

Sept. 15, 1964

C. A. PLANTE ETAL
CONTACT PRINTING APPARATUS

3,148,610

Filed Dec. 24, 1962

3 Sheets--Sheet 1

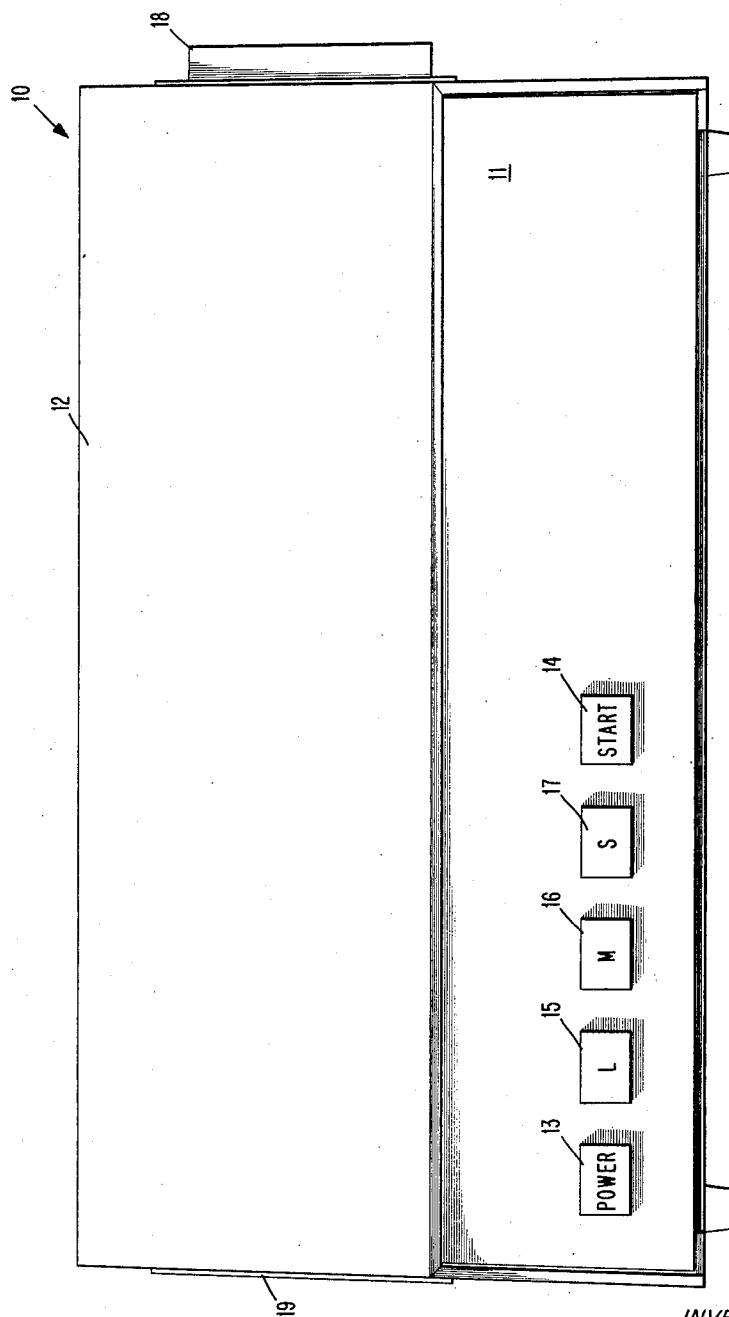


FIG. 1

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3 Sheets--Sheet 2

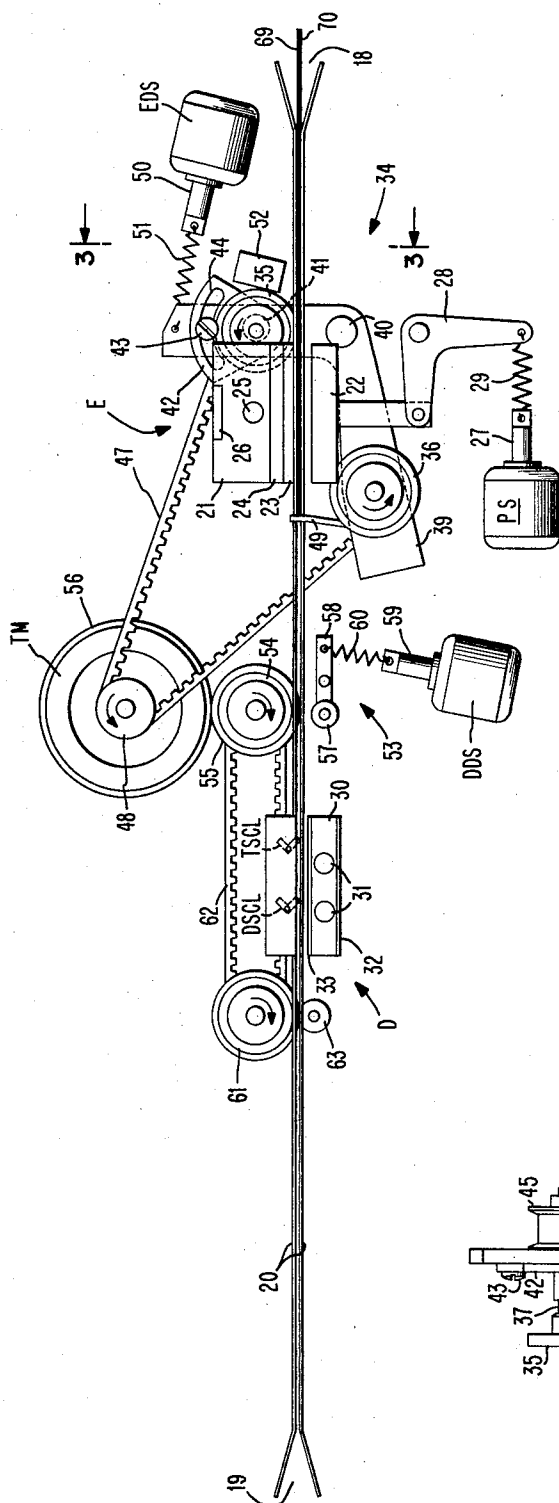


FIG. 2

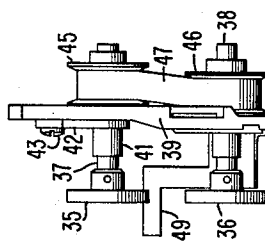


FIG. 3

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3 Sheets-Sheet 3

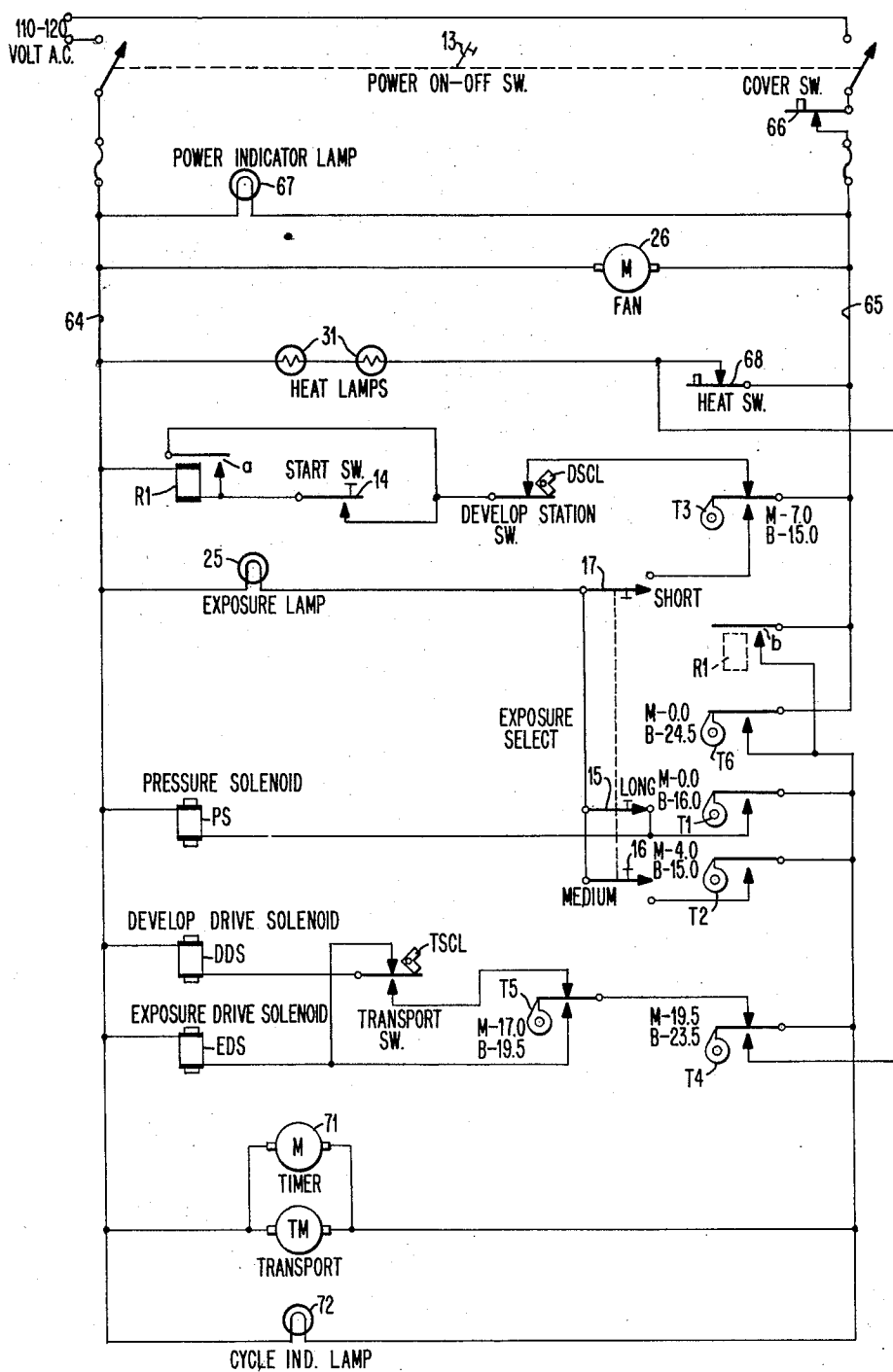


FIG. 4

1

3,148,610

CONTACT PRINTING APPARATUS

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8 Claims. (Cl. 95-73)

This invention relates to a contact printing apparatus of the type wherein a film frame image contained in a photoaperture card is reproduced on an unexposed film frame contained in another photoaperture card.

Diazotype contact printing or photocopying machines are well known wherein a negative or master copy, such as a microfilm negative carried by an index card, is exposed to a source of actinic radiation in contact with a light sensitive diazotype material in the form of an unexposed film frame in an index card to reproduce the master copy. After exposure, the negative or master copy card is separated from the exposed diazotype film in the copy card and is generally conveyed to one end of the machine for removal while the copy card having the exposed diazotype material is processed further through a developing section prior to delivery of the finished print and card outside the machine.

In machines of this kind the accepted mode of separating superposed master and copy sheets and transporting them to the various sections of the machine has been by means of conveyor systems comprising moving endless belts or bands which are often times assisted by pneumatic means. The use of such conveyor systems tends to complicate the general format of the machine with regard to arranging the various sections, such as the exposure and development stations, in order to accommodate the conveyor means. Also, problems arise with regard to reliable registration of the sheets at the various sections or stations.

In providing a simpler and more efficient contact printing apparatus of the kind referred to for reproducing film bearing cards, the present invention embodies the use of a horizontal card feed track which extends in a straight line from a card entry throat at one end of the machine through an exposure station and a development station to a card exit throat at the other end of the machine. A master card and a copy card are superimposed, arranged in a vertical position on the feed track at the entry throat and then manually moved on the track to the desired position in the exposure station. A novel arrangement of a card stop and continuously running drive rolls is provided at the exposure station which, in effect, straddles the superimposed cards and which, at the end of an exposure cycle, is automatically rendered effective to quickly and positively eject the two superimposed cards in opposite directions out of the exposure station. The master card is ejected back out the entry throat while the copy card is ejected along the feed track in the opposite direction to the required position in the development station. At the end of a development cycle, additional drive rollers are rendered effective to eject the copy card from the development station and out the exit throat of the machine. Suitable timing controls are provided to correlate the sequence of card movement with the operation of the exposure and development devices. This type of transport arrangement makes it

2

possible to employ a printer format which is simple and straightforward and which is accordingly efficient and reliable in operation.

Accordingly, a principal object of the present invention is to provide an improved card to card copy machine which is simple and straightforward in design and more efficient and reliable in operation.

A further object of the present invention is to provide a diazotype contact printing machine for reproducing onto the unexposed film frame of a photoaperture card the film frame image contained in a master photoaperture card.

A further object of the present invention is to provide a printing machine as in the preceding object and including an improved transport arrangement for processing the cards through the machine.

A still further object of the present invention is to provide in a diazotype contact printing machine a simple eject mechanism which will quickly and positively eject two superimposed sheets in opposite directions.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a front elevation view of a contact printing machine embodying the principles of the present invention.

FIG. 2 is a schematic view looking down into the machine of FIG. 1 with the top cover removed and showing the arrangement of the various mechanisms for processing the photoaperture cards.

FIG. 3 is an end elevation view of the exposure drive mechanism taken on line 3-3 of FIG. 2.

FIG. 4 is a wiring diagram.

Referring to FIG. 1, there is shown a preferred form of a card to card copier machine 10 in which a 33 mm. film frame image contained in a master photoaperture card is duplicated on the unexposed film frame contained in a copy photoaperture card by a diazotype contact printing process. The copier machine is a hand-fed, semi-automatic, desk-top device which may normally be located on top of a desk or work table and operated in environments with no special facilities other than the normal 60 cycle, 110-120 volt alternating current.

As shown, the general machine configuration comprises a cabinet 11 having a removable top cover 12. Arranged on the front of the cabinet is a power on-off push button switch 13, a process start push button switch 14 and three exposure selection push button switches 15, 16 and 17 which indicate long, medium and short exposure times respectively. At the right-hand side of the machine there is provided an entry throat 18 into which superimposed master and copy photoaperture cards are inserted for processing through the machine and at the left-hand side of the machine there is a delivery throat 19 through which the printed copy card exits.

Turning now to FIG. 2, there is shown schematically, looking down into the machine, the preferred arrangement of the several operating mechanisms of the machine and of the card transport path. The card transport path comprises a generally U-shaped card track or guide 20 located on the machine base and which extends horizontally and in a straight line the entire length of the

machine between the card entry and exit throats 18 and 19. Machine processable photoaperture cards are well known and the most widely used form is dimensioned in the order of 7 $\frac{3}{8}$ inches in length, 3 $\frac{1}{4}$ inches in width and .0007 inch in thickness. The present card throats and connecting card guide are adapted to receive and support two superimposed photoaperture cards which are positioned vertically on one of their long edges. The guide 20 is free of obstructions of any type which may interfere with card travel.

Located near the entry throat 18 is an exposure station E which comprises a lamp box 21 disposed on one side of the card guide and a pressure pad 22 disposed on the opposite side of the guide. The lamp box 21 comprises a card back-up block 23 made of Plexiglas or the like, a heat filter block 24 made of a suitable glass material and a projection lamp 25. A suitable cooling fan 26 is provided which establishes a flow of air through the card area to insure that the card contained film frame is not injured due to excessive temperature. The back-up block 23 should be of sufficient size that will cover the complete card aperture and the front and rear plane surfaces should be free of cuts, scratches and marks that would be damaging to the contact copying process. Also, the filter block 24 is preferably of such dimensions that all light from the exposure lamp 25 to the film plane is filtered.

The pressure pad 22 functions to press the emulsion surface of the copy card to the emulsion surface of the master card and pressure force will be applied before, during and momentarily after an exposure cycle. The pressure force is originated by energizing a pressure solenoid PS and is transmitted through the solenoid link 27 to a pivoted bell crank 28 and the pressure pad 22. When the solenoid is de-energized, a return spring 29 reverts the mechanism to its deactuated position.

Located toward the other end of the machine near the delivery throat 19 is a development station D which comprises a lamp box 30 preferably containing two 190 watt quartz infrared lamps 31 connected in series to supply the heat necessary for development. An aluminum type reflector plate 32 is mounted behind the lamps to intensify the heat and a suitable masking plate 33 is provided to shield the card from the heat except in the card aperture area.

In a contact printer machine of the type described thus far, perhaps the area of most importance is the provision of simple, efficient and reliable means for registering and transporting the cards through the exposure and development stations and out the machine. In the present improved transport arrangement, advantageous use is made of solenoid operated continuously driven feed rolls. In keeping with this, there is provided at the exposure station E an exposure drive mechanism 34 which is adapted to register the superimposed master and copy cards at the exposure station for an exposure cycle and which, at the completion of the exposure cycle, is capable when called upon to transport the copy card toward the development station D and expel the master card from the machine through the entry card throat 18. If it is desired to process a single card only through the machine, the mechanism is adjustable so that the single card may be expelled toward the development station.

Referring to FIGS. 2 and 3, the exposure drive mechanism comprises a pair of rubber bodied rollers 35, 36 mounted on shafts 37, 38 which rotate through bushings fastened to the arms of a bell crank 39. The bell crank is pivotally mounted on a suitable machine support member through a shaft 40. The bushing 41 which carries the roll 35 and shaft 37 is an adjustable eccentric bushing which is secured to a plate 42. Plate 42 is in turn adjustably secured to the bell crank by means of a screw 43 which extends through a curved slot 44 in the plate. By loosening the screw in the curved slot and adjusting the eccentric, the distance from the centerline of the

drive roll 35 to the centerline of the bell crank pivot shaft 40 can be adjusted to allow for the feeding of a single card through the machine as will be further described. Beneath the bell crank, timing belt sheaves 45, 46 are fastened on the shafts 37 and 38, respectively. A timing belt 47 connects the sheaves with a sheave 48 fastened to the shaft of a drive or transport motor TM so that the drive rollers are both continuously running in a counterclockwise direction as long as the drive motor is turned on.

The drive rollers straddle the card track 20 so that roller 35 may act on the master card and roller 36 on the copy card. In the normal position of the drive mechanism shown in FIG. 2, rollers 35 and 36 are positioned out of contact with cards located therebetween on the card track; however, a card stop member 49 integral with the bell crank is positioned in the card path and functions to register the superimposed master and copy cards in position for an exposure cycle. An exposure drive solenoid EDS is provided to actuate the drive mechanism at the completion of an exposure cycle. Energization of the solenoid will through the solenoid link 50 and spring 51 pull the bell crank in a clockwise direction against a stop block 52 and the continuously running drive rollers 35 and 36 will be swung to simultaneously contact the master and copy cards positioned therebetween. At the same time, the vertical leg portion of card stop 49 is moved out of the card path allowing roller 36 to eject the copy card toward the development station while roller 35 ejects the master card out through the entry throat 18. The drive rollers are preferably located so that they will engage the cards at approximately .031 inch from the bottom edges of the cards. When the solenoid is de-energized, the return spring 51 and timing belt 47 will revert the exposure drive mechanism back to its deactuated position. If it is desired to process a single card through the machine, the drive roll 35 may be adjusted through the eccentric previously described so that when the bell crank is actuated only the drive roller 36 will come into actual contact with the single card to eject it toward the development station.

Positioned ahead of the development station is a development drive mechanism 53 which functions to intercept the card coming from the exposure station and forward it on into the development station. The development drive mechanism comprises a rubber bodied roller 54 mounted on a rotatable vertical shaft and positioned on one side of the card guide 20 to contact the card approximately .031 inch from the bottom edge of the card. The roller 54 is continuously driven in a clockwise direction by means of the meshed roller gear 55 and drive motor gear 56. Positioned on the other side of the card guide and opposite the roller 54 is a pressure roll 57 rotatably mounted on a pivot arm 58. A development drive solenoid DDS is connected to the pivot arm through the solenoid link 59 and spring 60 and energization of the solenoid DDS at the proper time in the cycle will result in swinging the pressure roll clockwise to pinch an intercepted card against the rotating drive roller 54 which results in the card being forwarded into the development station D. Located in the development station are a transport switch card lever TSCL and a development switch card lever DSCL and, as will be further described, the transport switch card lever functions when actuated by a card to drop out the development drive solenoid and thereby locate the card in proper position for film development.

Beyond the development station there is provided an eject roller 61 mounted on a rotatable vertical shaft and roller 61 is continuously driven in a clockwise direction by means of a timing belt 62 which in turn is driven from the roller 54 shaft. Roller 61 is also positioned vertically to contact the card approximately .031 inch from the bottom edge of the card. On the other side of the card guide 20 and opposite the roller 61 is positioned a back-

up roll 63 which is rotatably supported. At the completion of a development cycle, the card at the development station will be forwarded by the development drive mechanism 53 into the bite of rollers 61, 63 and these rollers function to eject the card to a position where it will partially extend out of the exit throat 19. The extent of feed is such as to adequately allow the operator to grasp and remove the card and yet not allow the operator to grasp the card by the film contained therein.

The operation of the machine will now be summarized with particular reference to the wiring diagram shown in FIG. 4, pointing out the timing controls which correlate the sequence of card movement with the operation of the exposure and development devices.

Depression of the power switch button 13 closes the double-throw power on-off switch to apply 110-120 volts A.C. across the two main lines 64, 65 of the machine. A cover switch 66 is closed when the machine cover 12 is in place thus enabling circuits to be completed to energize the cooling fan 26, power-on indicator lamp 67 and the development heat lamps 31. A heat switch 68 in series with the heat lamps allow the lamps to cycle, thus preheating the development station in preparation for film development. The desired exposure button 15, 16 or 17 is then depressed and locked in place depending upon whether a long, medium or short cycle is desired. In the present example, button 15 is closed for a long cycle.

A master card 69 and copy card 70 are superimposed with the emulsion side of the film in the master card matched against the emulsion side of the film in the copy card and the two cards are inserted into the entry throat 18 with the master card toward the rear and the cards' aperture areas as the leading edges. The cards are pushed along the card guide 20 until they register against the card stop 49. A momentary depression of the start button 14 causes energization of the relay R1 and the relay contacts R1a and R1b. Should a card be located in the development station, the DSCL card lever would open the normally closed development station switch and energization of relay R1 would be prohibited. With the relay energized, the now closed contacts R1a establish a hold circuit for the relay coil and the now closed contacts R1b bypass a timer self on-off switch T6 thus allowing circuits to be completed to energize a timer motor 71, the transport motor TM and a cycle indicator lamp 72. The timer motor operates the various cam controlled timer switches which control the sequence of operations.

The timer switch T1 normally open contacts now close to energize the pressure solenoid PS and with the long exposure cycle button 15 depressed and locked, a circuit is also completed to illuminate the exposure lamp 25. If the medium or short length exposure button had been selected, the control of the exposure lamp illumination would be transferred to either the contacts of timer switch T2 or T3. Only one of the three exposure selection buttons can be locked in at any time and that one controls, through the timer, the illuminating and extinguishing of the exposure lamp. If none of the three selection buttons are locked in, the machine will function, but the lamp will not come on.

Timer switch T1 extinguishes the exposure lamp and de-energizes the pressure solenoid at the same instant. Timer switches T2 and T3 each will extinguish the exposure lamp one second before switch T1 de-energizes the pressure solenoid. At this time, the timer switch T4 and timer switch T5 contacts are in their normally closed position but since there is no card in the development station, the normally open contacts of the transport switch remain open in preparation for card transport.

One second after timer switch T1 de-energizes the pressure solenoid, the contacts of timer switch T5 transfer and circuits are completed through timer switches T4 and T5 to energize the exposure drive solenoid EDS and the development drive solenoid DDS to eject the master card out through the entry throat 18 and to transport the copy card

to the development station. As soon as the copy card actuates the TSCL card lever the transport switch contacts transfer causing de-energization of solenoid DDS and the development drive stops. The copy card also stops at which time it is in the proper location for development. With the copy card in the development station, the DSCL card lever is actuated to open the development station switch and this prohibits the starting of another machine cycle until the card is removed. The relay R1 was previously dropped out when the timer switch T3 contacts transferred at which time the timer switch T6 contacts closed to take over the duties of supplying power to the machine.

At the same time that the development drive is stopped, the timer switch T4 contacts transfer to drop out the exposure drive solenoid EDS and also to complete a circuit to the development heat lamps 31. While the timer switch T4 contacts are in the transferred position, the timer switch T5 contacts transfer back to their normal position in preparation for card exit transport. The development cycle ends when the timer switch T4 contacts transfer back to their normal position, in which position they now complete a circuit through the timer switch T5 contacts and the still transferred contacts of the transport switch to energize the development drive solenoid DDS. As a result, the copy card is expelled out of the development station and transported to the exit card throat 19. Next, the timer switch T6 contacts open de-energizing everything except the fan motor 26 and the power indicator lamp 67. The copy card is removed from the exit throat and the machine is ready for another cycle of operation.

The machine may be easily modified if it is desired to change the manner in which the cards are transported. For example, by increasing the duration of time that the development drive solenoid DDS is energized the copy card may be continuously fed past the development lamps and on out the exit throat. Also, it may be desired after an exposure cycle to eject only the copy card and leave the master card at the exposure station for hand removal from the entry throat. This may be done by adjusting the master card roller 35, as previously described, to render it ineffective or by removing the roller from the machine.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A contact printing machine having an exposure station and a development station for reproducing a copy photoaperture card from a master photoaperture card which comprises:

- a card entry throat;
- a card exit throat;
- a card guide extending from said entry throat through said exposure and development stations and to said exit throat;
- means for registering a superimposed master and copy card on said card guide at said exposure station;
- means for automatically ejecting said copy card after exposure from said exposure station and propelling same along said card guide toward said development station;
- means for receiving and locating said copy card on said card guide at said development station; and
- means for automatically ejecting said copy card after development from said development station and propelling same to said exit throat.

2. A contact printing machine having an exposure station and a development station for reproducing a copy photoaperture card from a master photoaperture card which comprises:

- a card entry throat;

a card exit throat;
 a card guide extending from said entry throat through said exposure and development stations and to said exit throat;
 means for registering a superimposed master and copy card on said card guide at said exposure station;
 means for automatically ejecting said copy card after exposure from said exposure station and propelling same along said card guide toward said development station and for simultaneously ejecting said master card from said exposure station and out through said entry throat;
 means for receiving and locating said copy card on said card guide at said development station; and
 means for automatically ejecting said copy card after development from said development station and propelling same to said exit throat.

3. A contact printing machine having an exposure station and a development station for reproducing a copy photoaperture card from a master photoaperture card which comprises:
 a card entry throat;
 a card exit throat;
 a card guide extending horizontally and in a straight line from said entry throat through said exposure and development stations and to said exit throat;
 means for registering a superimposed master and copy card vertically on said card guide at said exposure station;
 first roller drive means for automatically ejecting said copy card after exposure from said exposure station and propelling same along said card guide toward said development station and for simultaneously ejecting said master card from said exposure station and out through said entry throat;
 second roller drive means for receiving and locating said copy card on said card guide at said development station;
 said second roller drive means also serving to automatically eject said copy card after development from said development station; and
 third roller drive means for receiving said copy card and propelling same to said exit throat.

4. A contact printing machine having an exposure station and a development station for reproducing a copy photoaperture card from a master photoaperture card which comprises:
 a card entry throat;
 a card exit throat;
 a card guide extending horizontally and in a straight line from said entry throat through said exposure and development stations and to said exit throat;
 means for registering a superimposed master and copy card vertically on said card guide at said exposure station;
 continuously running first roller drive means;
 first circuit means for automatically rendering said first roller drive means effective to eject said copy card after exposure from said exposure station and propel same along said card guide toward said development station and to simultaneously eject said master card from said exposure station and out through said entry throat;
 continuously running second roller drive means;
 second circuit means for automatically rendering said second roller drive means effective for a short time to receive and locate said copy card on said card guide at said development station;
 third circuit means for automatically rendering said second roller drive means effective again to eject said copy card after development from said development station; and
 continuously running third roller drive means for receiving said copy card and propelling same to said exit throat.

5. In a contact printing machine having an exposure station where a master photoaperture card and a copy photoaperture card are superimposed in contact with each other for light exposure, means for separating the master and copy cards after exposure which comprises:
 a guide track for supporting said superimposed cards in a vertical position;
 a pivotal drive roller assembly having rotatable drive rollers which extend adjacent to the outer faces of said superimposed cards and which are normally out of contact with said faces;
 a card stop member integral with said assembly and normally positioned in said track to register said superimposed cards;
 means for rotating said drive rollers in the same direction; and
 means for pivoting said assembly to remove said card stop member from said track and to simultaneously engage said drive rollers with the outer faces of said superimposed cards to eject said cards in opposite directions out of said exposure station.

6. In a contact printing machine having an exposure station where a master photoaperture card and a copy photoaperture card are superimposed in contact with each other for light exposure, means for separating the master and copy cards after exposure which comprises:
 a guide track for supporting said superimposed cards in a vertical position;
 a pivotal member;
 a first rotatable drive roller on said member which extends adjacent to the outer face of one of said superimposed cards and normally out of contact therewith;
 a second rotatable drive roller adjustably mounted on said member which extends adjacent to the outer face of the other of said superimposed cards and normally out of contact therewith;
 a card stop member integral with said pivotal member and normally positioned in said track to register said superimposed cards;
 means for rotating said drive rollers in the same direction;
 means for pivoting said pivotal member to remove said card stop member from said track and to simultaneously engage said drive rollers with the outer faces of said superimposed cards to eject said cards in opposite directions out of said exposure station; and
 means for adjusting said second drive roller to prevent same from engaging the card adjacent thereto when said pivotal member is pivoted whereby only the card engaged by said first drive roller will be ejected out of said exposure station.

7. In a contact printing machine having an exposure station and a development station for reproducing a copy photoaperture card from a master photoaperture card;
 a card track extending through said exposure and development stations;
 a pivotal member at said exposure station and including a card stop member which normally extends into said card track to register a superimposed master and copy card on said card track at said exposure station;
 a pair of drive rollers rotatably supported on said pivotal member and arranged to straddle said registered superimposed cards without contacting said cards;
 means for rotating said rollers in the same direction; and
 means for pivoting said pivotal member to remove said card stop member from said card track and to simultaneously engage said rollers with said superimposed cards whereby said copy card is ejected in one direction toward said development station and said master card is ejected in an opposite direction out of said exposure station.

9

8. In a contact printing machine having an exposure station and a development station for reproducing a copy photoaperture card from a master photoaperture card;
 a U-shaped card track extending through said exposure and development stations;
 a pivotal member at said exposure station and including a card stop member which normally extends into said card track to register a superimposed master and copy card vertically positioned on said card track at said exposure station;
 a pair of drive rollers rotatably supported on said pivotal member and arranged vertically to straddle said

5

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10

registered superimposed cards without contacting said cards;
 means for rotating said rollers in the same direction; and
 means for pivoting said pivotal member to remove said card stop member from said card track and to simultaneously engage said rollers against the outside faces of said superimposed cards whereby said copy card is ejected in one direction toward said development station and said master card is ejected in an opposite direction out of said exposure station.

No references cited.