greatly increased over that required for the structure disclosed herein. Further, since the spring-shaft 60 can be readily flexed, or buckled, by any force which is directed at an angle to the longitudinal direction thereof, the overall mechanism can be operated more safely. Thus, if an operator's hand were inadvertently to be placed in the path of and lowered into contact with the moving pick-up assembly, the force imparted thereto would cause the shaft to buckle and the hand is less apt to be caught between the moving assembly and other parts, such as the window surface, of the apparatus. In addition, should the moving assembly be jammed by other means the shaft would buckle and avoid damage to the reciprocating driver assembly or the carrier (and, hence, the original document page located in the carrier).

In accordance with the above description of the operation in the first mode of the invention the copies of the document pages as they emerge from the machine are delivered in the desired prearranged collated order. If a second set of copies of the multi-page report is required, the same overall process is repeated and the total number of pages of the report are again exposed in the same order, with the cycle being repeated as often as desired in order to provide the required number of collated copies of the report.

For operation of the mechanism in a second mode for reproducing different numbers of copies of unrelated original documents, each of the documents is also placed in a separate carrier means. Before placing each carrier onto a stack for feeding to the copier device the operator indicates the number of copies of that particular document which are to be made by the use of an appropriate encoding device 40 which is located at one corner 41 of a carrier means. The encoding device may take many convenient forms one of which is partially shown in FIG. 8 as comprising a plurality of apertures 42 (e.g., 15 apertures), each appropriately numbered as shown.

Opaque movable element 43 is arranged to be slidably moved along edge 41 along the line of apertures 42 in order to indicate the number of copies desired. The operator moves element 43 to a position where it effectively covers the aperture corresponding to the number of copies desired (e.g., aperture number 14 as shown in dashed lines in FIG. 8).

The same encoding device is used on each carrier to identify the number of copies desired for each of the originals that are placed therein in the stack preparatory to making the actual copies themselves. The carriers are removed one at a time from the stacks in the manner discussed above, and when each carrier is set into position at the exposure window of the copier apparatus, the encoding device 40 moves into a position adjacent a photoelectric read-out device 45 which is

mounted in an appropriate location for that purpose and which operates as follows.

As shown in FIG. 9, read-out device 45 comprises a plurality of pairs of light conductive conduits 46a and 46b (e.g., 15 pairs thereof corresponding to the number of apertures in encoder 40), each pair of which is positioned adjacent one of the apertures 42 of the carrier encoding device 40 when the carrier is in position at the exposure window. Thus, an upper conduit 46a of each pair is directed toward its corresponding aperture 42 from above and a lower conduit 46b of each pair is directed toward its corresponding aperture from below. A light source 47 is mounted so as to direct light simultaneously through each of the upper conduits and thence through each aperture and, thus, through the lower conduits to a photocell circuit 48 via a photocell 48a as shown in FIG. 9A. For each aperture which is "open", i.e., a condition wherein the opaque member 43 is not present at such aperture to block off the aperture, light accordingly will be conducted through the aperture and through the lower circuit to the photocell circuit.

A commutator 49 causes a photocell 48a to be exposed consecutively to light received from each of the lower conduits in turn from apertures 1 through 15. So long as light is received in photocell 48a photocell circuit 40 produces an output signal such that the copier apparatus is actuated through appropriate switching elements (not shown) to make a copy of the original document contained in the carrier in question. As soon as commutator 49 reaches the aperture at which opaque member 43 has been placed (e.g., aperture 14 in the example of FIG. 8), no light impinges on photocell 48a and a different output signal is generated by photocell circuit 48 which shuts off the copier apparatus and simultaneously automatically actuates the motion of reciprocating assembly 24 to remove the carrier from the exposure window and return it toward the stack. The commutator also automatically re-sets to its initial position so as to be prepared to readout the next encoding device associated with the next carrier.

During operation in this mode, the inclined ramp means 37 may be removed from the path of returning carrier by being rotated or folded backwardly to a position under the bottom 13 of the rack 13 as shown in FIG. 5. Thus, when the carrier is returned to the rack it is not returned to a position at the bottom of the stack but rather passes under the rack and out through a slotted opening 51 whereupon it falls onto a suitable inclined platform formed by the mounting assembly 20 for rack 13 as shown in FIG. 4. Alternatively, the carrier may be returned to the rack, as before.

Thus, during the second mode of operation the correct number of copies of each document originally contained in stack 15 are delivered by the copying apparatus and the originals of the documents being copied are held for retrieval by each of the operators who had previously placed them in the stack.

What is claimed is:

1. A document feeding mechanism for feeding one or more documents to the viewing window of a copying apparatus, said mechanism comprising
 - carrier means for holding a single document to be copied;
 - rack means for holding a stack of one or more of said carrier means;

reciprocating means for sequentially moving said carrier means one at a time from one end of said stack at said rack means to said viewing window for producing a copy of the document in said carrier means and for returning said carrier means from said viewing window to the opposite end of said stack at said rack means, said reciprocating moving means including means for coupling said reciprocating moving means to said carrier means.

2. A document feeding mechanism in accordance with claim 1 wherein said coupling means is adapted to be coupled to the carrier means at the top end of said stack and further including

means for permitting the insertion of said returned carrier means to the bottom end of said stack.

3. A document feeding mechanism in accordance with claim 2 and further comprising

frame means for attaching said rack means to said copying apparatus substantially adjacent said viewing window;

and further wherein said insertion permitting means includes

ramp means attached below said stack at the side of said rack means nearest to said viewing window in the path of said carrier means during its return from said view window to said rack means, said ramp means thereby permitting said carrier means to be slidably inserted at the bottom of said stack at said return.

4. A document feeding mechanism in accordance with claim 3 and further including means for permitting said ramp means to be removed from said path of the carrier means.

5. A document feeding mechanism in accordance with claim 2 wherein said reciprocating moving means comprises

a movable arm;

pick-up means mounted at the end of said movable arm for removing said carrier means from the top end of said stack; and

means for moving said arm in a reciprocating manner.

6. A document feeding mechanism in accordance with claim 5 wherein said last-named means includes a motor for producing rotary motion;

a shaft connected at one end to said movable arm; linkage means coupling said motor to said shaft for imparting reciprocating motion to said shaft.

7. A document feeding mechanism in accordance with claim 6 wherein said shaft is flexible.

8. A document feeding mechanism in accordance with claim 7 wherein said flexible shaft comprises tubular spring means.

9. A document feeding mechanism according to claim 5 wherein

said carrier means each includes a magnetic means affixed thereto; and

a portion of said pick-up means is metallic, whereby a magnetic attraction occurs between said metallic pick-up means and said magnetic means.

10. A document feeding mechanism according to claim 9 wherein said pick-up means further includes means affixed thereto for guiding said pick-up means to a position adjacent the topmost carrier means of said stack when said pick-up means is moved toward said rack means to remove said topmost carrier means therefrom.

11. A document feeding mechanism in accordance with claim 10 wherein said guiding means includes an upwardly inclined planar surface mounted at the side of said pick-up means nearest said rack means.

12. A document feeding mechanism in accordance with claim 1 wherein said carrier means is moved from said stack to said viewing window and is returned from said viewing window to said stack in a single reciprocating motion of said reciprocating moving means.

13. A document feeding mechanism in accordance with claim 1 wherein

said stack comprises a plurality of said carrier means placed in said rack in a preselected order; and

further including

means for cyclically operating said reciprocating moving means for successively moving said plurality of carrier means from said stack in said preselected order for producing copies of the documents retained therein and for returning said carrier means to said stack in said preselected order.

14. A document feeding mechanism in accordance with claim 1 wherein said carrier means comprise backing means;

transparent cover means attached to said backing means whereby a document can be inserted between said cover means and said backing means; and

means for preventing said document from accidentally escaping from said carrier means.

15. A document feeding mechanism in accordance with claim 14 wherein said backing means is made of a substantially rigid opaque material.

16. A document feeding mechanism in accordance with claim 14 wherein said transparent cover means is made of a flexible plastic material.

17. A document feeding mechanism according to claim 14 wherein said preventing means comprises at least one magnetic means affixed to said backing means and a metallic element affixed to said cover means and oppositely disposed to said magnetic means.

18. A document feeding mechanism in accordance with claim 1 wherein said carrier means each includes a magnetic element and said rack means includes magnetic means for providing an attractive force on said magnetic elements for retaining the remaining ones of said stack of carrier means when one of said carrier means is moved therefrom by said moving means.

19. A document feeding mechanism for feeding one or more documents to the viewing window of a copying apparatus, said mechanism comprising

carrier means for holding a single document to be copied;

rack means for holding a stack of one or more of said carrier means;

means for moving one of said carrier means of said stack from said rack means to said viewing window for producing a copy of the document in said carrier means, said moving means including means for coupling said moving means to said carrier means;

stop means mounted adjacent said viewing window for causing said carrier means to be retained at said viewing window when said carrier means is moved thereto from said stack; and

means for aligning said carrier means at said viewing window.

13

20. A document feeding mechanism in accordance with claim 19 wherein said aligning means includes key means formed at one edge of each of said carrier means; and

corresponding key means formed at said stop means 5 for matching said carrier key means so as to align said carrier means at said viewing window.

21. A document feeding mechanism in accordance with claim 20 wherein

said carrier key means includes one or more indenta- 10 tions each having a preselected configuration formed therein; and

said corresponding key means comprises one or more protrusions each having the same preselected con- 15 figuration as said indentations.

22. A document feeding mechanism for feeding one or more documents to the viewing window of a copying apparatus, said mechanism comprising

carrier means for holding a single document to be 20 copied;

rack means for holding a stack of one or more of said carrier means;

means for moving one of said carrier means of said stack from said rack means to said viewing window for producing a copy of the document in said car- 25 rier means, said moving means including means for coupling said moving means to said carrier means;

said carrier means includes

encoding means for indicating preselected opera- 30 tional instructions to said copying apparatus; and

said mechanism further includes

decoding means mounted so as to be adjacent said encoding means when said carrier means is at 35 said viewing window for reading out said preselected operational instructions for providing an operating signal in response thereto; and

means responsive to said operating signal for actu- 40 ating the return of said carrier means to said rack from said viewing means when said preselected operational instructions have been carried out by said copier apparatus.

23. A document feeding mechanism in accordance with claim 22 wherein said encoding means comprises 45

14

a plurality of apertures located on said carrier, each said aperture being associated with a number; and

means for changing the optical characteristics of said apertures to correspond to said operational instruc- tions; and

said decoding means comprises photoelectric means responsive to the changed optical characteristics of said apertures for producing said operating signal.

24. A document feeding mechanism in accordance with claim 22 wherein

said operational instructions of said encoding means indicates a preselected number of copies of said documents held therein which are required to be made;

said decoding means reads out said preselected num- ber; and

said actuating means returns said carrier means to said rack when said preselected number of copies has been made of said copier apparatus.

25. A document feeding mechanism for feeding one or more documents to the viewing window of a copying apparatus, said mechanism comprising

means for holding a stack of one or more of said doc- uments;

reciprocating means for moving said documents one at a time in sequence from one end of said stack to said viewing window to permit copies thereof to be made at said viewing window and for returning said documents in sequence from said viewing window to the opposite end of said stack, said reciprocating moving means including

means for coupling said moving means to said docu- ments to permit said documents to be removed one at a time in sequence from said stack.

26. A document feeding mechanism in accordance with claim 25 and further including

means at said holding means for permitting said re- turned documents to be placed at the other end of said stack;

said documents being moved from said stack to said viewing window and returned to said stack in a single reciprocating motion of said reciprocating means.

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