Sept. 15, 1959 W. EICHENBAUM ET AL 2,903,965

CONTROL SYSTEM FOR DUPLICATING MACHINES

Filed Oct. 5, 1955 2 Sheets-Sheet 1

FIG. 1.

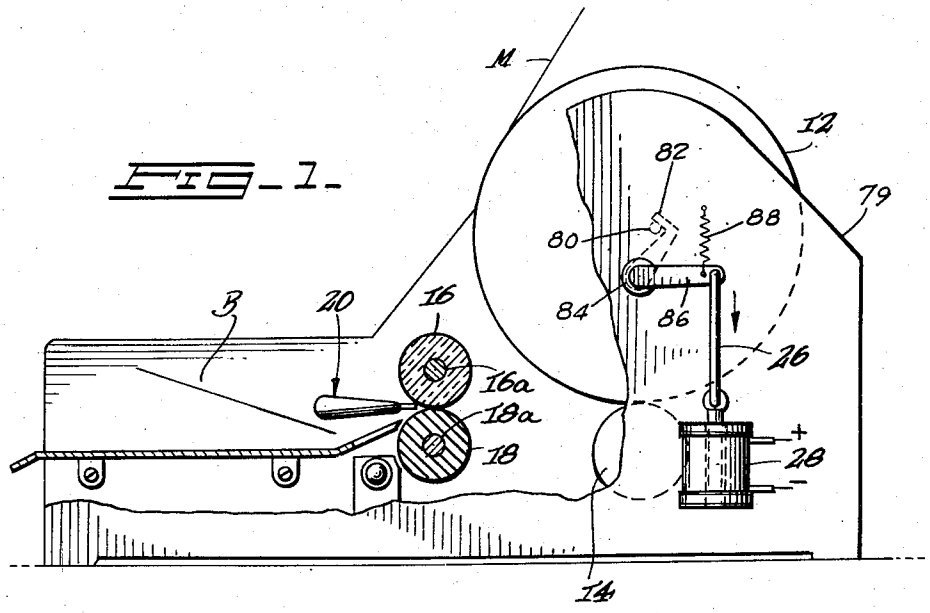


FIG. 2.

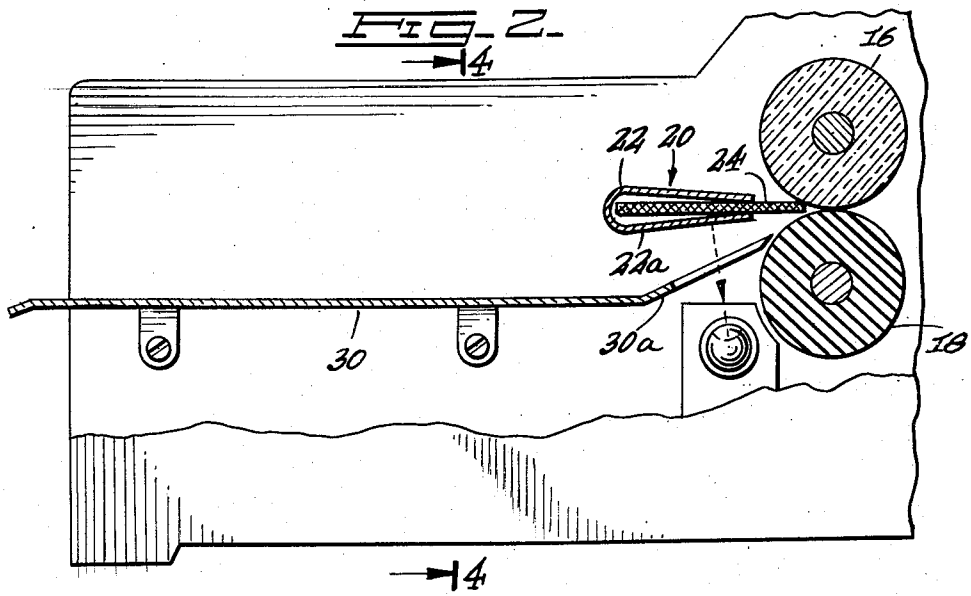
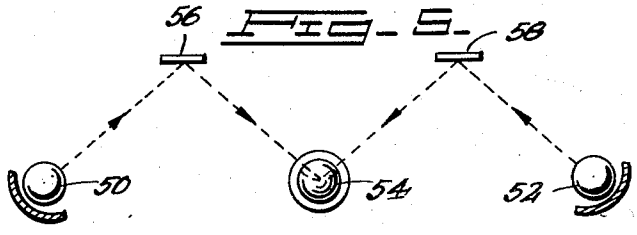


FIG. 5.



INVENTORS
WILLIAM EICHENBAUM
BY MANLEY MANDEL.
Morton Amster
ATTORNEY.

Sept. 15, 1959 W. EICHENBAUM ET AL 2,903,965

CONTROL SYSTEM FOR DUPLICATING MACHINES

Filed Oct. 5, 1955 2 Sheets-Sheet 2

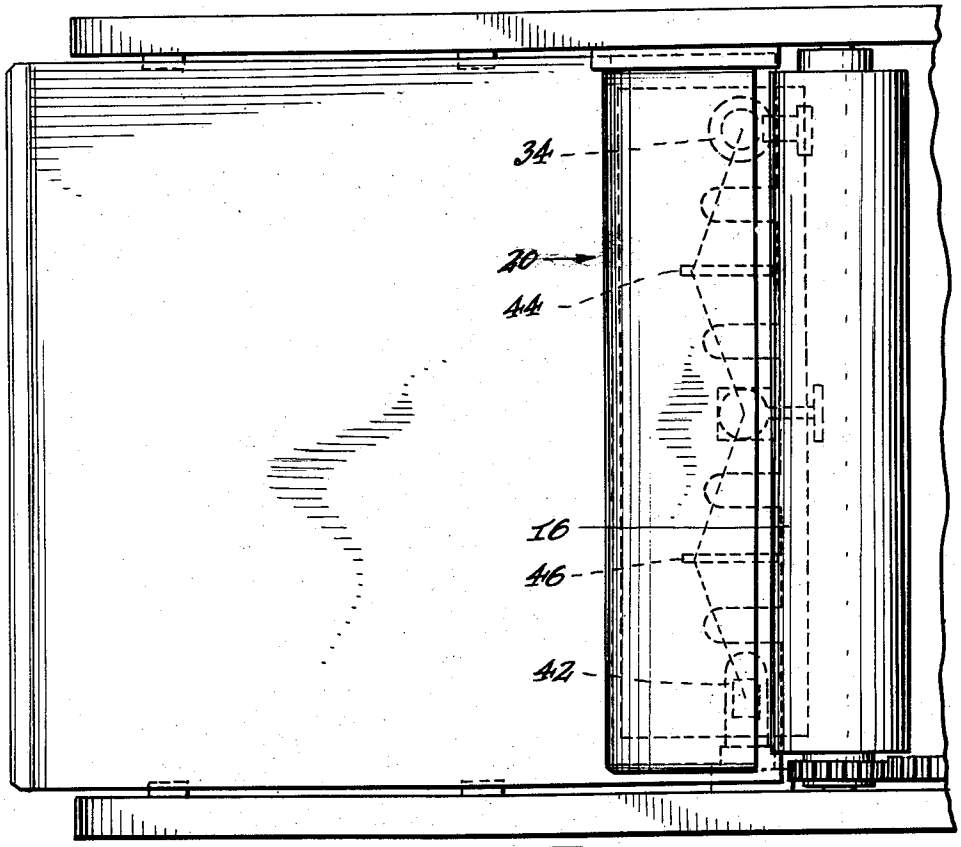
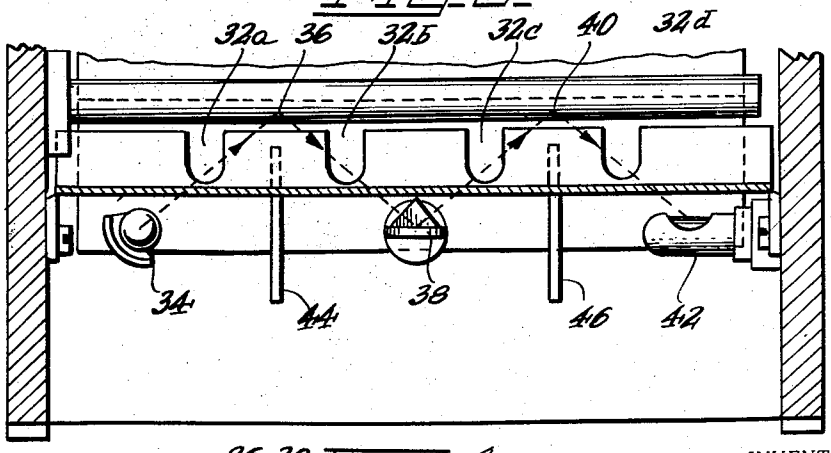


FIG. 3



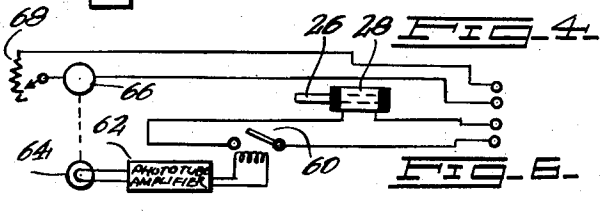


FIG. 4

FIG. 5

INVENTORS
WILLIAM EICHENBAUM
BY MANLEY MANDEL.
Morton Amster
ATTORNEY.

United States Patent Office 2,903,965 Patented Sept. 15, 1959

2,903,965

CONTROL SYSTEM FOR DUPLICATING MACHINES

William Eichenbaum, Jersey City, N.J., and Manley Mandel, Amherst, Mass.

Application October 5, 1955, Serial No. 538,672

8 Claims. (Cl. 101—235)

The present invention relates to improved duplicating machines, and in particular to a feeding system for delivering stock to the printing couple of said machine. This is a continuation-in-part of our earlier filed application Serial No. 459,394 filed September 30, 1954, and entitled Control System for Duplicating Machines, now abandoned.

The well known rotary duplicating machine includes a main duplicating drum which coacts with a pressing roller to provide a printing couple which is effective for duplicating upon tandem or coincident delivery of a master and a blank. Such duplicating apparatus usually is arranged for single-cycle operation which is initiated manually or pedally by an operator. Single-cycle operation is desired in that printings are to be made from master cards or sheets which are manually attached in succession to the duplicating drum. In advance of the printing couple, there is provided coacting feeding and wetting rollers which advance the stock, such as envelopes, post cards, letterheads, and the like to the printing couple.

In a typical operation, the machine operator attaches a master card to the duplicating drum, manually feeds the blank stock through the feeding and wetting rollers and then initiates the desired single-cycle operation by a foot or hand switch. This manner of control is exceptionally fatiguing to an operator. Further in attempting to build up speed for repeatedly performing the duplicating operation, vital for the economic handling of mass mailings, the operator must coordinate three separate and distinct movements for each duplication. In sequence, the operator must attach a master card on the duplicating drum, deliver the blank stock to a pick-up position relative to the wetting rollers, and trip the foot or hand switch to initiate the required single-cycle drive. The elimination of any one of the steps necessarily involves a material simplification of the duplicating operation, with attendant advantages from the standpoint of decreased cost and improved working conditions for the operator.

Separate and apart from the requirement for skilled personnel capable of exercising the degree of dexterity needed for high speed operation, it is not infrequent that imperfect registry of the blank and the master may occur or that a given master will not be duplicated. For example, the operator may inadvertently cause the cycling of the duplicating machine at an instant in time slightly earlier than the feed of the blank to a pick-up position relative to the wetting roller. Under such circumstances, the blank stock will not be fed by the wetting rollers to the printing couple for ultimate registry with the master. This obviously necessitates recycling with the same master, and apart from the inefficiency and wasted time, represents the possibility of missing a given master. Still further, even if the operator places the paper stock at the input or pick-up location relative to the feeding and wetting rollers, it is not uncommon for the feed of the stock to be such as to provide improper registry at the duplicating couple. Registry depends upon the position of the stock in relation to the feeding rollers, and the amount of thrust imparted to the stock. This represents a possible source of misalignment of the imprint, particularly when printing addresses on letterheads and/or window envelopes.

Accordingly, it is an object of the present invention to provide a duplicating machine obviating one or more of the aforesaid difficulties. Specifically, it is within the contemplation of the present invention to control the operation of a single-cycle duplication machine by the delivery of blank stock to the machine.

It is a still further object of the present invention to materially simplify control of a duplicating machine and to provide a reliable feed and delivery set-up assuring registration between blank stock and masters during the duplicating operation.

In the mentioned copending application, there is disclosed an arrangement of stock-sensing elements adjacent to and in advance of the printing or wetting rollers of the duplicating machine which are physically displaced by the advance of the blank stock and bring about cycling of the drive for the duplicating machine. Although the mechanisms described in said copending application have been found to be exceptionally useful, limitations are imposed for certain types of operations. Stock-sensing elements or fingers may be provided which are well counter balanced such that a rather light contact with the blank stock is sufficient to initiate the desired operation; however it has been found that certain lightweight stock is insufficient to bring about the required physical displacement of the sensing elements for operation. If the system of said copending application is too sensitive spurious or random operation may occur, which is undesirable for the reasons previously enumerated.

In accordance with the present invention, a light-responsive control system is arranged in advance of the feeding and wetting rollers and in controlling relation to the operating means for initiating the duplicating cycle upon advance of blank stock toward the feeding and wetting rollers. Advantageously, the light-responsive control system is arranged to provide a beam from a single light source having several passes back and forth across the feed path of the blank stock. Accordingly, it is possible to monitor a substantial region in advance of the feeding and wetting rollers with but a single light source and in a manner completely compatible with the incorporation of the light-responsive control into a standard duplicating machine.

As a feature of the present invention, several light sources may be arranged to monitor a predetermined region in advance of the feeding rollers. A single photocell may be used in conjunction with the several light sources and arranged to initiate the desired duplicating operation in response to the change in light level on the photocell relative to the light level at a quiescent condition. Accordingly, control may be achieved either through provision of an "on" or "off" light-responsive system or one which respons to "change-in-level."

The above brief description, as well as further objects, features and advantages of the present invention will be best appreciated upon reference to the following detailed description of presently preferred illustrative embodiments, when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is an elevational view, with parts broken away and in section for clarity, showing a standard duplicating machine nicluding a stock sensing and duplicating control system illustrating features of the present invention;

Fig. 2 is a sectional view, on a somewhat enlarged scale, showing the details of the light-responsive stock sensing system of Fig. 1;

Fig. 3 is a plan view of the input end of the duplicator

shown in Fig. 2, with the light-responsive control system illustrated by the broken line;

Fig. 4 is a sectional view taken substantially along the lines 4—4 of Fig. 2 and looking in the direction of the arrows;

Fig. 5 is a diagrammatic showing of a modified light-responsive control system demonstrating further features of the present invention; and,

Fig. 6 is a schematic diagram of a control circuit for a duplicating machine modified according to the present invention.

Referring now specifically to the drawings, there is shown a duplicating machine of broadly known structure which includes a main duplicating drum **12** and an auxiliary pressing roller **14**. The drum **12** and the roller **14** are in peripheral contact and cooperate to provide the well known printing couple. In advance of the printing couple, are feeding, and wetting rollers **16**, **18** mounted one above the other on shafts **16***a*, **18***a*. The rollers, **16**, **18** have a peripheral contact therebetween in substantially a common plane with the peripheral contact between the rollers of the printing couple. As illustrated, the roller **16** is of porcelain or other material suitable for the suspension thereon of a coating of a wetting agent from a wick assembly, generally designated by the reference numeral **20**. The wick assembly, seen best in Fig. 2, includes a holder body or tank **22** containing a wick **24** which is in wiping contact with the porcelain wetting roller **16** to place a thin suspension of an appropriate wetting agent on the peripheral surfaces of the wetting roller **16**.

Operatively connected to the feeding rollers **16**, **18** and the printing couple **12**, **14** is a single cycle drive including a continuously operating electric motor (not shown) connected by means of a slippable clutch (not shown) to drive the feeding rollers **16**, **18** and the printing couple **12**, **14**. Mounted on the printing roller **12** behind the side wall **79** of the duplicating machine is a pin **80** (shown in phantom) located to the right of the center of rotation of printing roller **12** with respect to the view of Fig. 1, so that, as printing roller **12** is driven by the electric motor for rotation in a counter-clockwise direction with respect to the view of Fig. 1, the pin **80** tends to move upwardly. This motion, however, is constrained by a latch **82** (located behind the side wall **79** of the duplicating machine and also illustrated in phantom) hooked over the pin **80**. The latch **82** is secured to the inner end of a rotatable shaft **84** journaled in the side wall **79** of the duplicating machine. Secured to the outer end of the shaft **84** is a crank arm **86**. The latter is biased upwardly by a tension spring **88** the ends of which are secured to the crank arm **86** and the side wall **79**. The tension of spring **88** urges crank arm **86**, shaft **84** and latch **82** for counter-clockwise rotation about shaft **84** as an axle, thus keeping latch **82** hooked over pin **80** to prevent printing roller **12** from being driven by the electric motor. Energization of solenoid **28** is effective to pull link **26** downwardly as indicated by the arrow, un-hooking latch **82** from pin **80**, and releasing printing roller **12** to perform a single rotation in response to the driving of the electric motor. By the time the single rotation is completed and pin **80** has returned once again to the position in which it can be constrained by latch **82**, the energizing impulse to solenoid **28** has terminated and the spring **88** has returned latch **82** to the proper position to constrain pin **80**, thus preventing further rotation of the printing roller **12** until the next energization of solenoid **28**. As to the operation of the duplicating machine itself, details thereof are well known in the art and further description of the exact mechanisms involved may be omitted in the interest of brevity.

A master card or sheet M is attached to the duplicating drum, for example by the clip illustrated in U.S. Patent No. 2,571,551 of Oct. 16, 1951, in the name of William Eichenbaum, one of the inventors herein. The master M comes into face-to-face or registering relation with the blank stock, designated by the letter B, which heretofore has been manually fed along the feed bed **30** to the wetting rollers **16**, **18**. It will be appreciated that the rotational orientation position of the master M at the beginning of a cycle and the fixed spacing of the feeding rollers **16**, **18** relative to the duplicating or printing couple **12**, **14** determined the portion of the blank stock B which will come into registry with the imprinting on the master M. To this end, suitable means are provided on the duplicating machine for rotationally orienting the drum in relation to the feeding rollers **16**, **18** to permit adjustment of the region of the printing on the blanks B. The master card M may be a ledger card or the like having a hectograph impression thereon of information to be transferred by the duplicating operation to the blank stock. As applied to the handling of installment buying accounts, the ledger card may contain information as to the customer's name, address and account number which may be reproduced in a required position on the blank stock, for example on envelopes for collection, collection notices, and advertising mail pieces. The described duplicating apparatus is subjected to a latitude of variation and substitution as may be well understood by those skilled in the art. Details of typical duplicating apparatus, including a cyclically operated duplicating drum, auxiliary pressing roller and delivery rollers, are found in a number of prior art patents including U.S. Patents Nos. 1,957,483 to Wolfson, of May 8, 1934, 1,988,056 to Storck of Jan. 15, 1935, Re. 19,951 to Storck of April 28, 1936, 2,061,525 to Storck of Nov. 17, 1936, 2,069,730 to Storck et al. of Feb. 2, 1937, 2,077,779 to Storck of April 20, 1937, 2,093,384 to Storck et al. of Sept. 14 1937, 2,138,682 to Storck of Nov. 29, 1938, and 2,172,113 to Storck et al. of Sept. 5, 1939.

In accordance with the present invention, a light-responsive control system is provided in association with the duplicating machine which is effective, adjacent to and in advance of the feeding and wetting rollers **16**, **18**, to initiate the single cycle duplicating operation in response to delivery of the blank stock B to the rollers **16**, **18**. To this end, the inclined leading section **30***a* of the feed bed **30** is provided with a number of notches or cutouts **32***a*, **32***b*, **32***c*, and **32***d* arranged at spaced locations across the width of the leading section **30***a*. The slots or cutouts permit a beam of light, emanating from the exciter lamp **34**, to be directed back and forth across the feed path along which the blanks B are advanced toward the feeding couple **16**, **18**. In this illustrative form of the invention and as seen best in Fig. 4, the exciter lamp **34** is arranged at one side of the feed bed **30** and is arranged to direct its beam upwardly through the first notch **32***a* toward the undersurface **22***a* of the tank or holder **22** of the wick assembly **20**. In lieu of employing a separate reflector for redirecting the beam downwardly across the feed path, as indicated by the directional arrows, it has been found advantageous, both from the standpoint of cost, simplicity and compactness to render the undersurface **22***a* of the tank **22** highly reflective. This may be achieved by providing a smooth, reflective plating on the surface **22***a*, as by chromium plating. The beam or leg which is directed downwardly from the location **36** on the tank holder **22** passes through the second notch **32***b* in the feed bed **32** and enters a prism **38** which is arranged to redirect the beam upwardly at an angle through the third notch **32***c* toward the location **40** on the reflective undersurface **22***a* of the tank or holder **22**. The reflective surface at this location redirects the beam downwardly at an angle through the fourth notch **32***d* to a photocell **42**, of well known structure per se, which is connected in controlling relation to a conventional photo tube amplifier. By appropriate arrangement of the light source **34** the reflective surface **22***a* of the tank holder **22**, the prism **38** and the photocell **42** it will be appreciated that four separate monitoring or sensing

locations are provided across the feed path from side to side of the machine. Upon feed of the stock past any one of these sensing locations or check points, the light beam is broken. This change from "on" to "off" of the light beam is detected at the photocell **42** and is employed to initiate the duplicating operation, as will be described in conjunction with Fig. 6. It will be appreciated that for some applications the prism **38** may be eliminated and the light beam directed upwardly and across the feed path toward a location substantially midway of the reflective surface **22***a* and thence downwardly at an angle to the photocell **42**. This of course will only give two sensing locations across the width of the feed bed, which may be sufficient for handling wide stock or for duplicating where the lateral disposition of the stock in relation to the master M is of no moment. Further, it will be appreciated that more than four separate legs to the light beam may be provided by additional prisms of the type illustrated. If needed, light baffles, such as designated by the reference numerals **44**, **46** may be interposed between the source **34** and the prism **38**, and between the prism **38** and the photocell **42** to assure adequate isolation of the respective sensing points and to avoid spurious operation.

In accordance with a further aspect of the present invention, it may be desirable to employ two light sources or exciter bulbs in conjunction with a single photocell and relay upon a change in light level to the photocell to initiate the desired control operation. As illustrated in Fig. 5, exciter bulbs **50**, **52** may be disposed at opposite sides of the feed bed **30** and arranged to direct their respective beams to a common photocell **54** disposed substantially midway of the feed bed **30**. In this form of the invention, each of the beams emanating from the respective light sources **50**, **52** includes one pass or leg extending upwardly at an angle across the feed path and a second pass or leg extending downwardly across the feed path toward the common photocell **54**. Reflection may be achieved at the points **56**, **58** through provision of separate reflectors or by using the reflective surface **22***a* of the tank **22**. In the modification illustrated in Fig. 5, it will be appreciated that a piece of blank stock which is of a width to straddle at least one leg of both the light beams **50**, **52** will completely block the light beams from the photocell **54** to initiate the control function. If the stock is of a width to break only the beam of one of the light sources a change in the light level at the photocell **54** from its normal or quiescent state will be brought about, which change in light level may be utilized for the control function. In the modification illustrated in Fig. 5, it will be appreciated that the respective light beams from the sources **50**, **52** may be arranged to have more than two passes across the feed path by the use of reflective surfaces and/or prisms, as illustrated in Fig. 4.

Detailed reference will now be made to the schematic diagram of Fig. 6 which shows a simplified circuit for operating the actuating member **26** under control of the solenoid **28**. The solenoid **28** is connected in a first circuit with a power relay **60** which is controlled from the output of a photo tube amplifier **62**. The photo tube amplifier **62** responds to a change in the light level on a photo tube **64**, which may be the photo tube **42** in the "on-off" system of Figs. 1–4 or may be the photo tube **52** in the "change-in-level" system shown diagrammatically in Fig. 5. The exciter lamp, indicated by the numeral **66** is connected to an appropriate source of line potential. In the illustrative circuit, a potentiometer is connected in series with the exciter lamp **66** so that its light output may be adjusted to a value which is at the threshold for operation of the power relay **60** as determined by the output of the photo tube amplifier **62**. By adjusting the potentiometer **68** or through the use of any equivalent electrical expedient, it is possible to arrange the photo tube **64** such that it will respond to a rather small change in light level. For the illustrative form of the invention, interruption of one of the beams will diminish the light level by a factor of one-half which will be sufficient for the desired control function. However, through the provision of potentiometer **68** in series with either of the light sources **50**, **52**, the system may be made as sensitive as required. It will be appreciated that the "change-in-level" system allows for duplicator control with materials other than those which are completely opaque in that the light level will change when such materials cross the light beams or legs.

A typical cycle of operation will now be described in detail:

The operator, standing at either side of the machine, attached the master M to the duplication drum **12** with one hand and then advances the blank stock B along the feed bed **30** toward the light beams in advance of the feeding rollers. Upon interrupting of any one of the light beams, the photo amplifier is effective to close the associated relay and the solenoid **28** to bring about the single cycle operation of the duplicating mechanisms. As the trailing end of the stock passes the sensing locations, the control circuit is returned to its normal or quiescent condition ready for delivery of the next blank for duplication.

From the foregoing description it will be appreciated that the present control system may be employed with all types of stock, and particularly with light weight stock which does not have sufficient rigidity to operate mechanical switching devices. The incorporation into conventional duplication machine of the present control system merely involves minor variations in the construction of the feed bed; in the preferred form of the invention a portion of the machine itself serves in combination with the photo cell system to direct the light beam in relation to the feed path. The reflection of a single beam back and forth across the feed path allows for a number of sensing locations without the requirement of multiple light sources and/or photo cells. The normal function of the duplication machine is preserved and the operator is able to operate this machine more smoothly and with minimum physical fatigue. The speed of the duplicating operation is limited only by the speed of the rotating drum of the printing couple and the time required for the operator to attach successive masters to the drum and advance successive blanks past the sensing location.

While preferred forms of the invention have been described, it will be appreciated that many changes may be made without departing from the scope and spirit of the invention as set forth in the appended claims; in certain instances some features of the invention may be used without a corresponding use of other features.

What we claim is:

1. A duplicating machine including a duplicating drum and a pressing roller, said duplicating drum being arranged to detachably carry a master, means for delivering stock toward said drum and pressing roller for registry with and duplication from said master, a single-cycle drive having operating means arranged to cyclically operate said duplicating drum and pressing roller and the delivery means, and light-responsive means in controlling relation to said operating means for cycling said drive in dependence upon feed of said stock to a predetermined location in advance of said delivery means, said light-responsive means including a source of light, a photocell, and means for directing light emanating from said source back and forth across the path along which stock is advanced toward said delivery means and toward said photocell, the directed light providing plural beams intersecting said path at spaced points along a line extending across said path.

2. In a duplicating machine, a printing couple, a feeding couple in advance of said printing couple, a single-cycle drive operatively connected to said printing and feeding couples for effecting drive of the respective cou-

ples, and photoelectric control means disposed at a predetermined location along a feed path in advance of said feeding couple and in controlling relation to said single-cycle drive for initiating single-cycle operation in dependence upon feed of stock past said predetermined location, said control means including at least one light source, a photocell, and reflecting means arranged to provide a light beam from said source to said photocell having multiple passes across said feed path, said multiple passes intersecting said feed path at spaced points along a line extending across said feed path.

3. A duplicating machine including a duplicating drum and a pressing roller, said duplicating drum being arranged to detachably carry a master, means for delivering stock along a feed path toward said drum and pressing roller for registry with and duplication from said master, a single-cycle drive having operating means arranged to cyclically operate said duplicating dum and pressing roller and the delivery means, means including a photocell in controlling relation to said operating means for cycling said drive in dependence upon feed of said stock to a predetermined location in advance of said delivery means, and a pair of light sources arranged to direct their respective beams back and forth across said feed path, said beams intersecting said feed path at spaced points along a line extending across said feed path, the means including the photocell being arranged to respond to a change in light level produced by interrupting the beam emanating from either light source of said pair.

4. In a duplicating machine, a printing couple, a feeding couple in advance of said printing couple, a single-cycle drive operatively connected to said printing and feeding couples for effecting drive of the respective couples, and photoelectric control means disposed at a predetermined location along a feed path in advance of said feeding couple and in controlling relation to said single-cycle drive for initiating duplicating operation in dependence upon feed of stock past said predetermined location, said control means including a pair of light sources, a photocell, and reflecting means arranged to provide a light beam from each of said sources to said photocell and each having multiple passes across said feed path, said multiple passes intersecting said feed path at spaced points along a line extending across said feed path.

5. In a duplicating machine including a duplicating drum and a pressing roller arranged to provide a printing couple, a pair of superposed feeding rollers in advance of said printing couple, a feed bed in advance of said feeding rollers for directing stock along a path toward said feeding rollers, said feed bed including a leading section terminating adjacent the lower feeding roller and below the plane of contact between said feeding rollers, a wick assembly spaced above said feed bed over said leading section having a wick in contact with the upper feeding roller, a single-cycle drive operatively connected to said printing couple and said feeding rollers for driving same through a duplicating cycle, at least one light source disposed below said feed bed at one side thereof, light-responsive means disposed below said feed bed and spaced from said light source and in controlling relation to said single-cycle drive, said wick assembly, said feed bed, and said light source being constructed and arranged in relation to each other and to said light-responsive means whereby a beam of light is formed from said light source and directed toward said light-responsive means having at least one leg directed upwardly at an angle across said feed path and a second leg directed downwardly at an angle across said feed path at a location laterally offset from said first leg.

6. In a duplicating machine including a duplicating drum and a pressing roller arranged to provide a printing couple, a pair of superposed feeding rollers in advance of said printing couple, a feed bed in advance of said feeding rollers for directing stock along a path toward said feeding rollers, said feed bed including a leading section terminating adjacent the lower feeding roller and below the plane of contact between said feeding rollers, a wick assembly spaced above said feed bed over said leading section having a wick in contact with the upper feeding roller, a single-cycle drive operatively connected to said printing couple and said feeding rollers driving same through a duplicating cycle, light sources disposed below and at opposite sides of said feed bed, light-responsive means disposed below said feed bed intermediate said light sources and in controlling relation to said single-cycle drive, said wick assembly, said feed bed, and said light sources being constructed and arranged in relation to each other and to said light-responsive means whereby beams of light are directed from said light sources toward said light-responsive means each having at least one leg directed upwardly at an angle across said feed path and a second leg directed downwardly at an angle across said feed path at a location laterally offset from said first leg.

7. A duplicating machine including a duplicating drum and a pressing roller, means on said duplicating drum for detachably securing a master to said duplicating drum, means for delivering stock toward said drum and pressing roller for registry with and duplication from said master, a single-cycle drive having operating means arranged to cyclically operate said duplicating drum and pressing roller and the delivery means, and means at a predetermined location in advance of said delivery means and including a photocell in controlling relation to said operating means for cycling said drive in dependence upon feed of said stock to said predetermined location.

8. In a duplicating machine, a printing couple, a feeding couple in advance of said printing couple, a single-cycle drive operatively connected to said printing and feeding couples for effecting drive of the respective couples, and photoelectric control means disposed at a predetermined location along a feed path in advance of said feeding couple and in controlling the said single-cycle drive for initiating single-cycle operation in dependence upon feed of stock past said predetermined location, said control means including at least one light source and a photocell arranged to provide a light beam from said source to said photocell extending across said feed path.

References Cited in the file of this patent

UNITED STATES PATENTS

2,542,073	Aberle	Feb. 20, 1951
2,641,998	Donald	June 16, 1953

FOREIGN PATENTS

1,041,086	France	Oct. 20, 1953