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R. ROBERTSON ET AL
CONVEYOR FOR DOCUMENTS

3,409,356

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2 Sheets-Sheet 1

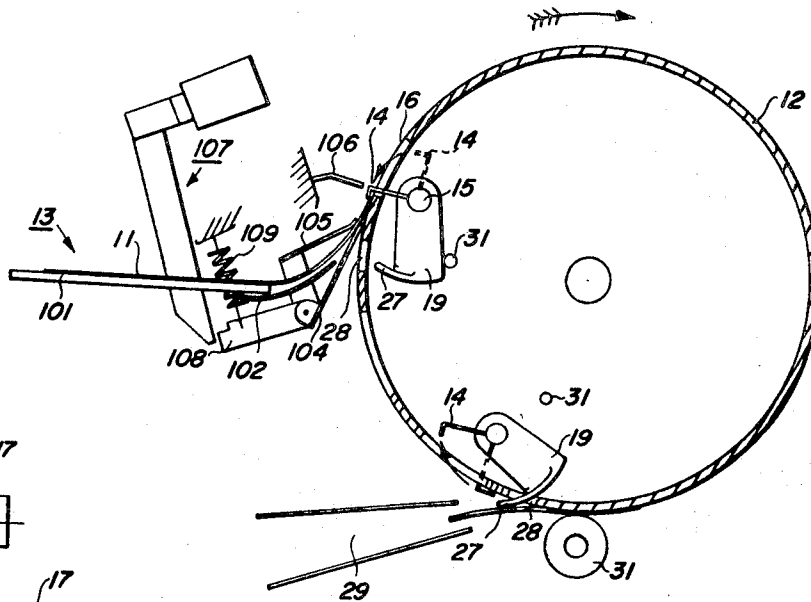


FIG. 1

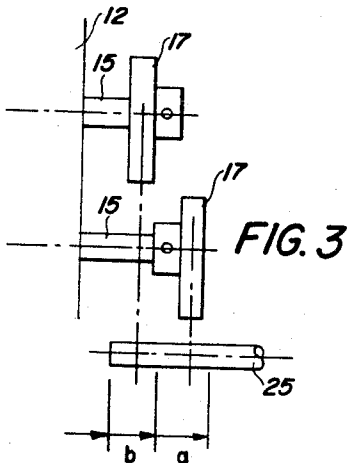


FIG. 3

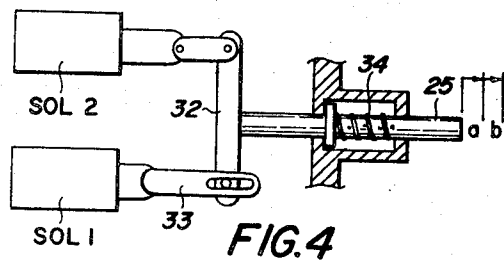


FIG. 4

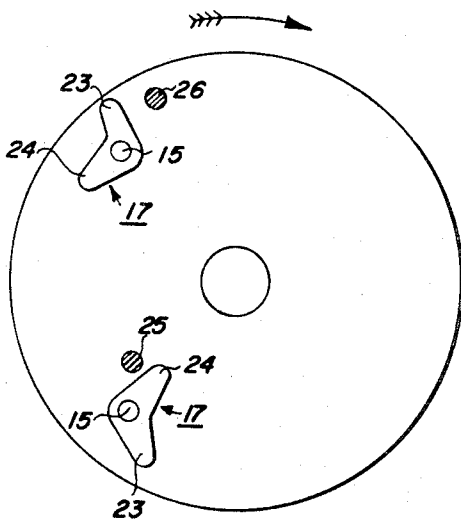


FIG. 2

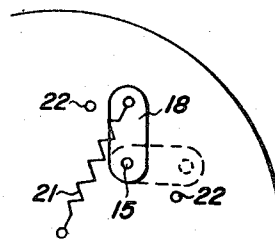


FIG. 2a

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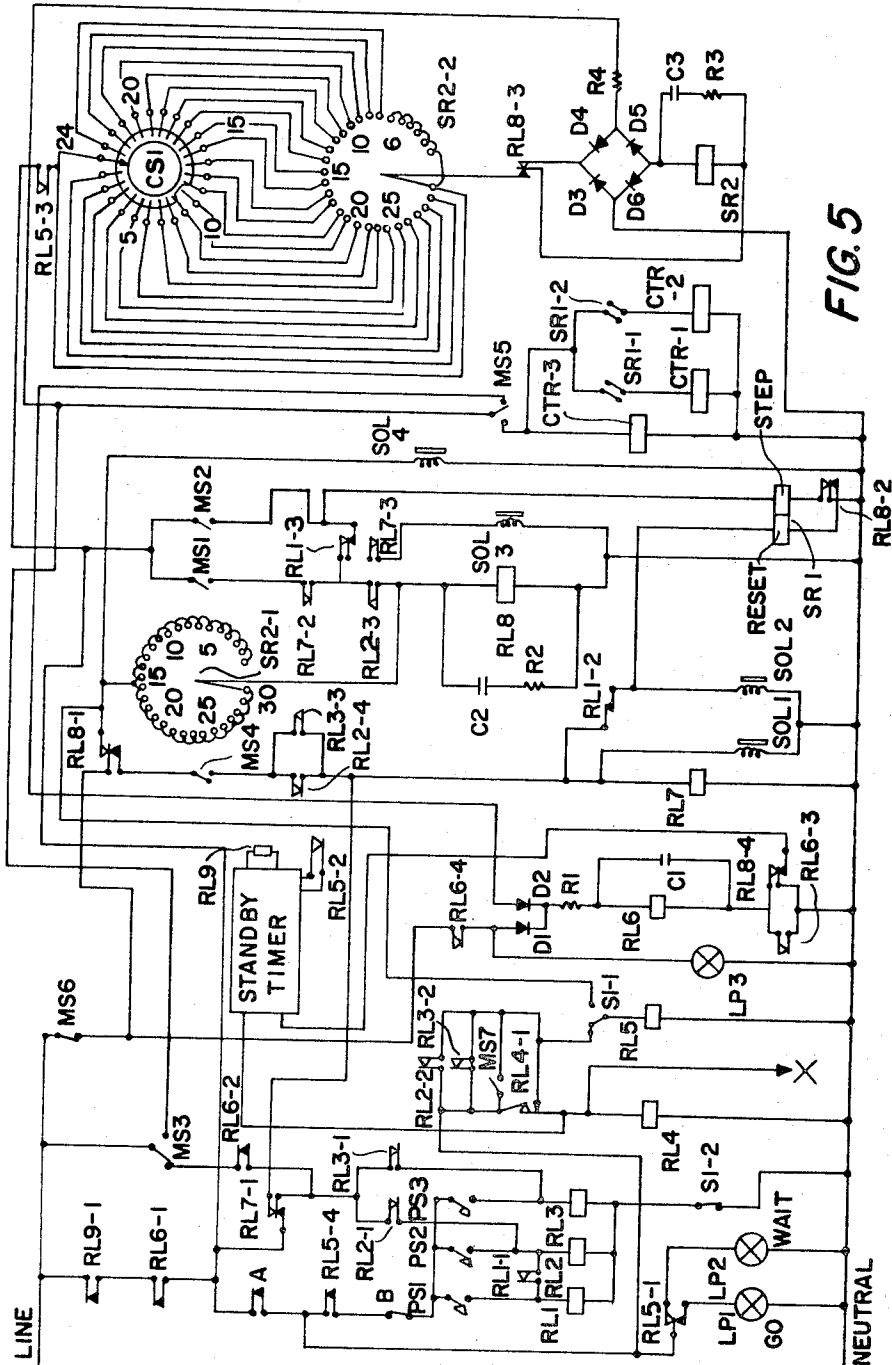
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CONVEYOR FOR DOCUMENTS

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2 Sheets-Sheet 2



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3,409,356

CONVEYOR FOR DOCUMENTS

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1 Claim. (Cl. 95—77.5)

ABSTRACT OF THE DISCLOSURE

A conveyor for carrying documents to be reproduced from a first station to subsequent stations having a first and second set of grippers mounted thereon and a pair of solenoids for actuating either the first or both sets of grippers.

This invention relates to copying machines and more particularly to a document conveyor for use in a copying machine.

It is often required to make a copy of an original document with the addition or subtraction of certain information. Certain portions of the document to be copied can be blanked out and additional information can be inserted by an overlay laid over the document while it is being copied. The basic document can be copied with a series of additions or subtractions by copying the document with a series of different overlays.

According to this invention there is provided a copy conveyor which may be in the form of a drum for carrying documents to be copied, a first set of grippers on the conveyor for holding a first document on the conveyor, a second set of grippers for holding a second document on the conveyor and spaced from the first set in the direction of movement of the conveyor, and means for selectively actuating the two sets of grippers. The original document can conveniently be held on the conveyor by the first set of grippers and a succession of overlays can be held on the conveyor in turn by the second set of grippers, so that a series of copies of the document with various additions and subtractions can be made.

Each set of grippers preferably comprises a gripper jaw and a snap-over spring toggle for holding the jaw in an open or closed position. The means for selectively actuating the two sets of grippers preferably comprises actuator means fixedly mounted adjacent the movable portion of the conveyor on which the grippers are mounted for actuating a set of grippers as the set passes the means to cause the gripper jaw to move from one position to the other. A common actuator means is preferably provided for both sets of grippers, so that the grippers can be operated in turn as they pass the actuator means. The actuator means may be movable into an inoperative position so that as a set of grippers passes the means in its inoperative position, the set of grippers is not moved from one position to the other. The actuator means may be movable to an intermediate position in which it is inoperative in respect to only one set of grippers, besides the positions in which it is operative or inoperative in respect to both sets of grippers.

It is therefore an object of this invention to improve copy conveyors.

Another object of this invention is to improve copy conveyors in order to allow the conveyor to accept and carry more than one document.

A still further object of this invention is to effect the activation of more than one set of grippers on a copy conveyor.

The invention includes within its scope a copying machine having a copy conveyor as set out above.

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For a better understanding of the invention as well as further objects and features thereof, reference is had to the following detailed description of the invention to be read in connection with the accompanying drawings, wherein:

FIGURE 1 is a section view through the conveyor of the copying machine,

FIGURE 2 is an end view of the conveyor of the machine shown in FIGURE 1 with parts removed for clarity,

FIGURE 2A is a partial end view of the opposite end of the conveyor shown in FIGURE 2,

FIGURE 3 is a side view of one end of the conveyor shown in FIGURE 2,

FIGURE 4 is a side view, partly in section, of further components at the end of the conveyor shown in FIGURE 3, and

FIGURE 5 is a circuit diagram of electrical components of the copying machine embodying the conveyor of FIGURE 1.

FIGURE 1 shows schematically a conveyor and guides for a document to be copied on a xerographic copying machine. In such a machine, the document 11 to be copied is fed onto a conveyor drum, and rotated with the drum at a constant speed. A line region at a fixed position around the drum is strongly illuminated, and an image of the region is transmitted by an optical system to a charged xerographic drum rotating at the same peripheral speed. The illuminated portions of the image discharge the corresponding regions of the xerographic drum so that a latent image of the document is formed on the drum. The latent image is developed and transferred to a copying sheet, as is described in U.S. Patent No. 3,187,651 issued June 8, 1965, to R. H. Eichorn et al.

The document 11 to be copied is fed onto the drum 12 along a guide 13. The guide 13 includes a feeding shelf 101, and a curved guide 102. Beyond the guide 102 is a pair of jaws 104 and 105. One jaw 104 is pivoted to move between a position tangential to the surface of the drum 12 and a position withdrawn from the drum. The other jaw 105 is spring-biased against the jaw 104. A stop 106 is located beyond the jaws 104 and 105 to stop the document passing between the jaws when the jaw 104 is in its withdrawn position. In the other position (tangential) of the jaw 104 the document passes between the stop 106 and the drum as it is drawn on to the drum. A solenoid-operated latch 107 co-operates with a latch arm 108 mounted on the jaw 104. When the latch is released, as is shown in FIGURE 1, the latch arm 108 is urged by means of a spring 109 so that the jaw 104 pivots towards the drum. In the latched or withdrawn position, the jaws 104 and 105 hold the end of the document against the stop 106.

A row of grippers 14 are mounted on a shaft 15 mounted within inside the drum, each gripper 14 extending through an aperture 16 in the drum. A dog 17 is mounted on the shaft 15 at one end and a toggle 18 at the other end. A weight 19 is loosely mounted for rotation about the shaft 15 inside the drum 12.

The toggle 18 is connected to a spring 21 which is secured to the end of the drum 12 on the side of the shaft remote from the free end of the toggle. Stops 22 are provided on either side of the shaft 15 to engage the toggle to limit the rotation of the shaft. The toggle and spring arrangement has two stable positions, one being shown in full lines and the other being shown in broken lines in FIGURE 2A.

The dog 17 at the other end of the shaft is arranged so that in one stable position of the toggle and spring arrangement, one arm 23 of the dog is directed radially outwards from the center of the drum and in the other

position the other arm 24 of the dog is directed radially inwards. Mounted on the machine adjacent the end of the drum on which the dog is located opening pin 25 and closing pin 26. The opening pin 25 is arranged to engage the inwardly directed arm 24 of the dog to rotate the dog 17 and the shaft 15 as the drum 12 passes the pin 25 so that the toggle 18 is moved from one stable position to be drawn by the spring 21 to the other stable position. As the toggle moves from one stable position to the other, the shaft 15 rotates through approximately a right angle so that the row of grippers 14 are moved from the position in which they bear on the exterior surface of the drum to a position in which they are withdrawn to the interior of the drum through the aperture 16.

The closing pin 26 is arranged to engage the outwardly directed arm 23 of the dog to rotate the shaft in the opposite direction to return the shaft to its original position. The grippers 14 are then extended through the aperture 16 in the drum surface to bear on the exterior surface of the drum and to grip the document whose leading edge is located for engagement by the closing grippers by the guide 13.

The opening operation occurs when the shaft 15 has just passed below the axis of the drum axis. The weight 19 hangs from the shaft 15 and has a protruding arm 27 which at this position of the shaft projects through an aperture 28 in the drum to urge the leading edge of the document away from the drum towards an exit chute 29. As the drum rotates further, the leading edge of the document is engaged by the mouth of the chute and guided away from the drum down the chute.

A pressure roller 31 engages the outer surface of the drum directly below its axis to prevent a document when released by the grippers 14 from moving relative to the surface of the drum.

The grippers 14 engage a document from the guide 13 as the grippers approach the top of the drum. At this position the weight 19 hangs freely inside the drum and the protruding arm 27 of the weight is contained within the drum and does not engage the document. A check stop 31 within the drum prevents the weight 19 from rotating in advance of the shaft 15.

In the copy drum of the present invention, two rows of grippers 14 are provided, space around the surface of the drum by a short distance. A common fixed closing pin 26 is provided to operate the two sets of grippers so that the grippers close in turn as the respective dogs 17 engage the closing pin.

A common opening pin 25 is provided to engage the dogs 17 of the two sets of grippers, the dogs being spaced parallel to the axis of the drum. The opening pin 25 is normally completely withdrawn from engagement with the dogs 17 of the two sets of grippers. A double solenoid arrangement is provided (shown in FIGURE 4) for the extension of the opening pin 25. The opening pin 25 is connected to cross arm 32, each end of the cross arms being connected to a separate solenoid. One solenoid SOL-1 is connected to one end of the cross arm 32 by means of a slotted link 33, and the other end of the cross arm 32 is connected to the armature of a second solenoid SOL-2 which is of longer throw than the first.

On energization of the first solenoid, the opening pin 25 is extended by a first distance a so that it only engages the dog of the second set of grippers. On energization of the second solenoid, the opening pin is further extended a second distance b to engage both dogs, the cross arm moving relative to the armature of the first solenoid by means of the slotted link 33. A spring 34 is provided to return the opening pin to its withdrawn position on de-energization of the solenoids. The closing pin is fixed to engage the dogs of the open grippers on each revolution, and closes either or both sets of grippers which have previously been opened by the opening pin.

A series of overlays is provided for adding and subtracting information from a master document. For ex-

ample, the master document may be a sales order and in conjunction with a series of transparent overlays there can be derived from the sales order an acknowledgement, stock order, advice note, dispatch note, goods receipt and invoice. Each derived document requires a different selection and presentation of information and it is likely that a different number of copies of each document is required. The overlay has a series of apertures adjacent the leading edge so that when the overlay is laid over a document on the copy drum, the grippers gripping the master document extend through the apertures.

The master document is first fed on to the shelf 101 and taken up by one set of grippers on the drum 12. The overlay is then fed on to the shelf 101 and is taken up by the second set of grippers on the drum 12 so that the overlay lies on top of the master document. The required number of copies is made of the master document with the overlay, the drum rotating once per copy, and then the overlay is released by opening the second set of grippers. The new overlay which has been inserted on the shelf 101 against the stop 106 during the first copying operation, is fed onto the drum by releasing the latch 107 and the next copying operation commences. Both master document and overlay can be released for replacement by opening both sets of grippers.

FIGURE 5 shows a control circuit for the copying apparatus. The circuit shows Solenoids 1, 2, 3, 4 denoted SOL-1, 2, 3, 4. Relays are denoted RL1, 2, 3, 4, 5, 6, 7, 8, 9, and their associated contacts referenced by the relay number, followed by their contact numbers. Electromagnetic counters are denoted CTR1, 2, 3. Microswitches are denoted MS1, 2, 3, 4, 5, 6, 7. Rectifiers are denoted D1, 2, 3, 4, 5, 6, a 30-station, 2 bank Uniselector denoted SR2, an electromagnetically operated stepping switch denoted SR1, a 23-way selector denoted CS1, 3 push button switches denoted PS1, 2, 3, a double pole, double throw switch denoted S1, and a preset timer.

The microswitches MS1, 2, 3, 4, are operated in this order, briefly, once per cycle of the document drum. MS5 is operated momentarily once per cycle of the document by a gripper bar, designed to carry the copy paper through the copying machine. When the machine is operating in the "printing" mode, MS5 will be held operated following the gripper bar by the copy paper trailing behind the gripper bar. The purpose of this microswitch will be described later. MS6 operates when the paper tray is withdrawn. MS7 operates when the jaws 104 and 105 are lowered to present any input material to the drum grippers. The three control buttons PS1, PS2 and PS3 are provided to control respectively changing the master document and copying, retaining the document but changing the overlay and copying, and changing the document without copying. The number of copies to be made is set by a dial CS1 operating SR2.

During the first cycle of document drum after Button PS2 has been closed, RL2 is energized by PS2 and locked on by RL2-1, RL5 is energized by RL2-2 and RL5-1 changes the "GO" indication on the control panel to "WAIT," by illuminating LP2, RL5-2 disables the timer circuit, RL5-3 causes SR2 (uniselector) to motor (on positive $\frac{1}{2}$ cycles by D6) by SR2-2 to the position determined by the copy selector switch CS1. This position will be 30- n (where " n " is the number of copies selected). RL5-4 will break the supply to control buttons PS1, 2, 3, so that no further instruction may be accepted. RL4 and line X are energized with RL5 by RL4-1, the latter also locking RL4 and line X to the supply. Energization of X will cause the machine main drive to be energized and cycling to commence. MS1, MS2, MS3 are ineffective on this cycle since all components connected to these microswitches are isolated by open contacts of either RL7 or RL8. On operation of MS4, RL7, SR1 reset coil, SOL1, SOL2 are energized by RL2-4. The gripper opening pin will be fully advanced to open both sets of grippers, and eject any document overlay in the machine.

All components will remain energized through RL7-1. RL2 will not be released by RL7-1 since it has a parallel supply with MS3 and RL6-2.

During the second cycle, on operation of MS1, RL8, SOL4 are energized by RL7-2 and RL2-3 and locked to the supply by RL8-1. SOL4 releases the latch restraining the paper feed rollers, so that copy paper may be fed. Note that RL8 supply is maintained by SR2-1. RL8-2 de-energizes SR1 reset coil and completes SR1 stepping circuit. RL8-3 prepares SR2 for normal stepping by full wave rectifier D3-D6. RL8-4 removes the neutral connection to the standby timer circuit connecting it instead to RL6.

On operation of MS2, SOL3 is energized by RL7-3 and RL1-3 to lower the feed-in chute 104, 105 and allow the document to be presented to the document grippers. SR1 step coil is energized for the duration of MS2.

On operation of MS3, RL2, RL7, SOL1, SOL2, are all deenergized. RL5 remains energized through MS7 since the feed-in chute is still in a lowered position. SR2 will step on position. Assuming for the moment that paper has been correctly fed and gripped, MS5 will have been operated and held over in advance of MS3 and a pulse will be directed to counters CTRS1, 2, 3 as determined by the states of SR-1 and SR-2 contacts. CTR1 registers copies 1-x (SR1/1 closed) CTR2 registers x-y (R1/2 closed) CTR3 registers all copies, and the sequence will reset (i.e. SR1 will reset) whenever PS2 or PS3 is operated. Break points x and y are present during the manufacture of SR1 by making appropriate connections between the counters and the SR1 contacts to provide meter indications for charging at different rates for numbers of copies made.

The method of operation now differs for making single copies or multiple copies. For single copies, if CS1 was set initially to one copy, then SR2 would have motored to position 29. On the second cycle, therefore, RL8 will be released by SR2-1 after MS3 has been operated (i.e. SR2 will step as MS3 reverts to its unoperated condition). RL8-1 will release SOL4 and the paper feed rollers will be latched up as they rise, to prevent any further printing. Since RL5-3 is still closed, SR2 will immediately motor to position 29. The operating of MS4 during the second cycle is ineffective since RL2-4 and RL3-3 are open.

During the third cycle for single copy operation, the feed-in chute will be raised and latched mechanically shortly after the beginning of the cycle, opening MS7 and releasing RL5. RL5-1 will illuminate the "GO" signal (LP1) and RL5-4 will restore the supply to the control buttons. RL5-2 will allow stand by timing to commence (to be described later). If the next instruction is now given the feed-in/print sequence will commence on the operation of MS4, as set out above. For continuous single copy working, therefore, a print will be produced on every other cycle.

For making multiple copies, the procedure differs from single copy working after the operation of MS3 in the second cycle. In this case RL8 is not released until the last copying cycle. In the second cycle, MS4 is ineffective since RL2 and RL3 are open. In the third cycle the feed-in chute will be latched mechanically shortly after beginning of cycle, opening MS7 and releasing RL5. RL5-1 will illuminate the "GO" signal (LP1) on the control panel to indicate that further instructions may be set and RL5-4 will restore the supply to the control buttons. The next document/original may now be positioned in the feed-in chute, CS1 set to the number of copies required and the appropriate control button pressed. RL5 will be energized and a "WAIT" signal (LP2) will appear on the control panel. The set instruction will be stored until the previous program has been completed.

In each of the fourth to *n*th cycles, for making *n* copies MS1 is isolated by RL7-2, operation of MS2 causes SR1 to be stepped on one position, operation of

MS3 causes one count to be registered on appropriate counters and SR2 stepped on one position (as MS3 reverts to its unoperated state), and MS4 is isolated by RL8-1.

During the last print cycle MS1 is isolated by RL7-2, operation of MS2 causes CR1 to be stepped on one position, operation of MS3 causes one count to be registered on the appropriate meters. RL8 is de-energized by SR2-1 as SR2 steps and RL8-1 will release SOL4 to prevent any further paper feeding.

If a further program has been set up as described above, then RL5-3 will be closed and SR2 will immediately motor to the position determined by CS1. The next feed-in/print sequence will commence at the operation of MS4 as described above. Provided, therefore, that the next program is set up before the end of current one, there will be no lost cycles and continuous printing will result. If no further instruction has been given, SR2 will not reset on the last print cycle as above (since RL5-3 will be open), but on receipt of any following instruction. The machine will assume a standby condition (described below) if no further instruction is given.

When control button PS1 has been selected for overlay printing, the sequence of operations is generally as described above but RL1 is energized through PS1, and RL1-1 causes energization of RL2 and also locks RL1 to RL2. During the first cycle, operation of MS4 causes SOL1 only to be energized with RL7 to open overlay grippers and eject any overlay which may be on the document drum, and SOL2 and SR1 reset coil are isolated by RL1-2 and thus the sequence of metering on CTRS1, 2, 3 is not reset. During the second cycle, operation of MS1 causes SOL3 to be energized by RL7-2, RL1-3, RL7-3 to lower the feed-in chute and allow the overlay to be presented to the overlay grippers. Operation of MS2 causes SR1 to be stepped one position. On operation of MS3, RL1, RL2, RL7, SOL1 are all released. RL5 remains energized through MS7 since the feed-in chute is still lowered. Third and subsequent cycles are as described above both for single and multiple copy modes.

Control button PS3 is selected for feeding in overlay master documents without making copies and for ejecting the machine contents at the end of a printing run. RL3 is energized through PS3 and locked to the supply by RL3-1. Since RL3 contacts parallel RL2 contacts, except for RL2-3, the feed-in cycles will be as described above, with the exception that RL8 and SOL4 will not be energized. No paper feeding will therefore occur. PS3 may be pressed at any time during a program as long as the "GO" signal is showing on the control panel, and will cause the machine to eject its contents automatically when printing is complete.

The standby period commences when RL8 is de-energized at the end of a program, and when RL5 is de-energized (no further program being set up), the standby timer circuit will commence timing and will energize RL9 after the present period. If RL9 operates during the period in which MS3 is operated, RL9-1 will break the supply momentarily to RL4 and line X. If RL9 operates at any other time it will remain energized, as will RL4 and line X by MS3, RL6-2, RL7-1, etc. until the operation of MS3. This will de-energize all components and the machine will commence a run down sequence of 2 cycles of the document drum after which the main drive will be stopped. Control buttons PS1, 2, 3 may be pressed at any time during standby or time out. RL5-2 will immediately disable the timer circuit and operation will continue as described above. The machine will always commence to execute any instruction at the first operation of MS4 after a button has been pressed.

If a sheet of paper is not fed correctly (or there is no paper in the tray) then MS5 will not be held over by the paper when a metering pulse is presented by MS3. If this is the case then the pulse will not be registered on

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the counters but diverted by D2 to RL6. The latter will lock to the line through D1, RL6-4 and MS6 and to the neutral through RL6-3. Lamp LP3 will be illuminated to give warning of the failure. RL6-1 and RL6-2 will break the line connection to RL1, 2, 3, 4, 5 line X and LP1 and LP2, and the machine will run down as described above. Any further program set up will, therefore, be cancelled.

Switch S1 is provided to cancel any waiting program.

While the invention has been described with reference to the structure disclosed herein, it is not confined to the details set forth, but is intended to cover such modifications or changes as may come within the scope of the following claim.

What is claimed is:

1. A device for carrying documents to be reproduced from a first station to subsequent stations including a copy conveyor,
a first set of grippers mounted on the conveyor for holding a first document on to the conveyor,

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a second set of grippers mounted on the conveyor for holding a second document on the conveyor,
said second set of grippers spaced from said first set of grippers in the direction of movement of the conveyor,

means mounted adjacent the conveyor for selectively actuating both sets of grippers,

a first solenoid for moving said means through a first position for actuating said first set of grippers, and
a second solenoid for moving said means into a second position for actuating both sets of grippers.

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JOHN M. HORAN, *Primary Examiner*.

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