United States Patent

[11] 3,600,085

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[54] **COUNTER FOR PHOTOCOPY MACHINE**
5 Claims, 7 Drawing Figs.

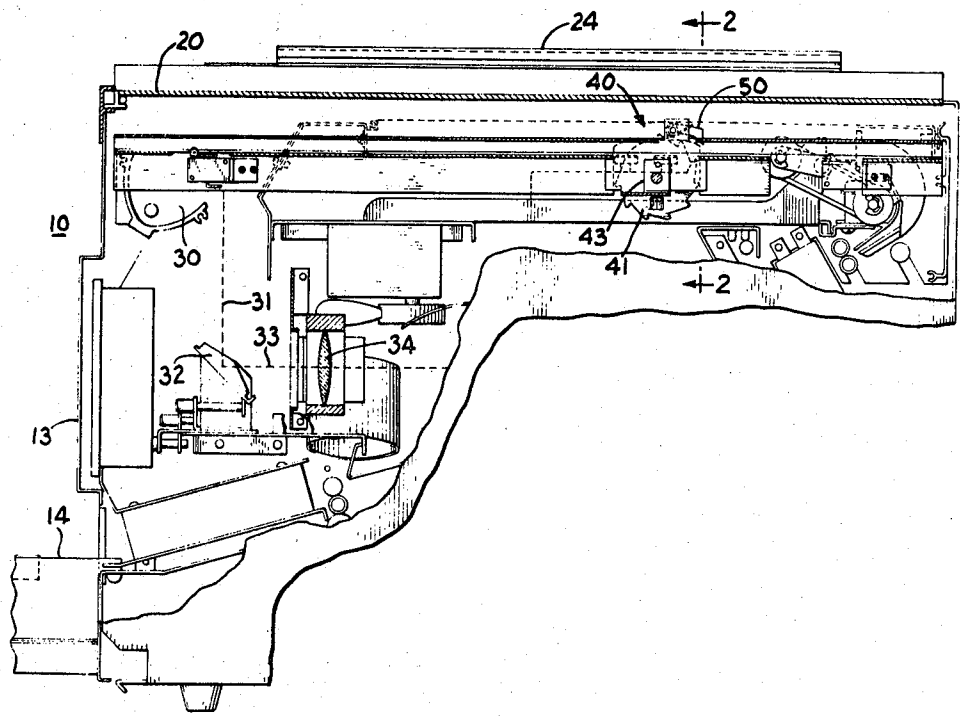
[52] **U.S. Cl.** **355/14,** 355/53, 355/95
[51] **Int. Cl.** **G03g 15/00**
[50] **Field of Search** 355/8, 3, 10, 11, 13, 14, 47, 49, 52, 66, 81, 84, 53, 86, 95

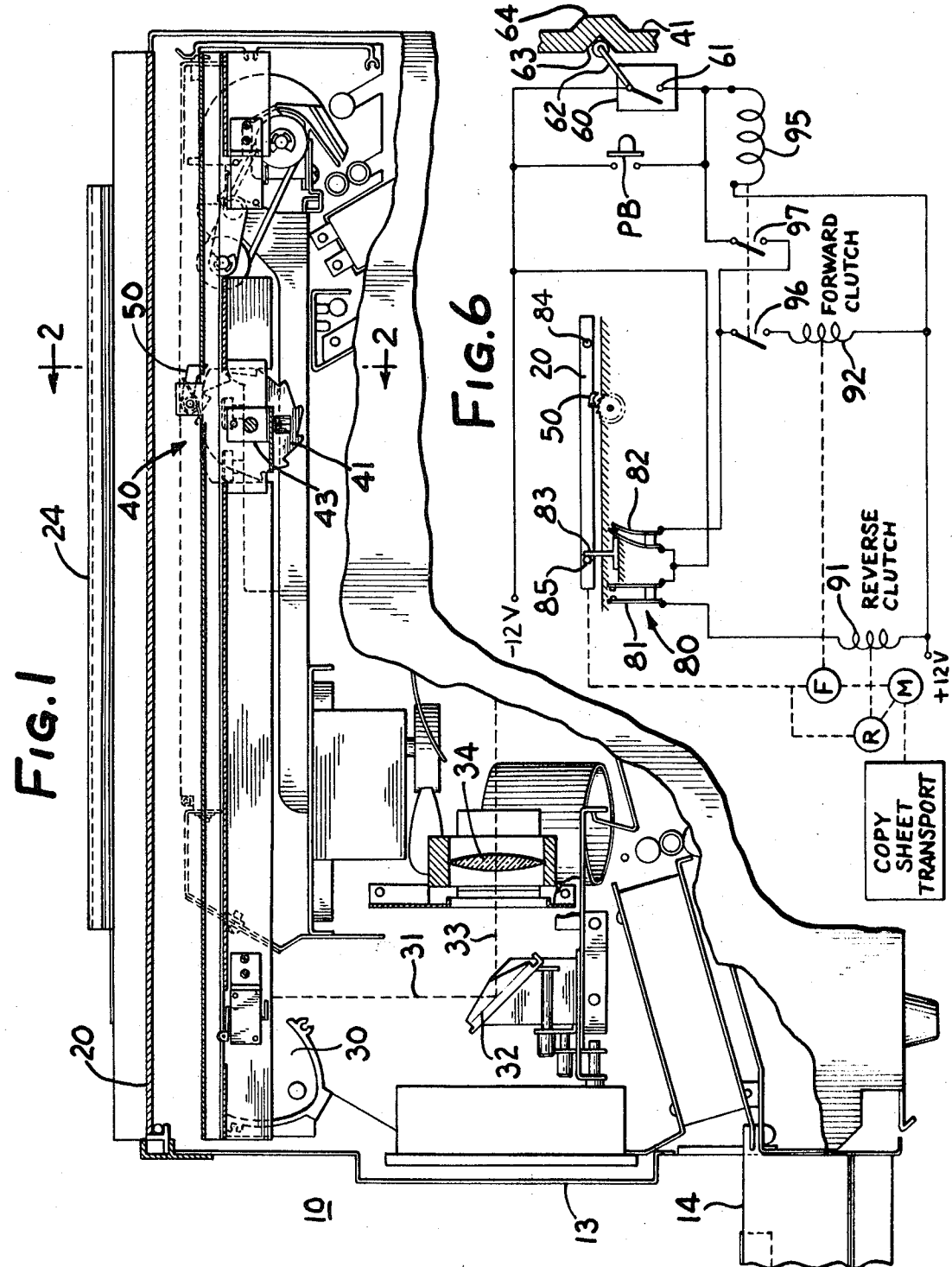
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ABSTRACT: A counter mechanism for a photocopy machine of the type having a reciprocating table or carrier, the mechanism including a dial, which is set to show the desired number of copies, directly coupled to a ratchet wheel. The ratchet wheel is indexed by a pawl on the table during each copy-making stroke so that the setting of the dial is successively reduced to a reference setting at which point a switch is operated to terminate further cycling of the table.





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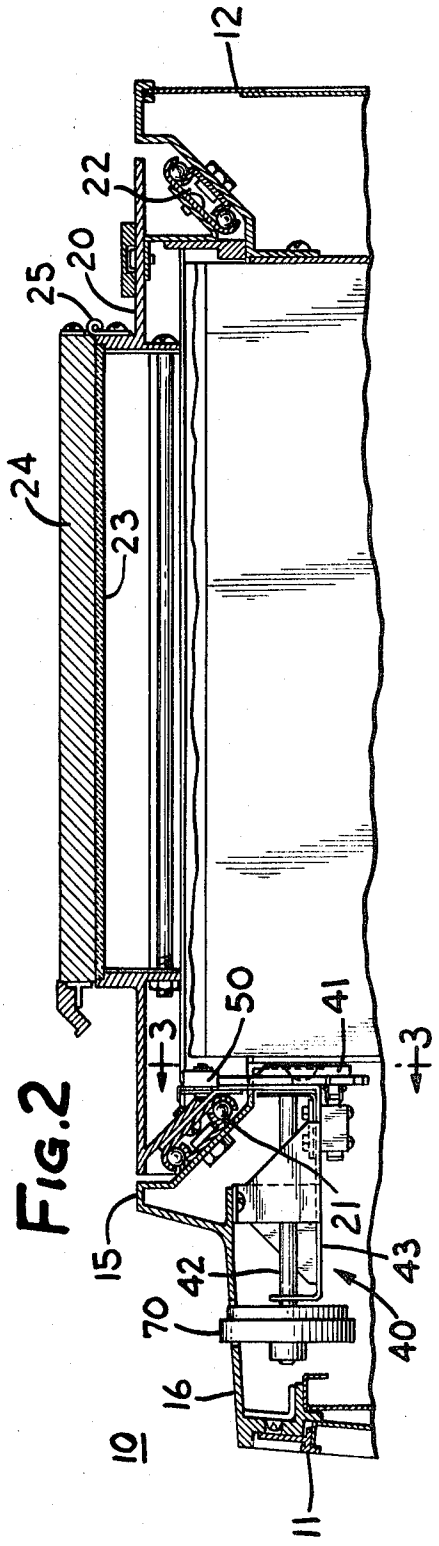


FIG. 2

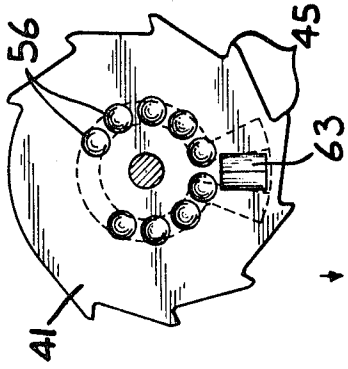


FIG. 5

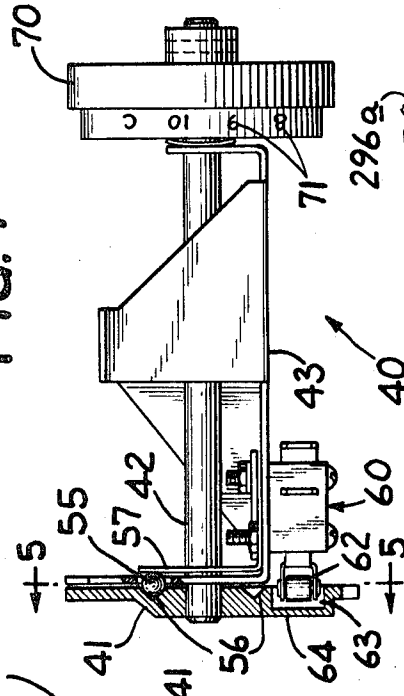


FIG. 4

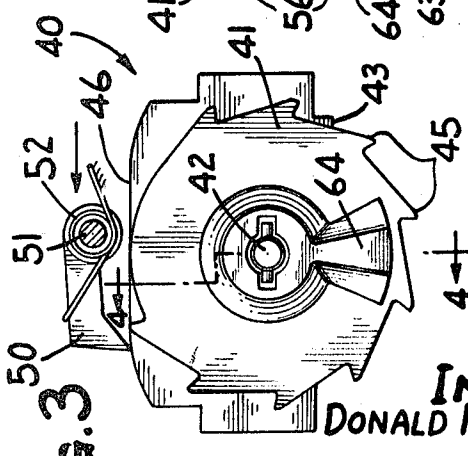


FIG. 3

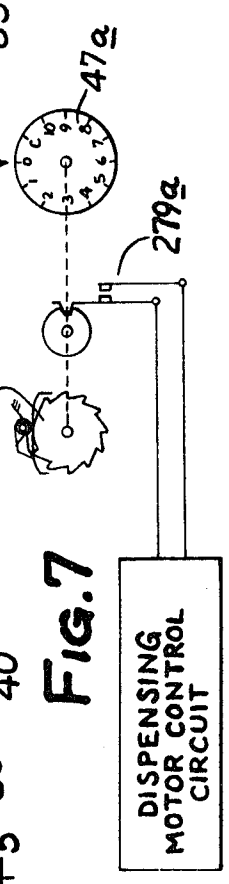


FIG. 7

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COUNTER FOR PHOTOCOPY MACHINE

It is an object of the present invention to provide a counter mechanism which is easily set to produce a desired number of copies, which provides a constant tally of the copies yet to be made, and which produces automatic shutoff when the set number of copies has been produced. It is a related object to provide a counter assembly which is extremely simple and which, in the preferred environment, requires only a single moving part, other than the actuating pawl on the table and the responsive switch. It is yet another object to provide a counter which is inherently reliable, which can be reset to a smaller or larger number of copies, if desired, while the copies are still being turned out, and which is universally useable in machines of the reciprocated table type, of both new and existing design, at minimum expense.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a fragmentary vertical section of a photocopy machine of the reciprocating table type incorporating the present invention.

FIG. 2 is a fragmentary vertical section taken along the line 2–2 in FIG. 1.

FIG. 3 is a fragmentary view of the ratchet wheel and pawl, in elevation, looking along the line 3–3 in FIG. 2.

FIG. 4 is a transverse fragmentary section looking along the line 4–4 in FIG. 3.

FIG. 5 is a view taken along the line 5–5 in FIG. 4, showing the opposite face of the ratchet wheel.

FIG. 6 is a simplified circuit diagram showing means for producing continued reciprocation of the moving table under the control of the counter mechanism.

FIG. 7 is a diagram showing application of the counter mechanism to a patented design of photocopy machine.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent forms of the invention included within the spirit and scope of the appended claims.

Turning now to FIGS. 1 and 2, there is shown a photocopy machine 10 having a rectangular housing including a near side 11, a far side 12 and a discharge, or left-hand side 13 which includes a collecting tray 14 for the finished copies. The top of the machine 15 has an apron or surface 16 which serves as a control panel.

Reciprocatingly mounted within the top surface 15 of the housing is a table 20 mounted on longitudinal ways 21, 22. The table includes a glass plate, or platen, 23 upon which the original sheet is mounted, face down, for exposure, held in place by a cover, or holddown, 24 having a longitudinal hinge 25. It will suffice to say that the original to be copied is placed against the platen of the reciprocating table and that the table undergoes a complete cycle of reciprocation for each copy to be produced. The drive for the table does not per se form a part of the present invention. As diagrammatically shown in FIG. 6, a motor M is provided having alternative forward and reverse clutches F and R respectively coupled to the table by suitable pinion and rack connections (not shown). For the details of a typical reciprocating drive under the control of forward and reverse clutches, reference is made to prior Sacre U.S. Pat. No. 3,424,526 which issued Jan. 28, 1969.

During the copying process the original is progressively exposed at an illuminating station which is at the discharge end of the machine having a suitable lamp assembly 30. The moving image of the illuminated portion of the original is projected downwardly along path 31 onto a mirror 32 from which it is projected horizontally along path 33 through a lens 34 which focuses the image upon a moving sheet of preconditioned photocopy paper transported in synchronism with the advancement of the table. The paper may, for example, be of the zinc-oxide-coated type conditioned by application of an overall electrostatic charge. The latter is selectively discharged by light from the original to produce a latent image of the original which is subsequently developed by application of colloidal particles of toner deposited and fixed upon the charge pattern. The copy sheet with its developed image is subsequently deposited in the collecting tray 14. For a complete discussion of a photocopy machine of the present type, reference is made to the above-mentioned Sacre patent.

In accordance with the present invention a counter assembly is provided including a control switch coupled to a settable ratchet wheel. The ratchet wheel is cyclically engaged by a pawl on the reciprocating table so that the table continues to reciprocate until a set number of copies have been produced, the pawl finally restoring the ratchet wheel to a reference position thereby to turn off the switch for automatically stopping the motion of the table and the cycling of the associated copying mechanism within the machine. Thus referring to FIGS. 1—5, a counter mechanism, or assembly, 40 is provided having a ratchet wheel 41 mounted upon a shaft 42 which is journaled in a subframe 43. The ratchet wheel has a plurality of teeth 45 which are dimensioned to project slightly above a horizontal guide surface 46 which forms the upper edge of the subframe 43.

For the purpose of engaging the ratchet teeth a pawl 50 is mounted at the edge of the reciprocating table 20, for example, on a horizontal pin 51, the pawl being biased downwardly by a spring 52 so that it rides along the guide surface 46 as the table cyclically reciprocates, clicking idly over the backside of a tooth. For insuring against retrograde movement, a detent mechanism is provided including a ball 55 which engages a succession of dimples 56 molded or otherwise formed in the sidewall of the ratchet wheel. The ball 55 is received in a suitable clearance opening in the subframe and is pressed in the direction of the dimples 56 by means of a leaf spring 57.

For making an electrical circuit when the ratchet wheel is in any one of its set positions and for breaking the circuit when the ratchet wheel is in its home or reference position, a switch 60 is provided having contacts 61 (see FIG. 6) and having an operator in the form of a cam follower 62 which registers with a recess 63 in the sidewall of the ratchet wheel when the latter is in reference position. Where the ratchet wheel is of molded construction, it is desirable to provide an embossment 64 on the opposite wall for the purpose of accommodating the recess 63 and maintaining an adequate wall thickness.

Mounted at the end of the shaft 42 of the assembly 40 is a setting knob which is preferably in the form of a drum or finger wheel 70 which projects conveniently through the control panel 16 and which has indicia 71 for setting the desired number of copies.

In operation, the finger wheel 70 is rotated to a position indicating the desired number of copies to be made. The accompanying rotation of the ratchet wheel causes the cam follower 62 of the switch to be cammed out of the recess, closing the switch contacts 61. With the movement of the table initiated by any desired control means, the engagement between the pawl 50 and the successive ratchet teeth, projecting above the guide surface 46, causes the ratchet wheel and knob to be restored, step by step, in successive copy-making cycles, to the final reference position where the switch 60 is turned off for automatically stopping further reciprocation of the table. This means for successively restoring a settable knob and its control elements to a reference or home position utilizes a direct mechanical engagement between a pawl and ratchet wheel resulting in a simple, effective and long-wearing construction which is more economical than alternative arrangements employing solenoid stepping devices to accomplish a similar function.

It is one of the features of the present counting arrangement that it may be utilized with any photocopy machine of the type having a reciprocating table, regardless of the specific construction of the table drive or the specific control circuitry which might be employed. In one possible control arrangement, shown in greatly simplified form in FIG. 6, limit

switches, actuated when the table reaches or nears its limit positions are used for causing the table to reciprocate for production of successive copies as long as the control switch **60** is turned on. As there shown, the control circuit **80** includes forward and reverse limit switches **81**, **82** under the control of a slide **83** which is positioned in the path of movement of forward and reverse stop lugs **84**, **85** mounted on the table. The forward limit switch **81** is connected in series with the winding **91** of the reverse clutch R while the reverse limit switch **82** is effectively connected in series with the winding **92** of the forward clutch F. The contacts **61** of the copy control switch **60** are connected in series with the winding of a "copy" relay **95** having a pair of control contacts **96** and a pair of sealing-in contacts **97**.

In operation, then, rotation of the setting knob, producing rotation of the ratchet wheel **41**, causes the switch cam follower **62** to be moved out of its recess, closing contacts **61** to energize the relay **95**. Assuming the table **20** starts from its retracted or "home" position, contacts **82** are closed. Thus closure of contacts **96** on the relay completes a circuit to the winding **92** of the forward clutch causing the table to be driven forwardly by the motor M. The slide **83** has sufficient friction, or may be detented if desired, so that contacts **82** remain closed until the table **20** approaches the limit of forward movement. Thereupon the limit stop lug **84** on the table engages the slide **83** to open the contacts **82** and to close the contacts **81**. This deenergizes the clutch winding **92** and energizes the reverse clutch winding **91** so that the table is driven in the opposite or retracting direction toward its home position. Upon approaching the end of the return stroke two things happen. The pawl **50** on the table, striking the presented tooth of the ratchet wheel **41**, causes the ratchet wheel to undergo a step of movement toward its reference position. At the same time the slide **83** is struck by the lug **85** on the table to open the contacts **81**, thereby deenergizing the clutch winding **91**, and to close contacts **82** to reenergize the winding **92** of the forward clutch, causing the table to begin another stroke of forward movement. It will be understood that transport means are provided within the photocopy machine for advancing copy sheets successively, synchronized with the cycling of the table **20**, thereby producing one photocopy for each table cycle. The table continues to cycle until the ratchet wheel **41** is restored to its home position accompanied by the dropping of the cam follower **62** on the control switch into its recess, opening contacts **61** for automatic deenergization of the relay **95** to terminate any further movement of a table.

To facilitate the making of single copies, a pushbutton PB may be provided in parallel with the contacts **61**, with the sealing-in contacts **97** serving to maintain the relay energized until the table **20** reaches the end of its forward movement. At such time, opening of contacts **82** deenergizes the winding **92** of the forward clutch, as well as deenergizing the relay **95**, and the making of contacts **81** energizes the winding **91** of the reverse clutch for the return stroke. At the end of the return stroke, as the table **20** assumes its home position, opening of the contacts **81** deenergizes the winding of the reverse clutch; however, closure of contacts **82** is ineffective to reenergize the forward clutch since the relay **95** is, by that time, in its dropped-out condition.

It will be understood that the diagram of FIG. **6** is for the purpose of illustrating the automatic operation of the counter and that a much more elaborate control circuit would be employed in a practical, commercial photocopy machine. For example, in a commercial machine such as disclosed in the above mentioned Sacre U.S. Pat. No. 3,424,526, the control switch associated with the ratchet wheel may be utilized to control a dispensing motor for dispensing individual copy sheets to a transport mechanism for transport to the exposing station where detector switches serve to initiate the cycling movement of the table which transports the original copy sheet.

Thus referring to FIG. **7** of the drawings, which may be understood in conjunction with FIG. **10** of the above-mentioned Sacre patent, the contacts **279*a*** associated with the cam follower, and which correspond to the contacts **61** in FIG. **6**, lead to the dispensing motor control circuit, with the contacts being effectively connected in series with the dispensing motor. Thus such motor is "abled" for operation as long as the ratchet wheel, indicated at **296*a***, and which is set by the dial **47*a***, is away from its reference position. When the ratchet wheel is finally restored to its reference position the dispensing motor is open circuited so that no more copy sheets may be fed. The failure of a copy sheet to arrive at the exposing station then serves, in turn, to prevent any further cycling of the table which carries the original document.

It will be understood that the particular shape and number of teeth on the ratchet wheel is a matter of design and that certain of the teeth may be omitted without departing from the invention. Thus in the embodiment of FIG. **7** teeth may be omitted corresponding to the "C" or "continuous" position of the dial **47*a*** as well as in the O position. Or a tooth may be omitted in the single copy position so that the production of single copies may be achieved by a simple touching of the pushbutton PB (FIG. **6**) without necessity for rotating a selector knob.

The present construction is in any event distinguished by extreme simplicity, having only a single rotating part, namely the shaft **42** and the ratchet wheel and knob which are connected to it. Thus the counter may be used universally with either new machines or machines of existing design with minimum modification. No electrical wiring other than for the switch **60**, is required and, because of the economy which the structure provides, it may be employed in machines at the low-cost highly competitive end of the line.

It will be apparent to one skilled in the art that the knob may, if desired, be arranged at right angles to the ratchet wheel simply by interposing a pair of bevel gears midway of the shaft **42**.

It is one of the features of the construction that the setting may be changed, either upwardly or downwardly, to change the number of copies, even as the copies are being produced. The terms "off" and "on" as applied to the switch **60** are relative terms, and the switch may be of the normally closed type, or normally open type, with a compensatory change in the circuit, without departing from the invention.

I claim as my invention:

1. In a photocopy machine the combination of a frame, means including a reciprocating table for mounting the original, driving means for cyclically moving the table, said driving means having associated transport means for exposing successive preconditioned photocopy sheets to the image of the original synchronized with the motion of the table to form a latent image with subsequent development of the image and discharge of the sheets, control means for said driving means including a switch for producing continued reciprocation of the table, a ratchet member coupled to the switch and having a reference position in which the switch is turned off and a series of set positions in which the switch is on, a pawl coupled to the table for engaging the ratchet member successively in successive cycles of the table and steppingly restoring the ratchet member from its set position to its reference position for automatically turning off the driving means when the set number of copies have been produced.

2. In a photocopy machine the combination of a frame, means including a reciprocating table for mounting the original, driving means for cyclically moving the table, said driving means having associated transport means for exposing successive preconditioned photocopy sheets to the image of the original synchronized with the movement of the table to form a latent image with subsequent development of the image and discharge of the sheets, control means for said driving means including a switch for producing continued reciprocation of the table as long as the switch is on, a ratchet wheel mounted on the frame adjacent the table and directly coupled

to the switch, means for defining a plurality of set ratchet wheel positions in which the switch is on and a reference position in which the switch is turned off, a pawl mounted along the edge of the table for engaging the ratchet wheel successively in successive cycles of the table and steppingly restoring the ratchet wheel from its set position to its reference position for automatically turning off the driving means when the set number of copies have been produced.

3. The combination as claimed in claim 2 in which the ratchet member is in the form of a wheel having a shaft, a setting knob on the end of the shaft calibrated in terms of the number of copies, and detent means for defining a plurality of set positions of the knob and ratchet wheel.

4. The combination as claimed in claim 2 in which a horizontal guide surface is provided adjacent the ratchet wheel and in which the pawl is biased downwardly against the horizontal guide surface, the ratchet wheel being so positioned with respect to the guide surface that the teeth of the ratchet wheel extend upwardly beyond the guide surface and into the path of horizontal movement of the pawl.

5. The combination as claimed in claim 2 in which the ratchet wheel presents a smooth surface in lieu of a tooth so that no tooth projects into the path of movement of the pawl when the ratchet wheel is in reference position.

Dedication

3,600,085.—*Donald R. Altergott*, Highland Park, Ill. COUNTER FOR PHOTOCOPY MACHINE. Patent dated Aug. 17, 1971. Dedication filed July 27, 1973, by the assignee, *American Photocopy Equipment Company*.

Hereby dedicates to the Public the entire term of said patent.

[*Official Gazette October 30, 1973.*]