COPY MACHINE WITH PREDETERMINED COUNTER

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ABSTRACT

A mechanical predetermined counter for a copy machine is provided with a non-resetting input control that continuously displays the number of copies to be made of an original in a repetitive sequence. An incrementing mechanical display shows the number of copies already produced in the sequence. Upon completion of the predetermined number of copies, the machine automatically terminates the sequence and is automatically restored to a ready condition to receive a new original document for copying.

6 Claims, 8 Drawing Figures
COPY MACHINE WITH PREDETERMINED COUNTER

BACKGROUND OF THE INVENTION

Copying machines which are oriented to casual operators are desirably arranged to be self-explanatory in their control thereby requiring a minimum of separate instructions or directions for use. The casual operator is expected to properly insert an original document, select the number of copies desired, initiate operation of the machine and remove the copies and the original upon completion of the copying sequence. Where the machine is virtually automatic in processing copies, it is also desirable to give some indication to the operator how many copies have been produced of a given original.

In the past, some copy machines have been provided with relatively simple mechanical selectors that are moved to an advanced position indicative of the number of copies to be produced and are returned progressively as copies are made until they have reached a home position, at which time the copying process terminates. At the other extreme are copy machines with electronic counters that compare and electronically display the desired number of copies as well as the copies already produced in a given sequence. These devices respond electronically to terminate the copying sequence when the desired number of copies have been produced.

An object of this invention is to provide a mechanical display and counter system with the versatility and operator convenience of existing electronic systems but with the relative low cost and simplicity of a purely mechanical device.

A more specific object of this invention is to provide a mechanical predetermined copy control counter having an operator positionable "number-of-copies" setting member that does not automatically return to a home position, but remains in the position set thereby conveniently enabling the production of the same number of copies from each sheet of a plural sheet document.

Our invention employs a stepping ratchet device for counting copy operations as sensed by the occurrence of a copy indicating event such as the end of a scanning operation. As copies are counted, a mechanical display connected to the stepping ratchet indicates the number of copies which have been made. A transfer dog mechanically represents the number of copies that have been made and moves progressively along a path until the desired number of copies has been attained. At this point the transfer dog is allowed to connect with an output member, preferable in the form of a ratchet, and transfers motion there to generate a mechanical output. This output is used to terminate the copy sequence and also to release the ratchet counter and display to be returned to their home position. A manually settable member variably positions the point at which the transfer dog is connected with the output member.

These and other objects, features and advantages of our invention will be apparent to those skilled in the art from reading and understanding the following more specific description of an illustrative preferred embodiment of our invention wherein reference is made to the accompanying drawings, of which:

FIG. 1 is an overall perspective view of a document copier having a predetermined copy control counter constructed in accordance with our invention.

FIG. 2 is a front plan view of the copy control counter of our invention.

FIGS. 3 and 4 are rear and bottom views respectively of the copy control counter shown in FIG. 2.

FIG. 5 is a schematic view of the interrelating the copy control counter shown in FIGS. 2 through 4 and the start and stop function of the copy machine to which it is connected.

FIGS. 6 and 7 are fragmentary views of certain elements in the copy control counter shown in FIGS. 2, 3 and 4 illustrating several details of construction.

FIG. 8 is a fragmentary view of a portion of the copy control counter shown in FIGS. 2, 3 and 4 and taken along line VIII — VIII.

Referring now more specifically to the drawing, FIG. 1 shows a document copying machine 10 that may be like the IBM Copier marketed by International Business Machines Corporation, Armonk, New York and described in IBM Copier Service Manual Form No. 241—5618—published 1970 by International Business Machines Corporation. Document copying machines of this type are operated by the insertion of an original document 11 in a scanning device such as a movable bed 12. The operator selects a desired number of copies and initiates operation of the machine. When the desired number of copies have been produced, the copy sequence is automatically terminated. Access is immediately given to the original 11, for example, by automatic lifting of cover 13 as shown in FIG. 1 to permit insertion of a new original document. Our invention employs a mechanical copy control mechanism 20 (see especially FIGS. 2 through 4) having a grasping knob, dial or "number-of-copies" setting member 80 that is rotatable by the operator to various angular positions to align one number 81 of a series with a relatively fixed index mark 82 thereby selecting the number of copies of an original document to be made in a repetitive sequence. When the copy sequence has been initiated, by closure of cover 13 and depression of start bar 14 (see also FIG. 5), copies are reproduced repeatedly and are discharged into exit pocket 15. As the copies are reproduced, a display window 16 in copier front panel 17 adjacent to setting member and index mark 82 exposes one of a series of numbers 40 on a display wheel 41 of a copy count indicator assembly 42 as an indication of the number of copies already produced. Thus the operator can easily view both the number in window 16 and the setting of member 80.

Each copy operation of the machine 10 is suitably detected, as by sensing motion of the scanning bed 12 to cause an input link 21 (see FIG. 3) of the copy control mechanism 20 to be imposed rightward. This movement increments a counter ratchet wheel 43 to advance the wheel 41 to display the next larger number 40. When the number of copies set by member 80 has been reached, an output link 22 (see FIG. 3) is moved clockwise to control termination of the copying sequence. The clockwise movement of link 22 also releases a holding pawl 60 (see also FIG. 8) from the ratchet 43 to allow a yieldable bias weight 61 to restore the display wheel 41 to its initial position as shown in FIG. 2. If desired, the numerals 40 on the display wheel...
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41 can be made transparent and superimposed between a suitable light source (not shown) and the window 16 to assist the operator in reading the displayed information. When the machine 10 operates to terminate the copy sequence, cover 13 is raised automatically to allow the operator to replace document 11 with a further document to be copied. If it is desired to produce the same number of copies of the further document, as in reproducing a multi-page document the operator merely reinitiates the operation by depression of start bar 14 since knob 80 remains in the position in which it was originally set.

A support frame 30 (see FIGS. 3 and 4) for the entire copy control mechanism 20 is provided by a main frame plate 31, a secondary frame plate 32 and interconnecting standoff rod member 33 and 34. A cantilevered shaft 35 anchored to the secondary frame plate 32 to provide the support for the various rotary operating members of the mechanism 20. A supplementary frame bracket 36 is mounted on the shaft 35 and is adjustably anchored by screw 32a to the secondary frame plate 32.

The mechanism for controlling the display wheel 41 is best seen in FIGS. 3, 4, 6 and 7. The input link 21 is pivoted to frame part 31 by stud 37 and connected through a rod 38 to a pawl link 50 that is pivoted about the shaft 35. A spring 51 biases pawl carrier link 50 to a rest position, as shown in FIG. 3 which is made adjustable by a set screw 52 having a free end 53 that abuts the frame rod member 33. A stepping pawl 54 is mounted by a pivot pin 55 on the pawl carrier 50 and is biased by a spring 56 into the teeth of the stepping or counting ratchet 43 (see also FIG. 6). Rightward movement of input link 21 thus rotates pawl carrier 50 counterclockwise in FIG. 3 against spring 51, and through pawl 54, drives ratchet 43 counterclockwise.

A pawl control cam 57 mounted by screws 58 onto frame plate 31 engages the tail 59 of pawl 54 at the end of its stroke to lift pawl 54 from the teeth of ratchet 43. The holding pawl 60 (see also FIG. 8) is shaped cooperatively with respect to the teeth of ratchet 43 so as to be pivoted about its axis 62 over the teeth of ratchet 43 and against its spring 63 when the ratchet 43 is driven in a counterclockwise direction. Holding pawl 60 ordinarily restrains ratchet 43 against clockwise motion as it is urged by a suitable yieldably urging bias means such as the weight or alternatively by a spring (not shown). Weight 61 is connected to ratchet 43 by a cord 64 that is tracked over guide wire 23 and loop 24 around cylindrical part 44 that is connected with ratchet 43 and the display wheel 41. The cord 64 is anchored to a pin 45 on the display wheel 41. Thus as pawl 54 steps ratchet 43, display member 41 connected thereto is incrementally advanced to show the next larger number 40 thereon at window 16.

Also connected with the counting ratchet 43 is a transfer dog 70 that is mounted by a pivot stud 70a on a carrier 71 that is rotatably mounted on the shaft 35. A wire spring 72 urges the transfer dog 70 radially inwardly against a cylindrical control surface 83 (see also FIGS. 6 and 7) of a control part or disc 84. The cylindrical control surface 83 is positioned adjacent an output ratchet 73 having teeth that are contained radially within the boundary of the surface 83. The surface 83 includes recessed or localized relieved portion some-
times referred to as a "deep tooth," 85 that effectively exposes a tooth of ratchet 73 to the transfer dog 70, when the transfer dog becomes radially aligned therewith. Accordingly, as transfer dog 70 is moved with ratchet 43 progressively counterclockwise with successive copy operations, no action occurs until the transfer dog 70 reaches the recessed or deep tooth portion 85. At this time transfer dog 70 is urged by its spring 72 into engagement with a tooth on ratchet 73. Continued counterclockwise movement of the transfer dog 70, thus produce counterclockwise motion of the ratchet 73 to generate a mechanical output for resetting the display wheel 41 and terminating the copy sequence.

This mechanical output is produced by an output plate 75 that is connected to the output ratchet 73 for rotation thereunder and is biased clockwise by a spring 76 to a position where it is arrested by engagement of an ear portion 75a with a stop abutment bracket 25 that is mounted by a screw 26 to the secondary frame part 32. Output plate 75 further includes an extension 77 (see particularly FIG. 4) that is connected by a pivot pin 78 to the output lever 22 which in turn is pivoted to the frame plate 31 by a screw stud 27. The spring 76 also biases output link 22 counterclockwise about its pivot 27. Upon counterclockwise movement of extension 77, output link 22 is pivoted clockwise and pulls release link 28 (see also FIG. 5). Also, a bent-over tab portion 79 of the output plate 75 engages a tapered portion 65 (see FIG. 8) of the holding pawl 60 to lift the holding pawl out of engagement with stepping ratchet 43.

A latch plate 90 is adjustably mounted on the output link 22 by a screw 91 which passes through an enlarged opening 92 in the latch plate 90 and is threaded into the output link 22. In operation, the output link 22 and latch plate 90 move as an integral unit. Referring also to FIGS. 2 and 4, there is shown a bent-over tab portion 93 of the latch plate 90 which provides a latching surface for engagement by a keeper link when output link 22 is pivoted clockwise, and raises tab 93 into engagement with keeper 94. Keeper 94 is biased by a spring 95 to a holding position for receiving the tab 93 at all times except when display wheel 41 is in the position shown in FIG. 2. In the home position, the lower right end 96 of keeper link 94 is engaged by a pin 46 carried by the display wheel 41. During operation, as display wheel 41 progresses from its home position, pin 46 moves away from end 96 allowing spring 95 to bias keeper 94 against the top surface of tab 93. When output link 22 is pivoted clockwise in FIG. 3 upon completion of the set number of copy operations, tab 93 is moved rightwardly with the movement of link 22 and keeper 94 is freed to move downwardly bringing the latching edge 97 thereof into intercepting engagement with the tab 93. Link 22 is thereby prevented from restoring to its counterclockwise position under influence of its bias spring 76 (see FIGS. 3 and 4).

As indicated above, the clockwise displaced position of link 22 acts through tab 79 to remove holding pawl 60 from counting ratchet 43 and free bias weight 61 to return the display wheel 41 toward its home position. When display wheel 41 has moved to the position shown in FIG. 2, pin 46 engages end 96 of keeper 94 to lift latch surface 97 from its intercepting engagement
with tab 93. Output link 22 thereupon is freed to restore to its position as shown in FIG. 3 by spring 76 and restores the holding pawl 60 into engagement with the counting ratchet 43.

The "number-of-copies" setting member 80 is rotatably mounted on the shaft 35 coaxially with the counting ratchet 43 and the output ratchet 73. A stationary filler member 39 carrying the index mark 82 is also supported by shaft 35. Movement of member 80 positions the relieved portion 85 control surface 83 angularly about shaft 35. The angular location of relieved portion 85 determines how many steps ratchet 43 must make before the transfer dog moves into engagement with output ratchet 73. Accordingly the angular position of setting member 80 as indicated by the alignment of a number 81 with index mark 82, determines the number of copies to be made in a sequence. A tooth detent wheel 86 (see FIGS. 4 and 6) is connected with the setting member 80 for unitary rotation and is releasable retained in a set position by engagement of a detent link 87 having rounded tooth engaging portions 88 thereon. Detent link 87 is pivotally mounted on supplemental frame bracket 36 by hot upset stud 36a. A spring 89 is anchored on bracket 36 and bias the detent teeth 88 against toothed wheel 86.

A copy sequence in the document copying machine 10 can be terminated either by interrupting the main power drive or by simply making the machine available to a new original document. In the IBM Copier mentioned above the sequence termination is accomplished by releasing the document cover like 13 herein for automatic opening thus providing the operator with access to the original already copied and enabling the insertion of a new original. Also, the IBM Copier is conditioned, by the opening of cover 13, to terminate motor operation when the cycling process is complete. It is possible to insert new documents for copying at a sufficiently rapid rate, however, that the motor does not stop operation. The copy control mechanism 20 of this invention can operate with a variety of sequenced termination approaches. FIG. 5 shows a schematic approach similar to that employed in the IBM Copier. In FIG. 5, the start bar 14 is shown mounted on pins 100 by slot 101 for vertical sliding movement. A spring 102 normally urges the start bar 14 to its "up" position as shown. When start bar 14 is depressed, ledge 103 thereof moves below a latch keeper ledge 104 allowing latch 105 to be pivoted counterclockwise by its spring 106. This motion of latch keeper 105 closes a switch 107 to signal the machine that a copy cycle sequence has been initiated. Latch keeper 105 is coupled to output link 28 of the copy control mechanism 20 (see FIG. 3) through link 28 or other linkage if necessary, but without interference therefrom due to the provision in link 22 of an elongated slot 29 therein.

Accordingly a copy sequence is initiated by depression of start bar 14 which becomes latched in its active position by keeper 105. The copy control mechanism 20 operates as described above and upon attainment of the set number of copying operations, produces a leftward pull FIG. 3, or rightward pull FIG. 5, on link 28 through output link 22. The pull on link 28 pivots latch keeper 105 clockwise to release start bar 14 for upward movement by its spring 102 thereby terminating the copy sequence in progress and making the machine available for a subsequent sequence of copy operations.

While a specific illustrative embodiment has been described herein, for purposes of illustration, it is to be understood that various modifications and additions can be made to the specific structure disclosed without departing from the inventive concept disclosed herein. Accordingly the subject matter sought to be patented is limited solely by the language of the appended claims.

We claim:
1. In combination with a document copying machine, a mechanical copy control mechanism comprising:
   a "number-of-copies" setting member settable at a number of positions indicative of different numbers of copies of an original to be produced in a repetitive copy sequence,
   means for releasably retaining said setting member in any of its positions,
   numerical indicia mechanically associated with said setting member for indicating the number of copies for which said setting member is positioned,
   a copy count indicator assembly having a display member that is movably positioned adjacent said setting member and including further numerical indicia for indicating the number of copies of an original document which have been made in a sequence,
   means for yieldingly urging said display member toward a home position,
   means responsive to operation of said document copying machine for incrementally advancing said display member upon occurrence of each copy operation,
   a transfer dog operatively interconnected with said display member for movement therewith and cooperatively interconnected with said setting member when the number of repetitive sequential copy operations performed by said document copying machine equals the set number of desired copies for generating a mechanical output, and
   means responsive to said mechanical output for terminating the repetitive sequence of copying said original.

2. Apparatus as defined in claim 1 wherein said setting member comprises a graspable input part and a control part positioned by said input part, said control part comprising a control surface having a localized relieved portion, said copy count indicator assembly further comprising:
   means mounting said transfer dog to ride on said control surface and to be movable into said relieved portion thereof when aligned therewith, and wherein said means for generating a mechanical output comprises a toothed member positioned adjacent said control member and drivingly engageable by said transfer dog when said dog moves into said relieved portion of said control surface.

3. Apparatus as defined in claim 1 wherein said "number-of-copies" setting member comprises a dial, and wherein said display member further comprises a dial, and means mounting said dials coaxially for independent rotation.

4. Apparatus as defined in claim 2 wherein said "number-of-copies" setting member comprises a dial, and wherein said display member further comprises a
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dial, and wherein said toothed member comprises a circular ratchet, and means mounting said dials and said circular ratchet coaxially for independent rotation.

5. Apparatus as defined in claim 1 further comprising holding means operatively engaged or normally operatively engaged with said display member for preventing movement of said display member by said yieldably urging means,

means responsive to said mechanical output for withdrawing said holding means from said operative engagement with said display member, latch means cooperable with said holding means when withdrawn from said operative engagement for retaining said holding means withdrawn until released, and means responsive to said display member reaching

to restore said holding means into said operative engagement with said display member.

6. Apparatus as defined in claim 1 further having a control panel including a window portion, said copy count indicator assembly being mounted on said control panel adjacent said window portion for displaying a single number of said numerical indicia through said window portion, and said “number-of-copies” setting member being positioned adjacent said window portion and oriented to present a number of said numerical indicia indicative of the number of copies sought, adjacent said window for convenient simultaneous viewing therewith.

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