Feb. 16, 1971 P. G. BIELIK 3,564,593

COUNTDOWN COUNTER FOR DUPLICATING MACHINE

Filed Oct. 20, 1969 2 Sheets-Sheet 1

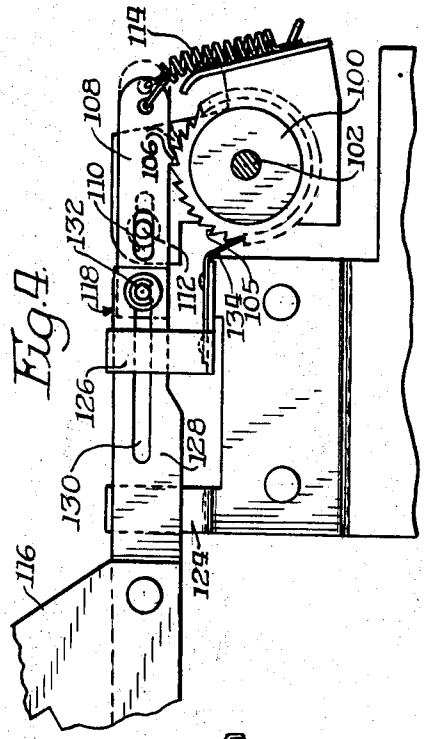

Fig. 4

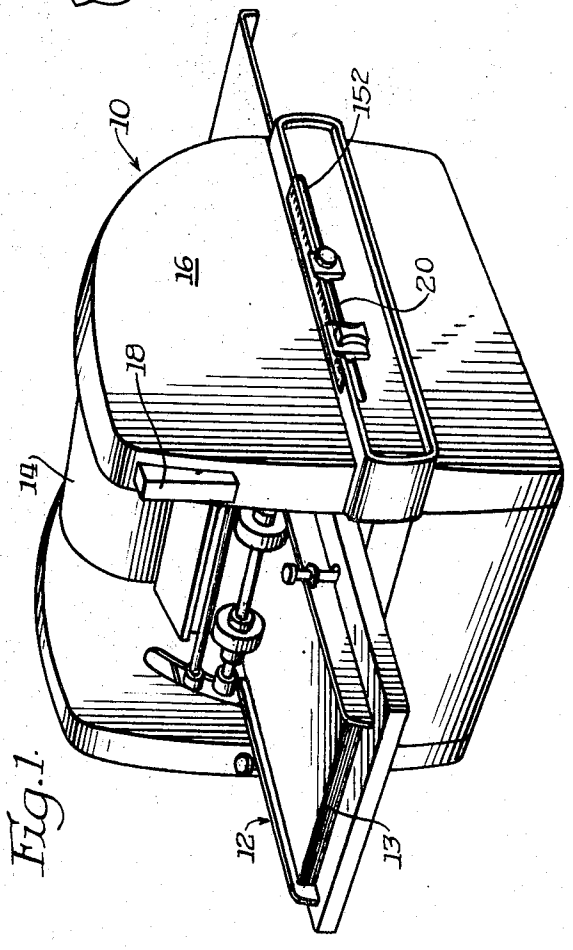

Fig. 1.

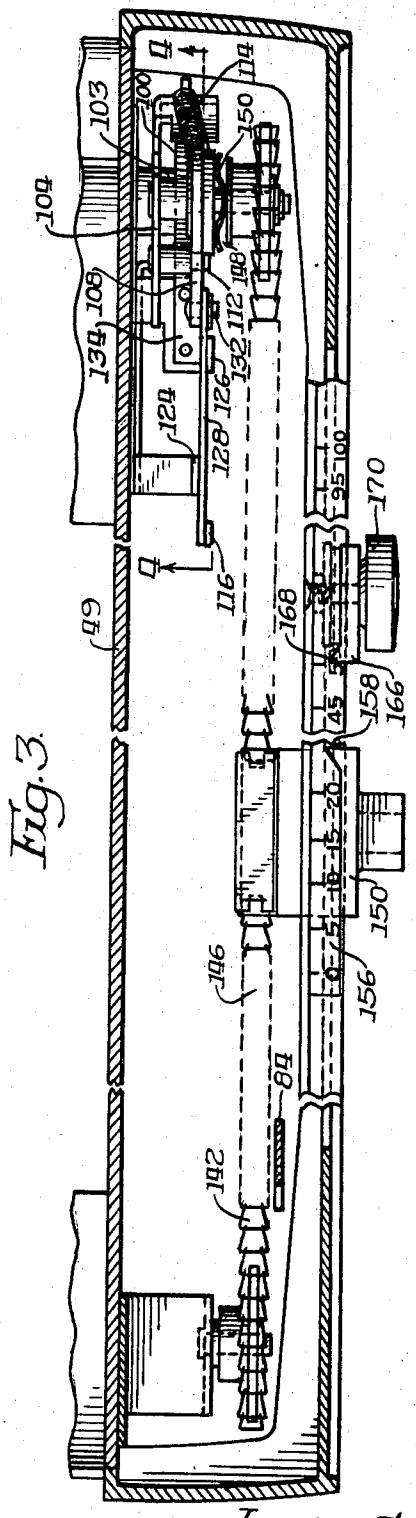

Fig. 3.

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COUNTDOWN COUNTER FOR DUPLICATING MACHINE

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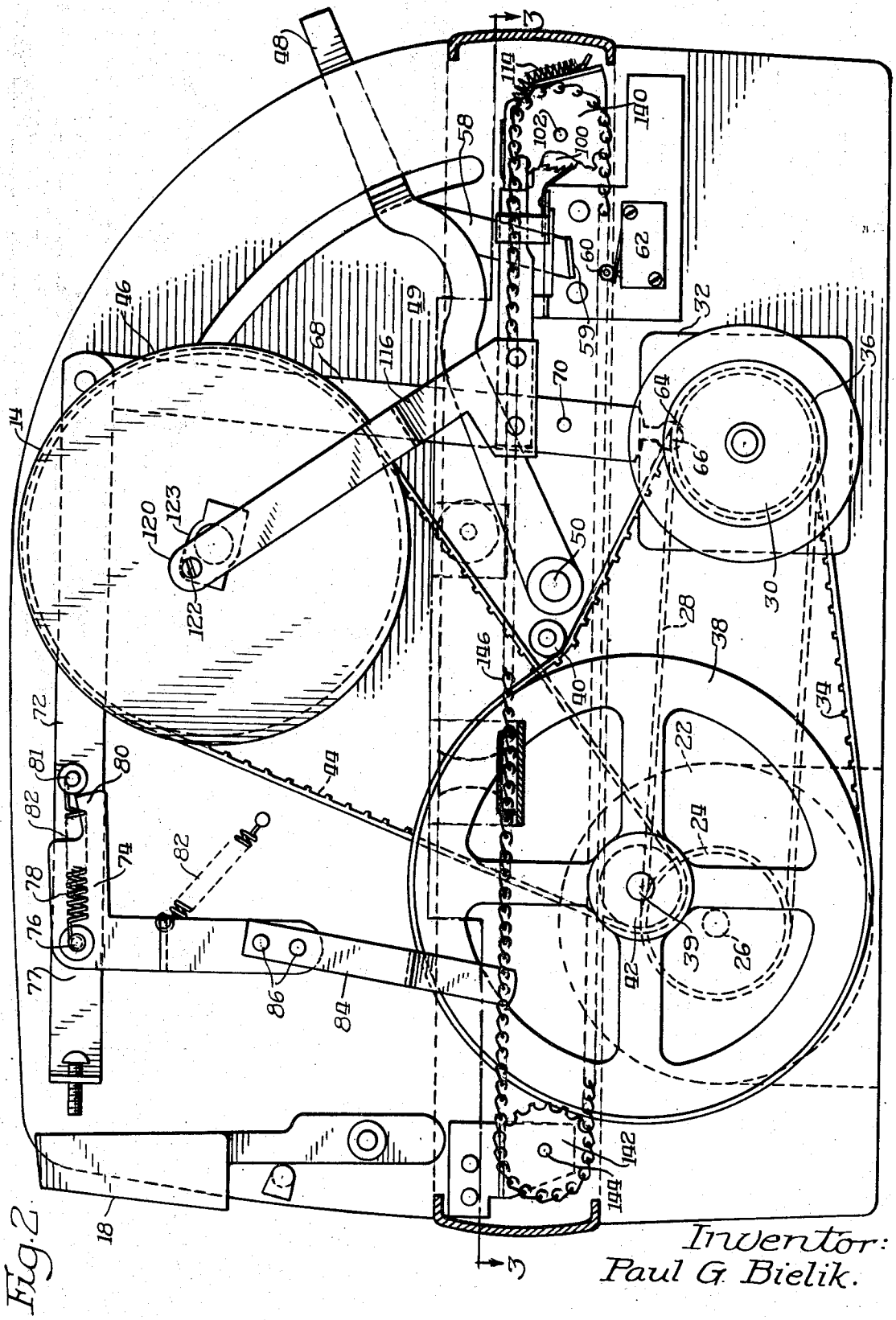

Fig. 2.

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3,564,593

COUNTDOWN COUNTER FOR DUPLICATING MACHINE

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U.S. Cl. 235—132 5 Claims

ABSTRACT OF THE DISCLOSURE

This invention is directed to countdown counting apparatus for use with duplicating machines including a copy selector movable along a straight line path rather than a rotary path, which may be pre-set to duplicate any desired number of copies. Operationally, the copy selector is automatically indexed one unit in the direction of its home position during each duplicating cycle of the machine. Operation of duplicating machine is automatically terminated upon the selector attaining the home position.

FIELD OF THE INVENTION

This invention relates in general to counters. In particular, this invention relates to countdown counting apparatus for duplicating machines which may be pre-set to a numerical indicia reflecting a given number of sheets to be duplicated, which automatically counts down one numerical indicia per operational cycle of the machine and which terminates operation of the machine upon duplication of the proper number of copies.

DESCRIPTION OF THE PRIOR ART

Typical prior art duplicating machines such as spirit duplicators or mimeograph type duplicating machines employ count "up" counters, having a meter or register which may be manually adjusted to a zero reading and thereafter register one indicia for each duplication cycle. In using this type of counter, the operator visually observes the register and manually terminates operation of the machine when the desired count is achieved. Other count up counters may employ presettable means which automatically terminate operation of the machine upon reaching the desired count.

Many of the above noted type prior art counting devices and various modifications thereof, particularly those employed in the well-known spirit duplicating machines, utilize a complex, expensive rotary counting mechanism which is operatively coupled to the spirit duplicator by equally complex and expensive linkage and gears. In addition, many of said prior art counters are difficult to read and maintain in proper adjustment, thereby causing dissatisfaction and objection by many operators and detracting from the overall simplicity and acceptability of quick, efficient, easy to operate spirit duplicating machines.

SUMMARY OF THE INVENTION

This invention obviates many of the above-mentioned problems, difficulties and inconveniences of prior art counters typically employed in duplicating machines, particularly low cost spirit duplicators, by providing a simple counter having a straight line rather than a rotary scale. The counter is adapted to be pre-set to duplicate any desired number of copies and sequentially counts down to zero as each copy is reproduced. Upon the counter reaching a home position, operation of the duplicating machine is automatically terminated.

In accordance with the invention, which will be described in the environment of a spirit duplicator but

which may obviously be used with other duplicating apparatus employing different principles of reproduction, an eccentric is provided at the end of a duplicating drum shaft or other rotating member. A driving arm having an end limited to reciprocating motion, is pivotally connected to the eccentric and the reciprocating end is coupled by a lost motion linkage to a pawl arm carrying a pawl member positioned for cooperation with a plurality of teeth provided at the circumference of a ratchet wheel. Rotational movement of the eccentric causes the pawl to "take" one tooth of the ratchet wheel per operational cycle of the duplicating machine. Rotation of the ratchet wheel is converted into translatory or longitudinal horizontal movement by means of a sprocket coupled to the ratchet wheel, an idler sprocket and a chain trained about each of the sprockets. A copy count selector, which functions both as a copy indicator and as a manually movable selector, is secured to the chain and cooperates with numerical indicia printed on a plate attached to the side panel of the machine. The selector is moved to a position corresponding to the number of copies it is desired to duplicate, and thereafter indicates the number of copies remaining to be duplicated by the machine. The selector actuates a trip lever terminating operation of the duplicating machine when it reaches its home position corresponding to zero indicia.

Accordingly, the primary object of this invention is to provide, in a cyclically operating machine, a low cost, presettable countdown counter which automatically terminates operation of the machine upon completion of any given number of cycles.

Another object of this invention is to provide, in a duplicating machine, low cost, economical and reliable countdown counting apparatus which may be pre-set to effect a desired count by shifting a copy count selector in a straight line direction and which has a longitudinal rather than a circular indicia scale.

It is also an object of this invention to provide, in a duplicating machine, a presettable countdown counter having a selector movable in a straight line direction including means for terminating operation of the duplicating machine upon achieving the desired copy count.

Additional objects of this invention will become apparent to those versed in the art of registers and counters upon an understanding of the following detailed description of the countdown counter of the invention taken in conjunction with the accompanying drawings wherein a preferred embodiment of the invention is shown in the environment of a spirit duplicating machine, and wherein:

FIG. 1 is a front-side perspective view of a spirit duplicating machine including the countdown counter of the invention;

FIG. 2 is an enlarged side elevational view of the duplicating machine shown in FIG. 1 with the protective overlying panel removed for clarity;

FIG. 3, on the same sheet as FIG. 1, is a slightly reduced top plan view of the countdown counting apparatus of the invention taken along line 3—3 of FIG. 2, but with the protective side panel in place; and

FIG. 4 is a greatly enlarged side elevational view of the pawl arm, ratchet wheel, and lost motion linkage of the counter as viewed along line 4—4 of FIG. 3.

Referring now to FIG. 1 of the drawings, a spirit duplicating machine comprising the environment in which the invention will be described, and generally referred to by reference numeral **10**, is seen to include a supply station **12**, supporting a stack of paper sheets **13**, a duplicating drum **14**, a protective side panel **16** overlying a number of moving elements comprising a portion of the operative mechanism of the machine, a start button **18** extending through a front edge portion of side panel **16**

for initiating operation of the machine, and a countdown counter **20**.

Turning now additionally to FIG. 2, spirit duplicating machine **10** includes an electric drive motor **22** having an output shaft **26** and a pulley **24** secured thereto. A drive belt **28** shown in phantom, is trained around motor pulley **24** and an input pulley **30** of a mechanical clutch **32**. A second drive belt **34** is trained over an output pulley **36** of clutch **32** and over a large speed reduction pulley **38** rotatably supported on a jackshaft **39**. Belt **34** is maintained in a properly tensioned condition by a small tension roller **40** engaging its exterior surface. A small pulley **42** is affixed to shaft **39** and a belt **44** is trained from pulley **42** to a large drum pulley **46** having substantially the same diameter as the diameter of duplicating drum **18**. The described shafts and pulleys together effect a substantial speed reduction from the output shaft **26** of drive motor **22** to the duplicating drum **14** rotating the drum at a maximum speed of about 110 revolutions per minute.

A control lever **48** pivotally secured at **50** to a lateral support frame **49**, is provided for regulating the pressure of a small roller, not shown, against drum **14**. Lever **48** includes an attached depending leg **58** having a flat end tab **59** positioned to cooperate with an actuator **60** of an electrical switch **62**. Switch **62** is serially connected to drive motor **22** and a source of electrical power, thus, as control lever **48** is pivoted to its lower limit of movement, tab **59** engages actuator **60**, opening the switch contacts and de-energizing the driving motor. As the control lever is pivoted upwardly, actuator **60** is released, closing the contacts of switch **62** and energizing the motor.

Mechanical clutch **32** includes a socket **64** which receives a complementary, spherical shaped member **66** carried at the lower end of a generally vertical clutch link **68** pivotally mounted to the lateral frame at **70**. The upper end of clutch link **68** is connected to the right end of a horizontally extending "run" lever **72** which is moved toward the right upon actuation of start button **18**, thereby engaging the clutch to rotate the drum.

Run lever **72** is locked into the run position, that is with the lever positioned toward the right, by a right angle shaped toggle **74** pivotally carried on the lateral frame at **76**. A slot **77** defined by the lever at pivot **76** allows the run lever to be moved back and forth and assists in limiting its movement to the horizontal direction. A tension spring **78**, extending between pivot **76** and a stud **81** normally biases lever **72** to the left, however, when the machine is operating, lever **72** is retained in its right position by a nose **80** of the toggle which cooperates with stud **81**. A second tension spring **82** holds the toggle in its "run" position. A depending extension lever **84** is adjustably secured to the lower leg of toggle **74** by fasteners **86**. As will be noted in greater detail below, clockwise movement of toggle lever **74** allows stud **81** to escape from nose **80** and enter a pocket **82** of the toggle, releasing lever **72** and disengaging the clutch.

For clarity, the clutch and accompanying linkage have been shown in a simplified form as compared to the structure typically employed. The more complex linkage merely positions the drum **14** to facilitate inserting a spirit master in a drum clamp, not shown.

Turning now to FIGS. 3 and 4, in addition to FIG. 2, in accordance with the invention, the countdown counter comprises a ratchet wheel **100** staked to a horizontal shaft **102** suitably mounted for rotation in a bearing **103** carried on a bracket **104** which is secured to the lateral frame **44** of the machine. Ratchet wheel **100** includes a large number of circumferential teeth **105**. A pawl arm **108** having a pawl **106** along its bottom edge cooperates with teeth **105** to index the ratchet wheel one tooth at a time in a manner described in greater detail hereinafter. Pawl arm **108** defines a slot **110** receiving a stud **112** extending from the bracket which restricts the arm to straight line,

reciprocating movement. A tension spring **114** is provided at the right end of the pawl arm to retain it in a normal position shown in dotted lines in FIG. 4.

Pawl arm **108** is connected to a driving arm **116** through a lost motion linkage **118**. The driving arm includes an inclined portion (FIG. 2) having a terminal end **120** which is pivotally connected at **122** to an eccentric **123** driven by the drum axis. A horizontal lower end **128** of the driving arm is limited to reciprocating motion by a guide **124** bearing against the inner surface of the arm and a second guide **126** (FIG. 4) which partially surrounds end **128**. The lower end defines a horizontal slot **130** which receives a stud **132** fixed to the left end of the pawl arm, together forming the lost motion linkage.

Pawl arm **108** is moved a short distance to the left at the completion of each back stroke of arm end **128** as the driving arm is reciprocated back and forth responsive to rotation of drum **14**. The pawl arm indexes ratchet wheel **100** one tooth in the counter-clockwise direction. As arm end **128** is displaced to the right, spring **114** returns pawl arm **108** and pawl **106** to its normal position and the pawl engages the adjacent ratchet tooth in preparation for the next indexing operation. A detent spring **134** is secured to frame **104** and cooperates with the ratchet wheel to prevent movement in the clockwise direction.

A sprocket **140** having a bearing **141** is journaled on shaft **102**. An idler sprocket **142** is journaled on a shaft **144** carried on lateral frame **49**, adjacent the front of the machine below start button **18**. The axis of rotation of idler sprocket **142** is parallel to that of sprocket **140** and the sprockets are generally aligned with one another. A chain **146**, such as a ladder chain, is trained around each of the sprockets to convert the rotary movement of the ratchet wheel to straight line motion of the chain.

Sprocket **140** is coupled to ratchet wheel **100** by a slip clutch **148** comprising a bowed washer **151** which is compressed between the opposing surfaces of the ratchet wheel and the sprocket. Thus, the slip clutch transmits counter-clockwise indexing movement of the ratchet wheel to sprocket **140** and chain **146** to achieve coincident movement thereof an indexing movement of the upper leg of the chain, from right to left. On the other hand, the slippage of clutch **148** allows the upper chain leg to be moved from left to right, and allows sprocket **140** to be rotated clockwise while index wheel **100** is maintained stationary by detent **134**.

A copy count selector **150** is secured to the upper leg of chain **146** for facilitating movement of the chain in a back and forth direction. Copy count selector **150** extends through a horizontal slot **152** formed in the protective side wall **16** of the duplicating machine and is readily accessible to the operator. The copy count selector includes a pointer **158** which cooperates with a series of spaced apart indicia **156** representing the number of copies to be duplicated. The number of copies desired to be duplicated is initially selected by moving the selector from its home position, to the left so that the pointer is aligned with the desired copy count indicia. During each duplication cycle, pawl arm **108** and pawl **106** cause ratchet wheel **100** to index one tooth. This movement is transmitted to the copy count selector by the chain, and the selector is indexed one unit to the left in the direction of its home position.

In addition to allowing the upper chain leg to be moved from left to right for initially setting the counter by movement of copy count selector **150**, slip clutch **148** also functions as an overriding clutch which enables the operator to re-set the copy count selector at any time during the countdown cycle without damaging the counter. For instance, if the copy count selector is preset to a given indicia **156**, and operation of the machine is initiated by depressing start button **18**, the operator may move selector **150** to the left or right while the machine is operating to increase or decrease the number of copies

to be reproduced and may even return the selector to its home position to terminate operation of the machine. The slip clutch prevents movement of the chain from being transmitted to ratchet wheel **100.**

Extension lever **84** is disposed in the path of copy count selector **150** and is moved to the left as pointer **158** reaches the zero indicia mark. This movement releases stud **81** of run lever **72** from nose **80** and terminates operation of the machine.

To facilitate the duplication of a plurality of the same number of copies, a stop **166** for the copy count selector is provided. The selector stop is adapted for movement along a track formed by the edges of slot **152,** and may be fixed at any desired position along the slot with its pointer **168** indicating the number of copies desired to be reproduced, by firmly tightening a large thumb screw **170.** Thereafter, by merely moving the copy count selector to the right until its pointer **158** is adjacent the pointer of stop **166,** the same number of copies will be reproduced during each extended cycle of operation of the duplicating machine. In addition, as the copy count selector is sequentially indexed to the left towards its home position, operation of the duplication machine will be terminated.

What has been described is a countdown counter for a duplicating machine or the like which is economical, of simple construction, reliable, which may be pre-set by moving a selector along a straight line path and which terminates operation of the machine upon completion of the copying cycle.

It is obvious that upon study by those skilled in the art, the disclosed invention may be altered or modified both in physical appearance and in construction without departing from its inventive concept. Therefore, the scope of protection to be given this invention should not be limited by the embodiment described above, but should be determined by the essential descriptions thereof which appear in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Countdown counting apparatus for duplicating machines or the like comprising: a ratchet wheel rotatably mounted on said duplicating machine; a pawl cooperating with said ratchet wheel; lost motion means operatively coupling said pawl to a powered member of said duplicating machine and causing the pawl to index said ratchet wheel a given distance responsive to each duplicating cycle; means coupled to said ratchet wheel for converting its rotary motion into translatory motion; a copy count selector secured to said converting means and adapted for straight line indexing movement from a pre-set copy count indicating position to a home position; and means terminating operation of said duplicating machine responsive to the copy count selector attaining its home position, whereby said copy count selector may be pre-set to duplicate a given number of copies and is indexed in the direction of its home position during each cycle of said duplicating machine.

2. The countdown counting apparatus as set forth in claim **1** wherein said motion-converting means comprise a rotatably mounted first pulley; a second pulley mounted in line with and spaced away from said first pulley; a flexible member trained about said pulleys, coupling one to the other; said copy count selector being secured to said flexible member, and including additionally: means limiting said ratchet wheel to movement only in the direction moved by said pawl, and slip clutch means coupling said ratchet wheel to one pulley thereby enabling manual displacement of said copy count selector to a pre-set copy count indicating position without imparting movement to said ratchet wheel.

3. The countdown counting apparatus as set forth in claim **2** wherein said duplicating machine includes a rotatably mounted duplicating drum; a first arm having a first end eccentrically coupled to said drum and having a second end defining a slot extending parallel to its direction of movement, including means limiting said second end to back and forth movement in a direction generally parallel to the direction of movement of said selector; a second arm carrying said pawl and having a pin captivated in said slot for moving said pawl arm in a direction causing the pawl to index said ratchet wheel at least one unit for each revolution of the drum, and spring means biasing said second arm in the opposite direction to return the arm to a normal position.

4. The countdown counting apparatus as set forth in claim **3** wherein said apparatus is supported on an exterior side frame of said machine and wherein said selector protrudes through and is accessible from the exterior of an overlying side panel, said selector being movable through a path extending from the front to the back of said duplicating machine.

5. The countdown counting apparatus as set forth in claim **4** including indicia markings on said side panel for indicating the number of copies desired to be duplicated; means on sad copy count selector cooperating with said indicia markings, and manually settable stop means including means for locking said stop means at any selected position to facilitate movement of said selector to said given position thereby facilitating repeated duplication of a given number of copies.

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STEPHEN J. TOMSKY, Primary Examiner

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